# DENTAL ANTHROPOLOGY OF THE KHASIS OF SHILLONG

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Abstract

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## INTRODUCTION

"Dental anthropology is defined as a study of people (and their close relatives) from the evidence provided by teeth" (Hillson, 2003). Dental anthropology is a subfield of physical anthropology under the broad discipline of anthropology which is concerned with the study of human teeth-one of the anatomical systems of man. One of the main themes of dental anthropology has been a study of variation in size and shape of the teeth, as recorded in casts of living mouths or seen in the skulls of archaeological and fossil collections. Dental anthropology includes a study of the development of teeth in relation to age, their appearance in the mouth, and the processes of wear and other changes that occur once they are in place. It also includes the microscopic traces, preserved inside the tissues of the teeth, of the growth and ageing processes. Yet another area of interest is the study of the biochemistry of dental tissues (Hillson, 2003). Many contributors to this area of research come from fields outside of anthropology, notably dentistry, genetics, anatomy, and paleontology. It encompasses a broad range of subjects which, in turn, have finer levels of specialization. Some workers concentrate on developmental aspects of the dentition, from tooth germ formation to developmental defects of crown. Others focus on post-eruptive changes such as ordinary crown wear and culturally-prescribed dental

modification. The study of dental pathologies, in particular caries, patterns of tooth loss, and periodontal disease, provides yet another avenue of research. Researchers interested in those elements of human dentition that have some underlying genetic basis of study of tooth size and morphology (Cadien, 1972).

Kirk (1973) has very rightly pointed out that the main purpose of the contemporary physical anthropology and human population genetic researches has been to expound the nature and extent of biological variations in different human populations and the meaning of these differences in the understanding of the ongoing evolutionary process at both micro and macro levels. The systems used have been varying from time to time, and among the other systems regularly studied in this context, human dentition is of special interest and occupies important place. The special interest evinced on dentition may be due to its diachronic capability, to know about our species and racial origins, ease of direct comparison with living and also past human populations facilitating of a much greater time depth in micro and macro evolutionary investigations and number of synchronic proposes (Rami Reddy, 1986). Teeth being the hardest and most durable materials of all parts of the body due to the presence of enamel and dentine in them preserve well and hence account for a large proposition of the human and pre-human fossils remains available for study. The environment has revealed by many a study postulating modes of inheritance for different dental traits (Kraus, 1951; Turner, 1967). They are the least biased to subjectivity and hence greatly help in comparison and classification of populations as the biogenetic markers like blood groups, red cell enzymes, dermatoglyphics, etc. do. The different dental aspects of study which attracts

the attention of human biologists are crown morphology, metrics, health, evolution, growth, genetics usage, forensic and ethnographic treatment, all of which can be used as research tools and areas of studies (Rami Reddy, 1986).

Dental anthropology is academically located within the human bone biology studies. Its main goal is to recognize attributes in the teeth form which can help us create bicultural dynamics of human populations, specially related to health–illness state, feeding habits and micro evolutionary transformations, related themselves to the ethno genesis of current and ancient times. In Dental anthropology, teeth are used to obtain information on culture, health, diet, variability and evolutionary trends as well as eruption and dental pathologies in the past and modern populations.

Dental *eruption* is generally defined as the time when any part of the crown has emerged through the gingival surface (Rami Reddy, 1986).The term *emergence* refers to the moment any portion of the crown piers the gingiva. Actual penetration of the gingiva is merely a transitory stage in the total process of tooth eruption. It refers to the movement of a tooth towards its final occlusal position.

Dental anthropology began in the eighties of the eighteen century when physical anthropological investigations centered mainly round the analysis of the morphology of the skeletons and teeth, though as a subject of academic research, its importance was not recognized until 1900. The root of the dental anthropology lay in the seventies of the $19^{th}$ century as shown by a number of investigations, when the subject got its breakthrough for the first time.

Following Krogman's work, research on dental anthropology proliferated in numerous anthropological and dental research journals. In addition, there were a number of special journal issues, dissertations, monographs, and books developed to this subject (e.g. Moorrees, 1957; Brothwell, 1963; Wolpoff, 1971; Kurten, 1982; Reddy, 1985). In the American Journal of Physical Anthropology alone, annual report of the editorial notes that dental papers comprised about 11% of the total manuscripts submitted in 1985. This is not a new trend, but rather a continuation of interest that has existed since the early days of the journal.

While anthropology was very much alive on the individual level, there was no forum in which to communicate with others in the field to facilitate the exchange of ideas. The Dental Anthropological Association (DAA) was officially, created in 1986 during the American Association of Physical Anthropologists (AAPA) meeting in Albuquerque, New Mexico, and established the 'Dental Anthropology Newsletter' as its official publications. Since its inception, the DAA has sponsored symposia and scientific sessions where it exemplifies the diversity in dental anthropology, including interest in recent and archaeological populations as well as variation in methodological approaches and scientific results.

The term Dental anthropology first appears in the title of an article published in1900 by George Buschan, although Klatsky and Fisher are credited with its formal introduction. The field is rooted in French, German, and English encyclopedic mammalian deontological treatises of the past two centuries. That teeth poses qualities valuable for anthropological study (i.e. they are durable; evolutionary conservative and

yet adaptable; rich with genetically determined traits; and reflective of behavior, ecology, and diet) was recognized by such 19th century natural historians.

In the early 20th century, scholars began to pay attention to teeth as an additional system that began to provide insight into human variation. Most of the emphasis was on human skeletal remains because techniques for making impressions of the living were limited. Ales Hrdlicka, who had access to an enormous sample of Native American skeletal remains at the Smithsonian Institution, was among the first to note interesting dental morphological distinctions between major human groups. In particular, Hrdlicka (1911, 1920) noted that American Indians were distinguished from other human populations by the development of pronounced marginal ridges on the lingual surface of the upper incisors (i.e. shoveling). W.K. Gregory (1922), in his opus the origin and evolution of the human dentition, also noted morphological attributes of recent humans, but he did not feel that intergroup variation was pronounced or significant.

Although Hrdlicka authored many books, he never wrote one devoted entirely to teeth. The task was left to other pioneers in this field, including T.D. Campbell (1925) in Austria and J.C.M. Shaw (1931) in South Africa. These workers studied the size, morphology, number, wear, and pathology of Australian aboriginals and South African black populations, respectively. Given the paucity of Comparative data, their books were largely descriptive in nature. To complement these early dental monographs, other significant contributors during this period include R.W. Leigh's (1925) analysis of oral pathology under varied environmental conditions , W.M. Krogman's (1927) paper on anthropological aspects of human teeth , C. Nelson's (1938) study of the Pecos Pueblo

population , and M.S. Goldstein's (1948) work on the teeth of Texas Indian crania. Other key contributions at this time were Percy Butler's (1937, 1939) articles on the field effect in the mammalian dentition one of the most influential papers in the history of dental anthropology, A.A. Dahlberg's (1945). "The changing dentition of man" applied Butler's concept of dental fields to human teeth, forever changing the minor in which anthropologists would analyze metric, morphologic, and numeric variation in the dentition.

G.W. Lasker's (1950) paper "Genetic analysis of racial traits of the teeth" set the stage for new ways of thinking about the inheritance and utility of dental morphological variation. In the late 1940's, Dahlberg (1951) initiated a major dental casting project among the Pima Indians of Arizona. After modest beginning with plaster casts made from wax bite impressions, Al and Thelma Dahlberg went on to collect over 8000 Pima Indian casts. From this foundation, Dahlberg was able to build up some of the first characterizations of the extant American Indian dentition.

The 1950's saw a flurry activity in the anthropological uses of the teeth. C.F.A. Moorrees (1957) published The Aleut Dentition, which covered all facets of dental anthropology, from size, morphology, and number to pathology and oral tori. T. Murphy (1959a, 1959b) developed new standards for scoring tooth crown wear based on the pattern of dentine exposure, a scheme that provided for more information on wear than the Broca scale of the late 19$^{th}$ century. Lasker (1957) discussed the potential uses of dental morphology in the interpretation of forensic remains, while Bertran Kraus (1951, 1957; Kraus and Jordan, 1965; Kraus et.al; 1959) conducted pioneering work in dental

genetics and odontology. S.M. Garn, along with his colleagues at the Fels Institute, began publishing dozens of articles that focused on dental variation, development, and interactions between variables.

Following the publication of dental Anthropology, the field greatly expanded in terms of practitioners and publications. From 1963 to the present, many articles and dissertations have dealt with various aspects of the human dentition. Topical trends include an ever increasing emphasis on methodologically standardized studies of tooth crown and root morphology dimensions, increased interest in oral health concerns, especially the negative impacts of agriculture, and a greatly expanded interest in the study of developmental stresses measured by growth defects, in particular linear enamel hyperplasia. The International Symposium of Dental Morphology, which met in 1965, would meet on regular basis across the next decades, leaving in its wake a number of significant edited volumes that highlighted current research on dental ontogeny, genetics, and variation (Butler and Joysey, 1978; Dahlberg, 1971; Kurten, 1982).

Recent development in the fields, since 1991 ,there has been at least 3 broadly influenced developments in the fields (1) the Dental Anthropology Association founded in 1986,enlarged the size of the its small Newsletter, changed name to Dental Anthropology, and adopt at the standards and styles of a professional journal, all carried out under the editorship by Alice M. (Sue) Haeussler, (2) English translations were made for the large and largely unread body of dental anthropology studies written in Russia , and a dental anthropological research programme was initiated in the People's Republic of China, (3) the publication of several books designed to be used as textbooks, as well as

scientific references, in dental anthropology. There are, of course, many other advances since 1991, including increased course offerings in dental anthropology in a number of universities and colleges, continued publication of the assembled papers for the International Dental Morphology meetings, development of new methods, descriptions of new fossil dentitions, and new synthesis on human and non-human dental variation, among other subjects.

This thesis has been divided into eight chapters. The first chapter gives the general introduction relating to the scope and the importance of the study. The chapter will also deal with the statement of the problem and objectives of study along with a brief description of the area of study as well as the study population. The second chapter will contain the review of literature. This chapter will also examine the research work carried out by anthropologists and other scientists outside India and in India with special reference to populations in Northeast India. The third chapter will include the nature, sources and methods of data collection. This chapter will also deals with the methods of data analysis. The fourth chapter will describe the results of the data analysis on dental eruption. The fifth chapter will also describe the results of the data analysis on dental and oral pathology. The sixth chapter will describe the results of the data analysis on dental morphology. The seventh chapter will deal with interpretations of the findings given in chapters – IV, V and VI, taking into consideration the findings on other populations as well. The eight chapter will summarize the methodological aspects and the findings of the study.

**Objectives of the study**

1. To study the impact of *Kwai* (betel nut and leaf with lime) and tobacco chewing, on dental health of the Khasis.
2. To access the eruption pattern of permanent teeth, their eruption age and other, in both boys and girls.
3. To access the prevalence of dental caries and periodontal diseases, in both sexes.
4. To record the various morphological patterns prevailed among the Khasis of Shillong.
5. To find out the relationships of eruption pattern, prevalence of dental caries, periodontal diseases and frequency occurrence of various morphological traits with certain demographic and socio-economic variables such as age, sex, income and education.
6. To compare the findings of the present study with those reported for other populations.

## MATERIALS AND METHODS

### Study Area and Population

The present study was carried out in Shillong, which is the capital of Meghalaya. Shillong is the only urban agglomeration in Meghalaya. It consists of Shillong Municipality, Shillong cantonment, Mawlai, Nongthymmai, Pynthorumkhrah and Madanritimg. The present study was conducted among the Khasis of Malki. It is one of the oldest Khasi dominated localities under Shillong municipality.

The data for the present study was collected from the Khais subjects of Malki, Shillong. Malki is divided into eigth different localities viz, Nongshilliang, Lumbalang, Nongpyngrope, Khliehshnong, Kharmalki, Dhankheti, Chinapatty and Pdengshnong. For the prsent study, 1254 males and 1263 female Khasi subjects of the age group 5 months to 75+ years were examined.

The subjects were drawn only from the Khasi households. The educational background, the number of family members, income of the family and food habits of the subjects was also recorded.

The Khasis, a mongoloid tribe, inhabit Khasi and Jaintia Hills of Meghalaya. There are four subgroups of Khasi-namely, the Khynriam, Pnar, War and Bhoi. Khynriams live in the middle ranges of the Khasi hills, while the Pnars accupy the Jaintia hills lying on the eastern side. The Bhoi inhabit the low hills towards north and North West of the area. The wars are met with on the slopes and deep valleys towards south.

The Khasis form a matrilineal society which is casteless and which gives the women a rightful place in the home and in the community. In a family authority is vested on the mother. Descent is always through the female line. Succession is also through the female line.

The Khasi are the only tribal group in North-East India who speak a dialect of the Monkhmer group of Austro-Asiatic sub-family of linguistic group in the midst of an encircling population, all belonging to the Tibeto-Burman linguistic family.

The staple food of the Khasi is rice, vegetables, fish and all kinds of meat specially beef and pork. The Khasis ordinarily do not use milk as part of their food. The usually eat boil, unspiced food. Man, woman and children are chewers of *Kwai* (areca nuts and betel-leaf with lime).

**Socio-economic categories**

In the present study, certain socio-economic variables were classified arbitrary into different groups with a view to understanding their influence on demographic variables. Our classifications may be briefly describe as follows:

*Income Groups:* Data on household income were collected directly from the heads of the households. The per capita income of the household was classified as follows:\

Above $75^{th}$ pencentile ($\geq$ Rs. 1501) = High Income Group

$50^{th}$ to $75^{th}$ percentile (Rs. 1126 to 1500) = Middle Income Group

Below $50^{th}$ percentile ($\leq$ Rs. 1125) = Low Income Group

*Educational Level:* Data on educational attainment of individuals in the present study were arbitrarily classified as follows: Three categories illiterate includes those individuals who were unable to read and write and those who had no education. The individuals who attended school upto standard V were grouped into Primary level of education. The individuals with educational level from V-VIII were in Middle level, IX-X is High and XI-XII were grouped into Higher Secondary level of education. Graduate, Post-Graduate and Technical education were grouped into another category.

*Family Size:* The family size was classified into three categories. The individuals who live in a household with less than 5 family members were considered as having a Small family size. The Medium family size includes those individuals who lived in a household with 5-6 family members. The individuals who lived in a household with more than 6 family members were grouped in Large family size.

**Dental Eruption**

Special care was taken to determine the actual ages of the subjects. Parents of the subjects were asked the actual date of birth of their wards. The subjects whose parents failed to give the correct information were not included in the sample. The sample comprises of only those subjects whose both parents were from the same tribe. Age of an individual was calculated according to the decimal calendar given by Weiner and Lourie (1981) from his/her birthday to the date of his/her dental and oral examination. The sample of males and females were distributed over 35 age groups. The 4.500 to 5.499

years were placed in the age group of 5-year, subjects ranging in age from 5.500 to 6.499 formed 6-year age group, and so on.

The recommendation of Wheeler (1988) for morphological features was followed to study differences between deciduous and permanent teeth. The observations were made with the aid of dental mirror, dental probe and spatula in sufficient day light. If any part of the crown had pierce the gum to become visible, the tooth was considered emerged. Some missing permanent teeth was counted as erupted when the subject could recall their emergence and/or extraction, and if the cavity were present. The coding of teeth is as follows: I, C, P, and M stands for incisor, canine, premolar and molar respectively. The numeral signifies the tooth's position. Positioning of the numeral on lower or upper end of the latter signifies mandibular or maxillary tooth, respectively. The other additional background information in each subject was gathered, which includes their income, education and personal habits such as smoking, tobacco and *Kwai* chewing. Eruption status of permanent dentition for each and every subject was recorded.

**Dental Pathology**

For dental pathology samples were collected from all the age groups of both the sexes.

A. *Dental caries:* Since dental caries had to be assessed for entire dentition, all the teeth of the subjects were examined. Following WHO's (1977) recommendations, the teeth in either type of dentition were examined and diagnosed sound when were un-effected by caries, and decayed, filled and missing owing to caries.

Dental probe, dental mirror, spatula and torch were used to examine the subject's teeth. The method of direct visual observation was followed during the investigation. The dental caries was noticed in the labial, buccal, lingual, mesial as well as in the occlusal sides of the teeth. For its correct observation and assessment, each of the subjects was asked to open his/her mouth, a torch was focused and entire dentition was screened as thoroughly.

B. *Periodontal Diseases:* The method detailed by Russell (1976) was used to score periodontal index per person.

C. *Oral Hygiene:* Simplified oral hygiene index given by Greene and Vermillion (1964) was applied in collecting data for oral hygiene.

**Dental Morphology:**

Thee occurrence of supernumerary teeth or hyperdontia, carabelli's trait, shovel-shaped incisors, diastema, crowding, cingulum, occlusion of teeth, was recorded as suggested by Weiner and Lourie (1981).

**Data analysis**

The entire data was tabulated for statistical analysis, like percentage frequencies and median ages. To complete the median emergence time for each individual tooth, probit transformation was used (Fisher and Yeats, 1948; Mayhall et. al., 19978). Accordingly, for each tooth the proportion of emergence at various age levels was transformed into probits. The calculations were done for the two sides' pooled data. The probit values were then plotted on graph paper, and the visually best fitted slope was

obtained through a series of iterations. The regression line thus obtained was used to determine the estimated age of emergence (read as a projection of the probit value 5 on the horizontal scale) and estimated standard deviation (difference between the projection of the probit values 5 and 4). To find out the association, if any, between the prevalence of dental pathology and variables such as sex, income, eating habits, and dental pathology, chi-square test was used.

## FINDINGS OF THE PRESENT STUDY

The present thesis consists of eight chapters. The findings of the present study are presents in three chapters. Chapter IV deals with the dental eruption of the Khasis of Shillong. Dental pathology and morphology are presented in Chapters V and VI respectively.

### Dental eruption:

1. In both the sexes of the Khasis, the first permanent tooth erupts at 6 years of age.
2. Except the third molar (M3), all the permanent teeth complete eruption by 14 years of age in both boys and girls.
3. The third molar (M3) starts emerging by 17 years of age.
4. By 25 years, 96.05% and 95.46% of permanent teeth completes in the Khasi males and females respectively.
5. The median of their counterparts age of eruption of various teeth in girls is lower than that of their counterparts.

6. The eruption of all permanent teeth except the third molar takes place between the median ages 5.85 years to 12.20 years in girls and 6.55 years and 12.30 years in the boys.
7. The order of eruption of the permanent teeth is as follows:

   In males- $M_1>M^1>I_1>I^1>I_2>I^2>C_0>P_1>C^0>P^2>P^1>P_2>M_2>M^2>M^3>M_3$

   In females- $M_1>M^1>I_1>I_2>I^1>I^2>C_0>C^0>P^1>P_1>P^2>M_2>P_2>M^2>M_3>M^3$

**Dental Pathology**

1. Prevalence of caries was observed earliest at 2 years of age group.
2. The mild, moderate and the severe forms of caries affected Khasi children were recorded earliest in the age group of 2 years, 3 years and 4 years respectively.
3. The frequency of caries affected posterior teeth (premolar and molar) is higher than the anterior teeth (incisor and canine).
4. Prevalence of caries affected teeth is significantly higher in the illiterate compared to the literate Khasi ($x^2=20.87$, df=1, $p>0.05$, significant).
5. Prevalence of the caries is significantly low among the *Kwai* chewers compared to the non chewers ($x^2=80.21$, df=1, $p>0.05$, Significant).
6. The difference between the smokers and the non-smokers is insignificant ($x^2=0.44$, df=1, $p<0.05$, Insignificant) in respect of the prevalence caries.
7. Difference between the tobacco chewers and non-chewers ($x^2=1.03$, df=1, $p<0.05$, insignificant) is insignificant in respects of the prevalence of caries.
8. Incidence of gingivitis increases as the age group increases.
9. Upto the age of 5 years not a single subject was found affected by gingivitis.

10. The percentage of higher periodontal index score increases with the increase of age.
11. The prevalence of periodontal disease is high among the illiterate (54.71%) compared to the literate (44.64%) Khasis. They differ significantly ($x^2$=4.34, df=1, p>0.05, Significant).
12. The poor form of OHI (DI-S) debris index is more frequent among the males is (13.00%) than the females (15.00%). In general, the percentage frequency decreases as the age group increases.
13. The OHI (CI-S) increases in the higher age groups in both the sexes.
14. The prevalence of gingivitis found to be highest in the high income group, i.e., (82.40%) in males and (85.37%) in females.

**Dental Morphology:**

1. Supernumerary teeth could be observed only in the permanent teeth. Males has slightly higher incidence of supernumerary teeth compared to their counterparts.
2. In both the sexes, the occurence of supernumerary teeth are absent in the lowest and the highest age groups. In males the highest frequency of this trait was observed in the age group 11-15 years whereas in females, 16-20 years.
3. The incidence of carabelli's anomaly is highest among 11 years age group in boys and 10 years in the girls. However, this trait does not follow any specific pattern regarding its distribution.
4. The occurrence of carabelli's anomaly is slightly higher in males compared to the females.

5. The incidence of carabelli's anomaly decreases with the increase of the age group.
6. The incidence of shoveling is found to be higher in the males (8.30%) than that of the females (5.36%).
7. The incidences of shovel-shaped incisors are high in the maxillary incisor compared to the mandibular in both the jaws and sexes.
8. No diastema was observed upto the age of 2 yerars. Females have higher incidence of diastema compared to the males in both the types of teeth.
9. The incidence of crowding is high in the lower age groups. After 50 years of age, the occurrence of crowding is almost absent.
10. The individuals with normal bite are high in both the sexes compared to the mal-occlusion. However the percentage of the overbite is slightly high compared to the under bite subjects.
11. The percentage frequency of the subjects with normal occlusal pattern decreases with the increase of the age.
12. Bisexual variation of mal-occlusion is insignificant ($x^2$=1.88, df=1, $p<0.05$, insignificant), however the incidence of mal-occlusion is slightly high in females than the males.

## CONCLUDING REMARKS

The present study was conducted to examine the dental eruption, dental and oral pathology and morphology of the Khasis of Shillong. The eruption is recorded earliest mandibular teeth of girls and slowest in the maxillary jaws of boys. However, by 14 years of age, eruption of all teeth except the M3 completes. All the teeth erupt early in girls than in boys. The first tooth to emerge is the first molar and the last is the third molar teeth in the dental arcade of both the sexes of the Khasis. When compared with some Mongoloid children of Northeast India, the eruption time is found to be late among the Khasi children. The percentage frequency of the caries affected children is found to be highest in all population when compared with some other Mongoloid populations of Northeast India. Incidence dental and oral pathology was compared between the age groups, sexes, income groups, etc. The incidence of caries is high among both the sexes of the illiterate Khasis compared to the literate. However, it is found that the incidence of caries is less among the *Kwai* and the tobacco chewers compared to the non-chewers. But the smokers have higher frequency of caries. It is expected that the prevalence is inversely proportional to the income. But the finding of the present study shows that the trend is opposite, i.e., the higher income group people have high incidence of dental caries. Similarly, the *Kwai* chewing also decreases the frequency of the periodontal diseases.

It was expected that the incidence of dental caries and oral pathology is low in high income group, smaller family size, higher education and, high in the low income group, large family size, low education and chewing habits of *Kwai*, tobacco, etc. which

it is not always true. Present study reveals that the low incidence of dental caries, calculus and oral pathology may be found among the low income group, large family size and *Kwai* and tobacco chewers also.

## REFERENCES


Adler, P. and E. Godeny. 1952. Studies on the eruption of permanent teeth. *Acta Geneet Stat. Med.* Vol. 3: pp. 30-49.

Banerjee.A.R, P.Banerjee and K. Dutta. 1984. "Eruption of Permanent Teeth Among the Bengalee Girls and Boys". Presented at the *UGC National Seminar on Dental Anthropology*: Applications and Methods held at Tirupati from March 10-12.

Bhasin, M.K., A.K. Sharma and I.P. Singh. 1977. "Permanent dental emergence in the Kuluis of Himachal Pradesh". *The Anthropologist,* XXI, pp. 9-14.

Butler, P.M. 1939. Studies in the mammalian dentition- and of differentiation of post canine dentition, *Proceedings of the Zoological Society,* London, B, 107: pp. 103-132.

Butler, P.M. and K.A. Joysey. 1978. *Development, function and evolution of teeth,* London: Academic Press.

Cadien, J.D. 1972. "Dental variation in man". *In perspective on Human Evolution,* Vol. 2, S.L. Washburn and P. Dolhinow, Eds. New York: Holt, Rinehart and Winston, Inc., pp. 199-222.

Campbell, T.D. 1925. *Dentition and Palate of the Australian Aboriginal,* University of Adelaide, Publication No. 1, Adelaide: Hassel Press.

Clements, E.M.B., E. Davies-Thomas and K.G. Pickett. 1953. Time of eruption of permanent teeth in British children 1947-1948. *British Medical Journal,* 1: pp. 1421-1424.

Dahlberg, A.A. 1951. "The dentition of the American Indian". In The Physical Anthropology of the American Indian, W.S. Laughlin, (ed.), New York: Viking Fund Inc, pp. 138-176.

Dahlberg, A.A. 1971. *Dental morphology and evolution,* Chicago: University of Chicago Press.

Dahlberg, A. and R. Menegaz-Bock. 1958. Emergence of the permanent teeth in Pima Indian children. *Journal of Dental Research,* Vol. 37: pp. 1123-1140.

Dahlberg, A.A. 1945. Paramolar tubercle (Bolk), *American Journal of Physical Anthropology,* Vol. 3: pp. 97-103.

Fisher, R.A. and F. Yates. 1948. Statistical Tables for Biological, Agricultural and Medical Research. Oxford: Oliver and Boyd.

Friedlaender, J.S. and H.L. Bailit. 1969. Eruption times of the deciduous and permanent teeth of natives of Bongainville Island, territory of New Guinea: A study of racial variation. *Human Bioliology* Vol. 41: pp. 51-65.

Garn, S.M. and A.B. Lewis. 1963. Phylogenetic and intraspecific variations in tooth sequence polymorphism. Contribution to symposia of the society for the study of Human Biology. In D.R. Brothwell (ed.): *Dental Anthropology,* Vol. V. Pergamon Press, London.

Garn, S.M., M.N. Jerrold, S.T. Sandisky and T. Frederick. 1973. Economic impact on tooth emergence. *American Journal of Physical Anthropology,* Vol. 39: pp. 233-237.

Goldstein, M.S. 1948. "Dentition of the Indian crania from Texas". *American Journal of Physical Anthropology., Vol. 6: 63-84.*

Greene, J.C., and Vermillion, J.R. 1964. The simplified oral hygiene index. *Journal of American Dental Association,* 68(7).

Gregory, W.K. 1922. *The origin and evolution of the human dentition,* Baltimore: Williams & Watkins.

Helm, S. and B. Seidler. 1974. Timing of permanent tooth emergence in Danish Children. *Community Dent. Oral Epidemoil.* Vol. 2: pp. 122-129.

Hilson, S. 2002. Dental Anthropology. Cambridge University Press, Cambridge.

Hrdlicka, A. 1911. "Human dentition and teeth from the evolutionary and racial standpoint". *Dominion Dental Journal,* Vol. 23: pp. 403-417.

Hrdlicka, A. 1920. "Shovel-shaped teeth". *American Journal of Physical Anthropology,* Vol. 3: pp. 429-465.

Hurme, V.O. 1957. Time and sequence of tooth eruption. *J. Forensic Sci.* Vol. 2: pp. 377-388.

Jaswal, S. 1983. "Age and Sequence of Permanent-Tooth Emergence Among Khasis". *American Journal of Physical Anthropology,* Vol. 62: pp. 177-186.

Kasar, S. 2006. Eruption of permanent teeth and prevalence of dental caries among the Garo boys of Rangsakona and Dehalbagan villages of Ri-Bhoi district of Meghalaya and Ambher village of Kamrup district of Assam. *MSc. Dissertation,* Shillong, NEHU.

Kaul, S.S. and R.K. Pathak. 1989 "Estimation of calendar age from the emergence times of permanent teeth in Punjabi children in Chandigarh, India". *Annals of Human Biology,* Vol. 15(4): pp. 302-309.

Kaul, V. and S. Prakash. 1982. "Eruption of permanent teeth in Jats of Haryana". III *International Congress of Auxology,* Belgium, Abstract No. 002.

Kaul, S.S. and Sushma and S. Bindu. 1975. "Emergence of permanent teeth in school children in Chandigarh, India". *Archives of Oral Biology,* Vol. 20: pp. 587-593.

Kelley, M.A. and C.S. Larsen. 1991. Advances in dental anthropology, New York: Wiley-Liss.

Kirk, R.L. 1973. Serum protein and enzyme groups in physical anthropology with special reference to Indian populations. *In Physical Anthropology and its Extending Horizons.* A. Basu, A.K. Ghosh, S.K. Biswas nad R. Ghosh (eds). pp. 198-209. Orient Longman, Calcutta.

Kraus, B.S. 1951. "Carabelli's anomaly of the maxillary molar teeth observations on Mexicans and Padago Indians and an interpretation of the inheritance". *American Journal of Human Genetics,* Vol. 3: pp. 348-355.

Krumholt, L., B. Roed-Peterson and J.J. Pinborg. 1971. Eruption times of the permanent teeth in 622 Ugandan children. *Archs. Oral Biol.* Vol. 16: pp. 1281-1288.

Kurten, B. 1982. *Teeth: form, function, and evolution,* New York: Columbia University Press.

Kuski, K. and S.M. Garn. 1957. Tooth eruption sequence in fossil and modern man. *American Journal of Physical Anthropology.* Vol. 15: pp. 469-488.

Lalrammuana, C. 2006. Eruption of permanent teeth and prevalence of dental caries among the Garo girls of Rangsakona and Dehalbagan villages of Ri-Bhoi district of Meghalaya and Ambher village of Kamrup district of Assam. *MSc. Dissertation,* Shillong, NEHU.

Lasker, G.W. 1950. "Genetic analysis of racial traits of the teeth". Cold Spring Harbor Symposia on Quantitative Biology, pp. 191-203.

Leigh, R.W. 1925. Dental Pathology of Indian tribes of varied environmental and food conditions, *American Journal of Physical Anthropology,* Vol. 8: pp. 179-199.

Limbu, D.K. 1996. "Eruption of permanent teeth among the Gallong of Arunachal Pradesh". *Journal of Human Ecology.*, Vol. 7: pp. 221-222.

Lotha, T. 2009. Eruption of permanent teeth among the Sakachep children of Saitsama village of Jaintia Hills district, Meghalaya. *MSc. Dissertation,* Shillong, NEHU.

Lotha, Z. 2005. Eruption of permanent teeth and dental caries among the Biate boys of Saipung Village, Meghalaya. *MSc. Dissertation,* Shillong, NEHU.

Milner, G.R. and C.S. Larsen. 1991. Teeth as artifacts of human behaviour: International mutilation and accidental modification, in Kelley, M.A. & Larsen, C.S. (eds.). *Advance in dental anthropology,* New York: Wiley-Liss: pp. 357-378.

Mayhall, J.T., P.L. Belier and M.F. Mayhall. 1978. Canadian Eskimo Permanent tooth emergence timing. *American Journal of Physical Anthropology* ,Vol. (49: pp. 211-216.

Moorrees, C.F.A. 1957. *The Aleut Dentition: A Coorelative study of Dental characteristics in an Eskimoid people*, Cmabridge, Harvard University Press.

Murphy, T. 1959b. Gradients of dentine exposure in human molar tooth attrition, *American Journal of Physical Anthropology,* Vol. 17, pp. 179-186.

Nanda, R.S. and F.N. Chawla. 1966. "Growth and Developmenet of dentition in Indian Children. I. Development of permanent teeth. *American Journal of Orthodontics,* Vol. 52: pp. 837-853.

Nelson, C.T. 1938. "The teeth of the Indians of Pecos Pueblo". *American Journal of Physical Anthropology,* Vol. 23: pp. 261-293.

Niswander, J.D. and C. Sujaka. 1960. Dental eruption, stature and weight of Hiroshima children. *Journal of Dental Research.* Vol. 39: pp. 959-963.

Rami Reddy, V. 1981. "Eruption of permanent teeth among the people of Gulbargar, Karnataka"' Presented at the *III International Symposium on Human Biology*: *Variation in Human Growth and Physique* held at Bozsak (Hungary) from May 26-30).

Rami Reddy, V. 1982a. "Impact of caste and religion on the permanent dental eruption in India". Presented at the *III International Congress of Auxology: Growth and Development teeth* held at Brussels (Belgium) from August 26-30).

Reddy, V.R. 1986. Dimensions of Anthropology, Vol. I, B.R. Publishing Corporation, New Delhi.

Saini, S. 1972. "Order and eruption times of permanent teeth, state of dental health, height and weight of school-going boys in Chandigarh". *MSc. Dissertation, Punjab University,* Chandigarh.

Singh, S.P. 1980. "Eruption of permanent teeth in Gaddi Rajput males of Dhaula Dhar Range of the Himalayas". *Zeitschrift fur Morphologic and Anthropologic,* Vol. 70: pp. 293-301.

Saxena, B. "Eruption of permanent teeth, state of dental health and body size of school-going girls in Chandigarh. *MSc. Dissertation, Punjab University,* Chandigarh.

Shaw, M.J.C. 1931. *The Teeth, the Bony Palate and the Mandible in Bantu Races of South Africa*, London, John Bale Sons and Deniels Son.

Sidhu, L.S. and Gupta. 1973. "Sequence and age of eruption of permanent teeth in the Punjabi populations of Patiala. *The Eastern Anthropologist,* Vol. 26: pp. 260-270.

Steggerda, M. and T.J. Hill. 1942. Eruption time of teeth among Whites, Negroes and Indians. *American Journal of Orthodontics,* Vol. 28: 361-370.

Syiemlieh, S. 2004. Eruption of permanent teeth and dental caries among the Deori boys of Mahadevpur Deori villages, Arunachal Pradesh. *MSc. Dissetation,* Shillong, NEHU.

Tsochu, R. 2002. Eruption of permanent teeth and dental caries in the Marngar girls of Ri-Bhoi district, Meghalaya. *MSc. Dissertation,* Shillong, NEHU.

Turner, II, C.G. 1967. Crystalline organization of dental mineral, in Miles, A.E.W. (Ed.) *Structural and chemical organization of teeth,* London: Academics Press, Vol. 2, pp. 165-200.

Wallace, J.A. 1977. Gingival eruption sequences of permanent teeth in early hominids. *American Journal of Physical Anthropology.* Vol. 46: pp. 483-494.

Wolpoff, M.H. 1971. *Metric trends in humanid dental evolution,* Cleveland: Case Western Reserve University Press.

World Health Orgonization, 1975.*Oral Health Surveys-Basic methods,* Second Edition, Geneva.

# DENTAL ANTHROPOLOGY OF THE KHASIS OF SHILLONG

By

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Thesis

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the degree of Doctor of

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DECLARATION

I, Sarnali Saikia, hereby declare that the subject matter of this thesis is the record of work done by me, and that the contents of this thesis did not form the basis of the award of any previous degree to me or to the best of my knowledge to anybody else, and that the thesis has not been submitted by me for any research degree in any University/Institute.

This is been submitted to the North Eastern Hill University, for the award of the **Degree of Doctor of Philosophy in Anthropology**.

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Saikia

Shillong: The 3rd June, 2010 (Sarnali Saikia)

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# CHAPTER-I

## INTRODUCTION

"Dental anthropology is defined as a study of people (and their close relatives) from the evidence provided by teeth" (Hillson, 2002). Dental anthropology is a subfield of physical anthropology under the broad discipline of anthropology which is concerned with the study of human teeth-one of the anatomical systems of man. One of the main themes of dental anthropology has been a study of variation in size and shape of the teeth, as recorded in casts of living mouths or seen in the skulls of archaeological and fossil collections. Dental anthropology includes a study of the development of teeth in relation to age, their appearance in the mouth, and the processes of wear and other changes that occur once they are in place. It also includes the microscopic traces, preserved inside the tissues of the teeth, of the growth and ageing processes. Yet another area of interest is the study of the biochemistry of dental tissues (Hillson, 2002). Many contributors to this area of research come from fields outside of anthropology, notably dentistry, genetics, anatomy, and paleontology. It encompasses a broad range of subjects which, in turn, have finer levels of specialization. Some workers concentrate on developmental aspects of the dentition, from tooth germ formation to developmental defects of crown. Others focus on post-eruptive changes such as ordinary crown wear and culturally-prescribed dental modification. The study of dental pathologies, in particular caries, patterns of tooth loss, and periodontal disease, provides yet another avenue of research. Researchers interested in those elements of human dentition that have some underlying genetic basis of study of tooth size and morphology (Cadien, 1972).

Kirk (1973) has very rightly pointed out that the main purpose of the contemporary physical anthropology and human population genetic researches has been

to expound the nature and extent of biological variations in different human populations and the meaning of these differences in the understanding of the ongoing evolutionary process at both micro and macro levels. The systems used have been varying from time to time, and among the other systems regularly studied in this context, human dentition is of special interest and occupies important place. The special interest evinced on dentition may be due to its diachronic capability, to know about our species and racial origins, ease of direct comparison with living and also past human populations facilitating of a much greater time depth in micro and macro evolutionary investigations and number of synchronic proposes (Rami Reddy, 1986). Teeth being the hardest and most durable materials of all parts of the body due to the presence of enamel and dentine in them preserve well and hence account for a large proposition of the human and pre-human fossils remains available for study. The environment has revealed by many a study postulating modes of inheritance for different dental traits (Kraus, 1951; Turner, 1967). They are the least biased to subjectivity and hence greatly help in comparison and classification of populations as the biogenetic markers like blood groups, red cell enzymes, dermatoglyphics, etc. do. The different dental aspects of study which attracts the attention of human biologists are crown morphology, metrics, health, evolution, growth, genetics usage, forensic and ethnographic treatment, all of which can be used as research tools and areas of studies (Rami Reddy, 1986).

Dental anthropology is academically located within the human bone biology studies. Its main goal is to recognize attributes in the teeth form which can help us create bicultural dynamics of human populations, specially related to health–illness state,

feeding habits and micro evolutionary transformations, related themselves to the ethno genesis of current and ancient times. In Dental anthropology, teeth are used to obtain information on culture, health, diet, variability and evolutionary trends as well as eruption and dental pathologies in the past and modern populations.

Dental *eruption* is generally defined as the time when any part of the crown has emerged through the gingival surface (Rami Reddy, 1986).The term *emergence* refers to the moment any portion of the crown piers the gingiva. Actual penetration of the gingiva is merely a transitory stage in the total process of tooth eruption. It refers to the movement of a tooth towards its final occlusal position.

**Uses**

Dental anthropology much like those of other subfields of anthropology can be applied to the welfare of the mankind in the areas of dental development, pathology, morphology, forensic deontology and odontometry. The area of dental development can be used in the application of tooth eruption times and calcification standards in the nationwide nutritional survey, in the diagnosis and treatment of children with growth disturbances, in solving a number of orthodontic problems including malocclusion, in the age estimation of skulls of unknown age, in the evaluation of racial differences and primate evolution, in the determination of personal identity or individuality of persons involved in different crimes, accidents, explosions, etc. and tooth formation standards based on the study of crown and root development of teeth in clinical assessment of early or late dental maturity.

In the area of dental pathology, dental caries and periodontal disease are the most common oral problems of man. In view of the alarming increase in the prevalence rates of these diseases in the human populations, it is of outmost importance to study these diseases in relation to different demographic, socio-economic, environmental and hereditary factors to delineate standards and levels of health for the public health planner to devise and extend preventive and treatment services to the well being of one and all.

While the area of dental morphology is generally used in the understanding of biological history and racial classifications of human populations as also in micro-evolutionary studies, it is necessary to assess the incidence of malocclusion cases in relation to a number of genetic and non-genetic factors to plan and gear up treatment needs.

In the area of forensic deontology, teeth identification made by employing different methods and sophisticated equipment can be used linking the victim or the suspect to a particular crime /accident. Similarly, in the area of odontometry, standards of tooth size are applied in the personal identity or establishment of the individuality of a person, and also in orthodontic diagnosis and treatment. Norms of tooth size, dental arch, size and shape, tooth spacing and crowding obtained in relation to different variables can be used as a frame of reference to understand those of individual subjects viewed and their practical implications. It is urgently needed to undertake carefully planned research investigations into the dental anthropology of the people to obtain and standardize the findings for application to different situations concerning their oral health, forensic and related problems in India in general and Northeast India in particular. Tooth morphology

provides few clues as to age, sex, body size, elapsed time since death, etc., so its primary usage is in discerning the ethnic affiliation or race of an individual (Scott and Turner II, 2000).

**History and development**

In pre-Darwinian times, the nascent field of physical anthropology focused on human racial variation and classification. Teeth played almost no role in these early discussions, as workers focused on externally visible characteristics like skin, hair, eye colour, hair and nose form, stature, etc. By the end of the nineteenth century with few exceptions (e.g. P. Broca and crown wear, W.H. Flower and tooth crown size, L.H. Murrey and oral pathology) teeth had yet to enter anthropological consciousness in any significant way (Scott, 1997).

Dental anthropology began in the eighties of the eighteen century when physical anthropological investigations centered mainly round the analysis of the morphology of the skeletons and teeth, though as a subject of academic research, its importance was not recognized until 1900. The root of the dental anthropology lay in the seventies of the 19$^{th}$ century as shown by a number of investigations, when the subject got its breakthrough for the first time.

In 1927, Krogman published the first comprehensive review of research on the biology of extinct and extant populations. In 1927, Krogman published the first comprehensive review of research on primate dentition. This hundred page treatise, comprising an entire issue of the journal of dental research, should be considered a

cornerstone in the field. It is obvious that to Krogman (1927), dental anthropology included the study of dental growth, theories of dental origin, primate dentition and population variation.

Following Krogman's work, research on dental anthropology proliferated in numerous anthropological and dental research journals. In addition, there were a number of special journal issues, dissertations, monographs, and books developed to this subject (e.g. Moorrees, 1957; Brothwell, 1963; Wolpoff, 1971; Kurten, 1982; Reddy, 1984). In the American Journal of Physical Anthropology alone, annual report of the editorial notes that dental papers comprised about 11% of the total manuscripts submitted in 1985. This is not a new trend, but rather a continuation of interest that has existed since the early days of the journal.

While anthropology was very much alive on the individual level, there was no forum in which to communicate with others in the field to facilitate the exchange of ideas. The Dental Anthropological Association (DAA) was officially, created in 1986 during the American Association of Physical Anthropologists (AAPA) meeting in Albuquerque, New Mexico, and established the 'Dental Anthropology Newsletter' as its official publications. Since its inception, the DAA has sponsored symposia and scientific sessions where it exemplifies the diversity in dental anthropology, including interest in recent and archaeological populations as well as variation in methodological approaches and scientific results.

The term Dental anthropology first appears in the title of an article published in 1900 by George Buschan, although Klatsky and Fisher are credited with its formal

introduction. The field is rooted in French, German, and English encyclopedic mammalian deontological treatises of the past two centuries. That teeth poses qualities valuable for anthropological study (i.e. they are durable; evolutionary conservative and yet adaptable; rich with genetically determined traits; and reflective of behaviour, ecology, and diet) was recognized by such 19th century natural historians as L. Rousseau, G. Koch, J. Henle, and R. Owen.

In the early 20th century, scholars began to pay attention to teeth as an additional system that began to provide insight into human variation. Most of the emphasis was on human skeletal remains because techniques for making impressions of the living were limited. Ales Hrdlicka, who had access to an enormous sample of Native American skeletal remains at the Smithsonian Institution, was among the first to note interesting dental morphological distinctions between major human groups. In particular, Hrdlicka (1911, 1920) noted that American Indians were distinguished from other human populations by the development of pronounced marginal ridges on the lingual surface of the upper incisors (i.e. shoveling). W.K. Gregory (1922), in his opus the origin and evolution of the human dentition, also noted morphological attributes of recent humans, but he did not feel that intergroup variation was pronounced or significant.

Although Hrdlicka authored many books, he never wrote one devoted entirely to teeth. The task was left to other pioneers in this field, including T.D. Campbell (1925) in Austria and J.C.M. Shaw (1931) in South Africa. These workers studied the size, morphology, number, wear, and pathology of Australian aboriginals and South African black populations, respectively. Given the paucity of Comparative data, their books were

largely descriptive in nature. To complement these early dental monographs, other significant contributors during this period include R.W. Leigh's (1925) analysis of oral pathology under varied environmental conditions , W.M. Krogman's (1927) paper on anthropological aspects of human teeth , C. Nelson's (1938) study of the Pecos Pueblo population , and M.S. Goldstein's (1948) work on the teeth of Texas Indian crania. Other key contributions at this time were Percy Butler's (1937, 1939) articles on the field effect in the mammalian dentition one of the most influential papers in the history of dental anthropology, A.A. Dahlberg's (1945). "The changing dentition of man" applied Butler's concept of dental fields to human teeth, forever changing the minor in which anthropologists would analyze metric, morphologic, and numeric variation in the dentition.

P.O. Pederson's (1949), The East Greenland Eskimo Dentition, with its extensive set of observations on Inuit and a bibliography citing articles in a diverse array of languages, ushered in a new age for dental anthropology. At this time, following key theoretical developments that led to the modern evolutionary synthesis, anthropologists started paying more heed to genetics and process, and less to typology and classification. G.W. Lasker's (1950) paper "Genetic analysis of racial traits of the teeth" set the stage for new ways of thinking about the inheritance and utility of dental morphological variation. In the late 1940's, Dahlberg (1951) initiated a major dental casting project among the Pima Indians of Arizona. After modest beginning with plaster casts made from wax bite impressions, Al and Thelma Dahlberg went on to collect over 8000 Pima Indian

casts. From this foundation, Dahlberg was able to build up some of the first characterizations of the extant American Indian dentition.

The 1950's saw a flurry activity in the anthropological uses of the teeth C.F.A. Moorrees (1957) published The Aleut Dentition, which covered all facets of dental anthropology, from size, morphology, and number to pathology and oral tori. T. Murphy (1959a, 1959b) developed new standards for scoring tooth crown wear based on the pattern of dentine exposure, a scheme that provided for more information on wear than the Broca scale of the late 19th century. Lasker (1957) discussed the potential uses of dental morphology in the interpretation of forensic remains, while Bertran Kraus (1951, 1957; Kraus and Jordan, 1965; Kraus et.al; 1959) conducted pioneering work in dental genetics and odontology. S.M. Garn, along with his colleagues at the Fels Institute, began publishing dozens of articles that focused on dental variation, development and interactions between variables.

Although the term "dental anthropology" had been used earlier, one of the crystallizing events of the field was the publication of Dental Anthropology, edited by Don R. Brothwell (1963). This work emanated from the Symposia of the Society for the Study of Human Biology. A perusal of the contents is telling. Of 15 contributions, 3 dealt with primate teeth, 1 with fossil hominid teeth, and 11 with recent human populations. That balance approximates the overall focus of dental research during the middle of the 20th century.

Following the publication of dental Anthropology, the field greatly expanded in terms of practitioners and publications. From 1963 to the present, many articles and

dissertations have dealt with various aspects of the human dentition. Topical trends include an ever increasing emphasis on methodologically standardized studies of tooth crown and root morphology dimensions, increased interest in oral health concerns, especially the negative impacts of agriculture, and a greatly expanded interest in the study of developmental stresses measured by growth defects, in particular linear enamel hyperplasia. The International Symposium of Dental Morphology, which met in 1965, would meet on regular basis across the next decades, leaving in its wake a number of significant edited volumes that highlighted current research on dental ontogeny, genetics, and variation (Butler and Joysey, 1978; Dahlberg, 1971; Kurten, 1982; Mayhall and Heikkinen, 1999; Pederson *e .al.*, 1967; Radlanski and Renz, 1995, Russel *et al.*; 1988; Smith and Tchernov, 1992; Zadzinska, 2005).

Recent development in the fields, since 1991 ,there has been at least 3 broadly influenced developments in the fields (1) the Dental Anthropology Association founded in 1986,enlarged the size of the its small Newsletter, changed name to Dental Anthropology, and adopt at the standards and styles of a professional journal, all carried out under the editorship by Alice M.(Sue) Haeussler, (2) English translations were made for the large and largely unread body of dental anthropology studies written in Russia , and a dental anthropological research programme was initiated in the People's Republic of China, (3) the publication of several books designed to be used as textbooks, as well as scientific references, in dental anthropology. There are, of course, many other advances since 1991, including increased course offerings in dental anthropology in a number of universities and colleges, continued publication of the assembled papers for the

International Dental Morphology meetings, development of new methods, descriptions of new fossil dentitions, and new synthesis on human and non-human dental variation, among other subjects.

**Dental Eruption**

Dental age, like skeletal age and secondary sex character age, is useful for the assessment of biological age, the significance of which has been greatly recognized in the diagnosis and treatment of children with growth disturbances (Tanner, 1962). It can be estimated from data on tooth eruption in such situation where it is highly difficult to estimate chronological age on the basis of historical events. A proper estimation of the dental age can be accomplished only by reference to standards established on the population of which the subject is a member living in the same environmental conditions. If a large sample is studied, possibly from racial group, one can establish either a trend, a constant, or a distribution within that sample of sufficient reliability to justify its application to that group as a whole so that it could be distinguished from other populations (Reddy, 1986).

The process by which the crown of the developing tooth passes through its interrosseous surroundings and is maintained in normal occlusion within the oral cavity is known as tooth eruption. Tooth eruption is generally defined as the time when any part of the crown of the tooth has emerged through the gingival surface. In the words of Rabinow (1973), "... dental maturation is a continuum, comparable to skeletal maturation. One may calculate dental ages through the entire growth period, from foetal life to adolescence, by accessing stages of tooth formation, crown calcification, root

development and eruption status from appropriate roentgenograms (oblique jaw views or pantomograms) and comparing the developmental status of each tooth with appropriate norms".

The age and order of eruption of deciduous and permanent teeth show as much marked variation between one individual and the other as among the different racial groups within the same region or outside. As such Hellman (1923), six decades ago, remarked: "The arrival of a comet which makes its appearance once in many years, can be accurately calculated to a small fraction in time, but notwithstanding the inestimably greater frequency with which the event of eruption occurs, the appearance of a tooth defines accurate forecast", which is perhaps valid even today. Therefore, one can establish a trend or a constant if a larger sample is studied from a racial group.

Unlike in permanent teeth eruption times there is no significant difference in the eruption times of deciduous teeth in children of same physical health in many ethnic groups as well as between males and females, through the role of genetic factors has been shown by twin studies.

After the crown and part of the root are formed, the tooth penetrates the mucous membrane and makes its entry into the mouth. Further formation of root is supposed to be an active factor in pushing the crown towards its final position in the mouth. Eruption of the tooth is said to be completed when most of the crown is in evidence and when it has made contact with its antagonists in the opposing jaw. Eruption may and usually does continue after this; i.e. more of the crown may become exposed and the tooth may move further occlusally to accommodate itself to new conditions.

**Permanent dentition**

The permanent sets of teeth which are 32 in number are larger in size and continue to function throughout the life span of an individual if well cared. These teeth start eruption, generally, from the age of 5.5 to 6 years and have fully erupted and come into occlusion by the age of 21 years or so. All the deciduous teeth are replaced by the permanent teeth during the age of 6 to 13 years. The care of deciduous teeth is equally important as care of the permanent teeth because they not only function in the early childhood but they also act as guides to permanent (development) successors as well as help in proper development of the jaws. The diseases which affect the deciduous teeth could also be passed on to the permanent teeth.

The transition to the permanent dentition begins with the emergence and eruption of the first permanent molars, shedding of the deciduous incisors, and emergence and eruption of the permanent incisors. After the shedding of the deciduous canines and molars, emergence and eruption of the permanent canines and premolars, and emergence and eruption of the second permanent dentition is completed except for the third molars. This process requires about 20 years to complete. The permanent or succedaneous teeth replace the exfoliated deciduous teeth in a sequence of eruption that exhibit great variety. The number of teeth in adults, including third molars when present, is 32.

The permanent dental formula in human is:

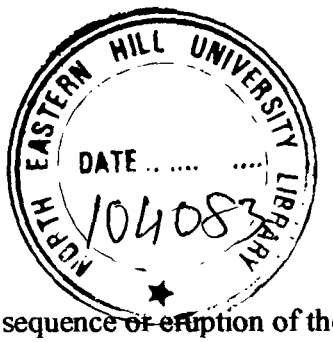
$$\frac{2}{2}\,I \;\frac{1}{1}\,C \;\frac{2}{2}\,P \;\frac{3}{3}\,M = 16$$

In a clinical notation system for the permanent dentition, the maxillary teeth are numbered from 1 to 16, beginning with the right third molar. Beginning with the mandibular left third molar, the teeth are number 17 through 32. Thus, the right maxillary first molar is designated as 3, the Maxillary left central incisor as 9, and the mandibular right first molar as 30. The entire dentition is designated by the notation:

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 |

The usual order in which the permanent teeth appear is as follows:

1. First Molars
2. Mandibular Central and Lateral Incisors
3. Maxillary Central Incisors
4. Maxillary Lateral Incisors
5. Mandibular Canines
6. First Premolars
7. Second Premolars
8. Maxillary Canines
9. Second Molars
10. Third Molars.




It has been suggested that a certain sequence of eruption of the teeth is considered to be favourable to the development of a normal occlusion.

**Dental Caries**

Dental caries or tooth decay and pyorrhea or periodontal diseases are the commonest diseases of the mouth. The former being the disease of the tooth proper and the later, that of the supporting structures of the tooth. Both these diseases have afflicted not only the human races all over the world since pre-historic times up-to-date but also the non-human primates.

Dental caries is a pathological condition of the teeth resulting in the decalcification of the dentine or enamel and the disintegration of the remaining organic material often leading to the loss of the teeth and occurs in association with other conditions such as periodontal disease, which causes recession of the alveolar bone resulting in loosening of the teeth and their subsequent loss; dental enamel hypoplasia, which is a developmental enamel defect is the deciduous and permanent teeth seen as transverse lines, pits, and grooves on the enamel surface; ante-mortem or tooth loss; and attrition, which is the gradual wearing away of the hard parts of the teeth.

The IDF (International Dental Federation) Commission on Classification and Statistics for Oral Conditions (COSTOC) in its recommendation to the World Health Organization, on the classification of epidemiologic studies of dental caries and definitions of related terms (1975), defined dental caries "as a localized, pathologic process of bacterial origin, that results in the demineralization of the hard tooth structures

and progression to cavitations. Caries, being a disease process, starts with a microscopic cavity. The term 'caries' designates 'decay of animal tissue'. Hence, it is necessary to specify tooth decay as dental caries ...". It is characterized by the molecular decay of bone softening the enamel and dentine in which it becomes thin and dark and usually breaks down with the formation of pus. It is generally held that there are micro-organisms of the type *Lactobacillus acidophilus odontolycticus* in the mouth which are carcinogenic in nature and produce acids by acting on food debris lodging around the teeth. These acids largely dissolve the hard tissues of the teeth leading to dental caries. German scientists named Leber and Rottenstein in 1867, and Underwood and Mills in 1881, propounded the Acidogenic theory based on the experiments conducted on animals. Experiments confirmed this facts, because the existence of micro-organisms in man's mouth is necessary to ensure the physiological functions in the body, although it is still unknown which type of micro-organism or virus is responsible for the disease as many kinds of them produce acids under varying circumstances ranging from neglect of oral hygiene to sugar containing food debris. Miller (1983) through his classic work made the explanation of the etiology of dental caries widely acceptable which according to him, was known as "Chemico-parasitic theory". There are other theories too such as the Proteolytic theory of Boedecker and Gottlieb, and also the Proteolysis-Chelation theory of Isenberg, Martin, Shatz and others put forth in 1950s on the etiology and pathogenesis of caries, which did not convince the scientific world.

James (1979) lists a number of contributory factors causing tooth decay which he divides into two broad categories namely- intra-oral and extra-oral causes. Included in the

intra-oral causes are the dental plaque consisting of food and bacteria in a creamish film sticking to the teeth; anatomy of the tooth – shape, form and structure; position of the teeth; dental appliances and restoration; and lack of saliva flow. The extra-oral causes are hereditary; high sugar intake, nutritional deficiency in calcium, phosphorous, fluorides, vitamins A, C and D and proteins, soft foods, and bottle feeding. Laus (1981), however, reduces them only to four to five well known factors which cause dental caries; low fluoride levels in drinking water, food products containing large quantities of sugar, bad childhood health in general, inadequate quantities of saliva and disturbance of its optimal composition. Hereditary predisposition of dental tissue to caries appears to be another factor. The most important factors that contribute to the disease are consumption of food products with increased quantities of sugar and fluoride-lacking drinking water. When the disease acquires a high degree of severity the affected individual finds it difficult to eat and swallow and at times resulting in speech problems and fever.

First of all, there is a loss of polish and translucency of the tooth surface, i.e. it changes the colour from white to brown or black. The area becomes soft and porous and the food starts getting lodged into it. The person becomes sensitive to cold and hot drinks and sweet and sour things. It gives mild to severe toothache depending upon the nearness and involvement of the pulp. The tooth becomes tender and is not able to chew food with it. In Sushruta Samhita the symptoms are described thus: "The tooth becomes loose and perforated by black holes accompanied by a copious flow of saliva. The appearance of an extremely diffused smell with a sudden aggression of the accompanying pain without any apparent cause is also one of its specific features". Once the pulp is involved, it becomes

a passage for the oral micro-organisms to travel into the bone, smelling appear into that area and other complications of inflammation follow.

Caries of the teeth could be acute or rampant when the susceptibility is very high. Almost all surfaces are affected. Even the very immune areas, viz. the cervical and proximal surfaces of mandibular incisors are involved. The other type is chronic or slow growing. It may involve one tooth or a group of teeth at the same time. There is another type called arrested, where further progress of caries does not take place because the area had become self-clean sample and secondary detain has formed.

It has been labeled as a disease of the Western countries but this is not true. It is very much prevalent in our country. Different surveys conducted in this country reveal that the incidence is on the increase in the developing countries. More and more children are affected by it. It is second important disease next to pyorrhea for loss of teeth in Indians. Tylor and Marshal Day observed in 1939 a low incidence of caries in Kangra Valley. Marshal Day and Tandon (1940) from another group of children in Punjab recorded that caries was much less than in American children. Shourie (1941) made a comprehensive survey of children from various parts of India. He reported that 44.5% of the children were free from caries which was considered to be much higher than that recorded in children in England and U.S.A. The incidence of caries in deciduous teeth was higher in girls than in boys. Urban children in all age groups showed more caries than the rural children. Thereafter, a number of surveys carried out by Vacher (1952), Mangi and Jalili (1961) showed the caries incidence to be on the increase.

## Oral Pathology

### Periodontal disease

Periodontal disease is the most common oral health problem of man and also a major problem in modern dental practice. Palaeopathological studies indicate that man has been subject to periodontal disease since prehistoric times, and our earliest historical records reveal an awareness of periodontal disease and need for treating it.

Periodontal disease was the commonest of all disease which there was evidence in the embalmed bodies of the Egyptians of 4000 years ago. Oral hygiene was practiced by the Sumerians of 3000 B.C., and elaborately decorated golden toothpicks found in the excavations at Ur in Mesopotamia suggest an interest in cleanliness of the mouth. In the oldest known Chinese medical work, written about 2500 B.C. by Hwang Fi, oral disease is divided into three types, as follows: 1) Fong Ya, or inflammatory conditions; 2) Ya Kon, or diseases of the soft investing tissues of the teeth; 3) Chong Ya, or dental caries. Gingival inflammations, periodontal abscesses, and gingival ulcerations are described in accurate detail. One gingival condition is described as follows: "The gingivae are pale or violet red, hard and lumpy, sometimes bleeding; the toothache is continuous". Herbal remedies, "Zn-hine-tong", are mentioned for the treatment for these conditions. The Chinese were among the earliest people to use the "chew stick' as a toothpick and toothbrush to clean the teeth and massage the gingival tissues.

Among the ancient Greeks, Hippocrates of Cos (460-335 B.C.) was the father of modern medicine, the first to institute a systematic examination of the patients pulse,

temperature, respiration, secretion, sputum and pains. He discussed the function and eruption of the teeth and also the etiology of periodontal disease.

Among the Romans, Aulus Cornelius Celsus (first century A.D.) referred to diseases which affect the soft parts of the mouth and their treatment as follows: "If the gums separate from the teeth, it is beneficial to chew unripe pears and apples and keep their juices in the mouth". He described looseness of the teeth caused by the weakness of their roots or by flaccidity of the gums and noted that in these cases it is necessary to touch the gums lightly with a red hot iron and then smear them with honey. The Romans were very interested in oral hygiene.

Rhazes (850-923), an Arabian of the Middle Ages, recommended opium, oil of roses, and honey in the treatment of periodontal disease. To strengthen loosened teeth he recommended astringent mouth washes and dentifrice powders. He described a procedure of scarification of the gingiva, and strong counterirritants in the treatment of disease of the gums.

In the fifteenth century, Valescus of Montpellier (1382-1417) stated that in order to treat disease of the gums, tartar must be removed little by little either with iron instruments or with dentifrices. In the fourteenth century and fifteenth centuries references is also made to white wine, roasted salt, and aromatic substances as adjuncts in periodontal therapy.

With the beginning of the eighteenth century dentistry developed the early signs of scientific curiosity which were the precursors of present day research disciplines.

Pierre Fauchard (1678-1761), the father of modern dentistry, in the first and second editions of his epochal treatise "Le Chirurgien Dentiste" discussed many aspects of the subject of periodontology. He described chronic periodontal disease as a "kind of scurvy" which attacked the gums, the alveoli, and the teeth.

With the beginning of the twentieth century there developed a prolific group of clinicians and scientists throughout the world with a major interest in the periodontal field.

The periodontium is the investing and supporting tissues of the tooth, and consists of the periodontal ligament, the gingiva, cementum, and alveolar bone. The cementum is considered a part of the periodontal ligament. The periodontium is subject to morphological functional variations as well as changes with age.

Pyorrhea or periodontal disease unlike dental caries is the disease of the periodontium or the supporting structures of the teeth namely the gum, alveolar bone, periodical membrane and cementum. Inflammation and dystrophy are the two ways by which the disease of the periodontium occurs. Inflammation of the gums or gingiva results in gingivitis manifested as change in colour, enlargement, bleeding, puffiness, friability, ulceration or sloughing. Gingivitis is the first stage of the periodontal disease when the gums are affected. Accumulation of tartar (calculus), the scaly yellowish or brownish hard chalk-like substance that forms at the gums around the teeth, is the most common cause of gingivitis, others being the bacterial infection, acute necrotizing ulcerative gingivitis, mouth-breathing habit, axis and contour of the teeth, faulty dental fillings, presence food particles between the teeth, abrasions, cuts, fingernail and fishbone

injuries, puberty and pregnancy periods, skin disease, syphilis, tuberculosis, leukemia or blood cancer, vitamin C deficiency, etc. Periodontal disease or periodontitis is the extension of gingivitis when inflammatory conditions spread to deeper structures leading to characterized by degenerating factors affect the gums and periodontium resulting in the fall of certain teeth. Thus periodontal disease, which is also widespread a disease as dental caries, leads to tooth loss, bad smell tooth spacing, deterioration in the general bodily health, etc.

The term periodontal disease has receive different meanings and is used rather ambiguously. It is used in a general sense to encompass all diseases of the periodontium in much the same way as are terms such as live disease and kidney disease. It may be considered synonymous with periodontopathia, although this term is not in current use.

Periodontal disease may be of different types. The most common by far is also called periodontal disease; in old text-books and papers it was called pyorrhea, periodontoclasia, periclasia, etc. This disease is initiated by plaque accumulation in the gingivo-dental area and is basically inflammatory in character. Initially it is confirmed to the gingiva and is termed gingival disease, later supporting structures become involved and the disease receives the name of periodontal disease. The term chronic destructive periodontal disease, which very accurately describes the condition, was used.

| Periodontal disease | Periodontal disease | Chronic destructive periodontal disease | Periodontitis |
|---|---|---|---|
| (Synonym not *currently used:* periodontopathia) | Other disease of the *periodontium* | *Gingival disease* | Trauma from *occlusion*<br><br>Periodontal atrophy |

The above classification illustrates the different meanings currently assigned to the term periodontal disease.

The terminal effect of periodontal disease observed in adults has their inception earlier in life. Gingival disease in childhood may progress to jeopardize the periodontium of the adult. The increasing awareness of the prevalence of gingival and periodontal disease in children, coupled with the need for more information regarding the early stages of periodontal disease, have focused attention upon the periodontium in childhood.

Gingivitis, inflammation of the gingiva, is the most common form of gingival disease. Inflammation is almost always present in all form of gingival disease because of the bacterial plaque, which cause inflammation and irritational factors that favour its accumulation and are very often present in the gingival environment. The inflammation caused by dental plaque gives rise to associate degenerative, necrotic and proliferation changes in the gingival tissues.

The role of inflammation in individual cases of gingivitis varies as follows:

i). Inflammation may be the Primary and only pathologic change. This is by far the most prevalent type of gingival disease.

ii). Inflammation may be a Secondary feature, super-imposed upon systematically caused gingival disease.

iii). Inflammation may be the precipitating factor responsible for clinical changes in patients with systematic conditions that of themselves do not produce clinically detectable gingival disease. Gingivitis in pregnancy is an example.

The most common type of gingival disease is the simple inflammatory involvement caused by bacterial plaque attached to the tooth surface. This type of gingivitis, sometimes called chronic marginal gingivitis or simple gingivitis, may remain stationary for indefinite periods of time or may proceed to destruction of the supporting structures (Periodontitis).

## Dental Morphology

### Supernumerary Teeth

Supernumerary teeth or hyperdontia are extra teeth beyond the normal number unlike hypodontia or decrease in the number of teeth both representing numerical variations in the teeth. Supernumerary teeth of the present study cab be found in any location in the dental arch but are generally observed outside the dental arch. They are known to cause a considerable amount of dental disturbance by interfering with the

growth, development, and eruption and arrangement of the normal teeth. There may be certain supernumerary teeth which remain unerupted and block the eruption of other teeth, the presence of which can be highlighted only by X-rays without which it becomes highly difficult to decide which teeth are supernumerary and which represent normal dentition.

The supernumerary teeth are either peg-shaped or have a larger crown. They have often been considered as atavistic in nature indicating an ancestral or primitive pattern. They may be present on one side of the mouth and in line with the other teeth. Sometimes, these are hereditary with a higher frequency occurring in the maxilla. Usually, these are found in the premolar and molar regions in the deciduous as well as permanent dentitions. They occur in all human races in varying proportions. They also have been reported in non-human primates such as gorilla (4.4%), chimpanzee (2.9%), orangutan (6.8%) and gibbon (0.7%) as revealed by Colyer and Sprawson (1944).

**Carabelli's Cusp**

The cusp of Carabelli's is an accessory cusp that develops as an elevation or tubercle on the lingual surface of the mesiolingual cusp (protocone) or surface of the maxillary molars particularly the first one. The trait was first detected and described by Von Carabelli in 1842 since when it gained much importance as a 'marker' for differentiation between populations of different ethnic origins. Besides, it is also used in the phylogenetic studies. In the opinion of Lasker (1950) the anomaly of Carabelli appears to be an inherent constitutional variable in man and other primates. Its occurrence has been traced back to Paleolithic man particularly in Europe.

The trait shows considerable variation in its occurrence, size and location as known from a number of published works of different authors. The highest frequency of this trait occurs in the deciduous second molar followed by the permanent first, second and the third molars. The trait varies in size from a small furrow or groove or line to large cusp with a triangular tip; the intermediate form between these two extremes are a pit, a y-shaped furrow, a slight protuberance, and a small cusp often found with a furrow. The former two structures namely the furrow and pit are called as negative cusp while the latter two, protuberant and cusp formed structures are described as positive cusps. The trait may occur unilaterally and bilaterally. Regarding the location of the trait, it may be stated that the cusps occurs on the mesial half of the lingual surface of the deciduous second molars and permanent first molar whereas on the permanent second molar the structure is more distally located.

**Shovel-Shaped Incisors**

The term shoveling, first introduced by Muhlreiter in 1870 according to El-Najjar and Mc Williams (1978), is used to described a condition resulting from a combination of a concave lingual surface and elevated mesial and distal marginal ridges enclosing a central fossa in the upper and lower incisor teeth. It also occurs on the monocuspid canines when their mesial and distal lingual marginal ridges produced the shovelled contour. Hrdlicka (1911) who has done pioneering work in the area of dental anthropology reported pronounced shovelling in the incisor teeth of the American Indians. In the years 1920-21, he found the highest incidence of this trait in the incisors of different Mogoloid groups-Chinese, Japanese, Eskimos and American Indians whereas in

Negroes the population was lower and among the Caucasians the lowest. These findings of Hrdlicka were later confirmed by the works of a number of scholars, Nelson (1937-1938); Golstein (1948); Pedersen (1949); Dahlberg (1945 and 1949) showing that the shovel-shaped teeth are characteristics of the Mongoloid stock. The existence of this trait has been found in the Peking Man (*Sinanthropus Pekinensis*) by Weidenreich (1937) who suggested genetic continuity of the trait from the fossil human ancestors of China to the modern Mongoloid populations. Lasker (1950) found these teeth in 14% of White Americans studied by him. He noticed no difference in the incidence of the trait between central and lateral incisors but in the latter teeth, the character has been observed to be predominantly more pronounced. In the natives of Eastern Islands of New Guinea, Barksdale (1972) noticed the trait in only 6 percent of the samples. Campbell (1925) held that the character was not a frequent one in the Australian aboriginals.

**Diastema**

Diastema is a space or gap present between the maxillary central incisors or between the maxillary lateral incisors and canines. The former one is called median diastema which is more frequently observed in the maxilla. While the second type, the lateral diastema is occasionally combined with lack of or a reduction in the size of the lateral incisors. The lateral diastema is similar to its counterpart found in anthropoid apes and certain fossil men in which the mandibular canine, being large, needs space or diastema between the maxillary lateral incisors and canine. The diastema may be broad or narrow.

**Crowding**

Crowding is another nonmetric trait which is complex in nature. There is unanimity as to whether this trait which is prominent in modern man, as an inherent constitutional variable, Lasker (1950), but the fact is that the crowding of teeth results due to the inheritance of large teeth from one parent and small jaw from the other, which are determined before birth. This is unlike in the case of spacing which occurs between teeth when the jaw is large and teeth are small. Thus, the existence of crowding as also spacing indicates that the tooth size need not be in complete accord with the jaw size. According to Cadien (1972) "extreme crowding of teeth probably is not an advantageous condition, so selection may be operating to reduce it". Therefore, Crowding, one of the many causes for malocclusion, may be considerably influenced by genetic as well as environmental factors.

The dental anomaly which is known for its significance in understanding human evolution is most neglected in population studies in India or outside. The only study known to the writer is that of Boyd (1972) among the natives of Eastern Highlands of New Guinea who have shown crowding to the extent of 34.4% cases in mandible and 26.1% cases in maxilla in sample of 218 dental casts of natives. There were only nine cases with marked crowding in which the arch length was found to be greater than 5 mm. Mandibular crowding has been found to be significantly greater in these natives. Boyd in an attempt to relate crowding to tooth size computed the mean mesiodistal tooth measure from second molar to second molar in each arch for the natives and found a progressive

increase in tooth size as crowding becomes more severe. On the whole, the absolute tooth size was found to be greater in subjects with crowding than in those with spacing.

**Cingulum or Lingual Cusp**

El-Najjar and Mc Williams (1978) following black and wheeler define Cingulum as "the lingual cusp known of an anterior tooth. A self or swelling which is found on the tooth just above the cervical line is the site of the development of many supernumerary cusps". According to Segal (1963), "the ridge found on the lingual lobes of the incisors and the canine is termed the 'cervical ridge', or the 'cingulum'. It is more specifically in the cervical portion of the lingual surface. It may be present as a prominence in the cervical one-third of the deeply concave, lingual surface of the upper and lower, central and lateral incisors of the permanent as well as deciduous dentition. In shape, it may be just the highest area at the junction of marginal elevation or it may extend tongue-like into the concavity of the lingual surface. It may be simple or divided by the furrows into two or more smaller cusplets, Sicher(1965).

This dental tubercle is separate from the Shovel-shaped form of the incisors but the detection of this character becomes difficult when the marginal ridges come in contact with each other. This is also a primitive characteristic which helps in highlighting the racial differences between populations of different biological origins. The only work available in the literature is that of Pedersen (1949) among the East Greenland Eskimos for whom no percentage of the incidence of the cusp is given. Latter Barksdale (1972) reported the occurrence of lateral incisors with lingual cusps or Cingulum in 18% of the

casts of the Eastern Highland natives of New Guinea studied. No data are available on pedigree studies at all.

**Occlusion**

Dental occlusion is the relationship between the masticatory surface of the maxillary and mandibular teeth, when the mouth is closed. Individuals with correct or normal occlusion have their teeth of either jaw arranged in well-formed arches, elliptic maxilla and parabolic mandible, presence of contact between individual teeth and between each tooth of one jaw with two teeth of opposing jaw barring the mandibular central incisors and maxillary wisdom teeth, all forwardly placed mandibular teeth but central incisors, smaller arch than the upper one to facilitate the occlusion of the former inside the latter showing the upper incisors covering the lower incisors and the coincidence between the two jaws in the midline.

The normal or excellent occlusion of the natural dentition described above is not a fixed or static condition due to the changing cultural environment of man in space and time and any deviation or failure from the norms, or when the biting surfaces do not meet correctly, it makes the occlusion defective which is termed as malocclusion to differentiate it from the normal occlusion. The term malocclusion is ill-defined and biased, Corruccini and Whitley (1981) since it does not necessarily cause a functional problem, Moorrees *et al.*, (1971). Therefore, majority of the people prefer to speak of "occlusal variation" rather than using the word malocclusion.

The irregular occlusal variation or the so-called malocclusion is caused by hereditary or environmental factors. Those scientist or orthodontists who emphasize the role of genetics in the causation of malocclusion have not totally ignored the environmental causes. They, however, emphasize such factors as finger or thumb-sucking, mouth breathing, abnormal muscle patterns, inadequate masticatory function, abnormal swallowing patterns, and premature loss and over retention of milk teeth apart from a number of hereditary factors such as large teeth and small jaws, abnormal skull growth, cleft palate, ill-developed soft tissues like short upper lip and abnormally large tongue, deviation in the eruption times and the pattern of teeth etc. and certain diseases like rheumatoid arthritis and rheumatic fever of childhood affecting jaw growth in the areas of condyles forming part of temporo-mandibular joints; decrease or increase in the number of teeth; diseases and injuries; endocrine dysfunction, forceps delivery and so on.

# CHAPTER-II

## REVIEW OF LITERATURE

## DENTAL ERUPTION

Data pertaining to tooth emergence in populations of India are scanty. In India most investigations have been concerned with eruption of teeth. Shourie (1946) conducted pioneering work on the South Indian boys and girls. Nanda and Chawla (1966) studied middle socio-economic class and school children in Lucknow. Tooth eruption among school going Punjabi boys and girls in Chandigarh has been studied by Saini (1972), Saxena (1972) and Kaul *et al.*, (1975) and, among Punjabis of Patiala by Sidhu and Gupta (1973). A study on eruption times of permanent teeth in the poorer socio-economic class school children of Kullu valley in Himachal Pradesh was carried out by Bhasin *et al.*, (1977). Rami Reddy (1981, 1982a) undertook dental studies on children of different caste groups of Gulbarga, Karnataka. The time of tooth emergence has been reported by Kaul and Prakash (1982) on Jats of Haryana, on Bengalee boys and girls by Banerjee *et al.*, (1984). Kaul and Pathak (1988) attempted the estimation of age from the total number of permanent teeth emergence in Punjabi children.

Though teeth eruption has been the subject of interest since centuries to scholars from various disciplines, it was not until recently that systematic and extensive studies have been made on it by several workers providing as much dependable results as possible.

Jelliffe and Jelliffe (1973), presented cross-sectional, longitudinal and hospital data on different ethnic groups from different parts of the world aimed at evaluating the feasibility of age grouping by dental assessment, and association between nutritional

status and timing of deciduous dental eruption and suggested that severe PCM (Protein Calorie Malnutrition), may lead to delay in teeth eruption.

Data pertaining to tooth eruption in population of India is scanty. The pioneer work in this regard was carried out by Powell (1902) in Bombay. This study was an attempt to define the range of variation rather than to estimate the mean age of eruption of teeth.

Reddy *et al.*, (1985), studied the eruption of deciduous dentition among the Velama of Southeastern Andhra Pradesh and found that the onset of tooth eruption occurred at the same age in both sexes, their completion was found to occur earlier in males than in females, and also children belonging to upper and middle income groups were found to have full complement of teeth at the lower ages compared to the lower income group. Singh and Singh (1995) explored the patterns and ages of primary dental eruption of Khatri children of Punjab. They observed that the Khatri boys and girls follow a pattern of eruption which is of universal in character. Their study further shows that the teeth in the upper and lower jaws do not differ in respect of the ages of eruption. The eruption of mandibular incisors is earlier in girls than in boys.

Saran (1993), reported that the first molars erupted in the age group of 4 to 5 years and the time of eruption of the third molar teeth is uncertain among the Christian Oraons of Ranchi district, Bihar.

Chhabra *et al.*, (1993), examined the sequence and eruption time of permanent teeth among the Punjabi boys and girls in a comparative perspective. The sequence of

eruption is M1, I1, I2, P1, C, P2 and M2 in upper jaw and in lower jaw C (canine) erupted earlier than P1.

Jaswal (1983) carried out a study on the age and sequence of permanent tooth emergence among the Khasi children of Shillong, Meghalaya.She observed that, tooth emergence in females was markedly earlier than in males. Limbu (1996) reported a similar trend among the Gallong children of Arunachal Pradesh as reported among the Khasi children by Jaswal.

Though there are reports on permanent tooth eruption among tribal children in India such as Gaddi Rajput males of Dhaula Dhar Range of Himalaya by Singh (1980), but report on such study is scanty among the tribal community of Northeast India.

## DENTAL PATHOLOGY

**A. Dental Caries**: The IDF (International Dental Federation) Commission on Classification and Statistics for Oral Condition (COSTOC) in its recommendation of the World Health Organization, on the classification of epidemiologic studies of dental caries and definitions of related terms (1975), defined dental caries "as a localized, pathologic process of bacterial origin, that results in the demineralization of the hard tooth structures and progression to cavitations".

Though there is a variation in the prevalence patterns of dental caries from time to time, from country to country and from region to region within a country, the fact is that the disease has afflicted all the nations of the world.

Barmes (1981) on the basis of epidemiological studies distinguishes five levels of dental caries prevalence: very low, when the decayed or missing teeth are a few, low, moderate, high, and very high, when the number of carious or missing teeth is quite high. He reports from a recent study made on children age 13-14 years that the levels of dental caries ranges from moderate to very high in a number of developed countries. In certain highly industrialized countries like Japan, prevalence of dental caries has shown an increasing trend, whereas in the developing, countries it is very low level.

In 1932, Goldstein reported presence of very low proportion of caries among the Eskimos. The same author in 1948 reported a fairly higher incidence of caries among the Texas Indians. Godavari *et al.*, (1960) studied the incidence of dental caries among school children in Bang Chan, Thailand and observed the low incidence. One of the reasons of this low incidence of caries was low intake of sugar. Kalvani *et al.*, (1960) studied a group of provincial Thai children and they found that the prevalence of dental caries was less in the rural areas where less refined carbohydrates and more fruits and vegetables and glutinous rice were eaten.

Alvarez *et al.*, (1988) carried out a cross-sectional study on evaluation of dental caries in primary teeth and nutritional status of Peruvian children from low socio-economic conditions and found 49% were found to be chronically malnourished, and nutritional deficits that lead to not only tooth exfoliation but also susceptible to caries attack later in life.

The prevalence of this disease was studied by few people in India. Shourie (1946) has shown a marked rise among the Punjabis of Lahore. Anadi Pal (1983) examined the

incidence of dental diseases like caries, tooth loss, alveolar abscess, etc. among the Negritos of Andaman Islands and found that extremely low rate of dental abscess reflects that the Negritos were devoid of any form of periodontal diseases. Very low incidence of caries suggests that the traditional diet of the people was mostly free from carbohydrates items. Complete absence of the exposure of the pulp cavity through dental attrition points towards a softer food habit. Reddy et al., (1985) studied the prevalence of dental caries among the Balijas of Tirupati town of Andhra Pradesh, aged between 20-40 years and found that 44% of the individuals were found with caries, females (49%) were found to be more prone to this than males (38.5%).

Basha *et al.*, (1998) studied dental caries and fluorosis among Muslims of low, middle and upper income groups of Kurnool district, Andhra Pradesh. The study reports prevalence of caries is about 38.6% of the overall sample with considerable variation between age, sex, income and habit. The study further reports how caries correlates with fluorosis in rural and urban situation. Venugopal *et al.*, (1998) examined prevalence of caries among the children of Mumbai between age group 1 year and 14 years and found 35.6% had dental caries. Parental income was not to have any bearing on caries prevalence, but parental literacy, particularly maternal literacy was shown to influence caries prevalence in children. The study also shows that prevalence was low in well-nourished and in those taking vegetarian type of diet.

Ghoshmaulik and Devi (1999) studied the relations between dental caries and a few genetic markers and salivary factors, among the Oriya speaking Hindu populations living in Bhubaneswar. The study reports nearly 43% of the sibs were affected with

caries and concluded that dental caries seem to have biological predisposition. Chronic illness of digestive tract, parasitic infection of intestine, persistent throat infection etc. are likely to produce acidic oral fluid, which may be accentuated by antigenic affinity present in the saliva. Cultural habits like chewing of betel nut or unhygienic method of tooth care, sweet and tobacco consumption etc. are added factors.

Saravanan *et al.*, (2005) conducted a study among the children of 5 years of both the sexes in Pondicherry urban area by random selection .They found that the prevalence of caries to be 44.4% among the population, being higher in boys.

**B. Periodontal disease**: Studies on periodontal diseases have conducted in a fair number of populations outside India. King (1940), studied children of Isle of Lewis, age group 6 and 15 years and observed that 90% of them were affected by the periodontal disease. Greene (1960) found 92% of the school boys in low socio-economic area in Atlanta, Georgia are suffering from periodontal disease. Zimmerman and Baker (1960) studied prevalence of periodontal disease among the White children from Maryland, Negro children from Texas and White children from Texas and found 35%, 67% and 79% respectively.

Among the Indian populations few studies on periodontal diseases have been reported in literature. Marshall-Day (1944) studied among the low economic class boys of the Kangra district in India and observed that the prevalence of periodontal diseases is 81%. Dutta (1965) reported that the prevalence of periodontal diseases among the school going children of Calcutta are found to be 89.80%. Varidana *et al.*, (2007) carried out a study on Denagre district of Karnataka and found that gingivitis and periodontal disease

are more common in females than in males and as the age advance reduces, periodontal disease increases steadily and periodontal disease is high in subjects with poor oral hygiene.

Limbu (1990), observed the incidence of periodontal disease among the Gallong of Arunachal Pradesh to be 73.98%.

## DENTAL MORPHOLOGY

Among Indian populations very few studies on dental caries have been reported in literature. Day *et al.* (1950) studied the incidence of dental caries among the Punjabis. Rami Reddy *et al.* (1982) studied prevalence of dental caries among the Muslim of south-eastern Andhra Pradesh. Kunzru and Krishna Reddy (1984) undertook a study on dental caries among the two caste groups of Chittoor district, Andhra Pradesh. So far no one has reported studies on dental caries of the Mongoloid populations of Northeast India.

The dental traits purely based on phenotypic morphogenic classification consist of supernumerary teeth or hyperdontia and hypodontia, carabelli's anomally, shovel-shaped incisors, diastema, crowding, cingulum and occlusion.

The study of distribution and inheritance of the morphological characteristics of the teeth and jaws in the living as well as extinct man and non-human primates renders it possible to delineate the nature and extent of interrelationship between them, their origin and evolutionary part from variation. Some of the pioneering studies on these traits particularly among the Mongoloid populations have been made by Hrdlicka (1911), Dahlberg (1963), Paderson (1949), Hellman (1943), Moorrees (1957) and others.

**A. Supernumerary teeth or Hyperdontia and Hypodontia**: supernumerary or hyperdontia are extra teeth beyond the normal number unlike Hypodontia or decrease in number of teeth both representing numerical variations in teeth. Published literature shows a very few works on the numerical variations of most of which are limited to tribal population alone. One of the earliest studies made by Campbel (1925) among the living Australian aboriginals and on the skull shows 1.8% of supernumerary teeth. Sinclair et al. (1947) examined the dental conditions among the Papuans of New Guinea and found 2% of them were with supernumerary teeth. Pederson (1949) reported slightly less than 2% of supernumerary teeth in the East Greenland Eskimos, while he found 2.7% of the South African Bantus possessing these teeth.

In India too, studies have been conducted on this anomaly but a few populations only such as on the crania from the east India by Pal (1964); among the Vaisyas of Southern Andhra Pradesh by Reddy and Vijay Kumar (1978) and among Muslims of the same region by Rami Reddy et al. (1982b) in whom the proportions of supernumerary teeth noticed are 2%, 0.25% and 2.35% respectively. The work done in India in respect of this trait is limited.

**B. Carabelli's Trait**: The traits, Carabelli's triat gained much importance as a 'marker' for differentiation between populations of different ethnic origins. Several studies conducted on this dental polymorphism in a number of populations outside India revealed that it occurs in much higher incidence in the Caucasians and Negroes, than in Mongoloid and related groups( Dietz ,1944). The highest frequency of the trait ranging from 51% to 90% has been reported in European populations, slightly lower percentage

in African populations and in American Indians, and the lowest among the Arctic population (Alvesalo et al., 1975). The different populations of the Mongoloid stock studied are Pecos Indians by Nelson (1983); East Greenland Eskimos by Pederson (1949); Northwest and Labrador Eskimos and Pima and Blackfoot Indians by Dahlberg (1949). In Australians aboriginals Campbell (1925) found 33% of the molar teeth with carabelli's cusp. Pederson (1949) reported 29% of this trait in East Greenland Eskimos of white admixture, while in isolated areas where the admixture has been the least, the trait was nearly absent.

In India, this trait has been studied by Joshi et al. (1972) among the Hindus of Gujarat (64.6%); by Pal (1978) on the human crania from east India (26.4%); Bhasin et al. (1979) among the Jats of Haryana (61.2%) and by Rami Reddy et al., (1982a and 1982b) among the Pattusalis (26%) and Muslims (15%) of Southern Andhra Pradesh.

**C. Shovel- Shaped Incisors**: Hrdlicka (1911) who has done pioneering work in the area of dental anthropology pronounced shoveling in the incisors teeth of the American Indian. In the years 1920-21, he found the highest incidence of this trait in the different Mongoloid group-Chinese, Japanese, Eskimos and American Indians whereas in Negroes the proportions was lower and among Caucasians it was the lowest. These findings of Hrdlicka were later confirmed by the works of a number of scholars, Nelson (1938); Goldstein (1948); Pederson (1949); Dahlberg (1945-49) showing that the shovel-shaped teeth are characteristics of the Mongoloid stock. Laskar (1950) found shove-shaped teeth in 14% among the white Americans. He pointed out that there is no

difference in the incidence of the trait between central and lateral incisors but in the later teeth, the character has been observed to be predominantly more pronounced.

In India, the only studies on this dental trait are those of Ganguly (1960) among the Nicobar Islanders, whose frequency with shovel-shaped incisors comes very close to the proportions found in the people of Indonesia, Micronesia and Polynesia. Pal (1964) studied on the crania from eastern India and found 48% of this dental trait, Bhasin et al., (1979) studied among the Jats of Haryana and found 72.2% and Rami Reddy et al., (1982a & 1982b) among the Pattusalis (50%) and Muslims (5.74%) of southern Andhra Pradesh. Rami Reddy (1983) found shovel-shaped incisors slightly over 30% of male and 25% of female among the people of Gulbarga, Karnataka.

**D. Diastema**: The diastema though a questionable character, is of intrinsic value in the study of human phylogeny. Boyd (1972) reports the trait of diastema in 62 cases (28.4%) in a sample of dental casts of 218 natives of Eastern Highlands of New Guinea from which he concluded that the absolute tooth size in cases with spacing is relatively smaller than for those individuals with crowding, although their general body size and arch size were also smaller.

In India, Rami Reddy *et al.*, (1982a & 1982b) carried out a study on the prevalence of diastema among the Pattusalis and Musilims of Southern Andhra Pradesh and found out 3.25% and 5% of this dental trait respectively. The result of this study further shows that in both the populations the incidence of the trait is slightly higher in males than in females.

**E. Crowding**: Crowding is another non-metric trait which is complex in nature. According to Lasker (1950), the crowding of teeth results due to the inheritance of large teeth from one parent and small jaw from the other, which are determined before birth. According to Cadien (1972), "Extreme crowding of teeth probably is not an advantageous condition, so selection may be operating to reduce it". Therefore, crowding one of the many causes for it, malocclusion may be considerably influenced by genetic as well as environmental factors.

This dental anomaly which is known for its significance in understanding human evolution is most neglected in population studies in India or outside. The study is that of Boyd (1972) among the natives of Eastern Highlands of New Guinea who have shown crowding to the extent of 34.4% cases in mandible and 26.1% cases in maxilla in a sample of 218 dental casts of natives. Mandibular crowding has been found to be significantly greater in these natives. Boyd in an attempt to relate crowding to tooth size computed the mesiodistal tooth measure from second molar to second molar in each arch for the natives and found a progressive increase in tooth size as crowding becomes more severe.

**F. Cingulum:** According to Segal (1963) the ridge found on the lingual lobes of the incisor and the canine teeth is termed the cervical ridge or the cingulum. This is a primitive characteristic which helps in highlighting the racial difference between populations of different biological origins.

The only work available in literature is that of Pederson (1949) among the East Greenland Eskimos for whom no percentage of the incidence of the cusp is given.

Barksdale (1972) reported the occurrence of lateral incisors with lingual cusps or cingulum in 18% of the casts of the Eastern Highland natives of New Guinea.

In India, the only study conducted in this trait is that of Rami reddy et al. , (1982a &1982b) among the Pattusalis and Muslims of Southern Andhra Pradesh in whom the proportion of the trait has been found to be around 4%, and more frequent in maxillary incisors than the mandibular ones and central than lateral incisors.

**G. Occlusion:** Dental occlusion is the relationship between the masticatory surface of the maxillary and mandibular teeth, when the mouth is closed. The irregular occlusal variation or the so called malocclusion is caused by hereditary or environmental factors. Person s living in rural areas of developed countries, the prevalence rate of malocclusion have been found to be much lower than that in those in urban areas as revealed by the studies of Goose et al., (1957) in the West Midland country youths; Lavelle (1973) among youths and their parents in Central England; Barnard (1956) in the country dweller of Australia; and of Corruccini and Whitley (1981) in the rural Kentucky American community. Corruccini and Whitley (1981) ,on the basis of a number of works stated that "an important consideration in understanding occlusion variation is the tendency among non-technologic human societies for virtually all individuals to show nearly ideal occlusion. Malocclusion is malady of civilized man". From this statement it is clear that malocclusion results due to one of chewing stress on the modern process foods and the lacks of direction provided to the growing jaws and erupting teeth. A number of studies made on tribal populations have shown a high proportion of normal

occlusion than in a situation when these communities came in contact with industrial societies with a high rate of malocclusion.

In India very less studies have been conducted on occlusal variation. Sidhu et al., (1970) based on cephalometry, experimented on the school going Parsi children and Maharastrians of Bombay and concluded that the different eating habits were the cause of malocclusion. The works on dental occlusion contributed by some physical anthropologist are by Rami Reddy and Vijay Kumar (1978) among the Vaisayas of South Eastern Andhra Pradesh and by Rami Reddy (1983) among the people of Gulbarga, Karnataka. These studies have revealed a very low proportion of malocclusion cases as a result exposure to processed foodstuffs in spite of the existence of contact with the urban and the rural areas. The other studies carried out by Corruccini et al., (1982) was among the 265 Jat youths of Chandigarh (Punjab), both sexes (Males 145, females 120) aged between 12 and 16 years from seven schools representing the high, middle and lower socio-economic groups. It is revealed that the children of the lower socio-economic group mainly rural in origin showed significantly better dental occlusion with broader maxillary arches as their counterparts in developed countries and suggested a number of environmental factors as responsible for malocclusion such as deciduous tooth loss, nutritional heterosis and masticatory function.

Sengupta and Das (2002) carried out a study on tooth occlusion pattern among the Sonowal Kacharis of Dibrugarh District, Assam and found the frequency of overbite highest in males. The Sonowal females characteristically show a prevalence of edge to edge bite.

Though a number of studies have been conducted on many populations outside India, a survey of literature reveals that only a few of these are on Indian population. Practically no serious attempt has been made so far to study on dentition in the populations of Northeast India. Keeping this in view the Khasis of Shillong, Meghalaya have been chosen for the present study.

**Objectives of the present study:**

1. To study the impact of Kwai (betel nut and leaf with lime) and tobacco chewing on dental health of the Khasis.
2. To assess the eruption pattern of permanent teeth, their eruption age and order, in both boys and girls.
3. To assess the prevalence of dental caries and periodontal diseases, in both sexes.
4. To record the various morphological patterns prevailed among the Khasis of Shillong.
5. To find out the relationships of eruption pattern, prevalence of dental caries, periodontal diseases and frequency occurrence of various morphological traits with certain demographic and socio-economic variables such as age, sex, income and education.
6. To compare the findings of the present study with those reported for other populations.

# CHAPTER-III

## MATERIALS AND METHODS

In this chapter we shall discuss the materials collected for the present study and methods that have been applied. The present research study on dental anthropology of the Khasis of Shillong has been carried out in the Malki of Shillong city.

**AREA OF STUDY**

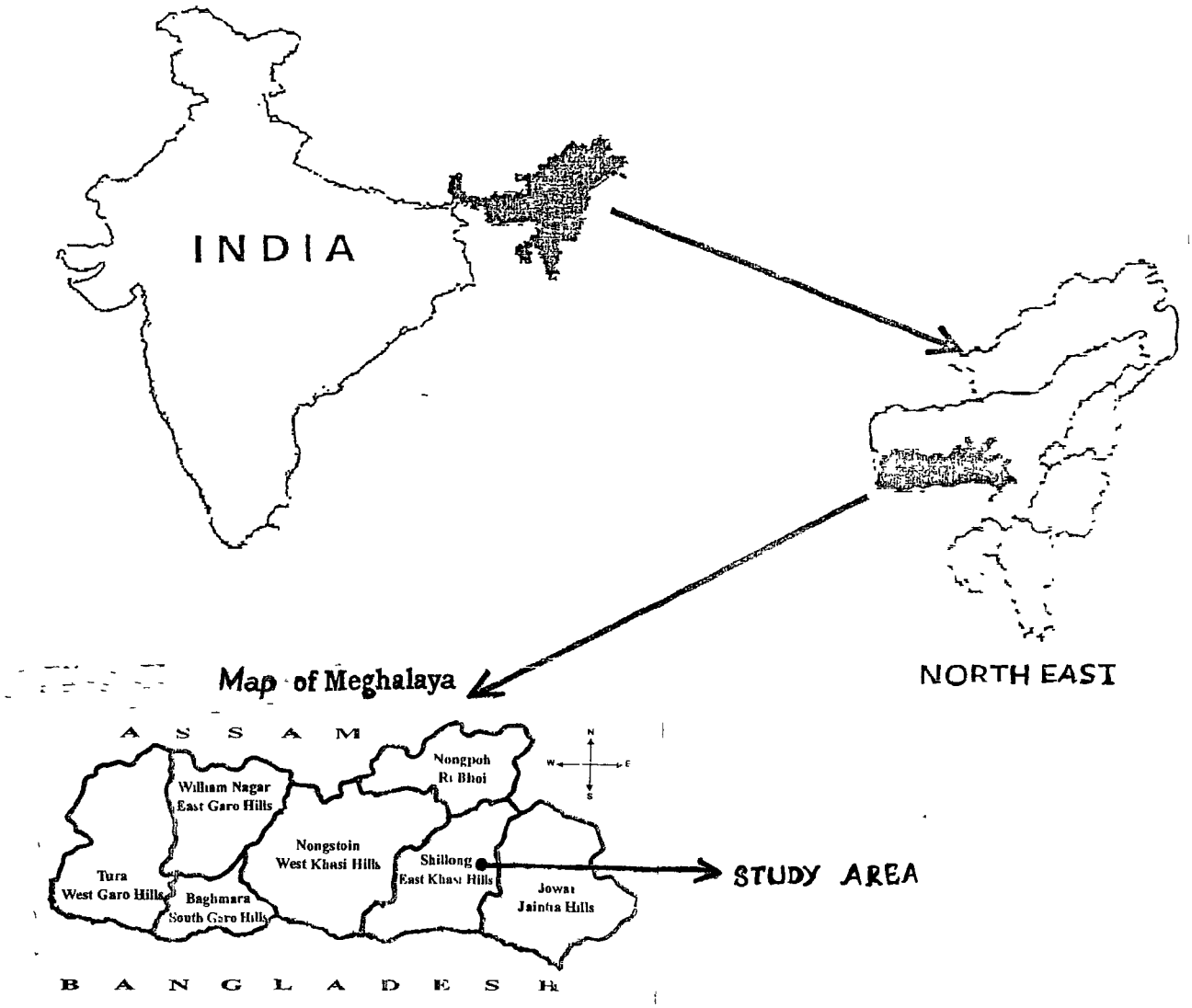
*Shillong is the capital of Meghalaya. It is situated at an elevation of* approximately 1,476 meters with 23 degree 34'N latitude and 91 degree 53'E longitude.

Shillong is the only one urban agglomeration in Meghalaya. It consists of Shillong Municipality, Shillong cantonment, Mawlai, Nongthymmai, Pynthorumkhrah and Madanriting. Present study will be conducted among the khasis of Malki. It is one the oldest Khasi dominated localities under Shillong municipality.

The data for the present study will be collected from the Khasi subjects of Malki Shillong. Malki is divided into eight different localities viz. Nongshilliang, Lumbalang, Nongpyngrope, Khliehshnong, Kharmalki, Dhankheti, Chinapatty and Pdengshnong. Malki is comprised of 2,782 households of which 1,947 belong to Khasi.

The subjects were drawn only from the Khasi households. The total sample is comprised of 1254 Khasi males and 1263 females .The entire is divided into 35 age groups. The sample were be comprised of only those subjects whose parents are Khasi. All the subjects should be apparently physically and mentally healthy.

# LOCATION MAP OF THE STUDY AREA



The educational background of the parents and their occupations, the number of family members, income of the family, food, drink and brushing habits of the subject will be recorded.

In all the populations' special care was taken to determine the actual ages of the subjects. A majority of the subjects were Christians and thus were requested to show their baptismal certificates for the birth date record. Parents of non-Christian subjects were asked to furnish the actual date of birth of their wards. The subjects who could not show their baptismal certificate or those whose parents failed to give the correct information were not included in the sample. The sample comprises of only those subjects whose both parents were from same tribe. Age of an individual was calculated according to the decimal age calendar given by Weiner and Lourie, (1969) from his/her birthday to the date of his/her examination. The sample of males and females were distributed over 11 groups so that 4.500 to 5.499 years were placed in the age group of 5-year-olds, subjects ranging in age from 5.500 to 6.499 formed 6 –year age group, and so on.

The observations were made with the aid of dental mirror, dental probe and spatula in sufficient day-light. If any part of the crown had pierced the gum to become visible, the tooth was considered emerged. Some missing permanent teeth were counted as erupted when the subject could recall their emergence and/or extraction, and if the cavity were present. The coding of teeth is as follows: I, C, P, and M stand for incisor, canine, premolar, and molar, respectively. The numeral signifies the tooth's position. Positioning of the numeral on lower or upper end of the latter signifies mandibular or maxillary tooth, respectively. The third molars are not included for the present study as

there are very high variations in emergence time of this tooth. The other additional background information in each subject was gathered, which includes their religion, parent's income, and personal habits such as smoking, chewing, and diet. Eruption status of permanent dentition for each and every child was recorded.

## DENTAL PATHOLOGY

**Dental Caries:** The dental caries was noticed in the labial, buccal, lingual, mesial as well as in the occlusal sides of the teeth. For its correct observation and assessment, each of the subjects was asked to open his/her mouth, a torch was focused and entire dentition was screened as thoroughly It is well known variables such as age, sex, heredity socio-economic level and intrauterine and postnatal environment influence the sequence and timing of tooth emergence. The information on time of tooth emergence in human is valuable in assessing diversity seen between populations. The dental status of an individual at a particular age, especially in the younger age groups, provides an index of physiological maturity for the clinician. The chronology of tooth emergence has often been used in the medico-legal cases for the estimation of age.

## ORAL HYGIENE

**Debris Index (DI-S)**: For the Debris Index (DI-S) a dental explorer is placed on the incisal third of the tooth and moved towards the gingival. The debris index score per person is obtained by totaling the debris score per tooth surfaces and dividing by the number of surface examined.

Criteria for scoring Oral Debris (DI-S)

Component of (OHI-S)

0 - No debris or stain present

1 - Soft debris covering not more than one third of the tooth surface

2 - Soft debris covering more than one third but not more than two thirds of the exposed tooth surface

3 - Soft debris covering more than two thirds of the exposed tooth surface.

The calculus index (CI-S) is performed by gently placing a dental explorer into the distal gingival crevice and drawing it sub-gingivally from the distal contact area to the mesial contact area (i.e. one half of a tooth's circumference is considered a scoring unit). The Calculus Index score per person is obtained by totaling the Calculus score per tooth surface and dividing by the number of surfaces examined. The OHI-S score per person is the total of the DI-S and CI-S scores per person.

The clinical levels of oral cleanliness for debris that can be associated with Group Simplified Debris Index Scores are as follows-

Good 0.3 to 1.6

Fair 0.7 to 1.8

Poor 1.9 to 3.0

Criteria for Scoring Calculus (CI-S)

Component of OHI-S

0 - Calculus present

1 - Supragingival calculus covering not more than one third of the exposed tooth surface.

2 - Supragingival calculus covering more than one third but not more than two thirds of the exposed tooth surface.

3 - Supragingival calculus covering more than two thirds of the exposed tooth surface.

The clinical levels of oral hygiene that can be associated with group OHI-S scores are as follows-

| | |
|---|---|
| Good | 0.0 to 1.2 |
| Fair | 1.3 to 3.0 |
| Poor | 3.1 to 6.0 |

The significance of the OHI-S is that like Russell's Periodontal Index,

It has been used extensively throughout the world and has contributed greatly to our understanding of periodontal disease. It is also used in the National Health Survey. The high degree of correlation(r-0.82) between OHI-S and PI make it possible, knowing one of the scores, to calculate the other score using regression analysis. The major strength of the OHI-Sis its use in epidemiologic surveys and in evaluating dental health education programmes. It can also be used to evaluate an individual's level of oral clean

lines and, to a more limited extent, can be used in clinical trials. The index is easy to use because the criteria are objective, the examination may be performed quickly, and a high level of reproducibility is possible with a minimum of training sessions.

## PERIODONTAL DISEASES

The method detailed by Russell (1976) will be used to score periodontal index per person.

The Periodontal Index (PI) was intended to estimate deeper periodontal disease than the P.M.A Index by measuring the presence or absence of gingival inflammation, its severity, pocket formation, and loss of masticatory function. The criteria given below are used to examine all of the gingival tissues surrounding each tooth. Because it measures both reversible and irreversible aspects of periodontal disease it illustrates an epidemiologic Index with a true biologic gradient. A PI Score per individual is determined by summing all of the tooth scores and dividing by the number of teeth examined.

**Periodontal Index (Russel)**

| Score | Criteria and Scoring for Field Studies |
|---|---|
| 0 | *Negative:* There is neither over inflammation in the investing tissue nor loss of function due to destruction of supporting tissues. |
| 1 | *Mild Gingivitis:* There is an overt area of inflammation in the free gingival but this area does not circumscribe the tooth. |
| 2 | *Gingivitis:* Inflammation completely circumscribes the tooth, but there is |

no apparent break in the epithelial attachment.

6 *Gingivitis with pocket formation:* The epithelial attachment has been broken and there is a pocket. There is no interference with normal masticatory function, the tooth is firm and has not drifted.

8 *Advanced destruction with loss of masticatory function:* The tooth may be loose; may have drifted; may sound dull on percussion with a metallic, instrument; may be depressible in its socket.

$$\text{Periodontal index score per person} = \frac{\text{Sum of individual scores}}{\text{Number of teeth present}}$$

| Clinical Condition | Group P1 Scores | Stage of Disease |
|---|---|---|
| Clinically normal supportive tissues | 0 to 0.2 | Reversible |
| Simple gingivitis | 0.3 to 0.9 | |
| Beginning destructive periodontal disease | 0.7 to 1.9 | |
| Established destructive periodontal disease | 1.6 to 5.0 | Irreversible |
| Terminal disease | 3.8 to 8.0 | |

## DENTAL MORPHOLOGY

The occurrence of supernumerary teeth or hyperdontia and hypodontia, carabelli's trait, shovel-shaped incisors, diastema, crowding, cingulum, occlusion of teeth, was recorded as suggested by Weiner and Lourie (1981).

## DATA ANALYSIS

The entire data was tabulated for statistical analysis, like percentage frequencies and median ages. To compute the median emergence time for each individual tooth, probit transformation was used (Fisher and Yeates, 1948; Mayhall *et al.*, 1978). Accordingly, for each tooth the proportion of emergence at various age levels was transformed into probits. The calculations were done for the two sides' pooled data. The probit values were then plotted on graph paper, and the visually best fitted slope was obtained through a series of iterations. The regression line thus obtained was used to determine the estimated age of emergence (read as a projection of the probit value 5 on the horizontal scale) and estimated standard deviation (difference between the projection of the probit values 5 and 4). To find out the association, if any, between the prevalence of dental pathology and variables such as sex, income, eating habits, dentifrices used and dental pathology, chi-square test was used.

## THE PEOPLE

The Khasis, a mongoloid tribe, inhabit Khasi and Jaintia Hills of Meghalaya. There are four sub-groups of Khasi-namely, the Khynriam, Pnar, War and Bhoi. Khynriams live in the middle ranges of the Khasi Hills, while the Pnars occupy the Jaintia hills lying on the eastern side. The Bhoi inhabit the low hills towards north and North West of the area. The wars are met with on the slopes and the deep valleys towards south.

The Khasis form a matrimonial society which is casteless and which gives the women a rightful place in the home and in the community. Descent is always through the female line. Succession is also through the female line.

The Khasis are the only tribal group in the North-East India who speak a dialect of the Monkhmer group of Austro-Asiatic subfamily of linguistic group in the midst of an encircling population, all belonging to the Tibeto-Burman linguistic family.

The staple food of the Khasis is rice, vegetables, fish and all kinds of meat specially beef and pork. The Khasis ordinarily do not use milk as part of their food. They usually eat boil, unspiced food. Man, woman and children are chewers of *Kwai* (betel nut and leaf with lime).

The term Khasi is applied to the group of matrilineal and Mon-Khmer speaking people who presently inhabit the East and West Khasi Hills and the Jaintia Hills district of Meghalaya state. It includes Bhois, Wars and Khynriams. The Bhois inhabit the north central part of the hills, the wars inhabit the precipitous hill sides and valleys of the southern part of the hills, the Khynriums occupy the central and the highest parts of the Meghalaya plateau, whose culture has provided the mode for interpreting the variations found elsewhere.

The history of the Khasi people before the advent of the British is not well documented. Their folklore and oral traditions tell about their supernatural origins, giving a section of Khasi intellectual the belief that they are autochthons of the land. It is generally believed that the Khasis were one of the first tribal groups to have migrated

from somewhere in the south-east, to the Bramaputra valley where they resided before entering the hills. In course of their migration their language and customs changed through contact with the Austric speakers. Their traditions tell that they moved gradually from the east to west, from the Jaintia Hills towards the Khasi Hills bordering the land of the Garo neighbours in the practice of shifting agriculture and search for iron ore.

The three districts (East Khasi Hills, West Khasi Hills and Jaintia Hills) form the central and eastern portions of the Meghalaya plateau. Of the total population of 1,328,343 in Meghalaya, the provisional figures of scheduled tribes in each of the three districts predominated by the Khasi are the Jaintia Hills 1,48,710, East Khasi Hills 3,74,081 and the West Khasi Hills 1, 56,995. It can be safely said that the Khasis may be near 500,000 in number, or even more if we include Khasis residing in districts outside the State of Meghalaya (1981 provisional figures).

The Khasis accept the language spoken in and around Cherrapunjee and presently, in and around Shillong as their standard languages. The various dialects are those of the Jaintias, Wars, Bhois, Lyngams and Amwis. The script is Roman, introduced first in 1842 by Thomas Jones, a Welsh Presbyterian missionary, who successfully applied it to the Cherrapunjee dialect. This language with its variation and script is used at home. The English language and script is used in relations with others. The need for interaction with non-tribal communities, and demands of living in the hills and on the foothills, have made the people conversant with Hindi, Bengali, Assamese and Nepali.

In the past, the Khasi man could be identified by the unstitched lower garment (dhoti), jacket and turban that he wore. Such attire is seldom used today, except on

ceremonial occasions. Their dress has, to a large extent, been westernized. The women, on the other hand, have retained their traditional dress consisting of an undergarment, and above it a two piece cloth pinned on each shoulder (jainsem) and a shawl (tapmoh). Older women continue to wear another wrap of woolen cloth (jainkup). Women wear gold and silver, jewellery usually of very pure form and aesthetically crafted by local smiths.

The Khasis are short-statured, mean being 1566.6 mm for men and 1471.5 mm for women. They have light mesocephalic head, mesorrhine nose and euryprosophic face. In ABO system, the Khasi show high frequency of O blood group (48.6%) and higher gene frequency (70.01). Finger-print pattern frequencies are whorls =39.26%, Loops =58.30% and Arches =2.44% (Das, 1978).

Boiled rice is their staple food and is eaten with fish (dried and fresh), a variety of meat (they love smoked beef and relish pork).eggs and vegetables. The preparations of the meals are simple. Fruit constitute an important part of the Khasi diet. Despite the favourable climate, dairy farming has not been a popular occupation as the Khasi did not use milk. Both the sexes eat betel nut as stimulant. Tobacco is smoked in cigarettes, in pipes and in the rarely seen traditional pipe (hookah). Fermented rice beer and distilled rice and millet that are made into alcoholic drinks are consumed in great quantity. These are prepared both for home and market consumption.

The Khasi are divided into a number of clans which trace their decent from ancestresses or Kiaws. The decendants of one common ancestress are called Shikur. A sub-clan is called Shokpoh. The smaller division of the clan is the family (ing). The clans are bound together by strict ties of religion, ancestor worship and funeral rites for those

who continue their tribal religion. Clans and sub-clans, having a common ancestry, cannot marry within the Kur and Kpoh.

The Khasi society is generally egalitarian but certain families alone may offer its males for the office of chief (Syiems) in the Khasi states (hima). In the entire area, the village headmen (Rangbah Shnong) have important administrative functions. Of late, there has been a tendency to ignore the age-old custom of taking one's name from the mother. Many Khasi families, particularly those from the urban areas, takes their names from the male line.

The typical Khasi marriage is one in which the couple choose their partner, which is motivated by personal preference rather than family considerations. For the non-christian Khasi, marriage is purely a civil contract. For Christians, it is a sacrament.

Elopement is frequent though marriage in church or according to the traditional ceremony with some variations is the rule. There is no bride price or dowry. A man married to the youngest daughter usually lives in the house of his wife's parents. Residence is either duolocal ormatrilocal in the case of marriage to younger daughter. Divorce is common and by mutual consent. Remarriage after the divorce is frequent among men and women.

The family property passes to the youngest daughter, failing which, to the youngest niece and if there is no niece, to the youngest male cousin. Distribution of self acquired property among children, relatives or other persons through a will is now legal.

# CHAPTER-IV

## DENTAL ERUPTION

Table 1: Age group- wise distribution of the sample (M=1254; F=1263)

| Sl. No. | Age groups (in decimal age) | Male | Total | Female | Total |
|---|---|---|---|---|---|
| 1 | 0.000-1.499 | 0001-0048 | 48 | 0001-0046 | 46 |
| 2 | 1.500-2.499 | 0049-0084 | 35 | 0047-0085 | 38 |
| 3 | 2.500-3.499 | 0085-0118 | 33 | 0086-0119 | 33 |
| 4 | 3.500-4.499 | 0119-0150 | 31 | 0120-0150 | 30 |
| 5 | 4.500-5.499 | 0151-0184 | 33 | 0151-0183 | 32 |
| 6 | 5.500-6.499 | 0185-0216 | 31 | 0184-0215 | 31 |
| 7 | 6.500-7.499 | 0217-0249 | 32 | 0216-0254 | 38 |
| 8 | 7.500-8.499 | 0250-0275 | 25 | 0255-0284 | 29 |
| 9 | 8.500-9.499 | 0276-0308 | 32 | 0285-0318 | 33 |
| 10 | 9.500-10.499 | 0309-0340 | 31 | 0319-0346 | 27 |
| 11 | 10.500-11.499 | 0341-0382 | 41 | 0347-0385 | 38 |
| 12 | 11.500-12.499 | 0383-0411 | 28 | 0386-0415 | 29 |
| 13 | 12.500-13.499 | 0412-0448 | 36 | 0416-0450 | 34 |
| 14 | 13.500-14.499 | 0449-0483 | 34 | 0451-0479 | 28 |
| 15 | 14.500-15.499 | 0484-0513 | 29 | 0480-0517 | 37 |
| 16 | 15.500-16.499 | 0514-0545 | 31 | 0518-0551 | 33 |
| 17 | 16.500-17.499 | 0546-0580 | 34 | 0552-0581 | 29 |
| 18 | 17.500-18.499 | 0581-0616 | 35 | 0582-0616 | 34 |
| 19 | 18.500-19.499 | 0617-0649 | 32 | 0617-0651 | 34 |
| 20 | 19.500-20.499 | 0650-0688 | 38 | 0652-0683 | 31 |
| 21 | 20.500-21.499 | 0689-0715 | 26 | 0684-0719 | 35 |
| 22 | 21.500-22.499 | 0716-0752 | 36 | 0720-0754 | 34 |
| 23 | 22.500-23.499 | 0753-0784 | 31 | 0755-0785 | 30 |
| 24 | 23.500-24.499 | 0785-0816 | 31 | 0786-0823 | 37 |
| 25 | 24.500-25.499 | 0817-0855 | 38 | 0824-0855 | 31 |
| 26-30 | 25.500-30.499 | 0856-0920 | 64 | 0856-0911 | 55 |
| 31-35 | 30.500-35.499 | 0921-0971 | 50 | 0912-0968 | 56 |
| 36-40 | 35.500-40.499 | 0972-1015 | 43 | 0969-1021 | 52 |
| 41-45 | 40.500-45.499 | 1016-1064 | 48 | 1022-1073 | 51 |
| 46-50 | 45.500-50.499 | 1065-1114 | 49 | 1074-1114 | 50 |
| 51-5635 | 50.500-55.499 | 1115-1157 | 42 | 1115-1149 | 34 |
| 56-60 | 55.500-60.499 | 1158-1190 | 32 | 1150-1183 | 33 |
| 61-65 | 60.500-65.499 | 1191-1226 | 35 | 1184-1215 | 31 |
| 66-70 | 65.500-70.499 | 1227-1158 | 31 | 1216-1252 | 36 |
| 70+ | 70.500+ | 1159-1188 | 29 | 1253-1287 | 34 |
| Total | | | 1254 | | 1263 |

Table 2: Number and percentage of erupted permanent teeth in the Khasi females (right maxillary)

| Age(In yrs) | $I^1$ | $I^2$ | $C^0$ | $P^1$ | $P^2$ | $M^1$ | $M^2$ | $M^3$ |
|---|---|---|---|---|---|---|---|---|
| 5 | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| 6 | 4(12.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 12(38.71) | 0(0.00) | 0(0.00) |
| 7 | 26(83.87) | 8(21.05) | 0(0.00) | 0(0.00) | 0(0.00) | 32(84.21) | 0(0.00) | 0(0.00) |
| 8 | 27(93.10) | 23(79.31) | 0(0.00) | 0(0.00) | 0(0.00) | 29(100.00) | 0(0.00) | 0(0.00) |
| 9 | 33(100.00) | 33(100.00) | 3(9.09) | 1(3.03) | 0(0.00) | 33(100.00) | 0(0.00) | 0(0.00) |
| 10 | 27(100.00) | 27(100.00) | 7(25.92) | 6(22.22) | 4(14.81) | 27(100.00) | 0(0.00) | 0(0.00) |
| 11 | 38(100.00) | 38(100.00) | 31(81.58) | 32(84.21) | 22(57.89) | 38(100.00) | 0(0.00) | 0(0.00) |
| 12 | 29(100.00) | 29(100.00) | 29(100.00) | 29(100.00) | 29(100.00) | 29(100.00) | 15(51.72) | 0(0.00) |
| 13 | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 0(0.00) |
| 14 | 28(100.00) | 28(100.00) | 28(100.00) | 28(100.00) | 28(100.00) | 28(100.00) | 28(100.00) | 0(0.00) |
| 15 | 37(100.00) | 37(100.00) | 37(100.00) | 37(100.00) | 37(100.00) | 37(100.00) | 37(100.00) | 0(0.00) |
| 16 | 33(100.00) | 33(100.00) | 33(100.00) | 33(100.00) | 33(100.00) | 33(100.00) | 33(100.00) | 0(0.00) |
| 17 | 29(100.00) | 29(100.00) | 29(100.00) | 29(100.00) | 29(100.00) | 29(100.00) | 29(100.00) | 2(6.90) |
| 18 | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 5(14.70) |
| 19 | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 9(26.47) |
| 20 | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 8(25.81) |
| 21 | 35(100.00) | 35(100.00) | 35(100.00) | 35(100.00) | 35(100.00) | 35(100.00) | 35(100.00) | 12(34.28) |
| 22 | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 13(38.23) |
| 23 | 30(100.00) | 30(100.00) | 30(100.00) | 30(100.00) | 33(100.00) | 30(100.00) | 30(100.00) | 11(36.67) |
| 24 | 37(100.00) | 37(100.00) | 37(100.00) | 37(100.00) | 37(100.00) | 37(100.00) | 37(100.00) | 18(48.65) |
| 25 | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 17(54.84) |

Figures in parenthesis represent percentage.

Table 2 represents the number and percentage of erupted permanent teeth in the right maxilla of the Khasis of Shillong, where at age group 6 years, only 12(38.71%) first maxillary molars and 4(12.00%) medial incisors have erupted. At the age group of 7 years 26(83.87%) medial incisors and 32(84.21%) first molars have erupted . By age group of 8 years, 27(93.10%) medial incisors and 23(79.31%) lateral incisors have erupted. Eruption of medial incisors, lateral incisors and first molars were completed by 9 years of age. At the same age group, 3(9.09%) canines and 1(3.03%) first premolar were present. At 12 year of age, eruption of almost all the teeth were completed excepting the second molar. By 13 years, all the right maxillary teeth in females completed their eruption. This table also shows the eruption of the third molar. It has been observed that 2(6.90%) numbers of third molar have erupted at17 years of age and 17(54.84%) by 25 years.

Table 3: Number and percentage of erupted permanent teeth in the Khasi females (left maxillary)

| Age (in yrs) | $I^1$ | $I^2$ | $C^0$ | $P^1$ | $P^2$ | $M^1$ | $M^2$ | $M^3$ |
|---|---|---|---|---|---|---|---|---|
| 5 | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| 6 | 2(6.45) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| 7 | 24(77.42) | 6(15.79) | 0(0.00) | 0(0.00) | 0(0.00) | 35(92.10) | 0(0.00) | 0(0.00) |
| 8 | 28(96.55) | 22(75.86) | 0(0.00) | 0(0.00) | 0(0.00) | 29(100.00) | 0(0.00) | 0(0.00) |
| 9 | 33(100.00) | 31(93.94) | 4(12.12) | 2(6.06) | 0(0.00) | 33(100.00) | 0(0.00) | 0(0.00) |
| 10 | 27(100.00) | 27(100.00) | 9(33.33) | 9(33.33) | 6(22.22) | 27(100.00) | 0(0.00) | 0(0.00) |
| 11 | 38(100.00) | 38(100.00) | 34(89.47) | 36(94.74) | 23(60.53) | 38(100.00) | 0(0.00) | 0(0.00) |
| 12 | 29(100.00) | 29(100.00) | 29(100.00) | 29(100.00) | 29(100.00) | 29(100.00) | 16(55.17) | 0(0.00) |
| 13 | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 0(0.00) |
| 14 | 28(100.00) | 28(100.00) | 28(100.00) | 28(100.00) | 28(100.00) | 28(100.00) | 28(100.00) | 0(0.00) |
| 15 | 37(100.00) | 37(100.00) | 37(100.00) | 37(100.00) | 37(100.00) | 37(100.00) | 37(100.00) | 0(0.00) |
| 16 | 33(100.00) | 33(100.00) | 33(100.00) | 33(100.00) | 33(100.00) | 33(100.00) | 33(100.00) | 0(0.00) |
| 17 | 29(100.00) | 29(100.00) | 29(100.00) | 29(100.00) | 29(100.00) | 29(100.00) | 29(100.00) | 4(13.79) |
| 18 | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 3(8.82) |
| 19 | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 5(14.70) |
| 20 | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 12(38.71) |
| 21 | 35(100.00) | 35(100.00) | 35(100.00) | 35(100.00) | 35(100.00) | 35(100.00) | 35(100.00) | 10(28.57) |
| 22 | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 17(50.00) |
| 23 | 30(100.00) | 30(100.00) | 30(100.00) | 30(100.00) | 30(100.00) | 30(100.00) | 30(100.00) | 14(46.67) |
| 24 | 37(100.00) | 37(100.00) | 37(100.00) | 37(100.00) | 37(100.00) | 37(100.00) | 37(100.00) | 24(64.86) |
| 25 | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 17(54.84) |

Figures in parenthesis represent percentage

Table 3 shows that 2(6.45%) medial incisors and 10(32.26%) first molars were erupted at 6 years of age. At the age group 7, there were 24(77.42%) medial incisors, 16(15.79%) lateral incisors and 35(92.10%) first molars. By 8 years of age, 28(96.55%) medial incisors, 22(75.86%) lateral incisors and all the first molars have completed their eruption. By 9 years, the medial incisor, lateral incisor and first molar have completed their eruption and 4(12.12%) canines,2(6.06%) first premolars were also present. By 12 years, all the teeth have completed their eruption, excepting the second molars, 16(55.17%). The eruption of all teeth except the third molar have completed in the left maxilla of females by 13 years of age. The third molar in this jaw of females first appeared at 17 years of age 4(13.79%) and by 25 years, 17(54.84%) third molars were found erupted.

Table 4: Number and percentage of erupted permanent teeth in the Khasi females (right mandibular)

| Age (in yrs) | $I_1$ | $I_2$ | $C_0$ | $P_1$ | $P_2$ | $M_1$ | $M_2$ | $M_3$ |
|---|---|---|---|---|---|---|---|---|
| 5 | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| 6 | 9(29.03) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 29(93.54) | 0(0.00) | 0(0.00) |
| 7 | 31(81.58) | 28(73.68) | 0(0.00) | 0(0.00) | 0(0.00) | 38(100.00) | 0(0.00) | 0(0.00) |
| 8 | 29(100.00) | 28(96.55) | 3(10.34) | 0(0.00) | 0(0.00) | 29(100.00) | 0(0.00) | 0(0.00) |
| 9 | 33(100.00) | 33(100.00) | 16(48.48) | 0(0.00) | 0(0.00) | 33(100.00) | 0(0.00) | 0(0.00) |
| 10 | 27(100.00) | 27(100.00) | 21(77.78) | 4(14.81) | 0(0.00) | 27(100.00) | 0(0.00) | 0(0.00) |
| 11 | 38(100.00) | 38(100.00) | 32(84.21) | 10(26.31) | 5(13.16) | 38(100.00) | 15(39.47) | 0(0.00) |
| 12 | 29(100.00) | 29(100.00) | 26(89.65) | 24(82.76) | 21(72.41) | 29(100.00) | 21(72.41) | 0(0.00) |
| 13 | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 33(97.06) | 0(0.00) |
| 14 | 28(100.00) | 28(100.00) | 28(100.00) | 28(100.00) | 28(100.00) | 28(100.00) | 28(100.00) | 0(0.00) |
| 15 | 37(100.00) | 37(100.00) | 37(100.00) | 37(100.00) | 37(100.00) | 37(100.00) | 37(100.00) | 0(0.00) |
| 16 | 33(100.00) | 33(100.00) | 33(100.00) | 33(100.00) | 33(100.00) | 33(100.00) | 33(100.00) | 0(0.00) |
| 17 | 29(100.00) | 29(100.00) | 29(100.00) | 29(100.00) | 29(100.00) | 29(100.00) | 29(100.00) | 5(17.24) |
| 18 | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 10(29.41) |
| 19 | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 16(47.06) |
| 20 | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 13(41.93) |
| 21 | 35(100.00) | 35(100.00) | 35(100.00) | 35(100.00) | 35(100.00) | 35(100.00) | 35(100.00) | 24(68.57) |
| 22 | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 21(61.76) |
| 23 | 30(100.00) | 30(100.00) | 30(100.00) | 30(100.00) | 30(100.00) | 30(100.00) | 30(100.00) | 16(53.33) |
| 24 | 37(100.00) | 37(100.00) | 37(100.00) | 37(100.00) | 37(100.00) | 37(100.00) | 37(100.00) | 29(78.38) |
| 25 | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 24(77.42) |

Figures in parenthesis represent percentage

Table 4 shows that 9(29.03%) medial incisors and 29(93.54%) first molars have erupted at 6 years of age. At 7 years, 31(81.58%) medial incisors, 28(73.68%) lateral incisors and all the first molars were present. By 8 years , the eruption of medial incisor and first molar have completed. 28(96.55%) lateral incisors and 3(10.34%) canines also observed in this age group. By 9 year of age, the medial and lateral incisors as well as the first molars have completed their eruption. 32(84.21%) canines, 10(26.31%) first premolars and 5(13.16%) second premolars were observed by 11 years of age .Excepting the third molar ,eruption of all teeth have completed by 12 years of age. By 14 years, eruption of all teeth completed excepting the third molar. At 17 years of age, third molar first appears in this quadrant of mandible with 5(17.24%) numbers and by 25 years, 24(77.42%) third molars have erupted.

Table 5: Number and percentage of erupted permanent teeth in the Khasi females (left mandibular)

| Age (in yrs) | $I_1$ | $I_2$ | $C_0$ | $P_1$ | $P_2$ | $M_1$ | $M_2$ | $M_3$ |
|---|---|---|---|---|---|---|---|---|
| 5 | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| 6 | 10 (32.26) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 30(96.77) | 0(0.00) | 0(0.00) |
| 7 | 29(76.32) | 25(65.79) | 0(0.00) | 0(0.00) | 0(0.00) | 36(94.74 | 0(0.00) | 0(0.00) |
| 8 | 29(76.32) | 26(89 .65) | 3(10.34) | 0(0.00) | 0(0.00) | 29(100.00) | 0(0.00) | 0(0.00) |
| 9 | 33(100.00) | 33(100.00) | 19(57.57) | 2(6.06) | 0(0.00) | 33(100.00) | 0(0.00) | 0(0.00) |
| 10 | 27(100.00) | 27(100.00) | 22(81.48) | 5(18.52) | 1(3.70) | 27(100.00) | 0(0.00) | 0(0.00) |
| 11 | 38(100.00) | 38(100.00) | 36(94.74) | 14(36.84) | 8(21.05) | 38(100.00) | 11(28.95) | 0(0.00) |
| 12 | 29(100.00) | 29(100.00) | 27(93.10) | 26(89.65) | 23(79.31) | 29(100.00) | 16(55.17) | 0(0.00) |
| 13 | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 31(91.18) | 0(0.00) |
| 14 | 28(100.00) | 28(100.00) | 28(100.00) | 28(100.00) | 28(100.00) | 28(100.00) | 28(100.00) | 0(0.00) |
| 15 | 37(100.00) | 37(100.00) | 37(100.00) | 37(100.00) | 37(100.00) | 37(100.00) | 37(100.00) | 0(0.00) |
| 16 | 33(100.00) | 33(100.00) | 33(100.00) | 33(100.00) | 33(100.00) | 33(100.00) | 33(100.00) | 0(0.00) |
| 17 | 29(100.00) | 29(100.00) | 29(100.00) | 29(100.00) | 29(100.00) | 29(100.00) | 29(100.00) | 7(24.14) |
| 18 | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 8(23.53) |
| 19 | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 12(35.29) |
| 20 | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 17(54.84) |
| 21 | 35(100.00) | 35(100.00) | 35(100.00) | 35(100.00) | 35(100.00) | 35(100.00) | 35(100.00) | 20(57.14) |
| 22 | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 19(55.88) |
| 23 | 30(100.00) | 30(100.00) | 30(100.00) | 30(100.00) | 30(100.00) | 30(100.00) | 30(100.00) | 17(56.67) |
| 24 | 37(100.00) | 37(100.00) | 37(100.00) | 37(100.00) | 37(100.00) | 37(100.00) | 37(100.00) | 22(59.45) |
| 25 | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 21(67.74) |

Figures in parenthesis represent percentage

Table 5 shows that at age group 6 years, 10(32.26%) medial incisors and 30(96.77%) first molars have erupted. At the age of 7 years, there are 29(76.32%) medial incisors, 25(67.79%) lateral incisors and 36(94.72%) first molars in left mandible of females. By 8 years of age, all the medial incisors and first molars have completed eruption including 26(89.65%) lateral incisors and 3(10.34%) canines. At the age group 9, 19(57.57%) canines and 2(6.06%) first premolars have erupted. In the age group of 10 years,22(81.48%) canines, 5(18.52%) first premolars, 1(3.70%) second premolar were found erupted. By 13 years of age all teeth had completed eruption except second molars. Eruption of teeth in the left mandible of females is completed by 14 years of age. Table -5 further reveals that third molar starts erupting at the age group of 17 years, 22(59.45%), 7(24.14%), 8(23.53%), 12(35.29%) and 21(67.47%) third molars were present at the ages 17 years, 18 years, 19 years, 24 years and 25 years respectively. This table also shows that in general the number of teeth increases as the age group increases.

Table 6: Number and percentage of erupted permanent teeth in the Khasi males (right maxillary)

| Age (in yrs) | $I^1$ | $I^2$ | $C^0$ | $P^1$ | $P^2$ | $M^1$ | $M^2$ | $M^3$ |
|---|---|---|---|---|---|---|---|---|
| 5 | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| 6 | 1(3.22) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 9(29.03) | 0(0.00) | 0(0.00) |
| 7 | 12(37.5) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 29(90.62) | 0(0.00) | 0(0.00) |
| 8 | 22(88.00) | 10(40.00) | 0(0.00) | 0(0.00) | 0(0.00) | 24(96.00) | 0(0.00) | 0(0.00) |
| 9 | 30(93.75) | 28(87.50) | 0(0.00) | 0(0.00) | 0(0.00) | 30(93.75) | 0(0.00) | 0(0.00) |
| 10 | 31(100.00) | 31(100.00) | 3(9.68) | 8(25.81) | 2(6.45) | 31(100.00) | 0(0.00) | 0(0.00) |
| 11 | 41(100.00) | 41(100.00) | 20(48.78) | 32(78.05) | 18(43.90) | 41(100.00) | 0(0.00) | 0(0.00) |
| 12 | 28(100.00) | 28(100.00) | 25(89.28) | 25(89.28) | 23(82.14) | 28(100.00) | 12(42.86) | 0(0.00) |
| 13 | 36(100.00) | 36(100.00) | 36(100.00) | 36(100.00) | 36(100.00) | 36(100.00) | 27(75.00) | 0(0.00) |
| 14 | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 0(0.00) |
| 15 | 29(100.00) | 29(100.00) | 29(100.00) | 29(100.00) | 29(100.00) | 29(100.00) | 29(100.00) | 0(0.00) |
| 16 | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 0(0.00) |
| 17 | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 7(20.59) |
| 18 | 35(100.00) | 35(100.00) | 35(100.00) | 35(100.00) | 35(100.00) | 35(100.00) | 35(100.00) | 13(37.14) |
| 19 | 32(100.00) | 32(100.00) | 32(100.00) | 32(100.00) | 32(100.00) | 32(100.00) | 32(100.00) | 16((50.00) |
| 20 | 38(100.00) | 38(100.00) | 38(100.00) | 38(100.00) | 38(100.00) | 38(100.00) | 38(100.00) | 22(57.89) |
| 21 | 26(100.00) | 26(100.00) | 26(100.00) | 26(100.00) | 26(100.00) | 26(100.00) | 26(100.00) | 21(80.77) |
| 22 | 36(100.00) | 36(100.00) | 36(100.00) | 36(100.00) | 36(100.00) | 36(100.00) | 36(100.00) | 20(55.55) |
| 23 | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 24(77.42) |
| 24 | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 20(64.52) |
| 25 | 38(100.00) | 38(100.00) | 38(100.00) | 38(100.00) | 38(100.00) | 38(100.00) | 38(100.00) | 27(71.05) |

Figures in parenthesis represent percentage

From Table- 6 it is observed that 1(3.22%) medial incisors and 9(29.03%) first molars have erupted at the age group of 6 years. By 7 years, 12(37.50%) medial incisors and 29(90.62%) first molars were observed to have erupted whereas the remaining teeth have not started erupting. At 8 year of age, there were 2(88.00%) medial incisors, 10(40.00%) lateral incisors and 24(96.00%) first molars. By age group 10 years, medial incisors and lateral incisors and first molars have completed eruption and 3(9.68%) canines, 8(25.81%) first premolars had erupted at this age group. At age group 12 years second molar also starts emerging. All the teeth have completed eruption in the right maxilla of males by the time it reaches the age of 13 years. The eruption of third molars begins at the age of 17 years. 7(20.59%), 13(37.14%), 16(50.00%), 22(71.05%) third molars were present in the age groups 17 years, 18 years, 19 years, 20 years and 25 years respectively.

Table 7: Number and percentage of erupted permanent teeth in the Khasi males (left maxillary)

| Age (in yrs) | $I^1$ | $I^2$ | $C^0$ | $P^1$ | $P^2$ | $M^1$ | $M^2$ | $M^3$ |
|---|---|---|---|---|---|---|---|---|
| 5 | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| 6 | 1(3.22) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 12(38.71) | 0(0.00) | 0(0.00) |
| 7 | 13(40.62) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 26(81.25) | 0(0.00) | 0(0.00) |
| 8 | 19(76.00) | 11(44.00) | 0(0.00) | 0(0.00) | 0(0.00) | 23(92.00) | 0(0.00) | 0 (0.00) |
| 9 | 31(96.87) | 25(78.12) | 0(0.00) | 0(0.00) | 0(0.00) | 30(93.75) | 0(0.00) | 0 (0.00) |
| 10 | 31(100.00) | 26(83.87) | 1(32.2) | 7(22.58) | 3(9.68) | 31(100.00) | 0(0.00) | 0(0.00) |
| 11 | 41(100.00) | 41(100.00) | 18(43.90) | 32(78.05) | 24(58.54) | 41(100.00) | 0(0.00) | 0(0.00) |
| 12 | 28(100.00) | 28(100.00) | 24(85.71) | 23(82.14) | 20(71.43) | 28(100.00) | 16(57.14) | 0(0.00) |
| 13 | 36(100.00) | 36(100.00) | 36(100.00) | 36(100.00) | 36(100.00) | 36(100.00) | 28(77.78) | 0(0.00) |
| 14 | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 0(0.00) |
| 15 | 29(100.00) | 29(100.00) | 29(100.00) | 29(100.00) | 29(100.00) | 29(100.00) | 29(100.00) | 0(0.00) |
| 16 | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 0(0.00) |
| 17 | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 9(26.47) |
| 18 | 35(100.00) | 35(100.00) | 35(100.00) | 35(100.00) | 35(100.00) | 35(100.00) | 35(100.00) | 16(45.71) |
| 19 | 32(100.00) | 32(100.00) | 32(100.00) | 32(100.00) | 32(100.00) | 32(100.00) | 32(100.00) | 10(31.25) |
| 20 | 38(100.00) | 38(100.00) | 38(100.00) | 38(100.00) | 38(100.00) | 38(100.00) | 38(100.00) | 19(50.00) |
| 21 | 26(100.00) | 26(100.00) | 26(100.00) | 26(100.00) | 26(100.00) | 26(100.00) | 26(100.00) | 13(50.00) |
| 22 | 36(100.00) | 36(100.00) | 36(100.00) | 36(100.00) | 36(100.00) | 36(100.00) | 36(100.00) | 24(66.67) |
| 23 | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 21(67.74) |
| 24 | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 17(54.84) |
| 25 | 38(100.00) | 38(100.00) | 38(100.00) | 38(100.00) | 38(100.00) | 38(100.00) | 38(100.00) | 29(76.31) |

Figures in parenthesis represent percentage

Table - 7 reveals that at the age group 6 year, 1(3.22%) medial incisors and 12(38.71%) first molars have erupted. There were 13(40.62%) medial incisors and 26(81.25%) first molars at the age group 7 years. 17(76.00%) medial incisors, 11(44.00%) lateral incisors and 23(92.00%) first molars were present at the age group of 8 years. By 10 years of age medial incisors and first molars have already completed eruption and 26(83.87%) lateral incisors, 1(3.22%) canine, 7(22.58%) first premolars and 3(9.68%) second premolars were found to be erupted. The second molar starts erupting only by the time it reaches 12 years of age. By 13 years, 28(77.78%) second molars and all other teeth have completed their eruption. By 14 years, almost all the teeth have completed erupting in the left maxilla of males. The table further shows that the third molar starts erupting at the age of 17 years as observed in other jaws. 9(26.47%), 16(45.71%), 10(31.25%) and 29(76.31%) third molars have erupted by the age group of 17 years, 18 years, 19 years and 25 years respectively.

Table 8: Number and percentage of erupted permanent teeth in the Khasi males (right mandibular)

| Age (in yrs) | $I_1$ | $I_2$ | $C_0$ | $P_1$ | $P_2$ | $M_1$ | $M_2$ | $M_3$ |
|---|---|---|---|---|---|---|---|---|
| 5 | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| 6 | 5(16.13) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 17(54.84) | 0(0.00) | 0(0.00) |
| 7 | 17(53.12) | 8(25.00) | 0(0.00) | 0(0.00) | 0(0.00) | 22(68.75) | 0(0.00) | 0(0.00) |
| 8 | 22(88.00) | 22(88.00) | 0(0.00) | 0(0.00) | 0(0.00) | 24(96.00) | 0(0.00) | 0(0.00) |
| 9 | 32(100.00) | 29(90.62) | 5(15.62) | 0(0.00) | 0(0.00) | 31(96.87) | 0(0.00) | 0(0.00) |
| 10 | 31(100.00) | 31(100.00) | 19(61.29) | 11(35.48) | 1(3.22) | 31(100.00) | 0(0.00) | 0(0.00) |
| 11 | 41(100.00) | 41(100.00) | 35(85.36) | 30(85.71) | 17(41.46) | 41(100.00) | 8(19.51) | 0(0.00) |
| 12 | 28(100.00) | 28(100.00) | 26(92.86) | 23(82.14) | 22(78.57) | 28(100.00) | 15(53.57) | 0(0.00) |
| 13 | 36(100.00) | 36(100.00) | 36(100.00) | 36(100.00) | 36(100.00) | 36(100.00) | 36(100.00) | 0(0.00) |
| 14 | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 0(0.00) |
| 15 | 29(100.00) | 29(100.00) | 29(100.00) | 29(100.00) | 29(100.00) | 29(100.00) | 29(100.00) | 0(0.00) |
| 16 | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 0(0.00) |
| 17 | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 3(8.82) |
| 18 | 35(100.00) | 35(100.00) | 35(100.00) | 35(100.00) | 35(100.00) | 35(100.00) | 35(100.00) | 12(34.28) |
| 19 | 32(100.00) | 32(100.00) | 32(100.00) | 32(100.00) | 32(100.00) | 32(100.00) | 32(100.00) | 21(65.62) |
| 20 | 38(100.00) | 38(100.00) | 38(100.00) | 38(100.00) | 38(100.00) | 38(100.00) | 38(100.00) | 21(55.26) |
| 21 | 26(100.00) | 26(100.00) | 26(100.00) | 26(100.00) | 26(100.00) | 26(100.00) | 26(100.00) | 10(38.46) |
| 22 | 36(100.00) | 36(100.00) | 36(100.00) | 36(100.00) | 36(100.00) | 36(100.00) | 36(100.00) | 17(47.22) |
| 23 | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 24(77.42) |
| 24 | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 21(67.74) |
| 25 | 38(100.00) | 38(100.00) | 38(100.00) | 38(100.00) | 38(100.00) | 38(100.00) | 38(100.00) | 20(52.63) |

Figures in parenthesis represent percentage

Table-8 shows that at 6 years of age there were only 5(16.13%) medial incisors and 17(54.84%) first, molars present in the right mandible of males. By 7 years of age, 17(53.12%) medial incisors, 8(25.00%) lateral incisors, and 22(68.75%) first molars are found to be erupted. At 8 years of age, there were 22(88.00%) medial incisors, 22(88.00%) lateral incisors and 24(96.00%) first molars were present. By 9 years of age, medial incisors and first molars have completed eruption and lateral incisors and canines were under the process of eruption. Medial incisors, lateral incisors and first molars have completed emerging at the age of 10 years.19 (61.29%) canines, 11(35.48%) first premolars, 1(3.22%) second premolar were under the process of eruption. By 12 years of age there were 26(92.86%) canines, 23(82.14%) premolars, 22(78.57%) second premolars and 8(19.51%) second molars were present. It has been observed that in the right mandible of males the eruption of teeth is completed by the age of 13 years. The third molar start erupting at the age of 17 years and a varying percentage of third molar is observed in different age groups. 3(8.82%) third molars at age group 17 years, 12(34.28%) at the age group 18 years, 21(65.62%) at the age of 19 years were present. The highest percentage is seen at the age group of 23 years, 24(77.42%) and at 25 years of age 20(52.63%) third molars were found to have emerged.

Table 9: Number and percentage of erupted permanent teeth in the Khasi males (left mandibular)

| Age (in yrs) | $I_1$ | $I_1$ | $C_0$ | $P_1$ | $P_2$ | $M_1$ | $M_2$ | $M_3$ |
|---|---|---|---|---|---|---|---|---|
| 5 | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| 6 | 3(9.68) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 16(51.61) | 0(0.00) | 0(0.00) |
| 7 | 16(50.00) | 10(31.25) | 0(0.00) | 0(0.00) | 0(0.00) | 23(71.87) | 0(0.00) | 0(0.00) |
| 8 | 21(84.00) | 22(88.00) | 0(0.00) | 0(0.00) | 0(0.00) | 25(100.00) | 0(0.00) | 0(0.00) |
| 9 | 31(96.87) | 30(93.75) | 6(18.75) | 0(0.00) | 0(0.00) | 32(100.00) | 0(0.00) | 0(0.00) |
| 10 | 31(100.00) | 31(100.00) | 21(67.74) | 9(29.03) | 0(0.00) | 31(100.00) | 0(0.00) | 0(0.00) |
| 11 | 41(100.00) | 41(100.00) | 36(87.80) | 30(73.71) | 14(34.15) | 41(100.00) | 12(29.27) | 0(0.00) |
| 12 | 28(100.00) | 28(100.00) | 27(96.43) | 22(78.57) | 20(71.43) | 28(100.00) | 16(57.14) | 0(0.00) |
| 13 | 36(100.00) | 36(100.00) | 36(100.00) | 36(100.00) | 36(100.00) | 36(100.00) | 36(100.00) | 0(0.00) |
| 14 | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 0(0.00) |
| 15 | 29(100.00) | 29(100.00) | 29(100.00) | 29(100.00) | 29(100.00) | 29(100.00) | 29(100.00) | 0(0.00) |
| 16 | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 0(0.00) |
| 17 | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 34(100.00) | 6(17.65) |
| 18 | 35(100.00) | 35(100.00) | 35(100.00) | 35(100.00) | 35(100.00) | 35(100.00) | 35(100.00) | 11(31.43) |
| 19 | 32(100.00) | 32(100.00) | 32(100.00) | 32(100.00) | 32(100.00) | 32(100.00) | 32(100.00) | 19(59.37) |
| 20 | 38(100.00) | 38(100.00) | 38(100.00) | 38(100.00) | 38(100.00) | 38(100.00) | 38(100.00) | 16(42.10) |
| 21 | 26(100.00) | 26(100.00) | 26(100.00) | 26(100.00) | 26(100.00) | 26(100.00) | 26(100.00) | 14(53.85) |
| 22 | 36(100.00) | 36(100.00) | 36(100.00) | 36(100.00) | 36(100.00) | 36(100.00) | 36(100.00) | 22(61.11) |
| 23 | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 16(51.61) |
| 24 | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 31(100.00) | 25(80.64) |
| 25 | 38(100.00) | 38(100.00) | 38(100.00) | 38(100.00) | 38(100.00) | 38(100.00) | 38(100.00) | 28(73.68) |

Figures in parenthesis represent percentage

Table- 9 shows that at 6 years of age, only 3(9.68%) medial incisors and 16(51.61%) first molars are observed to be present in the left mandible of male. At 7 years of age, 16(50.00%) medial incisors, 10(31.25%) lateral incisors and 23(71.87%) first molars have erupted. 21(84.00%) medial incisors, 22(88.00%) lateral incisors and all the first molars have erupted at 8 years of age. By 10 years, medial incisors, lateral incisors and first molars have completed eruption. 21(67.74%) canines, 9(29.03%) premolars were found in the same age group. By 13 years of age, all the teeth have completed eruption excepting the third molars. The eruption of third molar starts at 17 years of age .In case of left mandible of males the highest percentage is observed at the age group of 25 years i.e, 28(73.68%).

Table 10: Number and percentage of erupted permanent teeth in the Khasi females- sides pooled (maxillary)

| Age (in yrs) | $I^1$ | $I^2$ | $C^0$ | $P^1$ | $P^2$ | $M^1$ | $M^2$ | $M^3$ |
|---|---|---|---|---|---|---|---|---|
| 5 | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| 6 | 6(9.68) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 22(35.48) | 0(0.00) | 0(0.00) |
| 7 | 50(65.79) | 14(18.42) | 0(0.00) | 0(0.00) | 0(0.00) | 67(88.16) | 0(0.00) | 0(0.00) |
| 8 | 55(94.83) | 45(77.59) | 0(0.00) | (0.00) | 0(0.00) | 58(100.00) | 0(0.00) | 0(0.00) |
| 9 | 66(100.00) | 64(96.97) | 7(10.61) | 3(4.54) | 0(0.00) | 66(100.00) | 0(0.00) | 0(0.00) |
| 10 | 54(100.00) | 54(100.00) | 16(29.63) | 15(27.78) | 10(18.52) | 54(100.00) | 0(0.00) | 0(0.00) |
| 11 | 76(100.00) | 76(100.00) | 65(85.53) | 68(89.47) | 45(59.21) | 76(100.00) | 0(0.00) | 0(0.00) |
| 12 | 58(100.00) | 58(100.00) | 58(100.00) | 58(100.00) | 58(100.00) | 58(100.00) | 31(53.45) | 0(0.00) |
| 13 | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 0(0.00) |
| 14 | 56(100.00) | 56(100.00) | 56(100.00) | 56(100.00) | 56(100.00) | 56(100.00) | 56(100.00) | 0(0.00) |
| 15 | 74(100.00) | 74(100.00) | 74(100.00) | 74(100.00) | 74(100.00) | 74(100.00) | 74(100.00) | 0(0.00) |
| 16 | 66(100.00) | 66(100.00) | 66(100.00) | 66(100.00) | 66(100.00) | 66(100.00) | 66(100.00) | 0(0.00) |
| 17 | 58(100.00) | 58(100.00) | 58(100.00) | 58(100.00) | 58(100.00) | 58(100.00) | 58(100.00) | 6(10.34) |
| 18 | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 8(11.76) |
| 19 | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 14(20.59) |
| 20 | 62(100.00) | 62(100.00) | 62(100.00) | 62(100.00) | 62(100.00) | 62(100.00) | 62(100.00) | 20(32.26) |
| 21 | 70(100.00) | 70(100.00) | 70(100.00) | 70(100.00) | 70(100.00) | 70(100.00) | 70(100.00) | 22(31.43) |
| 22 | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 30(44.12) |
| 23 | 60(100.00) | 60(100.00) | 60(100.00) | 60(100.00) | 60(100.00) | 60(100.00) | 60(100.00) | 25(41.67) |
| 24 | 74(100.00) | 74(100.00) | 74(100.00) | 74(100.00) | 74(100.00) | 74(100.00) | 74(100.00) | 42(56.76) |
| 25 | 62(100.00) | 62(100.00) | 62(100.00) | 62(100.00) | 62(100.00) | 62(100.00) | 62(100.00) | 34(54.84) |

Figures in parenthesis represent percentage

Table- 10 shows the sides pooled number and percentage of erupted teeth where 6(9.68%) medial incisors and 22(35.48%) first molars have just emerged at 6 years of age group. At 7 years, 50(65.79%) medial incisors, 14(18.42%) lateral incisors and 67(88.16%) first molars have emerged and rest have not started to erupt. By 8 years of age 55(94.83%) medial incisors, 45(77.59%) lateral incisors and all the first molars have completed eruption. By 9 years of age the medial incisors and first molars have also completed eruption. There were 64(96.97%) lateral incisors, 7(10.61%) canines, 3(4.54%) first premolars also present at this age group. Second premolars first appear at the age of 10 years. By 13 years of age, all the teeth have completed eruption. The third molars appears to emerge at the age of 17 years. 6(10.3%) 8(11.76%), 14(20.59%), 22(31.43%) of third molars have erupted by the age group of 17 years, 18 years, 19 years and 20 years respectively.

Table 11: Number and percentage of erupted permanent teeth in the Khasi females- sides pooled (mandibular)

| Age (in yrs) | $I_1$ | $I_2$ | $C_0$ | $P_1$ | $P_2$ | $M_1$ | $M_2$ | $M_3$ |
|---|---|---|---|---|---|---|---|---|
| 5 | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| 6 | 19(30.65) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 59(95.16) | 0(0.00) | 0(0.00) |
| 7 | 60(78.95) | 53(69.74) | 0(0.00) | 0(0.00) | 0(0.00) | 74(97.37) | 0(0.00) | 0(0.00) |
| 8 | 58(100.00) | 54(93.10) | 6(10.34) | 0(0.00) | 0(0.00) | 58(100.00) | 0(0.00) | 0(0.00) |
| 9 | 66(100.00) | 66(100.00) | 35(53.03) | 2(3.03) | 0(0.00) | 66(100.00) | 0(0.00) | 0(0.00) |
| 10 | 54(100.00) | 54(100.00) | 43(79.63) | 9(16.67) | 1(1.85) | 54(100.00) | 0(0.00) | 0(0.00) |
| 11 | 76(100.00) | 76(100.00) | 68(89.47) | 24(31.58) | 13(17.10) | 76(100.00) | 26(34.21) | 0(0.00) |
| 12 | 58(100.00) | 58(100.00) | 53(91.38) | 50(86.21) | 44(75.86) | 58(100.00) | 37(63.79) | 0(0.00) |
| 13 | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 64(94.12) | 0(0.00) |
| 14 | 56(100.00) | 56(100.00) | 56(100.00) | 56(100.00) | 56(100.00) | 56(100.00) | 56(100.00) | 0(0.00) |
| 15 | 74(100.00) | 74(100.00) | 74(100.00) | 74(100.00) | 74(100.00) | 74(100.00) | 74(100.00) | 0(0.00) |
| 16 | 66(100.00) | 66(100.00) | 66(100.00) | 66(100.00) | 66(100.00) | 66(100.00) | 66(100.00) | 0(0.00) |
| 17 | 58(100.00) | 58(100.00) | 58(100.00) | 58(100.00) | 58(100.00) | 58(100.00) | 58(100.00) | 12(20.69) |
| 18 | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 18(26.47) |
| 19 | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 28(41.18) |
| 20 | 62(100.00) | 62(100.00) | 62(100.00) | 62(100.00) | 62(100.00) | 62(100.00) | 62(100.00) | 30(48.39) |
| 21 | 70(100.00) | 70(100.00) | 70(100.00) | 70(100.00) | 70(100.00) | 70(100.00) | 70(100.00) | 44(62.86) |
| 22 | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 40(58.82) |
| 23 | 60(100.00) | 60(100.00) | 60(100.00) | 60(100.00) | 60(100.00) | 60(100.00) | 60(100.00) | 33(55.00) |
| 24 | 74(100.00) | 74(100.00) | 74(100.00) | 74(100.00) | 74(100.00) | 74(100.00) | 74(100.00) | 51(68.92) |
| 25 | 62(100.00) | 62(100.00) | 62(100.00) | 62(100.00) | 62(100.00) | 62(100.00) | 62(100.00) | 45(72.58) |

Figures in parenthesis represent percentage

Table- 11 represents the side- pooled number of mandibular teeth erupted in the males. The table shows that at age group 6 years, 19(30.65%) medial incisors and 59(95.16%) first molars were found to emerged and when they reached 7 years of age, 60(78.95%) medial incisors, 53(69.74%) lateral incisors and 74(97.37%) first molars had emerged. By 8 years of age medial incisors and first molars have completed eruption. There were 54(93.10%) lateral incisors and 6(10.34%) canines in this age group and rest teeth have not erupted. By 10 years of age, 35(53.03%) canines, 2(3.03%) first premolars and 1(1.85%) second premolars show their appearance. The second molar appears at the age of 11 years. By the age of 13 years all the teeth in the mandible of female completed eruption excepting the second molar. But by the next age group i.e, 13 years, the eruption of all the teeth have completed. The eruption of third molar starts at the age of 17 years. 12(20.69%), 18(26.47%), 28(41.18%) and 45(72.58%) third molars have erupted by the age group of 17 years, 18 years, 19 years and 25 years respectively.

Table 12: Number and percentage of erupted permanent teeth in the Khasi males – sides pooled (maxillary)

| Age ( in yrs) | $I^1$ | $I^2$ | $C^0$ | $P^1$ | $P^2$ | $M^1$ | $M^2$ | $M^3$ |
|---|---|---|---|---|---|---|---|---|
| 5 | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| 6 | 2(3.22) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 21(33.87) | 0(0.00) | 0(0.00) |
| 7 | 25(39.06) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 55(85.94) | 0(0.00) | 0(0.00) |
| 8 | 41(82.00) | 21(42.00) | 0(0.00) | 0(0.00) | 0(0.00) | 47(94.00) | 0(0.00) | 0(0.00) |
| 9 | 61(95.31) | 53(82.81) | 0(0.00) | 0(0.00) | 0(0.00) | 60(96.87) | 0(0.00) | 0(0.00) |
| 10 | 62(100.00) | 57(91.93) | 4(6.45) | 15(24.19) | 5(8.06) | 62(96.87) | 0(0.00) | 0(0.00) |
| 11 | 82(100.00) | 82(100.00) | 38(46.34) | 64(78.00) | 42(51.22) | 81(98.78) | 0(0.00) | 0(0.00) |
| 12 | 56(100.00) | 56(100.00) | 49(87.50) | 48(85.71) | 43(76.78) | 56(100.00) | 28(50.00) | 0(0.00) |
| 13 | 72(100.00) | 72(100.00) | 72(100.00) | 72(100.00) | 72(100.00) | 72(100.00) | 55(76.39) | 0(0.00) |
| 14 | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 0(0.00) |
| 15 | 58(100.00) | 58(100.00) | 58(100.00) | 58(100.00) | 58(100.00) | 58(100.00) | 58(100.00) | 0(0.00) |
| 16 | 62(100.00) | 62(100.00) | 62(100.00) | 62(100.00) | 62(100.00) | 62(100.00) | 62(100.00) | 0(0.00) |
| 17 | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 16(23.53) |
| 18 | 70(100.00) | 70(100.00) | 70(100.00) | 70(100.00) | 70(100.00) | 70(100.00) | 70(100.00) | 29(41.43) |
| 19 | 64(100.00) | 64(100.00) | 64(100.00) | 64(100.00) | 64(100.00) | 64(100.00) | 64(100.00) | 26(40.62) |
| 20 | 76(100.00) | 76(100.00) | 76(100.00) | 76(100.00) | 76(100.00) | 76(100.00) | 76(100.00) | 41(53.95) |
| 21 | 52(100.00) | 52(100.00) | 52(100.00) | 52(100.00) | 52(100.00) | 52(100.00) | 52(100.00) | 34(65.38) |
| 22 | 72(100.00) | 72(100.00) | 72(100.00) | 72(100.00) | 72(100.00) | 72(100.00) | 72(100.00) | 44(61.11) |
| 23 | 62(100.00) | 62(100.00) | 62(100.00) | 62(100.00) | 62(100.00) | 62(100.00) | 62(100.00) | 45(72.58) |
| 24 | 62(100.00) | 62(100.00) | 62(100.00) | 62(100.00) | 62(100.00) | 62(100.00) | 62(100.00) | 37(59.68) |
| 25 | 76(100.00) | 76(100.00) | 76(100.00) | 76(100.00) | 76(100.00) | 76(100.00) | 76(100.00) | 56(73.68) |

Figures in parenthesis represent percentage

Number of erupted teeth (sides- pooled) in the maxilla of males is shown in Table-12, where it is observed that at 6 years of age only 2(3.22%) medial incisors and 21(31.25%) first molars were observed to have emerged. At 7 years of age, there were 25(39.06%) medial incisors and 55(85.94%) first molars have emerged. By 8 years of age 41(82.00%) medial incisors, 21(42.00%) lateral incisors and 47(94.00%) first molars have erupted. In 10 years of age group, the medial incisors have completed eruption, and 57(91.93%) lateral incisors, 4(6.45%) canines, 15(24.19%) first premolars, 5(8.06%) second premolars and 62(96.87%) first molars were erupted. By 12 years all the medial incisors, lateral incisor and first molars and 28(50%) second molars were found to be erupted. In the age group 13 years, all the teeth completed eruption except the second molars. Finally all the maxillary teeth completed erupting by 14 years of age. The third molars starts erupting by the age group of 17 years 16(23.53%), 29(41.43%), 26(40.62%) and 56(73.68%) third molars have erupted by the age group of 17 years, 18 years, 19 years and 25 years respectively.

Table 13: Number and percentage of erupted permanent teeth in the Khasi males – sides pooled (mandibular)

| Age (in yrs) | $I_1$ | $I_2$ | $C_0$ | $P_1$ | $P_2$ | $M_1$ | $M_2$ | $M_3$ |
|---|---|---|---|---|---|---|---|---|
| 5 | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| 6 | 8(12.90) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 33(53.22) | 0(0.00) | 0(0.00) |
| 7 | 33(51.56) | 18(28.12) | 0(0.00) | 0(0.00) | 0(0.00) | 45(70.31) | 0(0.00) | 0( 0.00) |
| 8 | 43(86.00) | 44(88.00) | 0(0.00) | 0(0.00) | 0(0.00) | 49(98.00) | 0(0.00) | 0(0.00) |
| 9 | 63(98.44) | 59(92.19) | 11(17.19) | 0(0.00) | 0(0.00) | 63(100.00) | 0(0.00) | 0(0.00) |
| 10 | 62(100.00) | 62(100.00) | 40(64.52) | 20(32.26) | 0(0.00) | 62(100.00) | 0(0.00) | 0(0.00) |
| 11 | 82(100.00) | 82(100.00) | 71(86.58) | 60(73.17) | 31(37.80) | 82(100.00) | 20(24.39) | 0(0.00) |
| 12 | 56(100.00) | 56(100.00) | 56(100.00) | 56(100.00) | 56(100.00) | 56(100.00) | 31(55.36) | 0(0.00) |
| 13 | 72(100.00) | 72(100.00) | 72(100.00) | 72(100.00) | 72(100.00) | 72(100.00) | 72(100.00) | 0(0.00) |
| 14 | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 0(0.00) |
| 15 | 58(100.00) | 58(100.00) | 58(100.00) | 58(100.00) | 58(100.00) | 58(100.00) | 58(100.00) | 0(0.00) |
| 16 | 62(100.00) | 62(100.00) | 62(100.00) | 62(100.00) | 62(100.00) | 62(100.00) | 62(100.00) | 0(0.00) |
| 17 | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 68(100.00) | 9(13.23) |
| 18 | 70(100.00) | 70(100.00) | 70(100.00) | 70(100.00) | 70(100.00) | 70(100.00) | 70(100.00) | 23(32.86) |
| 19 | 64(100.00) | 64(100.00) | 64(100.00) | 64(100.00) | 64(100.00) | 64(100.00) | 64(100.00) | 40(62.50) |
| 20 | 76(100.00) | 76(100.00) | 76(100.00) | 76(100.00) | 76(100.00) | 76(100.00) | 76(100.00) | 37(48.68) |
| 21 | 52(100.00) | 52(100.00) | 52(100.00) | 52(100.00) | 52(100.00) | 52(100.00) | 52(100.00) | 24(46.15) |
| 22 | 72(100.00) | 72(100.00) | 72(100.00) | 72(100.00) | 72(100.00) | 72(100.00) | 72(100.00) | 39(54.17) |
| 23 | 62(100.00) | 62(100.00) | 62(100.00) | 62(100.00) | 62(100.00) | 62(100.00) | 62(100.00) | 40(64.52) |
| 24 | 62(100.00) | 62(100.00) | 62(100.00) | 62(100.00) | 62(100.00) | 62(100.00) | 62(100.00) | 46(74.19) |
| 25 | 76(100.00) | 76(100.00) | 76(100.00) | 76(100.00) | 76(100.00) | 76(100.00) | 76(100.00) | 48(63.16) |

Figures in parenthesis represent percentage

Table-13 shows that at 6 years of age, 8(12.90%) medial incisors and 33(53.22%) first molars have erupted. 33(51.56%) medial incisors, 18(28.12%) lateral incisors and 45(70.31%) first molars were erupted at 7 years of age. By 9 years of age, the first molars have completed eruption. At the age of 10 years the medial incisors ,lateral incisors and first molars completed eruption. By 11 years of age, the second molars start eruption. The mandibular teeth in males completed eruption by 13 years. The third molars start eruption at the age of 17 years. 9(13.23%), 23(32.86%), 40(62.50%) and 48(63.16%) third molars have erupted at the age group of 17 years, 18 years, 19 years and 25 years respectively.

Table: 14 Number and percentage of erupted permanent teeth in the Khasi boys and girls excepting the third molar –sides pooled (maxillary and mandibular)

| Age (in yrs) | Maxillary | | | | Mandibular | | | |
|---|---|---|---|---|---|---|---|---|
| | Boys | | Girls | | Boys | | Girls | |
| | No. of teeth | Percentage | No. of teeth | Percentage | No. of teeth | Percentage | No. of teeth | Percentage |
| 6 | 23 | 5.30 | 28 | 6.45 | 41 | 9.45 | 78 | 17.97 |
| 7 | 80 | 17.86 | 131 | 24.62 | 96 | 21.43 | 187 | 35.15 |
| 8 | 109 | 31.14 | 158 | 38.92 | 136 | 38.86 | 176 | 43.35 |
| 9 | 174 | 38.84 | 206 | 44.59 | 196 | 43.75 | 235 | 50.87 |
| 10 | 205 | 47.23 | 203 | 53.70 | 246 | 56.68 | 215 | 56.88 |
| 11 | 389 | 67.77 | 406 | 76.32 | 428 | 74.56 | 359 | 67.48 |
| 12 | 336 | 85.71 | 379 | 93.35 | 339 | 86.48 | 358 | 88.18 |
| 13 | 487 | 96.63 | 476 | 100.00 | 504 | 100.00 | 472 | 99.16 |
| 14 | 476 | 100.00 | 392 | 100.00 | 476 | 100.00 | 392 | 100.00 |

Table 14 shows the percentage frequency of erupted teeth among the Khasi children of Shillong. The above table shows that the permanent teeth in both boys and girls start emerging at 6 years of age and completes by 14 years. Fig.1 depicts the

percentage frequency of permanent erupted teeth excepting the third molar in Khasi boys and girls (maxillary and mandibular).

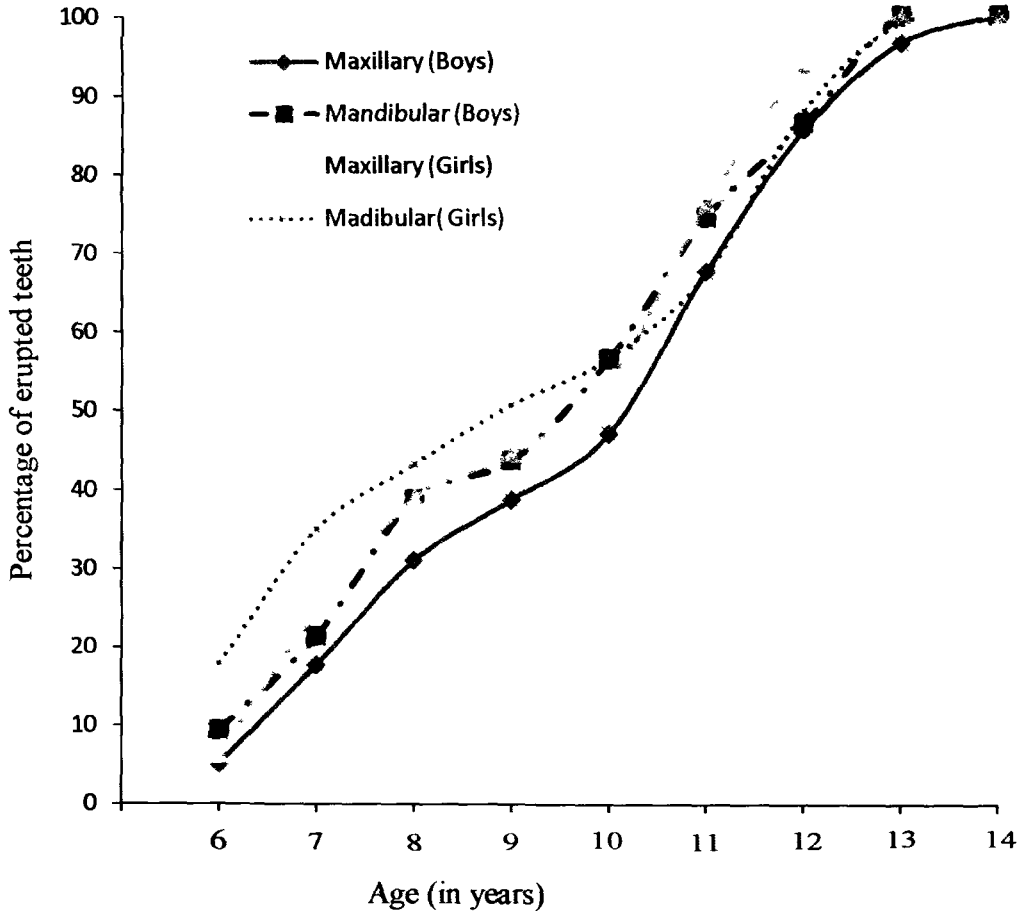



Fig.1. Percentage frequency of permanent erupted teeth excepting the third molar in Khasi boys and girls (maxillary and mandibular)

Table 15: Number and percentage of erupted teeth in the Khasi females – all teeth combined (maxillary)

| Age ( in yrs) | Number of teeth excluding M3 | Percentage |
|---|---|---|
| 6 | 28 | 6.45 |
| 7 | 131 | 24.62 |
| 8 | 158 | 38.92 |
| 9 | 206 | 44.59 |
| 10 | 203 | 53.70 |
| 11 | 406 | 76.32 |
| 12 | 379 | 93.35 |
| 13 | 476 | 100.00 |
| 14 | 392 | 100.00 |
| 15 | 518 | 100.00 |
| 16 | 462 | 100.00 |
| | **Number of teeth including M3** | |
| 17 | 412 | 88.79 |
| 18 | 484 | 88.97 |
| 19 | 490 | 90.07 |
| 20 | 454 | 91.53 |
| 21 | 512 | 91.43 |
| 22 | 506 | 93.01 |
| 23 | 445 | 92.71 |
| 24 | 560 | 94.59 |
| 25 | 468 | 94.35 |

The number and percentage of all erupted maxillary teeth combined in females is present in Table 15. This table shows that the percentage of erupted teeth increases with increasing age. There are 28(6.45%) teeth to have erupted at 6 years of age and by 10 years of age group more than 50% have erupted and 100% teeth have erupted by 13 years of age. All the teeth except the third molars have completed eruption by 13 years of age among the Khasi females. This table further shows that the third molar starts erupting at the age of 17 years and reaches almost 95% by 25 years of age. This

table reveals that all the teeth increases in percentage frequency as the age group increases.

Table 16: Number and percentage of erupted teeth in the Khasi females – all teeth combined (mandibular)

| Age (in yrs) | Number of teeth excluding M3 | Percentage |
|---|---|---|
| 6 | 78 | 17.97 |
| 7 | 187 | 35.15 |
| 8 | 176 | 43.35 |
| 9 | 235 | 50.87 |
| 10 | 215 | 56.88 |
| 11 | 359 | 67.48 |
| 12 | 358 | 88.18 |
| 13 | 472 | 99.16 |
| 14 | 392 | 100.00 |
| 15 | 518 | 100.00 |
| 16 | 462 | 100.00 |
| | **Number of teeth including M3** | |
| 17 | 418 | 90.09 |
| 18 | 494 | 90.81 |
| 19 | 504 | 92.65 |
| 20 | 464 | 93.55 |
| 21 | 534 | 95.36 |
| 22 | 516 | 94.85 |
| 23 | 453 | 94.37 |
| 24 | 569 | 96.11 |
| 25 | 479 | 96.57 |

Table-16 represents the mandibular teeth where a total of 78(17.97%) teeth have emerged at 6 years of age. In the lower jaw more than 50% of teeth observed to have emerged by 10 years of age and finally the eruption is

completed at age except the third molars. The third molars starts erupting at the age of 17 years and reaches almost 97% by 25 years of age. This table shows that generally all the teeth increases in percentage frequency as the age group increases.

Table 17: Number and percentage of erupted teeth the Khasi in females – all teeth combined (both the jaws)

| Age in yrs | Number of teeth excluding M3 | Percentage |
|---|---|---|
| 6 | 106 | 12.21 |
| 7 | 318 | 29.89 |
| 8 | 334 | 41.31 |
| 9 | 441 | 47.73 |
| 10 | 418 | 55.29 |
| 11 | 765 | 71.90 |
| 12 | 737 | 90.76 |
| 13 | 948 | 99.58 |
| 14 | 784 | 100.00 |
| 15 | 1036 | 100.00 |
| 16 | 924 | 100.00 |
| | **Number of teeth including M3** | |
| 17 | 830 | 89.44 |
| 18 | 978 | 89.89 |
| 19 | 994 | 91.36 |
| 20 | 918 | 92.54 |
| 21 | 1046 | 93.39 |
| 22 | 1022 | 93.93 |
| 23 | 898 | 93.54 |
| 24 | 1129 | 95.35 |
| 25 | 947 | 95.46 |

The number and percentage of erupted maxillary teeth combined in males is presented in Table 17, which shows that the number and percentage of erupted teeth

increases with increasing age. There were 23(5.30%) teeth to have erupted by 6 years of age and by 11years of age more than 50% of teeth have erupted. By 14 years of age all the teeth completed eruption excepting the third molars. The third molars starts erupting at the age of 17 years and by 25 years of age reaches almost 97%. This table shows that generally all the teeth increases in percentage frequency as the age group increases.

Table 18. Number and Percentage of erupted teeth in the Khasi males –all teeth combined (maxillary)

| **Age (in yrs)** | **Number of teeth excluding M3** | **Percentage** |
|---|---|---|
| 6 | 23 | 5.30 |
| 7 | 80 | 17.86 |
| 8 | 109 | 31.14 |
| 9 | 174 | 38.84 |
| 10 | 205 | 47.23 |
| 11 | 389 | 67.77 |
| 12 | 336 | 85.71 |
| 13 | 487 | 96.63 |
| 14 | 476 | 100.00 |
| 15 | 406 | 100.00 |
| 16 | 434 | 100.00 |
| | **Number of teeth including M3** | |
| 17 | 492 | 90.44 |
| 18 | 519 | 92.68 |
| 19 | 474 | 92.58 |
| 20 | 573 | 94.24 |
| 21 | 398 | 95.67 |
| 22 | 548 | 95.14 |
| 23 | 479 | 94.96 |
| 24 | 471 | 94.96 |

Table 18 reveals the number and percentage of erupted teeth combined in males. At the age of 6 years, 23(5.30%) teeth have erupted. Gradually the percentage increases

and as it reaches 10 years of age more than 50% teeth erupted. By 14 years of age the second molars 476(100%) teeth have erupted except the third molars. The third molars starts erupting at the age of 17 years and by 25 years of age it reaches almost 95%.

Table 19. Number and percentage of erupted teeth in the Khasi males – all teeth combined (mandibular)

| Age (in yrs) | Number of teeth excluding M3 | Percentage |
|---|---|---|
| 6 | 41 | 9.45 |
| 7 | 96 | 21.43 |
| 8 | 136 | 38.86 |
| 9 | 196 | 43.75 |
| 10 | 246 | 56.68 |
| 11 | 428 | 74.56 |
| 12 | 339 | 86.48 |
| 13 | 504 | 100.00 |
| 14 | 476 | 100.00 |
| 15 | 406 | 100.00 |
| 16 | 434 | 100.00 |
| | **Number of teeth including M3** | |
| 17 | 485 | 89.15 |
| 18 | 513 | 91.61 |
| 19 | 488 | 95.31 |
| 20 | 569 | 93.58 |
| 21 | 388 | 93.27 |
| 22 | 543 | 94.27 |
| 23 | 474 | 95.56 |
| 24 | 480 | 96.77 |
| 25 | 580 | 95.39 |

By observing all the teeth combined in males as given in Table-19 it is seen that in 6 years of age group, 41(9.45%) teeth have emerged and the number and percentage of

teeth erupted increases with the increasing age. At the age of 10 years, more than 50% teeth found to be erupted and by the end of 13 years, 504(100%) of teeth completed eruption. This table further shows that the third molar starts erupting at the age of 17 years and reaches 96% by 25 years of age. This table shows that all the teeth increases in percentage as the age group increases.

Table 20: Number and percentage of erupted teeth in the Khasi males – all teeth combined (both the jaws)

| **Age (in yrs)** | **Number of teeth excluding M3** | **Percentage** |
|---|---|---|
| 6 | 64 | 7.37 |
| 7 | 176 | 19.64 |
| 8 | 245 | 35.00 |
| 9 | 370 | 41.29 |
| 10 | 451 | 51.96 |
| 11 | 817 | 71.17 |
| 12 | 675 | 86.10 |
| 13 | 991 | 98.31 |
| 14 | 952 | 100.00 |
| 15 | 812 | 100.00 |
| 16 | 868 | 100.00 |
| | **Number of teeth including M3** | |
| 17 | 977 | 89.90 |
| 18 | 1032 | 92.14 |
| 19 | 962 | 93.94 |
| 20 | 1142 | 93.91 |
| 21 | 786 | 94.47 |
| 22 | 1091 | 94.70 |
| 23 | 953 | 96.70 |
| 24 | 951 | 95.87 |
| 25 | 1168 | 96.05 |

The number and percentage of erupted teeth combined in males is given in Table 20. It shows that 64(7.37%) teeth have erupted at the age of 6 years and as

the age group increases the percentage of erupted teeth also increases. Table 20 further shows that more than 50% of teeth erupted by the age of 11years. All the teeth except the third molars completed eruption by 14 years of age. The eruption of third molars starts at age of 17 years and reaches almost 96% by 25 years of age. From the table it has been observed that all the teeth increases in percentage with the increase of age. Fig.2 depicts the percentage frequency of erupted permanent teeth excepting the third molar in the Khasi boys and girls -all teeth combined.

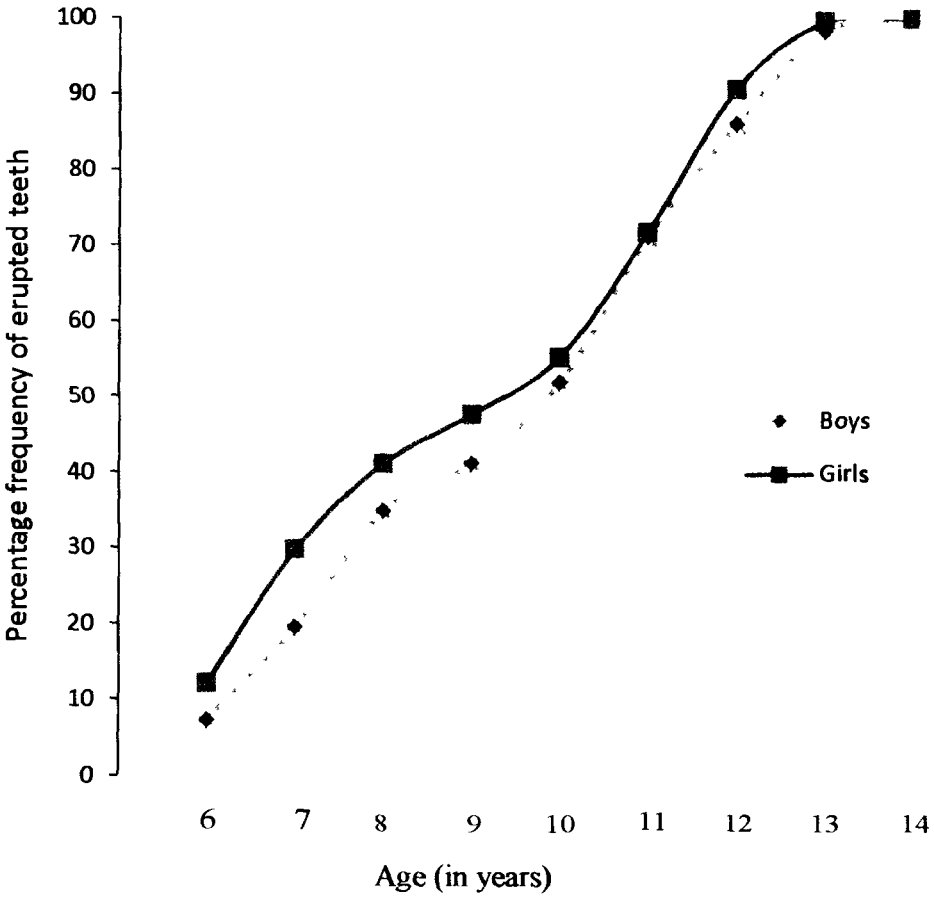



Fig. 2. Percentage frequency of erupted permanent teeth excepting the third molar in the Khasi boys and girls -all teeth combined.

Table 21: Median age (± S.D) of tooth emergence in the Khasi males and females- (left quadrant)

| JAW | SEX | $I^1$ | $I^2$ | $C^0$ | $P^1$ | $P^2$ | $M^1$ | $M^2$ | $M^3$ |
|---|---|---|---|---|---|---|---|---|---|
| (Maxillary) | Boys | 7.3 | 8.8 | 11.3 | 11.9 | 11.2 | 6.7 | 12.2 | 19.6 |
| | (± S.D) | (0.3) | (0.4) | (0.25) | (0.3) | (0.3) | (0.4) | (0.25) | (1.9) |
| | Girls | 6.7 | 6.8 | 10 | 10 | 10.6 | 6.1 | 12.2 | 22.7 |
| | (± S.D) | (0.35) | (0.3) | (0.3) | (0.3) | (0.25) | (0.3) | (0.1) | (2.05) |
| **JAW** | **SEX** | $I_1$ | $I_2$ | $C_0$ | $P_1$ | $P_2$ | $M_1$ | $M_2$ | $M_3$ |
| (Mandibular) | Boys | 7.5 | 7.7 | 10.2 | 11 | 11.5 | 6.3 | 11.6 | 21.6 |
| | (± S.D) | (0.35) | (0.35) | (0.4) | (0.3) | (0.25) | (0.25) | (0.2) | (2.05) |
| | Girls | 6.5 | 7.1 | 9.8 | 10 | 11.2 | 5.8 | 10.6 | 21.0 |
| | (± S.D) | (0.25) | (0.3) | (0.5) | (0.4) | (0.25) | (0.2) | (0.35) | (0.07) |

Table 22: Median age (± S.D) of tooth emergence in the Khasi males and females – (right quadrant)

| JAW | SEX | $I^1$ | $I^2$ | $C^0$ | $P^1$ | $P^2$ | $M^1$ | $M^2$ | $M^3$ |
|---|---|---|---|---|---|---|---|---|---|
| (Maxillary) | Boys | 7.6 | 7.9 | 10.8 | 10.7 | 11.3 | 6.9 | 12.4 | 20.3 |
| | (± S.D) | (0.35) | (0.30) | (0.20) | (0.45) | (0.30) | (0.35) | (0.25) | (1.50) |
| | Girls | 6.7 | 7.5 | 10.1 | 10.2 | 10.7 | 6.3 | 12.2 | 23.6 |
| | (± S.D) | (0.30) | (0.25) | (0.35) | (0.25) | (0.25) | (0.25) | (0.10) | (2.00) |
| **JAW** | **SEX** | $I_1$ | $I_2$ | $C_0$ | $P_1$ | $P_2$ | $M_1$ | $M_2$ | $M_3$ |
| (Mandibular) | Boys | 6.8 | 7.8 | 10.4 | 10.8 | 11.3 | 6.8 | 11.7 | 21.3 |
| | (± S.D) | (0.30) | (0.35) | (0.40) | (0.40) | (0.25) | (0.45) | (0.20) | (1.08) |
| | Girls | 6.4 | 6.8 | 9.6 | 11.0 | 11.6 | 5.9 | 11.4 | 20.5 |
| | (± S.D) | (0.20) | (0.30) | (0.50) | (0.30) | (0.20) | (0.15) | (0.40) | (1.06) |

Table- 21 and 22 present the median age (±SD) of tooth emergence with their standard deviations by age, sex and jaw of left and right side respectively. The side wise comparision of Tables 21 and 22 shows that all the teeth in the left

maxilla of boys have emerged earlier than the right maxilla except lateral incisors, canines and first premolars.

In case of girls medial incisor and second molar of left quadrant and right quadrant emerges at the same period of time. The other teeth were observed to erupt earlier in the left maxilla than the right maxilla.

Regarding the mandibular teeth except medial incisor, second premolar and third molar, all other teeth shows early eruption in the left mandible than in the right mandible of boys.

Girls shows earlier tooth emergence in the right mandible except first premolar, second premolar and third molar. They emerges earlier in the left mandible.

Table 23: Median age (± S.D) of tooth emergence among the Khasis-both quadrants combined

| JAW | SEX | $I^1$ | $I^2$ | $C^0$ | $P^1$ | $P^2$ | $M^1$ | $M^2$ | $M^3$ |
|---|---|---|---|---|---|---|---|---|---|
| (Maxillary) | Boys | 7.45 (0.35) | 8.35 (0.35) | 11.05 (0.23) | 11.3 (0.38) | 11.25 (0.3) | 6.8 (0.38) | 12.3 (0.25) | 19.95 (1.4) |
| | Girls | 7.15 (0.33) | 7.75 (0.28) | 10.05 (0.33) | 10.1 (5.05) | 10.65 (5.33) | 6.2 (3.1) | 12.2 (6.1) | 23.15 (11.57) |
| **JAW** | **SEX** | $I_1$ | $I_2$ | $C_0$ | $P_1$ | $P_2$ | $M_1$ | $M_2$ | $M_3$ |
| (Mandible) | Boys | 7.15 (0.33) | 7.75 (0.35) | 10.3 (0.4) | 10.9 (0.35) | 11.4 (0.25) | 6.55 (0.35) | 11.65 (0.2) | 21.45 (1.6) |
| | Girls | 6.45 (0.25) | 6.95 (0.3) | 9.7 (0.5) | 10.5 (0.35) | 11.4 (0.23) | 5.85 (0.18) | 11.0 (0.38) | 20.75 (1.07) |

Table- 23 reveals the median age (±SD) deviations by age sex and jaw of both sides respectively in boys and girls. It can be seen that all mandibular teeth with the exception of second premolar and third molar in boys and in girls, all

mandibular teeth emerge earlier than the maxillary teeth excepting first premolar and second premolar. The median age of eruption of various teeth in girls is always lower than that observed for boys. The entire eruption of permanent teeth(except third molars) takes place between median age 5.85 to 12.2 and 6.55 to12.3 in boys.

The order of eruption by jaw and sexes are follows: The order of eruption by jaw and sex is as follows -

**Order of Eruption**

The order of eruption of permanent tooth by jaw and sex among the Khasis is as follows:

Maxilla in males -$M^1 > I^1 > I^2 > C^0 > P^2 > P^1 > M^2 > M^3$

Maxilla in females -$M^1 > I^1 > I^2 > C^0 > P^1 > P^2 > M^2 > M^3$

Mandible in males -$M_1 > I_1 > I_2 > C_0 > P_1 > P_2 > M_2 > M_3$

Mandible in females -$M_1 > I_1 > I_2 > C_0 > P_1 > M_2 > P_2 > M_3$

Both the jaws combined

In males- $M_1 > M^1 > I_1 > I^1 > I_2 > I^2 > C_0 > P_1 > C^0 > P^2 > P^1 > P_2 > M_2 > M^2 > M^3 > M_3$

In females- $M_1 > M^1 > I_1 > I_2 > I^1 > I^2 > C_0 > C^0 > P^1 > P_1 > P^2 > M_2 > P_2 > M^2 > M_3 > M^3$

In both the jaws and sexes, the earliest erupted tooth is the first molar, followed by the medial incisor and then erupt the lateral incisors. But the canine

changes its placing according to the jaw and sex. Canines erupt earlier to the premolars and molars in both the jaws and both the sexes.

In both the jaws and sexes combined, the first tooth to be emerged is the first mandibular molar. In all the teeth considered right from first molar upto second molar the mandibular teeth emerge before the maxillary teeth of same type do, excepting the premolars which changes its placing depending upon the jaw and sex as explained earlier.

Table 24. Percentage frequency of erupted teeth in boys by age (Maxillary)

| Age (in years) | Populations | | | | | |
|---|---|---|---|---|---|---|
| | Garo (n=287) | Biate (n=190) | Deori (n=217) | Sakachep (n=74) | Gallong (n=494) | Khasi (n=1254) |
| 5 | 2.40 | 7.14 | 2.38 | 8.57 | 0.00 | 0.00 |
| 6 | 18.51 | 14.64 | 13.26 | 10.71 | 2.24 | 5.30 |
| 7 | 28.57 | 31.95 | 31.43 | 14.28 | 14.11 | 17.86 |
| 8 | 35.97 | 48.41 | 43.88 | 26.19 | 29.73 | 31.14 |
| 9 | 49.42 | 59.52 | 52.50 | 38.77 | 40.41 | 38.84 |
| 10 | 61.71 | 67.61 | 70.83 | 47.95 | 45.22 | 47.23 |
| 11 | 73.07 | 77.14 | 74.15 | 77.77 | 61.35 | 67.77 |
| 12 | 90.57 | 89.64 | 93.91 | 85.71 | 83.33 | 85.71 |
| 13 | 98.57 | 98.57 | 98.64 | 89.28 | 92.52 | 96.63 |
| 14 | 99.72 | 100 | 100 | 95.23 | 100 | 100 |
| 15 | 100 | 100 | 100 | 99.20 | 100 | 100 |

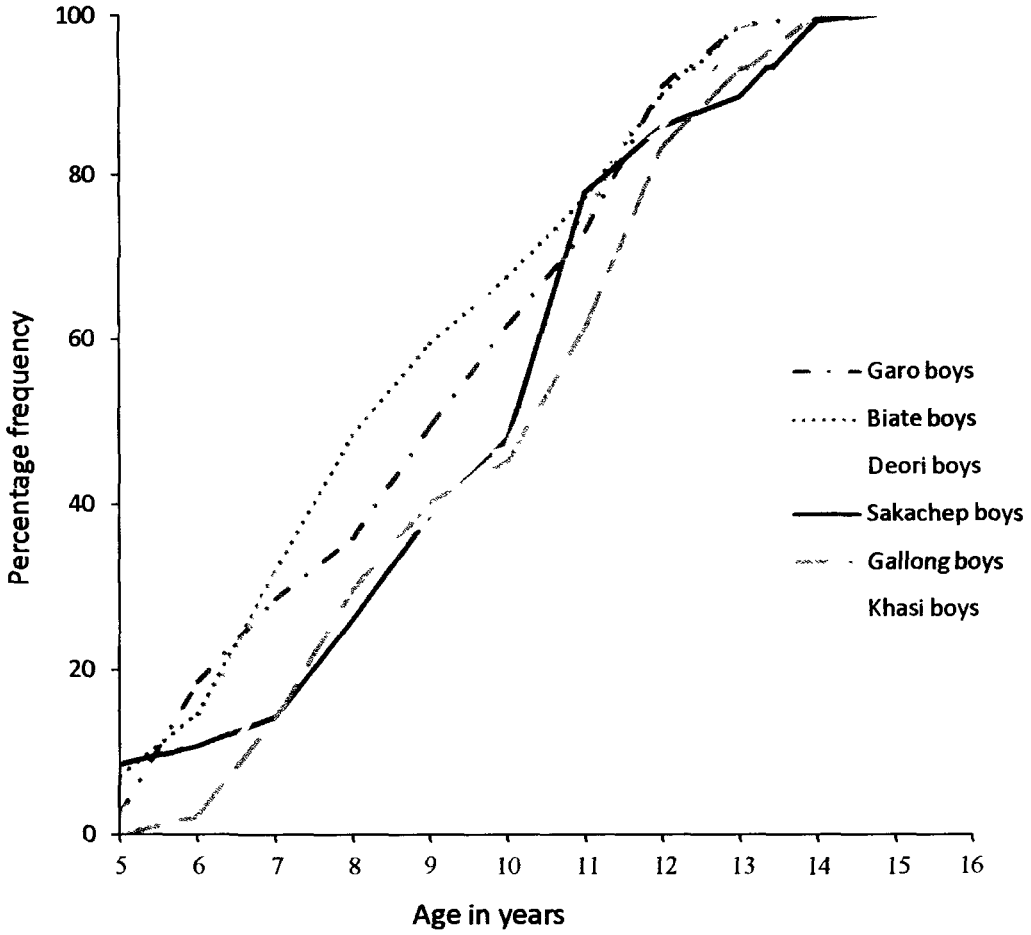



Fig. 3. Percentage frequency of erupted teeth in boys (Maxillary)

Table 24 shows the percentage frequency of erupted permanent maxillary teeth among some Mongoloid boys of Northeast India. The above table shows that by 5 year of age, permanent teeth start emerging in almost all the populations considered for comparison. The only exception is the Gallong and the Khasi boys where the permanent tooth emerges earliest at 6years of age. This table further reveals that the percentage of erupted permanent teeth increases with the increase of age. The eruption completes in almost all the populations by 14 years of age excepting the Sakachep boys where the

eruption completes by 15 years of age. Fig.3 depicts the trends of eruption of the permanent maxillary teeth in the boys of the above mentioned populations.

Table 25. Percentage frequency of erupted teeth in girls by age (Maxillary)

| Age (in years) | Populations | | | | |
|---|---|---|---|---|---|
| | Garo (n=303) | Sakachep (n=77) | Mamgar (n=335) | Gallong (n=515) | Khasi (n=1263) |
| 5 | 0.00 | 0.00 | 2.98 | 0.00 | 0.00 |
| 6 | 5.41 | 3.89 | 4.69 | 2.23 | 6.45 |
| 7 | 25.76 | 19.04 | 25.86 | 19.93 | 24.62 |
| 8 | 36.24 | 30.95 | 30.30 | 31.52 | 38.92 |
| 9 | 41.14 | 37.14 | 43.75 | 44.77 | 44.59 |
| 10 | 48.07 | 57.14 | 56.91 | 56.43 | 53.70 |
| 11 | 66.07 | 61.14 | 81.10 | 73.81 | 76.32 |
| 12 | 91.48 | 85.71 | 90.40 | 90.06 | 93.35 |
| 13 | 99.06 | 95.91 | 100 | 97.71 | 100 |
| 14 | 99.20 | 98.57 | 100 | 100 | 100 |
| 15 | 100 | 100 | 100 | 100 | 100 |

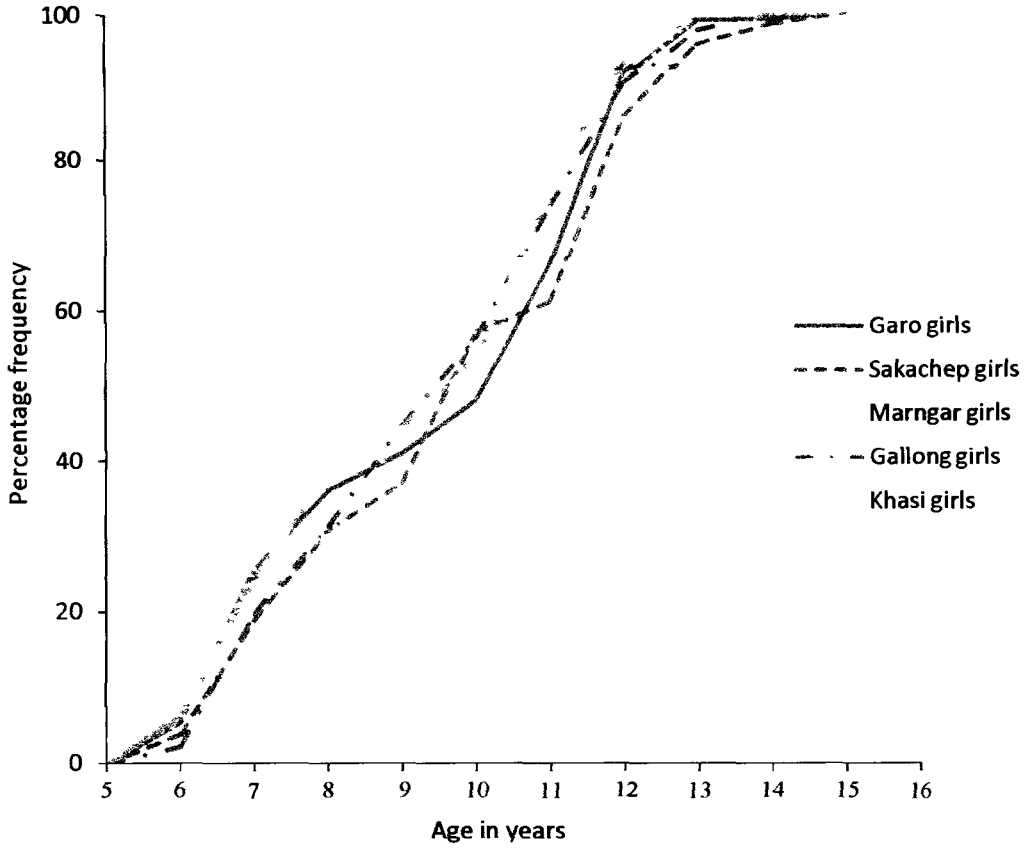



Fig. 4. Percentage frequency of erupted teeth in girls (Maxillary)

Table 25 shows the percentage frequency of erupted maxillary teeth among some mongoloid girls of Northeast India. The above table shows that the emergence of permanent teeth is advance in the Marngar girls (2.98) then the rest of the girls compared. By 6years of age permanent teeth start emerging in all the populations. Eruption of permanent teeth completes earliest in the Marngnar and the Khasi girls (13 years) followed by the Gallong girls (14 years). By 15 years of age eruption completes in all the populations compared. Fig.4 depicts the trends of eruption of the permanent maxillary teeth in the girls of the above mentioned populations.

Table 26. Percentage frequency of erupted teeth in boys by age (Mandibular)

| Age (in years) | Populations | | | | | |
|---|---|---|---|---|---|---|
| | Garo (n=287) | Biate (n=190) | Deori (n=217) | Sakachep (n=74) | Gallong (n=494) | Khasi (n=1254) |
| 5 | 3.69 | 8.57 | 3.74 | 10.00 | 0.00 | 0.00 |
| 6 | 23.54 | 15.71 | 15.65 | 10.71 | 6.53 | 9.45 |
| 7 | 34.85 | 33.45 | 32.50 | 23.21 | 25.51 | 21.43 |
| 8 | 42.06 | 53.57 | 50.34 | 35.71 | 40.36 | 38.86 |
| 9 | 53.43 | 61.50 | 56.07 | 46.93 | 44.55 | 43.75 |
| 10 | 64.28 | 71.42 | 73.81 | 59.18 | 54.20 | 56.68 |
| 11 | 75.54 | 79.28 | 81.29 | 86.50 | 63.74 | 74.56 |
| 12 | 92.57 | 89.64 | 97.09 | 90.47 | 92.26 | 86.48 |
| 13 | 99.14 | 98.92 | 98.64 | 96.42 | 98.67 | 100 |
| 14 | 100 | 100 | 100 | 97.61 | 100 | 100 |
| 15 | 100 | 100 | 100 | 100 | 100 | 100 |

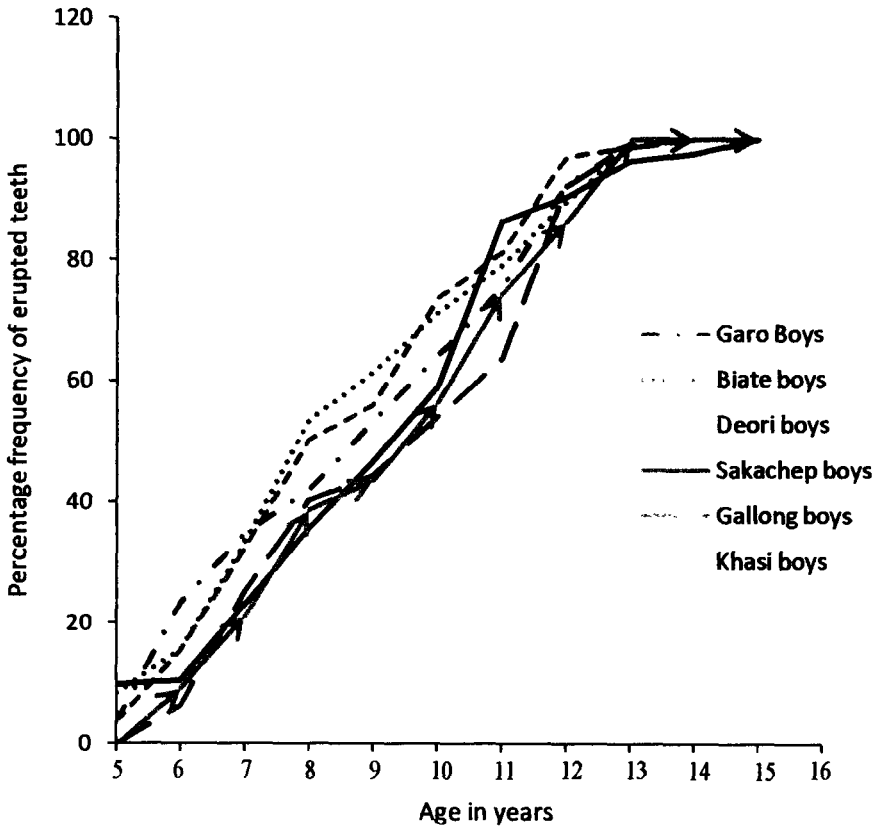



Fig. 5. Percentage frequency of erupted teeth in boys (Mandibular)

The percentage frequency of the erupted permanent mandibular teeth is given in Table 26. It is observed that at 5 years of age the above mentioned teeth have started emerging in all the populations except the Gallong and the Khasi. By 6 years of age, permanent teeth are observed in all the boys. It is observed that the increase in the erupted teeth is proportional to the increase in age groups. The mandibular permanent teeth completed its eruption earliest in the Khasi boys (13 years). By 14 years of age, eruption is completed in almost all the populations and delayed among the Sakachep boys upto 15 years. Fig.5 depicts the trends of eruption of the permanent mandibular teeth in the boys of the above mentioned populations.

Table 27. Percentage frequency of erupted teeth in girls by age (Mandibular)

| Age (in years) | Populations | | | | |
|---|---|---|---|---|---|
| | Garo (n=303) | Sakachep (n=77) | Marngar (n=335) | Gallong (n=515) | Khasi (n=1263) |
| 5 | 0.63 | 0.00 | 4.17 | 0.00 | 0.00 |
| 6 | 14.50 | 5.84 | 8.48 | 6.92 | 17.97 |
| 7 | 36.22 | 28.57 | 27.33 | 30.23 | 35.15 |
| 8 | 42.59 | 35.71 | 32.90 | 40.06 | 43.35 |
| 9 | 48.85 | 51.42 | 47.77 | 47.04 | 50.87 |
| 10 | 66.20 | 66.32 | 62.33 | 61.86 | 56.88 |
| 11 | 84.82 | 74.28 | 84.79 | 87.53 | 67.48 |
| 12 | 97.80 | 88.77 | 92.41 | 94.49 | 88.18 |
| 13 | 100 | 95.91 | 100 | 99.46 | 99.16 |
| 14 | 100 | 100 | 100 | 100 | 100 |
| 15 | 100 | 100 | 100 | 100 | 100 |

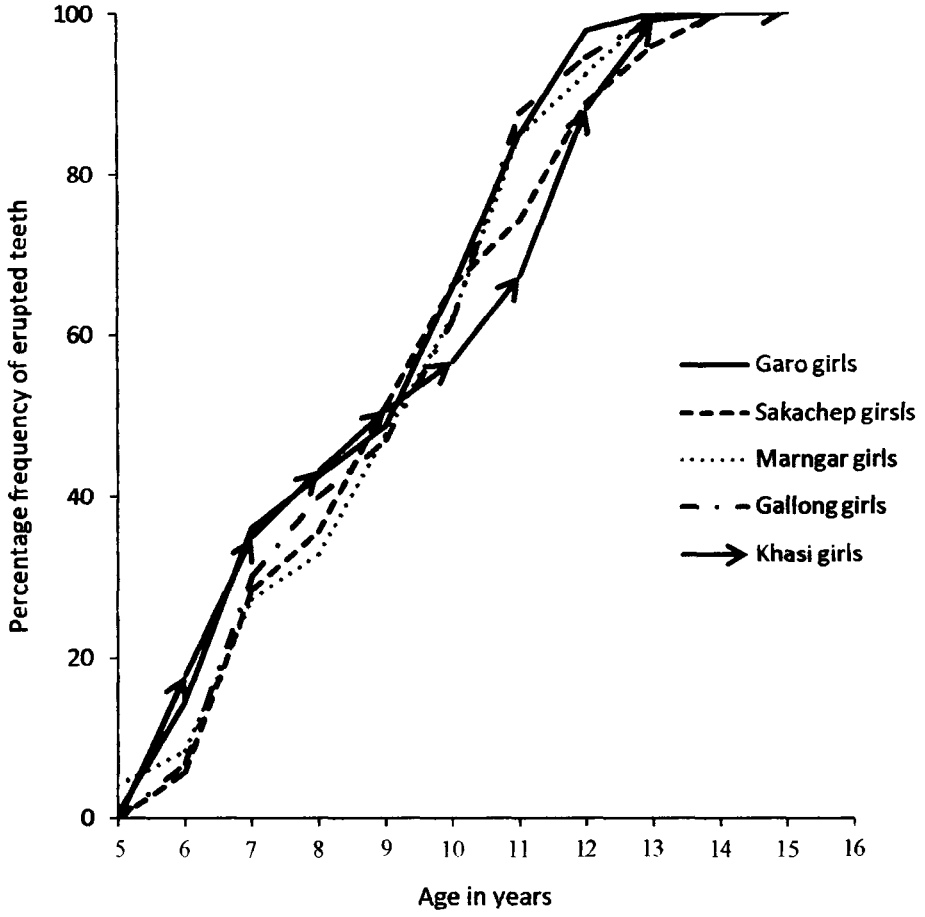



Fig. 6. Percentage frequency of erupted teeth in girls (Mandibular)

The percentage frequency of erupted teeth in the lower jaw of the girls is shown in the Table 27. It is observed that emergence of mandibular permanent teeth is advanced in the Garo and the Marngar girls (5 years). By 6 years of age, permanent teeth have emerged in all the populations. The percentage of erupted teeth increases as the age group increases. By 13 years eruption completes in the Garo and the Marngar girls. Finally, by 14 years the eruption of permanent teeth completes in all the populations considered for

the present study. Fig.6 depicts the trends of eruption of the permanent mandibular teeth in the girls of the above mentioned populations.

Table 28. Percentage frequency of erupted teeth in boys by age -all teeth combined

| Age (in years) | Populations | | | | |
|---|---|---|---|---|---|
| | Gallong (n=494) | Deori (n=217) | Biate (n=190) | Garo (n=287) | Khasi (n=1254) |
| 5 | 0.00 | 3.06 | 7.86 | 3.07 | 0.00 |
| 6 | 4.39 | 14.45 | 15.18 | 21.03 | 5.30 |
| 7 | 19.81 | 31.96 | 32.71 | 31.71 | 17.86 |
| 8 | 35.05 | 47.11 | 50.99 | 39.02 | 31.14 |
| 9 | 42.48 | 54.28 | 60.51 | 51.42 | 38.84 |
| 10 | 49.86 | 72.32 | 69.51 | 63.00 | 47.23 |
| 11 | 62.54 | 77.72 | 78.21 | 74.31 | 67.77 |
| 12 | 87.80 | 95.50 | 89.64 | 91.57 | 85.71 |
| 13 | 95.60 | 98.64 | 98.74 | 98.85 | 96.63 |
| 14 | 100 | 100 | 100 | 99.86 | 100 |
| 15 | 100 | 100 | 100 | 100 | 100 |

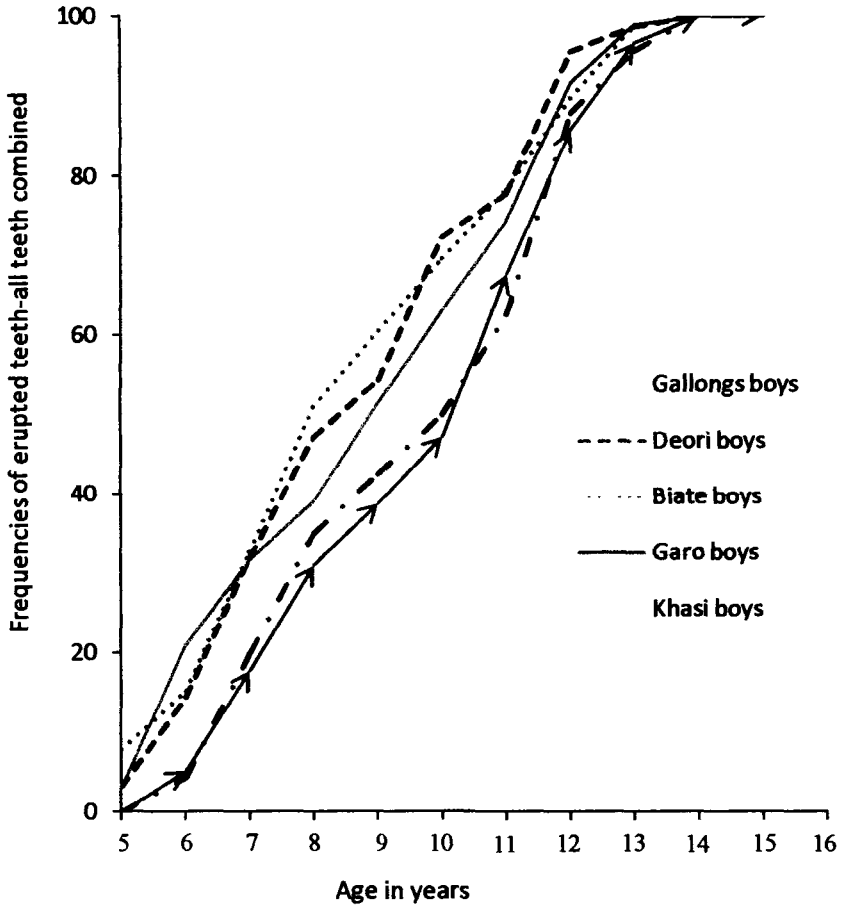



Fig.7 Percentage frequency of erupted teeth in boys -all teeth combined.

Table 28 shows the percentage frequency of the erupted permanent teeth in boys in boys when both the jaws are combined. These teeth erupt earliest among the Deori, Biate and the Garo boys (5 years) while they show late emergence by one year (6 years) among the Gallong and the Khasi boys. Percentage of the erupted teeth increases with the increase in age. By 14 years of age eruption of completes in almost all the populations excepting the Garo boys. Among the Garos eruption completes at 15 years of age. Fig.7 depicts the trends of eruption of the permanent teeth in the boys.

Table 29. Percentage frequency of erupted teeth in girls by age- all teeth combined

| Age (in years) | Populations | | | | |
|---|---|---|---|---|---|
| | Gallong (n=515) | Marngar (n=335) | Sakachep (n=77) | Garo (n=303) | Khasi (n=1263) |
| 5 | 0.00 | 3.57 | 0.00 | 0.31 | 0.00 |
| 6 | 4.57 | 6.58 | 13.39 | 9.95 | 6.45 |
| 7 | 25.08 | 26.60 | 22.80 | 30.99 | 24.62 |
| 8 | 35.79 | 31.60 | 33.33 | 39.41 | 38,92 |
| 9 | 45.90 | 45.76 | 44.28 | 45.00 | 44.59 |
| 10 | 59.14 | 61.55 | 61.73 | 57.14 | 53.70 |
| 11 | 80.67 | 82.95 | 67.85 | 75.59 | 76.32 |
| 12 | 93.77 | 91.41 | 87.24 | 94.64 | 93.35 |
| 13 | 98.58 | 100.00 | 95.91 | 99.37 | 100.00 |
| 14 | 100.00 | 100.00 | 99.28 | 99.60 | 100.00 |
| 15 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

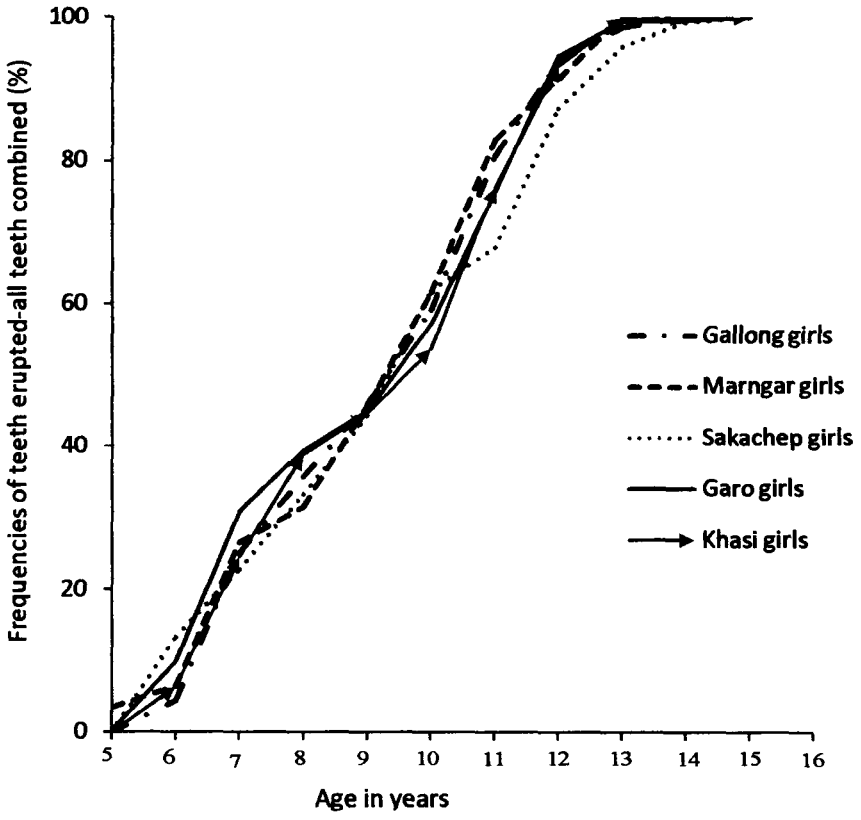



Fig.8 Percentage frequency of erupted teeth in girls -all teeth combined

Table 29 presents the percentage frequencies of the erupted permanent teeth among the girls, when all teeth are combined. Permanent teeth emerge first in the Marngar and the Garo girls at 5 years of age. By 6 years, they are observed in all the above populations. Eruption completes earliest in the Marngar and the Khasi girls (13years) followed by the Gallong (14years). Late completion of eruption is found in the Garo girls (15years). Fig.8 depicts the trends of eruption of the permanent teeth in the girls

# CHAPTER-V

## DENTAL CARIES, ORAL HYIEGENE AND PERIODONTAL DISEASES

In this chapter we shall deal with the dental caries, oral hygiene and periodontal diseases among the Khasis of Shillong, Meghalaya. In the present study we have included both the deciduous and the permanent teeth. The whole sample is divided into 35 age groups from age group 1 year to 70+ years.

Table 30. Caries affected individuals by age and sex

| Age ( in yrs) | Mild | | Moderate | | Severe | |
|---|---|---|---|---|---|---|
| | Males | Females | Males | Females | Males | Females |
| 1 | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| 2 | 1(2.86) | 1(2.63) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| 3 | 1(3.03) | 1(3.03) | 1(3.03) | 1(3.03) | 0(0.00) | 0(0.00) |
| 4 | 2(6.45) | 2(6.67) | 1(3.23) | 2(6.67) | 1(3.23) | 2(6.67) |
| 5 | 3(9.09) | 1(3.13) | 2(6.06) | 1(3.03) | 2(6.06) | 3(9.37) |
| 6 | 2(6.45) | 3(9.68) | 3(9.68) | 2(6.45) | 4(12.90) | 3(9.37) |
| 7 | 5(15.63) | 2(5.26) | 2(6.25) | 2(5.26) | 1(3.13) | 4(10.53) |
| 8 | 3(12.0) | 2(6.90) | 1(4.0) | 1(3.45) | 3(12.0) | 3(10.34) |
| 9 | 1(3.13) | 3(9.09) | 4(12.5) | 3(9.09) | 2(6.25) | 2(6.06) |
| 10 | 2(6.45) | 2(7.41) | 3(9.68) | 5(18.52) | 3(9.68) | 4(14.81) |
| 11 | 2(4.88) | 6(15.79) | 4(9.76) | 7(18.42) | 2(4.88) | 2(5.26) |
| 12 | 5(17.86) | 3(10.34) | 2(7.14) | 6(20.69) | 4(14.29) | 2(6.90) |
| 13 | 4(11.11) | 5(14.71) | 4(11.11) | 2(5.88) | 3(8.33) | 3(8.82) |
| 14 | 3(8.82) | 3(10.71) | 7(20.59) | 3(10.71) | 4(11.76) | 3(10.71) |
| 15 | 2(6.90) | 4(10.81) | 2(6.90) | 5(13.51) | 6(20.69) | 7(18.92) |
| 16 | 1(3.23) | 4(12.12) | 3(9.68) | 2(6.06) | 5(16.13) | 4(12.12) |
| 17 | 3(8.82) | 2(6.90) | 4(11.76) | 2(6.90) | 2(5.88) | 2(6.90) |
| 18 | 4(11.43) | 3(8.82) | 2(5.71) | 4(11.76) | 2(5.71) | 2(5.88) |
| 19 | 3(9.37) | 2(5.88) | 5(15.63) | 3(8.82) | 4(12.5) | 2(5.88) |
| 20 | 4(10.53) | 5(16.13) | 2(5.26) | 2(6.45) | 3(7.89) | 5(16.13) |
| 21 | 4(15.38) | 2(5.71) | 3(11.54) | 6(17.14) | 2(7.69) | 2(5.71) |
| 22 | 2(5.56) | 6(17.65) | 3(8.33) | 3(8.82) | 4(11.11) | 4(11.76) |
| 23 | 3(9.68) | 2(6.67) | 5(16.13) | 3(10.00) | 4(12.90) | 2(6.67) |
| 24 | 4(12.90) | 3(8.11) | 2(6.45) | 4(10.81) | 2(6.45) | 3(8.11 |
| 25 | 6(15.79) | 2(6.45) | 2(5.26) | 5(16.13) | 2(5.26) | 6(19.35) |
| 26-30 | 3(4.69) | 4(7.27) | 3(4.69) | 5(9.09) | 2(3.13) | 2(3.64) |
| 31-35 | 2(4.00) | 5(8.93) | 4(8.00) | 2(3.57) | 6(12.00) | 4(7.14) |

| | | | | | | |
|---|---|---|---|---|---|---|
| 36-40 | 3(6.98) | 4(7.69) | 3(6.98) | 3(5.77) | 2(4.65) | 4(7.69) |
| 41.45 | 5(10.42) | 2(3.92) | 3(6.25) | 2(3.92) | 3(6.25) | 3(5.88) |
| 46-50 | 4(8.16) | 2(5.00) | 5(10.20) | 5(12.5) | 3(6.12) | 2(5.00) |
| 51-55 | 2(4.76) | 3(8.82) | 2(4.76) | 2(5.88) | 5(11.90) | 4(11.76) |
| 56-60 | 3(9.37) | 2(6.06) | 4(12.5) | 2(6.06) | 2(6.25) | 3(9.09) |
| 61-65 | 2(5.71) | 4(12.90) | 2(5.71) | 2(6.45) | 3(8.57) | 3(9.68) |
| 66-70 | 3(9.68) | 2(5.56) | 3(9.68) | 4(11.11) | 2(6.45) | 5(13.89) |
| 71+ | 4(13.79) | 3(8.82) | 2(6.90) | 3(8.82) | 2(6.90) | 3(8.82) |

Caries affected individuals for different age groups for males and females are presented in Table 30. The above table reveals that generally the percentage of occurrence of mild , moderate and severe caries increases in individuals of both the sexes as the age increases. In both the sexes the mild form of caries are recorded earliest in 2 year of age and moderate in 3 years. By 4 years of age, mild, moderate and severe forms of caries are present. The frequency occurrence of mild form of caries is almost same in both the sexes whereas the moderate and severe forms occur with greater frequency in the females than the males. Highest prevalence of all three forms of caries are found in 15 year age group of both the sexes of the Khasis.

Table 31. Prevalence of caries in deciduous and permanent (mixed dentition) by age and sex

| Age ( in months and years) | Mild | | Moderate | | Severe | |
|---|---|---|---|---|---|---|
| | Boys | Girls | Boys | Girls | Boys | Girls |
| 5 mnts | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| 6 mnts | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| 7mnts | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| 8mnts | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| 9mnts | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| 10mnts | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| 11mnts | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| 12mnts | 1(0.18) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| 2 yrs | 2(0.29) | 3(0.40) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| 3 yrs | 1(0.15) | 2(0.30) | 1(0.15) | 0(0.00) | 2(0.30) | 2(0.30) |
| 4 yrs | 5(0.81) | 4(0.67) | 2(0.32) | 3(0.5) | 4(0.645) | 3(0.5) |
| 5 yrs | 4(6.61) | 6(0.94) | 2(0.30) | 3(0.47) | 2(0.30) | 1(0.16) |
| 6 yrs | 3(4.69) | 3(2.83) | 4(6.25) | 2(1.89) | 1(1.56) | 2(1.89) |
| 7 yrs | 2(1.14) | 3(0.94) | 4(2.27) | 3(0.94) | 3(1.70) | 5(1.57) |
| 8 yrs | 1(0.41) | 5(1.50) | 3(1.22) | 3(0.90) | 5(2.40) | 6(1.80) |
| 9 yrs | 2(0.54) | 2(0.45) | 2(0.54) | 4(0.91) | 3(0.81) | 4(1.91) |
| 10 yrs | 4(0.89) | 3(0.72) | 4(0.89) | 5(1.20) | 2(0.44) | 2(0.48) |
| 11 yrs | 6(0.73) | 3(0.39) | 5(0.61) | 2(0.26) | 3(0.37) | 1(0.31) |
| 12 yrs | 4(0.59) | 2(0.27) | 2(0.30) | 3(0.41) | 2(0.30) | 4(0.54) |
| 13 yrs | 2(0.20) | 5(0.53) | 5(0.50) | 1(0.10) | 2(0.20) | 7(0.74) |
| 14 yrs | 1(0.105) | 2(0.25) | 3(0.31) | 4(0.51) | 6(0.63) | 4(0.51) |

Table 31 shows the prevalence of caries in both the deciduous and the permanent teeth of the Khasi children by age and sex. Mild form of caries is recorded earliest in 1 and 2 year old males. By 3 years, mild, moderate and severe forms of caries are observed. The percentage of their occurance in caries increases in both sexes as the age increases. The mild and severe forms of caries is found in higher frequency among the females than the males whereas moderate form of caries

occur are higher in males. Highest prevalence of all the three forms of caries are found in 13 year age group of both the sexes. Table 32 further shows that the prevalence of caries in the mixed dentition increases as the age increases.

Table 32: Prevalence of caries in permanent teeth by age and sex

| Age (in yrs) | Mild | | Moderate | | Severe | |
|---|---|---|---|---|---|---|
| | Males | Females | Males | Females | Males | Females |
| 6 | 4(3.77) | 2(3.125) | 1(0.94) | 1(1.56) | 2(1.89) | 1(1.56) |
| 7 | 5(1.57) | 5(2.84) | 2(0.63) | 3(1.70) | 4(1.26) | 5(2.84) |
| 8 | 6(1.80) | 6(2.45) | 4(1.20) | 5(2.04) | 2(0.60) | 3(1.22) |
| 9 | 8(1.81) | 5(1.35) | 6(1.36) | 4(1.08) | 2(0.45) | 5(1.35) |
| 10 | 12(2.87) | 9(1.10) | 10(2.39) | 7(1.55) | 6(1.43) | 4(0.89) |
| 11 | 9(1.18) | 10(1.22) | 6(0.89) | 4(0.49) | 7(0.91) | 4(0.49) |
| 12 | 13(1.76) | 6(0.89) | 5(0.68) | 8(1.18) | 6(0.81) | 6(0.89) |
| 13 | 10(1.05) | 12(1.21) | 8(0.84) | 9(0.91) | 10(1.05) | 7(0.71) |
| 14 | 14(1.78) | 16(1.68) | 10(1.27) | 7(0.73) | 12(1.53) | 9(0.94) |
| 15 | 11(1.06) | 10(1.23) | 9(0.87) | 6(0.74) | 8(0.77) | 7(0.86) |
| 16 | 13(1.41) | 7(0.81) | 12(1.30) | 10(1.15) | 8(0.86) | 6(0.60) |
| 17 | 8(0.96) | 13(1.33) | 14(1.69) | 6(0.61) | 7(0.84) | 10(1.02) |
| 18 | 6(0.61) | 11(1.06) | 9(0.92) | 7(0.68) | 5(0.51) | 8(0.77) |
| 19 | 8(0.80) | 9(0.93) | 13(1.31) | 10(1.04) | 7(0.70) | 7(0.73) |
| 20 | 6(0.65) | 6(0.52) | 10(1.09) | 12(1.05) | 9(0.98) | 6(0.52) |
| 21 | 11(1.05) | 8(1.02) | 9(0.86) | 12(1.53) | 11(1.05) | 7(0.89) |
| 22 | 9(0.88) | 7(0.64) | 9(0.88) | 8(0.73) | 8(0.78) | 6(0.55) |
| 23 | 9(1.00) | 7(0.73) | 7(0.78) | 12(1.26) | 7(0.78) | 5(0.52) |
| 24 | 7(0.62) | 10(1.05) | 6(0.53) | 7(0.74) | 6(0.53) | 5(0.52) |
| 25 | 5(0.53) | 11(0.94) | 7(0.74) | 6(0.51) | 6(0.63) | 9(0.77) |

The number and percentage occurrence of caries affected permanent teeth is given in Table 32, which shows that the percentage of caries affected teeth do not follow any pattern of their distribution. The above table shows that in both the sexes

of the Khasi, the mild form of caries affected teeth have been recorded earliest in 6 years of age and the moderate and severe forms at 7 years of age in both the sexes. The occurrence of mild and moderate forms of caries is greater in males, whereas the severe form occur in equal frequency in both males and females.

Table 33. Position, Age and Sex-wise distribution of caries affected permanent teeth

| Age (in yrs) | Sex | Anterior Teeth (Incisor and Canine) | Percentage | Posterior Teeth (Premolar and Molar) | Percentage |
|---|---|---|---|---|---|
| 6 | Males | 2 | 0.01 | 2 | 0.01 |
| | Females | 1 | 0.00 | 3 | 0.02 |
| 7 | Males | 4 | 0.02 | 5 | 0.03 |
| | Females | 6 | 0.04 | 7 | 0.04 |
| 8 | Males | 7 | 0.04 | 7 | 0.04 |
| | Females | 5 | 0.03 | 4 | 0.25 |
| 9 | Males | 6 | 0.04 | 8 | 0.05 |
| | Females | 6 | 0.04 | 10 | 0.06 |
| 10 | Males | 9 | 0.06 | 11 | 0.07 |
| | Females | 11 | 0.07 | 7 | 0.04 |
| 11 | Males | 12 | 0.08 | 14 | 0.09 |
| | Females | 16 | 0.10 | 12 | 0.08 |
| 12 | Males | 10 | 0.06 | 17 | 0.11 |
| | Female | 8 | 0.05 | 12 | 0.08 |
| 13 | Males | 9 | 0.06 | 20 | 0.13 |
| | Females | 7 | 0.04 | 22 | 0.14 |
| 14 | Males | 6 | 0.04 | 19 | 0.12 |
| | Females | 10 | 0.06 | 10 | 0.06 |
| 15 | Males | 12 | 0.08 | 17 | 0.11 |
| | Females | 10 | 0.06 | 12 | 0.08 |
| 16 | Females | 10 | 0.06 | 16 | 0.10 |
| | Females | 7 | 0.045 | 20 | 0.13 |
| 17 | Males | 8 | 0.05 | 14 | 0.09 |
| | Females | 5 | 0.03 | 17 | 0.11 |
| 18 | Males | 12 | 0.08 | 18 | 0.12 |
| | Females | 15 | 0.10 | 15 | 0.10 |
| 19 | Males | 10 | 0.06 | 13 | 0.08 |
| | Females | 8 | 0.05 | 16 | 0.10 |
| 20 | Males | 7 | 0.045 | 19 | 0.1 |
| | Females | 9 | 0.06 | 16 | 0.10 |
| 21 | Males | 11 | 0.07 | 17 | 0.11 |
| | Females | 7 | 0.045 | 12 | 0.08 |

| | | | | | |
|---|---|---|---|---|---|
| 22 | Males | 12 | 0.08 | 15 | 0.10 |
| | Females | 10 | 0.06 | 13 | 0.08 |
| 23 | Males | 9 | 0.06 | 19 | 0.12 |
| | Females | 13 | 0.08 | 15 | 0.10 |
| 24 | Males | 7 | 0.04 | 20 | 0.13 |
| | Females | 13 | 0.00 | 15 | 0.10 |
| 25 | Males | 9 | 0.06 | 16 | 0.10 |
| | Females | 9 | 0.00 | 14 | 0.09 |
| 26-30 | Males | 7 | 0.04 | 12 | 0.08 |
| | Females | 8 | 0.05 | 1 | 0.12 |
| 31-35 | Males | 6 | 0.04 | 14 | 0.00 |
| | Females | 7 | 0.00 | 19 | 0.12 |
| 36-40 | Males | 8 | 0.05 | 16 | 0.10 |
| | Females | 10 | 0.06 | 14 | 0.09 |
| 41-45 | Males | 12 | 0.08 | 17 | 0.11 |
| | Females | 11 | 0.07 | 13 | 0.08 |
| 46-50 | Males | 6 | 0.04 | 12 | 0.08 |
| | Females | 7 | 0.045 | 17 | 0.11 |
| 51-55 | Males | 10 | 0.06 | 13 | 0.08 |
| | Females | 8 | 0.05 | 19 | 0.12 |
| 56-60 | Males | 7 | 0.04 | 18 | 0.12 |
| | Females | 8 | 0.05 | 12 | 0.08 |
| 61-65 | Males | 9 | 0.06 | 16 | 0.10 |
| | Females | 7 | 0.04 | 11 | 0.07 |
| 66-70 | Males | 8 | 0.05 | 17 | 0.11 |
| | Females | 8 | 0.00 | 16 | 0.10 |
| 71+ | Males | 9 | 0.06 | 13 | 0.08 |
| | Females | 10 | 0.06 | 18 | 0.115 |

Table 33 shows position age and sex wise distribution of caries affected teeth in Khasi males and females in Shillong. This table shows that the percentage of caries affected teeth are slightly more in the posterior teeth, ie., in premolar and molar compare to the anterior teeth. However by age and sex the distribution of caries affected permanent teeth do not show any pattern.

Table:34. Prevalence of caries according to literacy.

| Literacy | Male | | | | | Female | | | | | Total | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Present | % | Absent | % | Total | Present | % | Absent | % | Total | Present | % | Absent | % | Total |
| Illiterate | 20 | 60.61 | 13 | 39.39 | 33 | 48 | 70.54 | 26 | 29.41 | 68 | 68 | 67.33 | 33 | 32.67 | 101 |
| Literate | 269 | 20.05 | 805 | 74.95 | 1074 | 259 | 24.95 | 779 | 24.95 | 1038 | 528 | 25.00 | 1584 | 75.00 | 2112 |
| Total | 289 | 26.11 | 818 | 73.89 | 1107 | 307 | 27.76 | 799 | 72.24 | 1106 | 596 | 26.93 | 1617 | 73.07 | 2213 |

Bisexual variation $x^2 = 0.56$, df = 1, $p < 0.05$, Insignificant.

According to literacy in male $x^2 = 20.87$, df = 1, $p > 0.05$, Significant

According to literacy in female $x^2 = 66.25$, df = 1, $p > 0.05$, Significant.

Table 34 presents the prevalence of caries according to literacy. This table shows that the prevalence of caries is higher among the illiterates than the literates living in the same area.

Table: 35. Prevalence of caries among the *Kwai* (betel nut and leaf with lime) chewers and non-chewers.

| Sex | | *Kwai* chewers | | With caries | | Non-chewers | | With caries | |
|---|---|---|---|---|---|---|---|---|---|
| | | Number | % | Number | % | Number | % | Number | % |
| Male | 1254 | 970 | 77.35 | 73 | 7.52 | 284 | 22.65 | 87 | 30.63 |
| Female | 1263 | 1064 | 84.35 | 94 | 8.83 | 199 | 15.76 | 63 | 31.66 |
| Total | 2517 | 2034 | 80.81 | 167 | 6.63 | 483 | 19.50 | 150 | 5.95 |

Bisexual variation for *kwai* chewers vs.non chewers $x^2 = 0.07$, df = 1, $p < 0.05$, Insignificant.

Bisexual variation for *kwai* chewers $x^2 = 1.15$, df = 1, $p < 0.05$, Insignificant.

*Kwai* chewers vs.non chewer females $x^2 = 80.21$, df = 1, $p > 0.05$, Significant.

*Kwai* chewers and non chewer males $x^2 = 105.36$, df = 1, $p > 0.05$, Significant.

Table 35 reveals that the incidence of caries is significantly high in the non-chewers than the *Kwai* chewers in both the sexes. However, bisexual variation in respect of prevalence of caries is insignificant.

Table: 36. Prevalence of caries among the smokers and non-smokers.

| Sex | | Smokers | | With caries | | Non-Smokers | | With caries | |
|---|---|---|---|---|---|---|---|---|---|
| | | Number | % | Number | % | Number | % | Number | % |
| Male | 1254 | 323 | 25.76 | 38 | 11.76 | 931 | 74.24 | 78 | 8.38 |
| Female | 1263 | 0 | 0.00 | 0 | 0.00 | 1263 | 100.00 | 96 | 7.60 |
| Total | 2517 | 323 | 12.83 | 38 | 1.50 | 2194 | 87.16 | 174 | 6.91 |

Smokers vs. non smokers males $x^2 = 3.28$, df = 1, $p < 0.05$, Insignificant.

Bisexual variations among non smokers $x^2 = 0.44$, df = 1, $p < 0.05$, Insignificant.

Table 36 reveals that the smokers as well as non-smokers do not differ significantly in respect of prevalence of dental caries.

Table: 37. Prevalence of caries among the tobacco chewers and non-chewers

| Sex | No. | Tobacco chewers | | With caries | | Non-chewers | | With caries | |
|---|---|---|---|---|---|---|---|---|---|
| | | Number | % | Number | % | Number | % | Number | % |
| Male | 1254 | 576 | 45.93 | 12 | 2.08 | 678 | 54.07 | 23 | 3.49 |
| Female | 1263 | 667 | 52.81 | 20 | 3.00 | 596 | 47.19 | 17 | 2.9 |
| Total | 2517 | 1243 | 49.38 | 32 | 1.27 | 1274 | 50.61 | 40 | 1.58 |

Bisexual variations, $x^2 = 1.03$, df = 1, $p < 0.05$, Insignificant

Tobacco chewers vs. non chewer females, $x^2 = 0.02$, df = 1, $p < 0.05$, Insignificant.

Tobacco chewers vs. non chewers males, x2 = 2.25, df = 1, $p < 0.05$, Insignificant.

Sexual variation among non chewers, $x^2 = 0.31$, df = 1, $p < 0.05$, Insignificant.

The prevalence of dental caries among the tobacco chewers and non chewers is given in Table 37. The above table reveals that the bisexual variation as well as the variation between tobacco chewers and non chewers in respect of prevalence of caries is statistically insignificant.

Table 38. Prevalence of caries according to income level.

| | | Low income group | | Middle income group | | High income group | | Total |
|---|---|---|---|---|---|---|---|---|
| | Sex | M | F | M | F | M | F | |
| Normal | No. | 564 | 514 | 292 | 270 | 129 | 147 | 1916 |
| | % | 83.43 | 80.56 | 73.18 | 69.76 | 68.85 | 66.55 | 76.12 |
| Affected | No. | 112 | 124 | 107 | 117 | 67 | 74 | 601 |
| | % | 16.56 | 19.45 | 26.85 | 30.23 | 34.50 | 33.48 | 23.87 |
| Grand total | | 676 (26.90) | 638 (25.35) | 399 (15.85) | 387 (15.38) | 196 (7.79) | 221 (8.78) | 2517 |

According to income level in male, $x^2 = 33.25$, df = 2, $p > 0.05$, Significant

According to income level in female, x2 = 24.43, df = 2, $p > 0.05$, Significant.

Table 38 shows that the prevalence of dental caries increases with the increase in their income. Significant difference among the three income groups was observed in respect of the prevalence of the dental caries among the Khasis of Shillong.

Table 39. Periodontal Index Score in both the deciduous and permanent teeth (Mixed dentition) by age and sex

| Age | 0 | | 0.0-0.2 | | 0.3-0.9 | | 0.7-0.9 | | 1.6 -5.0 | | 3.8-8.0 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Boys | Girls | Boys | Girls | Boys | Girls | Boys | Girls | Boys | Girls | Boys | Girls |
| 5mnts | 7(100.00) | 8(100.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| 6mnts | 6(100.00) | 7(100.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| 7mnts | 7(100.00) | 10(100.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| 8mnts | 4(100.00) | 11(100.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| 9mnts | 8(100.00) | 14(100.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| 10mnts | 10(100.00) | 7(100.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| 11mnts | 8(100.00) | 6(100.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| 12mnts | 48(100.00) | 46(100.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| 2 yrs | 35(100.00) | 38(100.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| 3 yrs | 33(100.00) | 33(100.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| 4 yrs | 31(100.00) | 30(100.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| 5 yrs | 30(90.90) | 29(90.625) | 2(6.06) | 2(6.25) | 1(3.03) | 1(3.125) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| 6 yrs | 26(83.87) | 28(90.32) | 2(6.45) | 2(6.45) | 2(6.45) | 2(6.45) | 1(3.23) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| 7 yrs | 22(68.75) | 27(71.05) | 4(12.5) | 5(13.16) | 4(12.5) | 3(7.89) | 2(6.25) | 3(7.89) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| 8 yrs | 17(68.00) | 19(65.52) | 4(16.00) | 5(17.24) | 3(12.00) | 3(10.34) | 1(4.00) | 2(6.90) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 yrs | 15(46.87) | 18(54.54) | 6(!8.75) | 7(21.21) | 5(15.625) | 4(12.12) | 3(9.37) | 3(9.09) | 2(6.25) | 1(3.03) | 1(3.125) | 0(0.00) |
| 10yrs | 14(45.16) | 16(59.26) | 5(16.13) | 3(11.11) | 4(12.90) | 3(11.11) | 3(9.86) | 2(7.41) | 3(9.68) | 1(3.70) | 2(6.45) | 2(7.41) |
| 11yrs | 22(53.66) | 19(50.00) | 7(17.07) | 5(13.16) | 6(14.63) | 5(13.16) | 4(9.76) | 3(7.89) | 2(4.88) | 4(10.53) | 3(7.32) | 2(5.26) |
| 12yrs | 17(60.71) | 13(44.83) | 4(14.29) | 3(10.34) | 3(10.71) | 5(17.24) | 2(7.14) | 3(10.34) | 1(3.57) | 2(6.90) | 1(3.57) | 3(10.34) |
| 13yrs | 33(91.67) | 32(94.12) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 2(5.55) | 0(0.00) | 1(2.78) | 2(5.88) |
| 14yrs | 34(100.00) | 28(100.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0..00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |

The number and percentage of periodontal index scores by age and sex in the mixed dentition is shown in Table 39. Up to four years age group as well as 14 years age groups, the periodontal index score is found to be zero i.e., absent of the periodontal disease. In the next age group i.e., 5years, there are two individuals each of both the sexes who are in the 0-0.2 score and one each in the 0.3-0.9 score groups. By 9 years of age, subjects are distributed in almost all the periodontal score groups, including the 1.6-5.0 and 3.8 -8.0. This table does not show any increasing or decreasing trend according to the age groups.

Table 40 Periodontal index score in permanent teeth by age and sex

| Age (in yrs) | 0 | | 0.2 | | 0.3-0.9 | | 0.7-1.9 | | 1.6-5.0 | | 3.8-8.0 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Boys | Girls | Boys | Girls | Boys | Girls | Boys | Girls | Boys | Girls | Boys | Girls |
| 6 | 20(64.52) | 22(70.97) | 6(19.35) | 4(12.90) | 2(6.45) | 4(12.90) | 3(0.10) | 1(0.03) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| 7 | 17(53.13) | 19(50.00) | 7(21.88) | 10(26.32) | 2(6.25) | 3(7.89) | 3(9.38) | 4(10.53) | 3(9.38) | 2(5.26) | 0(0.00) | 0(0.00) |
| 8 | 14(56.00) | 13(44.83) | 4(16.00) | 7(24.14) | 3(12.00) | 4(13.79) | 2(8.00) | 4(13.79) | 2(8.00) | 1(3.45) | 0(0.00) | 0(0.00) |
| 9 | 10(31.25) | 9(27.27) | 10(31.25) | 6(18.18) | 5(15.62) | 3(9.09) | 6(18.75) | 2(6.06) | 1(3.125) | 3(9.09) | 0(0.00) | 0(0.00) |
| 10 | 12(38.71) | 10(37.03) | 7(22.58) | 5(18.52) | 8(25.81) | 5(18.52) | 1(3.13) | 3(11.11) | 4(12.90) | 2(7.41) | 0(0.00) | 0(0.00) |
| 11 | 15(36.58) | 12(31.58) | 11(26.83) | 8(21.05) | 4(9.76) | 9(33.33) | 5(12.19) | 7(18.42) | 6(14.63) | 2(5.26) | 0(0.00) | 0(0.00) |
| 12 | 13(46.43) | 15(51.72) | 6(21.42) | 6(20.69) | 3(10.71) | 5(17.24) | 4(14.28) | 2(6.90) | 4(14.28) | 1(3.45) | 0(0.00) | 0(0.00) |
| 13 | 11(30.55) | 10(29.41) | 8(22.22) | 5(14.70) | 6(16.67) | 8(23.53) | 6(16.67) | 4(11.76) | 5(13.89) | 4(11.76) | 0(0.00) | 1(2.94) |
| 14 | 9(26.47) | 14(50.00) | 9(26.47) | 5(17.86) | 4(11.76) | 5(17.86) | 7(20.59) | 2(7.14) | 3(8.82) | 1(3.57) | 1(2.94) | 1(3.57) |
| 15 | 12(41.38) | 12(32.43) | 5(17.24) | 6(16.22) | 4(13.79) | 7(18.92) | 2(6.90) | 5(13.51) | 2(6.90) | 5(13.51) | 1(3.45) | 2(5.41) |
| 16 | 14(45.16) | 10(30.30) | 4(12.90) | 7(21.21) | 5(16.13) | 6(18.18) | 5(16.13) | 4(12.12) | 2(6.45) | 4(12.12) | 1(3.23) | 2(6.06) |
| 17 | 15(44.12) | 16(55.17) | 6(17.65) | 3(10.34) | 4(11.76) | 6(20.69) | 3(8.82) | 2(6.90) | 3(8.82) | 1(3.45) | 3(8.82) | 1(3.45) |
| 18 | 14(40.00) | 12(35.29) | 5(14.29) | 8(23.53) | 4(11.43) | 7(20.59) | 7(20.00) | 3(8.82) | 3(8.57) | 2(5.88) | 2(5.71) | 2(5.88) |
| 19 | 12(37.5) | 9(26.47) | 7(21.87) | 8(23.53) | 4(12.5) | 6(17.65) | 3(9.37) | 4(11.76) | 4(12.5) | 5(14.71) | 2(6.25) | 2(5.88) |
| 20 | 9(23.68) | 12(38.71) | 9(23.68) | 6(19.35) | 7(18.42) | 8(25.81) | 7(18.42) | 2(6.45) | 3(7.89) | 1(3.23) | 3(7.89) | 2(6.45) |
| 21 | 7(20.92) | 8(22.86) | 5(19.23) | 8(22.86) | 7(26.92) | 5(14.29) | 3(11.54) | 6(17.14) | 3(11.54) | 3(8.57) | 1(3.85) | 5(14.29) |
| 22 | 11(30.56) | 10(29.41) | 7(19.44) | 8(23.53) | 5(13.89) | 6(17.65) | 5(13.89) | 4(11.76) | 3(8.33) | 4(11.76) | 5(13.89) | 2(5.88) |
| 23 | 13(41.93) | 14(46.67) | 4(12.90) | 6(20.00) | 6(19.35) | 3(10.00) | 5(16.13) | 3(10.00) | 1(3.23) | 1(3.33) | 2(6.45) | 3(10.00) |
| 24 | 12(38.71) | 11(29.73) | 5(16.13) | 7(18.92) | 4(12.90) | 9(24.32) | 4(12.90) | 3(8.11) | 2(6.45) | 4(10.81) | 4(12.90) | 3(8.11) |
| 25 | 16(42.10) | 9(29.03) | 6(15.79) | 5(16.13) | 8(21.05) | 7(22.58) | 4(10.53) | 7(22.58) | 2(5.26) | 2(6.45) | 2(5.26) | 1(3.23) |
| 26-30 | 32(50.50) | 28(50.90) | 10(15.63) | 9(16.36) | 9(14.06) | 6(10.90) | 5(7.81) | 4(7.27) | 4(6.25) | 5(9.09) | 4(6.25) | 3(5.45) |
| 31.35 | 25(50.00) | 24(42.86) | 7(14.00) | 10(17.86) | 8(16.00) | 7(12.5) | 5(10.00) | 8(14.29) | 1(2.00) | 3(5.36) | 4(8.00) | 4(7.14) |
| 36-40 | 16(37.21) | 21(40.38) | 8(18.60) | 7(13.46) | 6(!3.95) | 5(9.61) | 5(11.63) | 8(15.38) | 5(11.63) | 6(11.54) | 3(6.98) | 5(9.61) |
| 41-45 | 16(33.33) | 22(43.14) | 5(10.42) | 7(13.72) | 8(16.67) | 5(9.80) | 9(18.75) | 7(13.72) | 6(12.5) | 4(7.84) | 4(8.33) | 6(11.76) |
| 46-50 | 14(28.57) | 13(32.5) | 6(12.24) | 6(15.00) | 6(12.24) | 4(10.00) | 9(18.37) | 6(15.00) | 8(16.33) | 6(15.00) | 6(12.24) | 5(12.5) |
| 51-55 | 15(35.71) | 12(35.29) | 5(11.90) | 6(17.65) | 3(7.14) | 6(17.65) | 7(16.67) | 3(8.82) | 5(11.90) | 5(14.71) | 7(16.67) | 2(5.88) |
| 56-60 | 10(31.25) | 8(24.24) | 8(25.00) | 6(18.18) | 5(15.625) | 5(15.15) | 5(15.625) | 7(21.21) | 2(6.25) | 2(6.06) | 2(6.25) | 5(15.15) |
| 61-65 | 9(25.71) | 9(29.03) | 5(14.29) | 4(12.90) | 7(20.00) | 3(9.68) | 6(17.14) | 7(22.58) | 4(11.43) | 3(9.68) | 4(11.43) | 5(16.13) |
| 66-70 | 10(32.29) | 11(30.56) | 6(19.35) | 7(19.44) | 4(12.90) | 4(11.11) | 3(9.68) | 5(13.89) | 3(9.68) | 3(8.33) | 5(16.13) | 6(16.67) |
| 70+ | 11(37.93) | 8(23.53) | 5(17.24) | 8(23.53) | 3(10.34) | 6(17.65) | 3(10.34) | 7(20.59) | 2(6.90) | 1(2.94) | 5(17.24) | 4(11.76) |

Table 40 shows the Periodontal Index Score in permanent teeth by age and sex. The above table reveals that severity of Periodontal Index Score increases as the age increases. Up to 6 and 12 years, not a single subject has score of 1.6-5.0 and 3.8-8.0 respectively. The above table does not show any pattern of their distribution.

Table 41 Age group-wise distribution of prevalence of Gingivitis

| Age (in yrs) | Male (No. and Percentage) | Female (No. and Percentage) |
|---|---|---|
| 0 - 5 | 91(50.56) | 85(47.49) |
| 6-10 | 78(51.65) | 85(53.80) |
| 11-15 | 108(64.29) | 103(62.05) |
| 16-20 | 106(62.35) | 102(63.35) |
| 21-25 | 103(63.58) | 115(66.86) |
| 26-30 | 32(50.00) | 27(49.09) |
| 31-35 | 25(50.00) | 32(57.14) |
| 36-40 | 27(62.79) | 31(59.61) |
| 41-45 | 32(66.67) | 29(56.86) |
| 46-50 | 35(71.43) | 27(67.50) |
| 51-55 | 27(64.29) | 22(64.71) |
| 56-60 | 22(68.75) | 25(75.76) |
| 61-65 | 26(74.29) | 22(70.97) |
| 66-70 | 21(67.74) | 25(69.44) |
| 71+ | 18(62.07) | 26(76.47) |

Table 41 shows the prevalence of Gingivitis by age and sex among the Khasis of Shillong. At 5 years of age there are 50.56 percent males and 47.49 percent females were affected by gingivitis. By 21- 25 years the prevalence of gingivitis increases to 63.58 percent in males and 66.86 percent in females. The highest prevalence of gingivitis is observed at the age group 56- 60 years and 61- 65 years in males and females respectively. The above table further shows that generally gingivitis increases with the increase in age.

Table 42 Prevalence of OHI- (DI- S) among the Khasis of Shillong

| Age (in yrs) | Good (0.3-0.6) | | Fair (0.7-1.8) | | Poor (1.9-3.0) | |
|---|---|---|---|---|---|---|
| | Male | Female | Male | Female | Male | Female |
| 0-5 yrs | 42(11.97) | 52(16.35) | 56(13.24) | 47(10.88) | 37(10.66) | 48(11.79) |
| 6-10 yrs | 39(11.11) | 43(13.52) | 62(14.66) | 71(16.43) | 48(13.83) | 33(8.11) |
| 11-15 yrs | 47(13.39) | 57(17.92) | 73(17.26) | 66(15.28) | 41(11.82) | 29(7.12) |
| 16-20 yrs | 69(19.66) | 42(13.21) | 41(9.69) | 54(12.50) | 32(9.22) | 46(11.30) |
| 21-25 yrs | 55(15.67) | 41(12.89) | 45(10.64) | 60(13.89) | 45(12.97) | 38(9.34) |
| 26-30 yrs | 18(5.13) | 13(4.09) | 24(5.67) | 27(6.25) | 17(4.90) | 23(5.65) |
| 31-35 yrs | 14(3.99) | 10(3.14) | 18(4.25) | 15(3.47) | 10(2.88) | 27(6.63) |
| 36-40 yrs | 9(2.56) | 7(2.20) | 15(3.55) | 11(2.55) | 13(3.75) | 31(7.62) |
| 41-45 yrs | 10(2.85) | 12(3.77) | 14(3.31) | 9(2.08) | 20(5.76) | 29(7.12) |
| 46-50 yrs | 12(3.42) | 8(2.51) | 21(4.96) | 11(2.55) | 13(3.75) | 19(4.67) |
| 51-55 yrs | 9(2.56) | 6(1.89) | 16(3.78) | 10(2.31) | 11(3.17) | 18(4.42) |
| 56-60 yrs | 8(2.56) | 4(1.26) | 9(2.13) | 16(3.70) | 13(3.75) | 13(3.19) |
| 61-65 yrs | 7(1.99) | 10(3.14) | 12(2.84) | 14(3.24) | 16(4.61) | 7(1.72) |
| 66-70 yrs | 7(1.99) | 4(1.26) | 10(2.36) | 11(2.55) | 14(4.03) | 21(5.16) |
| 71 + yrs | 5(1.42) | 9(2.83) | 7(1.65) | 10(2.31) | 17(4.90) | 25(6.14) |
| Total | 351(13.94) | 318(12.63) | 423(16.80) | 432(16.80) | 347(13.78) | 407(16.17) |

Table 42 reveals the prevalence of OHI (DI-S) by age and sex. In the good Debris index score males are found to be higher in percentage than their female counterparts with 351(13.94 %) in males and 318 (12.63 %) in females. In respect of fair

and poor OHI, females are in higher frequency i.e., 432(17.16%) and 407(16.80%) respectively. It is observed that the poor form of OHI is more frequent among the females 407 (16.17 %) than the males 347(13.78 %). The above table reveals that in both the sexes the prevalence of Debris index scores decreases with the increase of age.

Table 43 Prevalence of OHI- (CI-S)

| Age (in yrs) | Good (0.3-0.6) | | Fair (0.7-1.8) | | Poor (1.9-3.0) | |
|---|---|---|---|---|---|---|
| | Male | Female | Male | Female | Male | Female |
| 0-5 | 9(1.85) | 11(2.03) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| 6-10 | 49(10.08) | 58(10.72) | 20(5.59) | 26(7.74) | 12(8.05) | 21(12.57) |
| 11-15 | 117(24.07) | 123(22.73) | 34(9.50) | 29(8.63) | 10(6.71) | 7(4.19) |
| 16-20 | 106(21.81) | 99(18.30) | 48(13.41) | 52(15.48) | 14(9.39) | 10(5.99) |
| 21-25 | 75(15.43) | 114(21.07) | 62(17.32) | 41(12.20) | 15(10.07) | 27(16.17) |
| 26-30 | 25(5.14) | 18(3.33) | 18(5.03) | 26(7.74) | 21(14.09) | 11(6.59) |
| 31-35 | 15(3.09) | 21(3.88) | 27(7.54) | 16(4.76) | 8(5.37) | 19(11.38) |
| 36-40 | 13(2.67) | 25(4.62) | 22(6.14) | 19(5.65) | 8(5.37) | 8(4.79) |
| 41-45 | 10(2.06) | 13(2.40) | 28(7.82) | 27(8.03) | 10(6.71) | 12(7.19) |
| 46-50 | 19(3.19) | 14(2.59) | 18(5.03) | 19(5.65) | 12(8.05) | 7(4.19) |
| 51-55 | 15(3.09) | 9(1.66) | 16(4.47) | 15(4.46) | 11(7.38) | 10(5.99) |
| 56-60 | 7(1.44) | 10(1.85) | 17(1.29) | 14(4.17) | 10(6.71) | 9(5.39) |
| 61-65 | 11(2.26) | 7(1.29) | 13(3.63) | 16(4.76) | 8(5.37) | 11(6.59) |
| 66-70 | 6(1.23) | 8(1.48) | 21(5.86) | 18(5.36) | 4(2.68) | 10(5.99) |
| 70+ | 9(1.85) | 11(2.03) | 4(3.91) | 18(5.36) | 6(4.03) | 5(2.99) |
| Total | 486(19.40) | 541(21.69) | 358(14.30) | 336(13.40) | 149(5.9) | 167(6.70) |

Table 43 shows the prevalence of OHI (CI – S) i.e., oral hygiene debris index for calculus or tartar, by age and sex among the Khasis of Shillong. In the 0 -5 years age group children, only good OHI (CI –S) index was present. The above table further reveals that in general, all the three types of calculus index scores (CI-S) decreases with the increase of age. Higher percentages of females belong to the good and poor scores. The number and percentage of male and females with good OHI is 486 (19.4 %) and 541 (21.6 %) respectively. The fair OHI occurs with a frequency of 358 (14.3 %) in males and 336 (13.4 %) in females whereas in the poor OHI, the percentages are 149 (5.9 %) and 167(6.7%) in the males and in females respectively.

Table 44 Prevalence of (OHI –S)

| Age (in yrs) | Good (0.0-1.2) | | Fair (1.3-3.0) | | Poor (3.1-6.0) | |
|---|---|---|---|---|---|---|
| | Male | Female | Male | Female | Male | Female |
| 0-5 | 112(21.62) | 104(22.03) | 48(10.41) | 54(11.94) | 20(7.52) | 21(6.32) |
| 6-10 | 92(17.76) | 88(18.64) | 39(8.46) | 46(10.18) | 20(7.52) | 24(7.23) |
| 11-15 | 78(15.06) | 66(13.98) | 65(14.10) | 78(17.26) | 17(6.39) | 22(6.63) |
| 16-20 | 67(12.93) | 56(11.86) | 81(17.57) | 68(15.04) | 21(7.89) | 38(11.45) |
| 21-25 | 61(11.78) | 67(14.19) | 70(15.18) | 63(13.94) | 31(11.65) | 37(11.14) |
| 26-30 | 26(5.02) | 16(3.39) | 18(3.90) | 13(2.88) | 20(7.52) | 26(7.83) |
| 31-35 | 15(2.89) | 13(2.75) | 11(2.39) | 22(4.87) | 24(9.02) | 21(6.32) |
| 36-40 | 10(1.93) | 12(2.54) | 17(3.69) | 19(4.20) | 16(6.01) | 21(6.32) |
| 41-45 | 9(1.74) | 8(1.69) | 20(4.34) | 18(3.98) | 19(7.14) | 25(7.53) |
| 46-50 | 14(2.70) | 7(1.48) | 23(4.99) | 13(2.88) | 12(4.51) | 20(6.02) |
| 51-55 | 9(1.74) | 7(1.48) | 18(3.90) | 10(2.21) | 12(5.64) | 17(5.12) |
| 56-60 | 5(0.96) | 8(1.69) | 13(2.82) | 12(2.65) | 14(5.26) | 13(3.92) |
| 61-65 | 7(1.35) | 5(1.06) | 12(2.60) | 9(1.99) | 16(6.01) | 17(5.12) |
| 66-70 | 7(1.35) | 8(1.69) | 11(2.39) | 16(3.54) | 13(4.89) | 12(3.61) |
| 70+ | 6(1.16) | 7(1.48) | 15(3.25) | 11(2.43) | 8(3.01) | 18(5.42) |
| Total | 518(41.31) | 472(57.67) | 461(36.76) | 452(36.07) | 266(21.21) | 332(26.50) |

Table 44 shows the prevalence of OHI-S among the Khasis of Shillong, which is the combination of both Debris and Calculus Index. This table reveals that there are more males 518 (41.31 %) in the good OHI-S category, compared to the females 472 (37.67%), similarly in the category of the poor OHI-S index also, females show higher percentage being 332 (26.5 %) than their male counterparts 266 (21.21 %).However, in respect of the prevalence of fair OHI-S, both males 461 (36.76 %) and the females 452 (36.07 %) are close to each other.

Table 45. Prevalence of Periodontal disease according to income

| | Low income group | | Middle income group | | High income group | | Total |
|---|---|---|---|---|---|---|---|
| NORMAL | M | F | M | F | M | F | |
| | 274 (44.64) | 257 (26.56) | 139 (38.61) | 173 (40.61) | 83 (43.46) | 92 (40.53) | 1018 (40.44) |
| AFFECTED | M | F | M | F | M | F | |
| | 337 (55.56) | 446 (63.44) | 221 61.39) | 253 (59.39) | 108 (56.54) | 135 (59.47) | 1499 (59.56) |
| TOTAL | 611 | 703 | 360 | 426 | 191 | 227 | 2517 |

Figures in parenthesis represent percentages

Prevalence of periodontal disease according to income level is presented in Table-45. The table shows that the higher prevalence of periodontal disease is observed among the Low income group individuals followed by the Middle income group. The High income group Khasis are found to be least affected.

Table:46. *Kwai* (betel nut & leaf with lime) chewing and prevalence of periodontal diseases

| Sex | Kwai chewer No. (%) | With periodontal disease No. (%) | Non-chewers No. (%) | Without periodontal disease No. (%) | Total No. (%) |
|---|---|---|---|---|---|
| Male | 970 (77.35) | 206 (21.24) | 284 (22.65) | 108 (38.03) | 1254 |
| Female | 1064 (84.24) | 314 (29.50) | 199 (15.76) | 84 (42.21) | 1263 |
| Total | 2034 | 520 | 483 | 192 | 2517 |

Male vs. Female, x2 = 0.55 df = 1. P < 0.05, Insignificant

*Kwai* chewes vs. non-chewers, $x^{2=}$ 12.52, df = 1, p <0.05, Insignificant

Male vs. female non-chewers of *Kwai*, $x^2 = 0.85$ df = 1,p<0.05, Insignificant.

Male vs. female *Kwai* chewers, $x^2 = 18.24$ df. = 1, p>0.05, Significant.

Table 46 reveals that the prevalence of periodontal disease in more among the Khasis who do not chew *Kwai* .Among the *Kwai* chewers the incidence of periodontal disease is found to be less.

Table: 47. Smokers and prevalence of periodontal diseases

| Sex | Smokers No. (%) | With periodontal disease No. (%) | Non-smokers No (%) | Without periodontal disease No (%) | Total No (%) |
|---|---|---|---|---|---|
| Male | 323 (25.76) | 72 (22.30) | 931 (74.24) | 106 (11.38) | 1254 |
| Female | 0 (0.00) | 0 (0.00) | 1263 (100.00) | 215 (17.02) | 1263 |
| Total | 323 | 72 | 2194 | 321 | 2517 |

Smokers vs. non-smokers, $x^2 = 23.49$. df =3 ,P>0.05, Significant

Table 47 shows that the prevalence of periodontal disease is significantly high among the smokers than the non-smokers. Non-smoker female Khasis have less incidence of periodontal disease than that of their male counterparts.

Table: 48. Chewing tobacco and Periodontal disease

| Sex | Chewers No. (%) | With periodontal disease No. (%) | Non-chewers No (%) | Without periodontal disease No (%) | Total No. (%) |
|---|---|---|---|---|---|
| Male | 576 (45.93) | 54 (9.40) | 678 (54.07) | 49 (7.20) | 1254 |
| Female | 667 (52.81) | 71 (10.64) | 596 (47.19) | 37 (6.20) | 1263 |
| Total | 1243 | 125 | 1274 | 86 | 2517 |

Tobacco chewers vs. non-chewers in female, $x^2 = 10.72$, df. = 3, Significant

Chewers of tobacco in male, $x^2 = 1.9$, df = 3 .$p<0.05$, Insignificant

Chewers of Tobacco in females, x2 = 0.55, df= 3 $p<0.05$, Insignificant.

Table 48 reveals the incidence of periodontal disease among the tobacco chewers as well non-chewers. This table shows that the incidence of periodontal disease is more among the tobacco chewers in both the sexes.

Table: 49. Prevalence of OHI (CI-S) according to family size

| | | Small family (Less than 5 members) | | Medium family (5-6 members) | | Large family (more than 6 members) | | Total |
|---|---|---|---|---|---|---|---|---|
| | Sex | M | F | M | F | M | F | |
| Normal | No. | 13 | 25 | 11 | 18 | 143 | 270 | 480 |
| | % | 6.14 | 9.65 | 3.69 | 5.10 | 23.40 | 34.57 | 19.10 |
| Affected | No. | 201 | 234 | 287 | 336 | 468 | 511 | 2037 |
| | % | 93.92 | 90.34 | 96.31 | 94.91 | 76.59 | 65.45 | 80.95 |
| Grand total | | 214 (8.50) | 259 (10.29) | 298 (11.85) | 354 (14.10) | 611 (24.27) | 781 (31.02) | 2517 |

In male $x^2 = 77.65$, df = 2, $p > 0.05$, Significant.

In female $x^2 = 151.08$, df = 2, $p > 0.05$, Significant.

Table 49 shows that the highest prevalence of calculus is observed in the Medium sized family followed by the Small sized family. The large family shows least prevalence compared to the rest. In respect of this trait the difference among the individuals belonging to the different family sizes are statistically significant.

Table: 50. Prevalence of Gingivitis according to family size

| | | Small family (Less than 5 members) | | Medium family (5-6 members) | | Large family (more than 6 members) | | Total |
|---|---|---|---|---|---|---|---|---|
| | Sex | M | F | M | F | M | F | |
| Normal | No. | 86 | 95 | 132 | 144 | 267 | 286 | 1010 |
| | % | 37.39 | 39.10 | 50.96 | 36.64 | 42.31 | 37.58 | 40.15 |
| Affected | No. | 144 | 148 | 127 | 249 | 364 | 475 | 1507 |
| | % | 62.61 | 60.91 | 49.03 | 63.35 | 57.68 | 62.41 | 59.87 |
| Grand total | | 230 (9.13) | 243 (9.65) | 259 (10.29) | 393 (15.61) | 631 (25.10) | 761 (30.23) | 2517 |

In male $x^2 = 9.72$, df = 2, $p > 0.05$, Significant.

In female $x^2 = 6$, df = 2, $p > 0.05$, Significant.

Table 50 shows the prevalence of gingivitis according to family size. The affected persons are significantly the Small family size than the medium and the large family sizes in both the sexes.

Table: 51. Prevalence of OHI(S) according to family size

| | | Small family (Less than 5 members) | | Medium family (5-6 members) | | Large family (more than 6 members) | | Total |
|---|---|---|---|---|---|---|---|---|
| | Sex | M | F | M | F | M | F | |
| Normal | No. | 87 | 60 | 64 | 70 | 83 | 112 | 476 |
| | % | 30.10 | 25.86 | 19.63 | 21.47 | 12.88 | 14.95 | 18.91 |
| Affected | No. | 154 | 172 | 262 | 256 | 561 | 637 | 2041 |
| | % | 63.90 | 74.13 | 80.36 | 78.55 | 87.11 | 85.04 | 81.10 |
| Grand total | | 241 (9.57) | 232 (9.25) | 326 (12.95) | 326 (12.95) | 644 (25.58) | 749 (29.75) | 2517 |

In male $x^2 = 64.35$, df = 2, $p > 0.05$, Significant.

In female $x^2 = 16.5$, df = 2, $p > 0.05$, Significant.

Table 51 shows that the prevalence of the oral hygiene debris index is significantly higher in the Large family size followed by the medium. Least prevalence is observed in the Small family size.

Table: 52. Prevalence of OHI (DI-S) according to family size

| | | Small family (Less than 5 members) | | Medium family (5-6 members) | | Large family (more than 6 members) | | Total |
|---|---|---|---|---|---|---|---|---|
| | Sex | M | F | M | F | M | F | |
| Normal | No. | 59 | 68 | 118 | 94 | 209 | 244 | 792 |
| | % | 26.15 | 27.53 | 35.75 | 29.19 | 30.73 | 34.26 | 31.46 |
| Affected | No. | 167 | 179 | 212 | 228 | 471 | 468 | 1725 |
| | % | 73.89 | 72.46 | 64.24 | 70.81 | 69.26 | 65.73 | 68.53 |
| Grand total | | 226 (8.98) | 247 (9.81) | 330 (13.11) | 322 (12.79) | 680 (27.02) | 712 (28.29) | 2517 |

In male $x^2 = 5.98$, df = 2, $p < 0.05$, Insignificant.

In female $x^2 = 5.09$, df = 2, $p < 0.05$, Insignificant.

Table 52 shows the prevalence of the debris index according to the family size. Higher percentage of debris is found in the Small family size compared to the rest However, the difference between the families and sexes are not statistically significant.

Table: 53. Prevalence of Periodontal disease according to income level

| | | Low income group | | Middle income group | | High income group | | Total |
|---|---|---|---|---|---|---|---|---|
| | Sex | M | F | M | F | M | F | |
| Normal | No. | 274 | 257 | 139 | 173 | 83 | 92 | 1018 |
| | % | 44.84 | 36.55 | 38.61 | 40.61 | 43.45 | 40.52 | 40.44 |
| Affected | No. | 337 | 446 | 221 | 253 | 108 | 135 | 1499 |
| | % | 55.15 | 63.44 | 61.38 | 59.38 | 56.54 | 59.47 | 59.55 |
| Grand total | | 611 (24.27) | 703 (27.93) | 360 (14.30) | 426 (16.92) | 191 (7.59) | 227 (9.02) | 2517 |

In male $x^2 = 3.66$, df = 2, $p < 0.05$, Insignificant.

In female $x^2 = 2.32$, df = 2, $p < 0.05$, Insignificant.

Prevalence of Periodontal diseases is shown among the different income groups in the Table 53. This table shows that the difference among the individuals of various income groups is statistically insignificant in both the sexes.

Table: 54. Prevalence of OHI (-S) according to income level

| | | Low income group | | Middle income group | | High income group | | Total |
|---|---|---|---|---|---|---|---|---|
| | Sex | M | F | M | F | M | F | |
| Normal | No. | 146 | 126 | 57 | 66 | 36 | 45 | 476 |
| | % | 23.21 | 18.39 | 14.57 | 16.71 | 19.45 | 19.39 | 18.91 |
| Affected | No. | 483 | 559 | 334 | 329 | 149 | 187 | 2041 |
| | % | 76.78 | 81.61 | 85.42 | 83.29 | 80.54 | 80.60 | 81.10 |
| Grand total | | 629 (25.00) | 685 (27.21) | 391 (15.53) | 395 (15.69) | 185 (7.35) | 232 (9.22) | 2517 |

In male $x^2 = 11.31$, df = 2, $p > 0.05$, Significant.

In female $x^2 = 0.81$, df = 2, $p < 0.05$, Insignificant.

Table-: 55. Prevalence of OHI (DI-S) according to income level

| | | Low income group | | Middle income group | | High income group | | Total |
|---|---|---|---|---|---|---|---|---|
| | Sex | M | F | M | F | M | F | |
| Normal | No. | 153 | 191 | 199 | 180 | 31 | 38 | 792 |
| | % | 24.67 | 27.52 | 50.63 | 45.80 | 15.65 | 20.11 | 31.46 |
| Affected | No. | 467 | 503 | 194 | 213 | 167 | 181 | 1725 |
| | % | 75.32 | 72.47 | 49.36 | 54.50 | 84.34 | 95.76 | 68.53 |
| Grand total | | 620 (24.63) | 694 (27.57) | 393 (15.61) | 393 (15.61) | 198 (7.87) | 189 (8.70) | 2517 |

In male $x^2 = 10.3.12$, df = 2, $p > 0.05$, Significant.

In female $x^2 = 62.82$, df = 2, $p > 0.05$, Significant.

Table: 56. Prevalence of OHI (CI-S) according to income level

| | | Low income group | | Middle income group | | High income group | | Total |
|---|---|---|---|---|---|---|---|---|
| | Sex | M | F | M | F | M | F | |
| Normal | No. | 88 | 78 | 97 | 84 | 62 | 71 | 480 |
| | % | 12.46 | 12.82 | 25.45 | 20.74 | 29.95 | 33.97 | 10.10 |
| Affected | No. | 618 | 530 | 284 | 321 | 145 | 138 | 2037 |
| | % | 87.53 | 87.17 | 74.54 | 79.25 | 70.04 | 66.02 | 80.92 |
| Grand total | | 706 | 608 | 381 | 405 | 207 | 209 | 2517 |

Table: 57. Prevalence of Gingivitis according to income level

| | | Low income group | | Middle income group | | High income group | | Total |
|---|---|---|---|---|---|---|---|---|
| | Sex | M | F | M | F | M | F | |
| Normal | No. | 153 | 191 | 199 | 180 | 38 | 31 | 792 |
| | % | 24.68 | 27.52 | 50.64 | 45.80 | 19.19 | 14.62 | 40.12 |
| Affected | No. | 467 | 503 | 194 | 213 | 167 | 181 | 1507 |
| | % | 75.32 | 72.48 | 49.36 | 54.20 | 82.43 | 85.37 | 59.87 |
| Grand total | | 620 | 694 | 393 | 393 | 205 | 212 | 2517 |

Tables 54,55.56 and 57 shows the prevalence of OHI(S), OHI(DI-S), OHI-(CI-S) and gingivitis according to the Family size. Excepting the Calculus the prevalence of all other oral diseases is more in the High income group individuals.

# CHAPTER-VI

## DENTAL MORPHOLOGY

In this chapter, we shall deal with dental morphology among the Khasis of Shillong.

Table: 58. Occurrence of supernumerary teeth by sex among the Khasis of Shillong

| Sex | No. of subjects with deciduous teeth | | | No. of subjects with permanent teeth | | |
|---|---|---|---|---|---|---|
| | Number examined | With supernumerary | Percentage | Examined | With supernumerary | Percentage |
| Male | 470 | 0 | 0.00 | 1074 | 36 | 3.30 |
| Female | 466 | 0 | 0.00 | 1074 | 24 | 2.23 |
| M + F | 936 | 0 | 0.00 | 2148 | 60 | 2.79 |

Table-58 shows the frequency distribution of subjects with supernumerary teeth by sex. Supernumerary teeth are absent in the deciduous teeth of all the subjects examined. Out of 1074 males and 1074 females examined for the supernumerary teeth in the permanent dentition, 36(3.35%) males and 24(2.23%) female subjects were found having this trait. The total number of subjects with supernumerary teeth in both the deciduous and the permanent dentition is found to 60(2.79%).

Table: 59. Frequency distribution of subjects with supernumerary teeth by age

| Age-group (in years) | Males | | | Females | | |
|---|---|---|---|---|---|---|
| | Number examined | With supernumerary teeth | Percentage | Number examined | With supernumerary teeth | Percentage |
| 0 -5 | 180 | 0 | 0.00 | 179 | 0 | 0.00 |
| 6 – 10 | 151 | 1 | 0.66 | 158 | 1 | 0.63 |
| 11-15 | 168 | 16 | 9.52 | 166 | 6 | 3.61 |
| 16-20 | 170 | 9 | 5.29 | 161 | 7 | 4.35 |
| 21-25 | 162 | 3 | 1.85 | 167 | 3 | 1.80 |
| 26-30 | 64 | 1 | 1.56 | 55 | 3 | 5.45 |
| 31-35 | 50 | 0 | 0.00 | 56 | 1 | 1.79 |
| 36-40 | 43 | 1 | 2.32 | 52 | 1 | 1.92 |
| 41-45 | 48 | 1 | 2.08 | 51 | 0 | 0.00 |
| 46-50 | 49 | 1 | 2.04 | 50 | 1 | 2.50 |
| 51-55 | 42 | 1 | 2.38 | 34 | 1 | 2.94 |
| 56-60 | 32 | 1 | 3.12 | 33 | 0 | 0.00 |
| 61-65 | 35 | 1 | 2.86 | 31 | 0 | 0.00 |
| 66-70 | 31 | 0 | 0.00 | 36 | 0 | 0.00 |
| 71 + | 29 | 0 | 0.00 | 34 | 0 | 0.00 |
| Total | 1254 | 36 | 2.87 | 1263 | 24 | 1.90 |

Table 59 shows the frequency distribution of subjects with supernumerary teeth by age group among the Khasis of Shillong. The percentage frequency of the supernumerary teeth is found highest in the age group, 11-15 years in males and 16-20 years in the females. This trait remains high in frequency in the age groups, 11-15, 16-20 and 21-25 years also and in very low frequency or absent in rest of the age groups in both males and females.

Table: 60. Supernumerary teeth in the Jaws by sex

| | | Males | | | Females | | | Both the sexes combined | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Left | | | Right | | | Both left and right | | |
| | | No. of teeth examined | Supernu-merary | % | No. of teeth examined | Supernu-merary | % | No. of teeth examined | Supernu-merary | % |
| MAXILLA | CI | 2476 | 21 | 0.85 | 2382 | 13 | 0.55 | 4858 | 34 | 7.00 |
| | L | 2284 | 4 | 0.17 | 2156 | 0 | 0.00 | 4440 | 4 | 0.09 |
| | C | 1997 | 3 | 0.15 | 1866 | 3 | 0.16 | 3863 | 6 | 0.15 |
| | PM1 | 2018 | 0 | 0.00 | 1918 | 0 | 0.00 | 3936 | 0 | 0.00 |
| | PM2 | 1835 | 0 | 0.00 | 1845 | 0 | 0.00 | 3680 | 0 | 0.00 |
| | M1 | 2480 | 2 | 0.08 | 2432 | 1 | 0.04 | 4912 | 3 | 0.06 |
| | M2 | 1792 | 0 | 0.00 | 1624 | 0 | 0.00 | 3416 | 0 | 0.00 |
| | M3 | 1278 | 0 | 0.00 | 1172 | 0 | 0.00 | 2450 | 0 | 0.00 |
| | Total | 16160 | 30 | 0.185 | 15395 | 17 | 0.11 | 31555 | 47 | 0.15 |
| | | | | | | | | | | |
| MANDIBLE | CI | 2352 | 0 | 0.00 | 2412 | 3 | 0.124 | 4764 | 3 | 0.06 |
| | LI | 2310 | 3 | 0.13 | 2238 | 3 | 0.134 | 4548 | 6 | 0.13 |
| | C0 | 1946 | 3 | 0.15 | 2238 | 0 | 0.00 | 4184 | 3 | 0.08 |
| | PM1 | 2218 | 0 | 0.00 | 2455 | 0 | 0.00 | 4673 | 0 | 0.00 |
| | PM2 | 1955 | 0 | 0.00 | 1862 | 1 | 0.05 | 3817 | 1 | 0.03 |
| | M1 | 2465 | 0 | 0.00 | 2387 | 0 | 0.00 | 4852 | 0 | 0.00 |
| | M2 | 1853 | 0 | 0.00 | 1905 | 0 | 0.00 | 3758 | 0 | 0.00 |
| | M3 | 1125 | 0 | 0.00 | 1027 | 0 | 0.00 | 2152 | 0 | 0.00 |
| | Total | 16224 | 6 | 0.04 | 16524 | 7 | 0.04 | 32748 | 13 | 0.04 |

Table 60 shows the incidence of supernumerary teeth in both the jaws by sex. There are 30 (0.185%) individuals who are having supernumerary teeth with slightly higher frequency in the left than in the right maxilla. In both the segments, supernumerary in central incisors are higher in number than the other teeth . This is followed by the lateral incisor and canine. No supernumerary teeth are found in the premolars. There are 2(0.08%) and 1(0.04) supernumerary teeth present in the first molars of males and females respectively. Differences in the occurrence of supernumerary teeth between males and females are found to be high . The incident of supernumerary teeth in the mandible is far less than that observed in the maxilla. In the mandible of male the supernumerary teeth is absent but in female 3(0.124%) of this trait observed. Three males and three females with supernumerary teeth in the lateral mandibular incisors were found. Three males have supernumerary teeth in the mandibular canine whereas the female is devoid of this trait. Only 1(0.05%) second premolar with supernumerary teeth is seen in the mandible of female which is absent in male.

Table 61. Frequency distribution of children with Carabelli's anomaly in deciduous teeth

| Sex | Total no. of children examined | No. with Carabelli's anamoly | Percentage |
|---|---|---|---|
| Boys | 470 | 78 | 16.59 |
| Girls | 466 | 66 | 14.16 |

The frequency distribution of children with Carabelli's anamoly in the deciduous molars by sex is given in Table -61 . Boys are higher in number than the girls in respect of this trait and the percentage being 16.59% and 14.16% respectively.

Table 62. Frequency distribution of children with Carabelli's anomaly by sex and age

| Age (in yrs) | Sex | | | | | |
|---|---|---|---|---|---|---|
| | BOYS | | | GIRLS | | |
| | Number Examined | With C.C | Percentage | Number Examined | With C.C | Percentage |
| 1 | 48 | 2 | 4.17 | 46 | 2 | 4.35 |
| 2 | 35 | 3 | 8.57 | 38 | 6 | 15.79 |
| 3 | 33 | 4 | 12.12 | 33 | 4 | 12.12 |
| 4 | 31 | 7 | 22.58 | 30 | 6 | 20.00 |
| 5 | 33 | 7 | 21.21 | 32 | 7 | 21.87 |
| 6 | 31 | 5 | 16.13 | 31 | 6 | 19.35 |
| 7 | 32 | 4 | 12.50 | 38 | 5 | 13.16 |
| 8 | 25 | 4 | 16.00 | 29 | 3 | 10.34 |
| 9 | 32 | 7 | 21.87 | 33 | 5 | 15.15 |
| 10 | 31 | 5 | 16.13 | 27 | 8 | 29.63 |
| 11 | 41 | 12 | 29.27 | 38 | 5 | 13.16 |
| 12 | 28 | 5 | 17.86 | 29 | 2 | 6.90 |
| 13 | 36 | 6 | 16.67 | 34 | 3 | 8.82 |
| 14 | 34 | 7 | 20.59 | 28 | 4 | 14.28 |
| | 470 | 78 | 16.59 | 466 | 66 | 14.16 |

Table 62 shows distribution of the children with Carabelli's anomaly by age and sex. The highest percentage of boys with this trait is found in the age group 12(29.27%) and the girls in the age group 10 years (29.63%). All other age groups show more or less similar frequency distribution. The number of boys with Carabelli's anomaly was higher than that of the girls.

Table 63: Frequency of occurrence of Carabelli's cusp on the maxillary deciduous molars by sex

| | MALES | | | FEMALES | | | COMBINED | | |
|---|---|---|---|---|---|---|---|---|---|
| | No. of teeth Examined | Proportion with C.C | % | No.of teeth Examined | Proportion with C.C | % | No.of teeth Examined | Proportion with C.C | % |
| Right | | | | | | | | | |
| First Molar | 455 | 1 | 0.22 | 442 | 0 | 0.00 | 897 | 1 | 0.1 |
| Second Molar | 461 | 72 | 15.61 | 458 | 60 | 13.10 | 919 | 132 | 14.36 |
| | 916 | 73 | 15.83 | 900 | 60 | 13.10 | 1816 | 133 | 14.47 |
| Left | | | | | | | | | |
| First Molar | 458 | 2 | 0.44 | 447 | 2 | 0.45 | 905 | 4 | 0.44 |
| Second Molar | 463 | 74 | 15.98 | 452 | 63 | 13.94 | 915 | 137 | 14.97 |
| | 921 | 76 | 16.42 | 899 | 65 | 14.39 | 1820 | 141 | 15.41 |
| R+ L | | | | | | | | | |
| First Molar | 913 | 3 | 0.33 | 889 | 2 | 0.22 | 1802 | 5 | 0.28 |
| Second Molar | 924 | 146 | 15.80 | 900 | 123 | 13.67 | 1834 | 269 | 14.67 |
| | 1837 | 149 | 6.13 | 1789 | 25 | 13.89 | 3636 | 274 | 14.95 |

Table -63 shows tooth wise occurrence of the carabelli's cusp in the maxillary molars by sex. The expression of the cusp is more or less equivalent on either side of the jaw. The prevalence of the carabelli's cusp on first molar is very low as compared to that of the second molar. In the right segment of maxilla the males show higher frequency of carabelli's cusp i.e., 73(15.83%) whereas in the females it is 60(13.10%). Similarly in the left segment of maxillary molars the males preceeds the females with a frequency of 76(16.42%) in males and 65 (13.39%) in females.

Table 64 .Frequency distribution of persons with Carabelli's anomaly by age and sex

| Age (in yrs) | MALES | | | FEMALES | | |
|---|---|---|---|---|---|---|
| | Number Examined | With C.C. | Percentage | Number Examined | With C.C. | Percentage |
| 0- 5 | 180 | 25 | 13.89 | 179 | 27 | 15.08 |
| 6-10 | 151 | 28 | 18.54 | 158 | 28 | 17.72 |
| 11-15 | 168 | 31 | 18.45 | 166 | 17 | 10.20 |
| 16-20 | 170 | 4 | 2.35 | 161 | 3 | 1.86 |
| 21-25 | 162 | 2 | 1.23 | 167 | 1 | 0.59 |
| 26-30 | 64 | 1 | 1.56 | 55 | 2 | 3.64 |
| 31-35 | 50 | 2 | 0.25 | 56 | 2 | 3.64 |
| 36-40 | 43 | 0 | 0.00 | 52 | 1 | 1.92 |
| 41-45 | 48 | 0 | 0.00 | 51 | 1 | 1.96 |
| 46-50 | 49 | 0 | 0.00 | 40 | 0 | 0.00 |
| 51-55 | 42 | 0 | 0.00 | 34 | 0 | 0.00 |
| 56-60 | 32 | 0 | 0.00 | 33 | 0 | 0.00 |
| 61-65 | 35 | 0 | 0.00 | 31 | 0 | 0.00 |
| 66-70 | 31 | 0 | 0.00 | 36 | 0 | 0.00 |
| 71 + | 29 | 0 | 0.00 | 34 | 0 | 0.00 |

Table 64 reveals that Carabelli's anomaly is present in the jaws of the males up to 35 years and in females up to the 45 years of age. The percentage frequency of this trait decreases as the age groups increases and eventually becomes absent.

Table 65. Frequency distribution of children with shoveling by age and sex

| Age (in yrs) | MALES | | | FEMALES | | |
|---|---|---|---|---|---|---|
| | No. Examined | With Shoveling | Percentage | No. Examined | Wit Shoveling | Percentage |
| 1 | 48 | 0 | 0.00 | 46 | 0 | 0.00 |
| 2 | 35 | 0 | 0.00 | 38 | 0 | 0.00 |
| 3 | 33 | 4 | 12.12 | 33 | 2 | 6.06 |
| 4 | 31 | 4 | 12.90 | 30 | 4 | 13.33 |
| 5 | 33 | 5 | 15.15 | 32 | 6 | 18.75 |
| 6 | 31 | 7 | 22.58 | 31 | 3 | 9.68 |
| 7 | 32 | 2 | 6.25 | 38 | 1 | 2.63 |
| 8 | 25 | 4 | 16.00 | 29 | 2 | 6.90 |
| 9 | 32 | 3 | 9.37 | 33 | 2 | 6.06 |
| 10 | 31 | 2 | 3.22 | 27 | 2 | 7.41 |
| 11 | 41 | 4 | 9.76 | 38 | 2 | 5.26 |
| 12 | 28 | 1 | 3.57 | 29 | 1 | 3.45 |
| 13 | 36 | 2 | 5.56 | 34 | 0 | 0.00 |
| 14 | 34 | 1 | 2.94 | 28 | 0 | 0.00 |
| Total | 433 | 39 | 9.0 | 466 | 25 | 5.36 |

The frequency distribution of Khasi children with shoveling by sex and age is shown in Table 65. This trait occurs with a higher proportion in boys aged 6 years age group and girls aged 5 years . In the first two years there is no incidence of shoveling .By 3 years this trait was observed in 4(12.12)boys and 2(6.06%) girls. In the age group 13 and 14 years, females were devoid of this trait, whereas 2(5.56%) and 1(2.94%) males were having shoveling respectively.

Table: 66. Incidence of shovel- shaped incisors in maxillary and mandibular permanent teeth by sex

| | Male | | | | | | | | | Female | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No. of teeth examined | Proportion with shovelling | | | | | | | | No. of teeth examined | Proportion with shovelling | | | | | | | |
| | | Mild | | Moderate | | Severe | | Total | | | Mild | | Moderate | | Severe | | Total | |
| | | No. | % | No. | % | No. | % | No. | % | | No. | % | No. | % | No. | % | No. | % |
| Maxilla | | | | | | | | | | | | | | | | | | |
| CI | 963 | 120 | 12.50 | 67 | 6.96 | 18 | 1.90 | 205 | 21.30 | 925 | 107 | 11.60 | 39 | 4.20 | 16 | 1.70 | 162 | 17.50 |
| LI | 948 | 143 | 15.10 | 51 | 5.40 | 15 | 1.60 | 209 | 22.00 | 902 | 95 | 10.50 | 32 | 3.50 | 12 | 1.30 | 139 | 15.40 |
| Total | 1910 | 263 | 13.80 | 118 | 6.20 | 33 | 1.70 | 414 | 21.00 | 1827 | 202 | 11.60 | 71 | 3.90 | 28 | 1.50 | 301 | 16.50 |
| Mandible | | | | | | | | | | | | | | | | | | |
| CI | 986 | 21 | 2.10 | 8 | 0.80 | 1 | 0.10 | 30 | 3.04 | 911 | 18 | 2.00 | 9 | 1.00 | 0 | 0.00 | 27 | 3.00 |
| LI | 979 | 17 | 1.70 | 5 | 0.50 | 0 | 0.00 | 22 | 2.20 | 887 | 13 | 1.50 | 4 | 0.45 | 0 | 0.00 | 17 | 1.90 |
| Total | 1965 | 38 | 1.90 | 13 | 0.70 | 1 | 0.05 | 52 | 2.60 | 1798 | 31 | 1.70 | 13 | 0.70 | 0 | 0.00 | 44 | 2.40 |

The distribution of three forms of shoveling i.e., mild , moderate and severe in maxillary and mandiblular incisors by sex is shown in Table- 66 . The proportion of maxillary incisors (21.7%)with shoveling of all the above types in male is higher than that of females (16.5%). In mandibular incisors the trait occurs with negligible frequencies (2.6%) in males and 2.4% in females). From the above table it is observed that the severe form of shoveling occurs only 0.1% in the central incisors and remains absent in the females.

Table 67. Frequency distribution of children with Diastema by age and sex

| Age (in months and yrs) | SEX | | | | | |
|---|---|---|---|---|---|---|
| | MALE | | | FEMALE | | |
| | Number Examined | with Diastema | Number Examined | Percentage | with Diastema | Percentage |
| 0-11 mnts | 50 | 0 | 0.00 | 63 | 0 | 0.00 |
| 1 | 48 | 0 | 0.00 | 46 | 0 | 0.00 |
| 2 | 35 | 0 | 0.00 | 38 | 0 | 0.00 |
| 3 | 33 | 2 | 6.06 | 33 | 4 | 12.12 |
| 4 | 31 | 3 | 9.7 | 30 | 2 | 6.7 |
| 5 | 33 | 0 | 0.00 | 32 | 1 | 3.125 |
| 6 | 31 | 5 | 16.13 | 31 | 1 | 3.2 |
| 7 | 32 | 2 | 6.25 | 38 | 3 | 7.9 |
| 8 | 25 | 2 | 8.00 | 29 | 2 | 6.9 |
| 9 | 32 | 1 | 3.12 | 33 | 4 | 12.12 |
| 10 | 31 | 2 | 6.45 | 27 | 0 | 0.00 |
| 11 | 41 | 1 | 2.44 | 38 | 2 | 5.26 |
| 12 | 28 | 1 | 3.6 | 29 | 2 | 6.9 |
| 13 | 36 | 1 | 2.8 | 34 | 4 | 11.8 |
| 14 | 34 | 0 | 0.00 | 28 | 1 | 3.6 |
| | 520 | 20 | 3 .85 | 529 | 26 | 4.91 |

Table -67 shows the percentage frequency of diastema is higher in the 6 and 4 years boys and girls respectively. The incidence of diastema was not observed in the children below 3 years of age. The frequency of diastema decreases from the 6 years of age in the boys, however it does not show any specific trend among the girls.

Table 68. Incidence of Diastema in deciduous teeth by sex

| | MALE | | | FEMALE | | | TOTAL | | |
|---|---|---|---|---|---|---|---|---|---|
| | MAXILLA | | | | | | | | |
| | Number Examined | with Diastema | % | Number Examined | with Diastema | Per. | Number Examined | with Diastema | % |
| CI-C | 491 | 11 | 2.24 | 499 | 13 | 2.60 | 990 | 24 | 2.42 |
| CI-LI | 968 | 3 | 0.30 | 986 | 5 | 0.05 | 1954 | 8 | 0.41 |
| LI- C | 972 | 2 | 0.20 | 997 | 3 | 0.30 | 1969 | 5 | 0.25 |
| Total | 2431 | 16 | 0.66 | 2482 | 21 | 0.8 | 4913 | 37 | 0.75 |
| | MANDIBLE | | | | | | | | |
| CI-CI | 478 | 3 | 0.63 | 482 | 3 | 0.6 | 960 | 6 | 0.625 |
| CI-LI | 950 | 1 | 0.11 | 984 | 1 | 0.10 | 1934 | 2 | 0.10 |
| LI-C | 984 | 0 | 0.00 | 991 | 1 | 0.10 | 1975 | 1 | 0.05 |
| Total | 2412 | 4 | 0.16 6 | 2457 | 5 | 0.20 | 4869 | 9 | 5.41 |

Table 68 shows the incidence of diastema according to the jaw and sex .The above table reveals that the frequency of CI-CI is highest followed by CI-LI in both the jaws and sexes. This trait does not show much difference between males and females.

Table: 69. Frequency distribution of children with Carabelli's anomaly in deciduous teeth.

| Sex | Total no. of children examined | No. with carabelli's anamoly | Percentage |
|---|---|---|---|
| Boys | 470 | 78 | 16.59 |
| Girls | 466 | 66 | 14.16 |

The frequency distribution of children with Carabelli's anomaly in the deciduous molars by sex is given in the Table 69. The number of boys is higher compared to the girls in respect of this trait and the percentage being 16.59% and 14.16% respectively.

Table: 70. Occurrence of Carabelli's cusp in the maxillary deciduous molars by sex

| Right | Males | | | Females | | | Both the sexes combined | | |
|---|---|---|---|---|---|---|---|---|---|
| | No. of teeth examined | Proportion with C.C. | % | No. of teeth examined | Proportion with C.C. | % | No. of teeth examined | Proportion with C.C. | % |
| First molar | 455 | 1 | 0.22 | 442 | 0 | 0.00 | 897 | 1 | 0.1 |
| Second molar | 461 | 72 | 15.61 | 458 | 60 | 13.10 | 919 | 132 | 14.36 |
| Total | 916 | 73 | 15.83 | 900 | 60 | 13.10 | 1816 | 133 | 14.47 |
| Left | | | | | | | | | |
| First molar | 458 | 2 | 0.44 | 447 | 2 | 0.45 | 905 | 4 | 0.44 |
| Second molar | 463 | 74 | 15.98 | 452 | 63 | 13.94 | 915 | 137 | 14.97 |
| Total | 921 | 76 | 16.42 | 899 | 65 | 14.39 | 1820 | 141 | 15.41 |
| L + R | | | | | | | | | |
| First molar | 913 | 3 | 0.33 | 889 | 2 | 0.22 | 1802 | 5 | 0.28 |
| Second molar | 924 | 146 | 15.80 | 900 | 123 | 13.67 | 1834 | 269 | 14.67 |
| Total | 1837 | 149 | 16.13 | 1789 | 125 | 13.89 | 3636 | 274 | 14.95 |

Table-70 shows tooth wise occurrence of the Carabelli's cusp on the maxillary molars by sex. The expression of the cusp is more or less equivalent on either side of the jaw. The prevalence of the Carabelli's cusp on first molar is very low as compared to that of the second molar. In the right segment of maxilla the male shows higher percentage of Carabelli's cusp with a frequency of 73 (15.83%) whereas the females were having 60 (13.10%) of the trait. Similarly in the left segment of maxillary molars the males proceeds the females with a frequency of 76 (16.42%) in males and 65 (13.39%) in females.

Table: 71 Frequency distribution of children with shoveling in the deciduous teeth

| Sex | Total number of subjects examined | With shoveling | Percentage |
|---|---|---|---|
| Boys | 470 | 39 | 8.30 |
| Girls | 466 | 25 | 5.36 |
| Total | 936 | 64 | 13.66 |

Table 71 shows the percentage frequency of the Khasi children with shovel shaped incisors. There are higher number of boys 39(8.30) than the girls, 25(5.36) with shoveling in their deciduous teeth.

Table: 72. Children with shoveling by age and sex

| Age (in yrs) | Male | | | Female | | |
|---|---|---|---|---|---|---|
| | No. Examined | With Shovelling | Percentage | No. Examined | With Shovelling | Percentage |
| 1 | 48 | 0 | 0.00 | 46 | 0 | 0.00 |
| 2 | 35 | 0 | 0.00 | 38 | 0 | 0.00 |
| 3 | 33 | 4 | 12.12 | 33 | 2 | 6.06 |
| 4 | 31 | 4 | 12.90 | 30 | 4 | 13.33 |
| 5 | 33 | 5 | 15.15 | 32 | 6 | 18.75 |
| 6 | 31 | 7 | 22.58 | 31 | 3 | 9.68 |
| 7 | 32 | 2 | 6.25 | 38 | 1 | 2.63 |
| 8 | 25 | 4 | 16.00 | 29 | 2 | 6.90 |
| 9 | 32 | 3 | 9.37 | 33 | 2 | 6.06 |
| 10 | 31 | 2 | 3.22 | 27 | 2 | 7.41 |
| 11 | 41 | 4 | 9.76 | 38 | 2 | 5.26 |
| 12 | 28 | 1 | 3.57 | 29 | 1 | 3.45 |
| 13 | 36 | 2 | 5.56 | 34 | 0 | 0.00 |
| 14 | 34 | 1 | 2.94 | 28 | 0 | 0.00 |
| Total | 433 | 39 | 9.0 | 466 | 25 | 5.36 |

The frequency distribution of Khasi children with shoveling by age and sex is given in the Table 72. This trait occurs with a higher frequency in male's aged 6 years age group and girls belonging to age group 5 years .In the first two years there is no incidence of shoveling. By 3 years, 4(12.12) boys and 2(6.06) girls were having this trait. In the age group 13 years and 14 years ,females were devoid of the trait, but the males were found to have 2(5.56%) and 1(2.94%) of shoveling in these age group respectively.

Table: 73. Frequency distribution of children with crowding by age and sex

| Age (in years) | Male | | | Female | | |
|---|---|---|---|---|---|---|
| | Number examined | With crowding | Percentage | Number examined | With crowding | Percentage |
| 1 | 48 | 0 | 0.00 | 46 | 0 | 0.00 |
| 2 | 35 | 2 | 5.7 | 38 | 3 | 7.9 |
| 3 | 33 | 1 | 3.03 | 33 | 2 | 6.1 |
| 4 | 31 | 2 | 6.45 | 30 | 2 | 6.7 |
| 5 | 33 | 5 | 15.15 | 32 | 1 | 3.1 |
| 6 | 31 | 5 | 16.1 | 31 | 4 | 12.9 |
| 7 | 32 | 3 | 9.4 | 38 | 7 | 18.4 |
| 8 | 25 | 6 | 24.0 | 29 | 3 | 10.3 |
| 9 | 32 | 3 | 9.4 | 33 | 3 | 9.1 |
| 10 | 31 | 2 | 6.45 | 27 | 5 | 18.5 |
| 11 | 41 | 1 | 2.4 | 38 | 2 | 5.3 |
| 12 | 28 | 3 | 10.7 | 29 | 2 | 6.9 |
| 13 | 36 | 1 | 2.8 | 34 | 0 | 0.00 |
| 14 | 34 | 4 | 11.8 | 28 | 2 | 7.1 |
| Total | 470 | 38 | 8.085 | 466 | 36 | 7.725 |

Table 73 shows the incidence of crowding by age and sex. The highest incidence of crowding 6(24.0%) was observed among the children of the age group 8 years which was followed by the children of age group 6 years with the frequencies 6(16.1%). This is followed by 5 (15.15%), 4(11.8% and 3(10.7%) respectively in the age group 5, 14, 12 years respectively. The higher incidence of occurrence of this trait is observed in the males. This trait occurs in high frequency in the age group of 10 years with 5(18.5%) and 7(18.4%) respectively among the Khasi girls.

Table: 74. Incidence of Crowding in deciduous teeth by sex

| | Male | | | Female | | | Both sexes combined | | |
|---|---|---|---|---|---|---|---|---|---|
| | No. examined | With crowding | % | No. examined | With crowding | % | No. examined | With crowding | % |
| Maxilla | | | | | | | | | |
| CI-CI | 470 | 2 | 0.4 | 466 | 1 | 2.2 | 936 | 3 | 0.3 |
| CI-LI | 470 | 10 | 0.2 | 466 | 12 | 2.6 | 936 | 22 | 0.02 |
| LI-C | 470 | 9 | 1.9 | 466 | 3 | 0.6 | 936 | 12 | 1.3 |
| Total | 1410 | 21 | 1.5 | 1398 | 16 | 1.1 | 2808 | 37 | 1.32 |
| Mandible | | | | | | | | | |
| CI-CI | 470 | 5 | 1.1 | 466 | 4 | 0.9 | 936 | 9 | 1.0 |
| CI-LI | 470 | 8 | 1.7 | 466 | 10 | 2.1 | 936 | 18 | 1.9 |
| LI-C | 470 | 4 | 0.85 | 466 | 6 | 1.3 | 936 | 10 | 1.1 |
| Total | 1410 | 17 | 1.2 | 1398 | 20 | 1.4 | 2808 | 37 | 1.3 |

Table 74 shows the incidence of crowding in deciduous teeth by sex .Boys show slightly higher percentage of crowding than the girls, with a frequency of 21(1.5%) and 16(1.1%) in boys and girls respectively. Crowding of maxillary central and lateral incisor of either sex was more frequent than any other tooth. In mandible it is with a frequency of 20(1.4%) and 17(1.2%) in boys. Crowding of mandibular central incisor of either sex was more frequent as between the central incisors and between lateral incisors and canine.

Table: 75. Incidence of Crowding in permanent teeth by age

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Number examined | With crowding | Percen-tage | Number examined | With crowding | Percen-tage | Number examined | With crowding | Percen-tage |
| MAXILLA | CI-CI | 1037 | 20 | 1.90 | 1054 | 34 | 3.20 | 2091 | 54 | 2.60 |
| | CI-LI | 1041 | 56 | 5.40 | 1030 | 61 | 5.90 | 2071 | 117 | 5.60 |
| | LI-C | 982 | 41 | 4.20 | 997 | 44 | 4.40 | 1979 | 85 | 4.30 |
| | Total | 3060 | 117 | 3.80 | 3081 | 139 | 4.50 | 6141 | 256 | 4.20 |
| | | | | | | | | | | |
| | C-PM1 | 1001 | 11 | 1.10 | 999 | 16 | 1.60 | 2000 | 27 | 1.35 |
| | PM1-PM2 | 1011 | 6 | 0.60 | 1017 | 5 | 0.50 | 2028 | 11 | 0.50 |
| | PM2-M1 | 1008 | 7 | 0.70 | 1014 | 2 | 0.20 | 2022 | 9 | 0.40 |
| | Total | 3020 | 24 | 0.90 | 3030 | 23 | 0.80 | 6050 | 47 | 0.80 |
| | Grand total | 6080 | 141 | 2.30 | 6111 | 162 | 2.60 | 12191 | 303 | 2.50 |
| | | | | | | | | | | |
| MANDIBLE | CI-CI | 1021 | 37 | 3.60 | 1044 | 58 | 5.50 | 2065 | 95 | 4.60 |
| | CI-LI | 1032 | 70 | 6.80 | 1018 | 84 | 8.25 | 2050 | 154 | 7.50 |
| | LI-C | 1046 | 52 | 5.00 | 984 | 63 | 6.40 | 2030 | 115 | 5.70 |
| | Total | 3099 | 159 | 5.10 | 3046 | 205 | 6.70 | 6145 | 364 | 5.90 |
| | | | | | | | | | | |
| | C-PM1 | 1038 | 23 | 2.20 | 1002 | 30 | 3.00 | 2040 | 53 | 2.60 |
| | PM1-PM2 | 1002 | 19 | 1.90 | 978 | 19 | 1.90 | 1980 | 38 | 1.90 |
| | PM2-M1 | 996 | 10 | 1.00 | 962 | 7 | 0.70 | 1958 | 17 | 0.90 |
| | Total | 3036 | 52 | 1.70 | 2942 | 56 | 1.90 | 5978 | 108 | 1.80 |
| | Grand total | 6135 | 211 | 3.40 | 5988 | 261 | 4.30 | 12123 | 472 | 3.90 |

Incidence of crowding by sex and tooth is shown in Table 75. Incidence of crowding is observed to be more frequent among the females than the males with the frequencies 139(45%) in females 117(3.8%) in males. In both the jaws, crowding of central and lateral incisors is more frequent than any other teeth . Crowding of maxillary as well as mandibular canines and premolars is reported with low frequencies.

The frequency of crowded teeth is found to be higher in mandible than the maxilla. This trait seems to be more frequent between central incisors and lateral incisors having 70(6.8%) of the trait in males and 84(8.25%) in females, which is followed by lateral incisors and canines with a frequency of 52(5.0%) in males and 63(6.4%) in females. Crowding between two central incisors is found to have a frequency of 37(3.6%) in males and 58(5.5%) in females.

Table: 76. Frequency distribution of children with Cingulum

| Sex | Total number of children examined | Number with Cingulum | Percentage |
|---|---|---|---|
| Boys | 470 | 30 | 6.20 |
| Girls | 466 | 43 | 9.20 |
| Total | 936 | 73 | 15.40 |

The incidence of Cingulum by sex among the Khasi children is shown in the Table 76. A total of 470 boys and 466 girls were examined, out of which, 30(6.2%) males and 43(9.2) females were having cingulum.

Table: 77. Frequency distribution of children with Cingulum by sex

| Age (in months/ years) | Male | | | Female | | |
|---|---|---|---|---|---|---|
| | Number examined | With cingulum | Percentage | Number examined | With cingulum | Percentage |
| 0-11 months | 50 | 0 | 0.00 | 63 | 0 | 0.00 |
| 1 year | 48 | 1 | 2.1 | 46 | 2 | 4.3 |
| 2 years | 35 | 3 | 8.6 | 38 | 7 | 18.42 |
| 3 years | 33 | 4 | 12.1 | 33 | 4 | 12.12 |
| 4 years | 31 | 3 | 9.7 | 30 | 2 | 6.7 |
| 5 years | 33 | 3 | 9.1 | 32 | 4 | 12.5 |
| 6 years | 31 | 4 | 12.9 | 31 | 6 | 19.35 |
| 7 years | 32 | 2 | 6.25 | 38 | 6 | 15.8 |
| 8 years | 25 | 2 | 8.0 | 29 | 3 | 10.3 |
| 9 years | 32 | 2 | 6.45 | 33 | 5 | 15.1 |
| 10 years | 31 | 5 | 16.1 | 27 | 3 | 11.1 |
| 11 years | 41 | 1 | 2.4 | 38 | 1 | 2.6 |
| 12 years | 28 | 0 | 0.00 | 29 | 0 | 0.00 |
| 13 years | 36 | 0 | 0.00 | 34 | 0 | 0.00 |
| 14 years | 34 | 0 | 0.00 | 28 | 0 | 0.00 |
| Total | 520 | 30 | 5.77 | 529 | 43 | 8.128 |

The age and sex wise distribution of children with cingulum is shown in table 77. Among all the age groups males, 10 years old children were found with this trait in higher frequency followed by age group 6 years and 3 years having 4 (12.9%) and 4(12.1%) respectively. Age groups 4 year, 5 year and 2 year were having 3 (9.7%), 3(9.1%) and 3 (8.6%) respectively. In females the highest percentage is observed in the age group 6 years with a frequency of 6 (19.35%) which is followed by age group 2 year, 7 year and 9 year having 7(18.42%), 6 (15.8%) and 5 (15.1%) respectively.

Table: 78. Incidence of cingulum in children by age

| Age (in months & years) | Right | | | | | | | | | Left | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CI | | | LI | | | CI-LI | | | CI | | | LI | | | CI-LI | | |
| | Number examined | With cingulum | Percentage | Number examined | With cingulum | Percentage | Number examined | With cingulum | Percentage | Number examined | With cingulum | Percentage | Number examined | With cingulum | Percentage | Number examined | With cingulum | Percentage |
| 0-11 mths | 113 | 0 | 0.00 | 113 | 0 | 0.00 | 226 | 0 | 0.00 | 113 | 0 | 0.00 | 113 | 0 | 0.00 | 226 | 0 | 0.00 |
| 1 year. | 94 | 2 | 2.10 | 94 | 1 | 1.06 | 188 | 3 | 1.60 | 94 | 3 | 3.20 | 94 | 1 | 1.06 | 188 | 4 | 2.10 |
| 2 years. | 73 | 6 | 8.20 | 73 | 4 | 5.50 | 146 | 10 | 6.80 | 73 | 5 | 6.80 | 73 | 2 | 2.70 | 146 | 7 | 4.80 |
| 3 years. | 66 | 4 | 6.10 | 66 | 4 | 6.06 | 132 | 8 | 6.06 | 66 | 4 | 6.06 | 66 | 1 | 1.50 | 132 | 5 | 3.80 |
| 4 years. | 61 | 3 | 4.90 | 61 | 2 | 3.30 | 122 | 5 | 4.10 | 61 | 2 | 3.30 | 61 | 4 | 6.50 | 122 | 6 | 4.90 |
| 5 years. | 65 | 5 | 7.70 | 65 | 2 | 3.10 | 130 | 7 | 5.40 | 65 | 5 | 7.70 | 65 | 2 | 3.08 | 130 | 7 | 5.40 |
| 6 years. | 62 | 8 | 12.90 | 62 | 1 | 1.60 | 124 | 9 | 7.20 | 62 | 8 | 12.90 | 62 | 1 | 1.60 | 124 | 9 | 7.30 |
| 7 years. | 70 | 6 | 8.60 | 70 | 2 | 2.80 | 140 | 8 | 5.70 | 70 | 6 | 8.60 | 70 | 2 | 2.80 | 140 | 8 | 5.70 |
| 8 years. | 54 | 5 | 9.20 | 54 | 0 | 0.00 | 108 | 5 | 4.60 | 54 | 5 | 9.30 | 54 | 0 | 0.00 | 108 | 5 | 4.60 |
| 9 years. | 65 | 5 | 7.70 | 65 | 2 | 3.10 | 130 | 7 | 5.4 | 65 | 3 | 4.60 | 65 | 2 | 3.08 | 130 | 5 | 3.80 |
| 10 years. | 58 | 4 | 6.90 | 58 | 1 | 1.70 | 116 | 5 | 4.30 | 58 | 4 | 6.90 | 58 | 2 | 3.40 | 116 | 1 | 0.90 |
| 11 years. | 79 | 5 | 6.30 | 79 | 0 | 0.00 | 158 | 5 | 3.20 | 79 | 5 | 6.30 | 79 | 0 | 0.00 | 158 | 5 | 3.20 |
| 12 years. | 57 | 1 | 1.70 | 57 | 0 | 0.00 | 114 | 1 | 0.90 | 57 | 1 | 1.70 | 57 | 0 | 0.00 | 114 | 1 | 0.90 |
| 13 years. | 70 | 0 | 0.00 | 70 | 0 | 0.00 | 140 | 0 | 0.00 | 70 | 0 | 0.00 | 70 | 0 | 0.00 | 140 | 0 | 0.00 |
| 14 years. | 62 | 0 | 0.00 | 62 | 0 | 0.00 | 124 | 0 | 0.00 | 62 | 0 | 0.00 | 62 | 0 | 0.00 | 124 | 0 | 0.00 |

Incidence of cingulum in maxillary deciduous teeth by age is presented in Table 78. Cingulum(CL) is found to be higher in right maxilla of 6 year old children which is followed by the age groups 8year,7year and then 2 year with the frequencies of 5(9.2%), 6(8.6%) and 6(8.3%) respectively. The cingulum is observed highest among the age group of 3 years i.e., 4 (6.06%). This is followed by 2 year,4year,and 5 year age groups with 4(5.5%), 2(3.3%) and 2(3.1%)% respectively.

Table: 79. Frequency distribution of persons with Cingulum in permanent teeth

| Sex | Total number of person examined | Number with Cingulum | Percentage |
|---|---|---|---|
| Male | 1037 | 121 | 11.7 |
| Female | 1054 | 134 | 12.7 |
| Total | 2091 | 255 | 12.19 |

Table 79 shows that out of a total of 2091 individuals, 121(11.7%) males and 134(12.7%) females are having cingulum.

Table: 80. Incidence of Cingulum in permanent teeth by sex

| | MALE | | | FEMALE | | | TOTAL | | |
|---|---|---|---|---|---|---|---|---|---|
| | No. of teeth examined | Proportion with Cingulum | Percentage | No. of teeth examined | Proportion with Cingulum | Percentage | No. of teeth examined | Proportion with Cingulum | Percentage |
| Right | | | | | | | | | |
| | | | | MAXILLA | | | | | |
| CI | 1037 | 121 | 11.7 | 1054 | 134 | 12.7 | 2091 | 255 | 12.2 |
| LI | 1041 | 52 | 5.0 | 1030 | 46 | 4.5 | 2071 | 98 | 4.7 |
| Total | 2078 | 173 | 8.3 | 2084 | 180 | 8.6 | 4162 | 353 | 8.5 |
| Left | | | | | | | | | |
| CI | 1035 | 120 | 11.6 | 1054 | 133 | 12.6 | 2089 | 253 | 12.1 |
| LI | 1040 | 53 | 5.1 | 1030 | 43 | 4.3 | 2070 | 96 | 4.6 |
| Total | 2075 | 173 | 8.3 | 2084 | 176 | 8.4 | 4159 | 349 | 8.4 |
| | | | | MANDIBLE | | | | | |
| Right | | | | | | | | | |
| CI | 1046 | 2 | 0.2 | 1057 | 1 | 0.1 | 2103 | 3 | 0.1 |
| LI | 1053 | 1 | 0.1 | 1048 | 0 | 0.00 | 2101 | 1 | 0.05 |
| Total | 2099 | 3 | 0.1 | 2105 | 1 | 0.05 | 4204 | 4 | 0.1 |

Incidence of cingulum by sex in incisors among the Khasis is shown in Table 80. The proportion of this trait in central incisors is found to be slightly higher in females than males. In both the right and the left segment of maxilla the proportion of cingulum in central incisors in females shows slightly higher percentage than male. Incidence of cingulum is found to be 134(12.7%) in female and 121(11.7%) in males. In the right segments .similarly 133(12.6%) in females and 120(11.6%) males were found with cingulum. The proportion of cingulum in the lateral incisors of both right and left segments is observed to be higher in males than females. In the right segment the percentage is 52(5%) in males and 46(4.5%) in females and in the left segment 53(5.1%) in males and 43(4.3%) in females.

# CHAPTER-VII

## DISCUSSION

The primary aim of the contemporary physical anthropological and human population genetic researches has been to expound the nature of biological variations in different human populations and the meaning of these differences in the understanding of the ongoing evolutionary process. But the systems used have been varying from time to time based on the technological development as well as the nature of the subject. Among the other systems regularly studied in this context, human dentition is of special interest and occupies important place long since (Reddy, 1986).

One of the main aims of the dental anthropology has a study of size and shape of the teeth. It includes a study of the development of teeth in relation to age, their appearance in the mouth, and the processes of wear and other changes that occur once they are in place. It also includes the microscopic traces, preserved inside the tissues of the teeth, of the growth and ageing processes, in relation to diet and other factors, and the recent development is a study of the biochemistry of the dental tissues (Hillson, 2002).

The present research work was carried out among the Khasis of Shillong considering their socio-economic traits like income, education, and family size. Other factors such as the time of eruption of permanent teeth, oral as well as dental pathology, and the morphology of the teeth among the Khasis have been recorded and analyzed in the present study.

Table 81. Median (± SE) age of permanent tooth eruption among some Mongoloid populations of Northeast India.

| Populations | Author | MAXILLA(Age in years) | | | | | | | MANDIBLE(Age in years) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $I^1$ | $I^2$ | $C^0$ | $P^1$ | $P^2$ | $M^1$ | $M^2$ | $I_1$ | $I_2$ | $C_0$ | $P_1$ | $P_2$ | $M_1$ | $M_2$ |
| Gallong (boys) | Limbu (1996) | 7.55 (±0.25) | 8.52 (±0.22) | 11.45 (±0.32) | 10.55 (0.20) | 11.42 (0.26) | 6.52 (0.40) | 12.67 (±0.22) | 6.55 (±0.18) | 7.60 (±0.18) | 9.87 (0.31) | 10.75 (0.20) | 11.32 (±0.15) | 6.35 (0.20) | 11.97 (0.18) |
| Gallong (girls) | Limbu (1996) | 7.20 (±0.23) | 8.37 (±0.22) | 10.70 (±0.35) | 9.77 (±0.43) | 10.77 (±0.31) | 6.35 (±0.20) | 11.90 (±0.23) | 6.40 (±0.20) | 7.45 (±0.19) | 9.45 (±0.20) | 10.05 (±0.27) | 10.85 (±0.35) | 6.07 (±0.15) | 11.35 (±0.37) |
| Marngar (girls) | Tsochu (2002) | 7.05 (±0.40) | 7.95 (±0.35) | 10.00 (±0.35) | 10.25 (±0.27) | 10.30 (±0.30) | 6.70 (±0.45) | 11.25 (±0.20) | 6.65 (±0.45) | 7.80 (±0.35) | 10.30 (±0.35) | 10.20 (±0.22) | 10.25 (±0.20) | 6.45 (±0.45) | 11.15 (±0.25) |
| Deori (boys) | Syiemleih (2004) | 6.90 (±0.05) | 7.00 (±0.45) | 9.60 (±0.05) | 9.40 (±0.05) | 10.20 (±0.45) | 5.90 (±0.05) | 11.00 (±0.05) | 6.40 (±0.35) | 7.00 (±0.45) | 9.80 (±0.45) | 9.90 (±0.05) | 10.20 (±0.05) | 5.80 (±0.40) | 10.40 (±0.06) |
| Biate (boys) | Lotha (2005) | 6.50 (±0.40) | 7.40 (±0.50) | 9.40 (±0.55) | 9.80 (±0.60) | 10.50 (±0.50) | 5.70 (±0.40) | 11.10 (±1.05) | 6.50 (±0.35) | 7.10 (±0.45) | 9.50 (±0.55) | 9.80 (±0.60) | 10.20 (±0.60) | 5.70 (±0.35) | 10.60 (±0.60) |
| Garo (boys) | Kasar (2006) | 6.30 (±0.40) | 7.90 (±0.05) | 9.70 (±0.45) | 9.80 (±0.35) | 10.90 (±0.30) | 5.80 (±0.30) | 12.30 (±0.30) | 5.90 (±0.35) | 6.90 (±0.30) | 9.00 (±0.35) | 9.70 (±0.40) | 10.80 (±0.45) | 5.80 (±0.30) | 11.90 (±0.25) |
| Garo (girls) | Lalrammuana (2006) | 6.60 (±0.20) | 7.80 (±0.40) | 10.70 (±0.35) | 9.80 (±0.40) | 11.20 (±0.14) | 6.60 (±0.35) | 12.10 (±0.40) | 6.00 (±0.30) | 7.10 (±0.25) | 9.60 (±0.25) | 9.20 (±0.30) | 10.70 (±0.20) | 6.20 (±0.25) | 11.50 (±0.35) |
| Sakachep (boys) | Lotha (2009) | 6.90 (±0.35) | 7.50 (±0.50) | 11.10 (±0.15) | 10.10 (±0.10) | 10.40 (±0.20) | 6.30 (±0.45) | 13.30 (±0.40) | 6.40 (±0.45) | 6.60 (±0.35) | 9.50 (±0.25) | 10.30 (±0.10) | 10.50 (±0.20) | 6.30 (±0.45) | 12.40 (±0.40) |
| Sakachep (girls) | Lotha (2009) | 7.50 (±0.25) | 8.60 (±0.25) | 11.70 (±0.20) | 10.40 (±0.25) | 10.60 (±0.25) | 6.80 (±0.30) | 12.90 (±0.30) | 7.20 (±0.30) | 7.50 (±0.25) | 9.00 (±0.15) | 10.40 (±0.25) | 10.90 (±0.30) | 6.70 (±0.25) | 12.60 (±0.25) |
| Khasi (boys) | Present study (2010) | 7.45 (±0.35) | 8.35 (±0.35) | 11.05 (±0.23) | 11.30 (±0.38) | 11.25 (±0.30) | 6.80 (±0.38) | 12.30 (±0.25) | 7.15 (±0.33) | 7.75 (±0.35) | 10.30 (±0.40) | 10.90 (±0.35) | 11.40 (±0.25) | 6.55 (±0.35) | 11.65 (±0.20) |
| Khasi (girls) | Present study (2010) | 7.15 (±0.33) | 7.75 (±0.28) | 10.05 (±0.33) | 10.10 (±5.05) | 10.65 (±5.33) | 6.20 (±3.10) | 12.20 (±6.10) | 6.45 (±0.23) | 6.95 (±0.30) | 9.70 (±0.50) | 10.50 (±0.35) | 11.40 (±0.23) | 5.85 (±0.18) | 11.00 (±0.38) |

Comparative study of order of eruption of permanent teeth among some Mongoloid populations of Northeast India by jaw and sex is shown in Table 81. As the available data on eruption of permanent teeth were excluding the third molar, we also compared our data on the similar number of teeth i.e., excluding the third molars. This table shows that all mandibular teeth tend to emerge earlier than their maxillary counterparts .Most of the teeth tend to emerge earliest in the Deori boys and late among the Skachep girls and the Khasi boys. This table further shows that the Gallong and the Khasi females are markedly advanced in their emergence times where as it is reverse in the case of the Garo and the Sakacheps.

Table 81 further shows that mostly the first mandibular molars ($M_1$) have emerged earlier to all other teeth, followed by the central incisor ($I_1$) and then the lateral incisor ($I_2$). The Incisors are followed by the canines ($C_1$) and then the second molar ($M_2$) which emerges at last. The emergence time for the third molar (M3) has not considered for the present study as this tooth has very high variation with regards to its time of emergence from individual to individual.

Both the first mandibular and maxillary incisors ($I_1$) and ($I^1$) emerge earliest by 5.9 years and 6.30years respectively among the Garo boys. The mandibular lateral incisor ($I_2$) emerges late i.e. 7.15years in the Khasi boys and earliest among the Sakachep boys (6.60years) followed by the Garo boys (6.90years). The maxillary lateral incisor ($I^2$) observed to be emerged earliest in the Deori boys (9.7years) followed by the Biate boys (7.40years). In the the Sakachep boys this tooth emerges very late (8.60 years). Among

all the populations compared, the Biate boys (9.40 years) show the earliest emergence of maxillary canine ($C^1$) followed by the Deori boys (9.60years). This tooth appears very late emergence among the Sakachep girls (11.70 years).The mandibular canine ($C_1$) appears advance among the Garo boys and the Sakachep girls (9.00years) whereas in the Marngar girls and the Khasi boys (10.30years) it is observed very late emergence. The maxillary premolars ($P^I$, $P^2$) tend to emerge very late among the Khasi and the Gallong boys (11.30years and 11.42years), whereas it is advanced in the Deori boys i.e. (9.40years and 10.20years). The earliest emergence of the mandibular first premolar ($P_1$) is observed in the Garo girls (9.20years) and late among the Khasi boys (10.90Years). The earliest emergence time for mandibular second premolar ($M_2$) was observed among the Deori and the Biate boys (10.20years) and it is late in the Khasi children (11.40years). The emergence of both the second molars ($M^2$, $M_2$) in both the upper and the lower jaws was first observed in the Deori boys (11.00years) and (10.40 years) respectively. These teeth emerged very late among the Sakachep children.

Sexual dimorphism for tooth emergence times was evident in the Gallong and the Khasi as has been noted by the previous work in other populations (Clements et.al., 1953; Moorerees, 1957; Dahlberg and Menegaz-Bock, 1958; Lee et al., 1965; Niswander and Sujaka,1960; Nanda Chawla,1966; Mayhall *et al.*,1978).The salient features of this sexual dimorphism in the Gallong, Garo, Skachep and the Khasi are as follows : All the permanent teeth in both the Gallong and the Khasi emerged at markedly earlier chronological ages than their counterparts. The Gallong and the Khasi females have acquired their permanent teeth in a shorter time span (7.15-7.20 years) than their male

counterparts (7.45-7.55years). As the females showed earlier emergence in all the permanent teeth, it has been suggested by Mayhall et al.(1978) that the earliest emerging teeth ( particularly $M_1$ and $I_2$ ) could be considered to be a transition period in which factors controlling emergence of permanent teeth are replacing those that control the emergence of the deciduous teeth. The eruption times of the permanent tooth among the Garos and the Sakacheps is more or less reverse. In both of these tribes, emergence times of most of these teeth are delayed in the females. The only exception was the second molar of the maxilla (12.30years), both the mandibular premolars (9.70 and10.80 years) and the second mandibular molar (11.90years) which emerge earlier in the Garo females where as in the Sakachep, the second maxillary molar (13.30years), the mandibular canine (9.50years) and the second mandibular premolar (10.50 years) emerge early.

The orders of eruption of permanent teeth (excepting the third molar) among some Mongoloid populations of Northeast India are as follows:

Khasi boys: $M_1 > M^1 > I^1 > I_1 > I_2 > I^2 > C_0 > P_1 > P^2 > C^0 > P_2 > M_2 > P^1 > M^2$

Khasi girls: $M_1 > M^1 > I_1 > I^1 > I^2 > I_2 > C_0 > C^0 > P^1 > P_1 > P^2 > M_2 > P_2 > M^2$

Garo boys: $M_1 = M^1 > I_1 > I^1 > I_2 > I^2 > C_0 > P_1 = C^0 > P^1 > P_2 > P^2 > M_2 > M^2$

Garo girls: $I_1 > M_1 > I^1 = M^1 > I_2 > I^2 > P_1 > C_0 > P^1 > P_2 > C^0 > P^2 > M_2 > M^2$

Sakachep boys: $M^1 = M_1 > I_1 > I_2 > I^1 > I^2 > C_0 > P^1 > P_1 > P^2 > P_2 > C^0 > M_2 > M^2$

Sakachep girls: $M_1 > M^1 > I_1 > I^1 > I_2 > I^2 > C_0 > P^1 = P_1 > P^2 > P_2 > C^0 > M_2 > M^2$

Gallong boys: $M_1 > M^1 > I_1 > I^1 > I_2 > I^2 > C_0 > P^1 > P_1 > P_2 > P^2 > C^0 > M_2 > M^2$

Gallong girls: $M_1 > M^1 > I_1 > I^1 > I_2 > I^2 > C_0 > P^1 > P_1 > C^0 > P^2 > P_2 > M_2 > M^2$

Biate boys: $M^1 = M_1 > I^1 = I_1 > I_2 > I^2 > C^0 > C_0 > P^1 = P_1 > P_2 > P^2 > M_2 > M^2$

Marngar girls: $M_1 > M^1 > I_1 > I^1 > I_2 > I^2 > C^0 > P_1 > C_0 > P^1 > P_2 > P^2 > M_2 > M^2$

Deori boys: $M_1 > M^1 > I_1 > I^1 > I_2 = I^2 > P^1 > C^0 > C_0 > P_1 > P_2 = P^2 > M_2 > M^2$

No sex differences could be observed for the populations compared, since the sequence of emergence in the mandible and that of the anterior teeth of the maxilla ($M^1I^1I^2$) in both sexes was the same .The only exception was the Garo females, where the sequence of emergence is observed as $I_1M_1I_2$ and $I^1M^1I^2$ . Gingival emergence of the canine relative to the premolars has been ascribed to sexual dimorphism, $C_1P^1$ for females and $P^1C_1$ for males (Adler and Godeny, 1952; Clements et al., 1953). Excepting both the sexes of the Khasi, Garo and the Deori boys, all have displayed the usual predominantly female sequence $C_1P^1$, while, none have shown the mandibular canine-maxillary first premolar ($P^1C_1$) sequence.

Sexual dimorphism with respect to the canine-second premolar sequence in the maxilla ($C^1P^2$ for females, $P^2C^1$ for males) has also been reported (Hurme, 1957; Steggerda and Hill, 1942). The above mentioned predominant female sequence ($C^1P^2$) is absent in all populations. The predominantly male sequence in the maxilla, $P^2C^1$, prevailed only among the Khasi and the Gallong boys.

Data on median emergence ages for the different ethnic groups of Northeast India indicate that the dominant sequence for both sexes is $C_1P_1$ in the mandible (Table 7) is

observed only among the Khasi, Garo and the Deori boys where as the $P_1C_1$ sequence has been reported only in the Garo and the Marngar girls.

Table 81 further shows that the relative emergence of the mandibular second Premolar ($P_2$) to its second molar ($M_2$) may be indicative of dimorphism in the majority of the ethnic groups. The emergence sequence $P_2M_2$ was observed in all the populations and both the sexes. The only exception was the Khasi females. The sequence $P_2M_2$ is relatively ancient, and the reverse ($M_2P_2$) which is present in Khasi girls is uncommon in modern human. However, Garn and Lewis (1963) have suggested the possibility of genetic control of the $P_2M_2$ and $M_2P_2$ sequences. Females at large are evolutionarily more advanced than males. The maxillary sequence, $P^2M^2$, did not reveal sex differences in all the populations compared.

The mandibular first molar- first incisor sequence also seems to show polymorphism. The $M_1I_1$ sequence predominates in both sexes in many populations. The $I_1$ $M_1$ sequence which is uncommon in human has been reported in the Garo females. That the $I_1M_1$ sequence has not been found in the early hominids and is only occasionally reported in modern human suggests that the "field" has shifted mesially to include the first molar (Wallace, 1977).The sequence polymorphism elaborated above have been suggested to be due to the genetically determined differences in the tooth formation timing and can be demonstrated within populations (Garn et.al., 1973). The sexual dimorphism for the above sequences observed in various populations is clearly due to

evolutionary trends, as early hominids were also sexually dimorphic in this respect in the time of tooth emergence.

The above sequence of tooth eruption shows that the earliest tooth to be emerged in most of the populations of Northeast India considered for the present comparative study is the first mandibular molar ($M_1$) followed by the first maxillary molar ( $M^1$ ). Only in the Garo girls the earliest tooth to erupt is the mandibular first incisor($I_1$ ) and among the Sakachep and the Biate boys it is the maxillary first incisor($I^1$). Anterior teeth are found to be emerged earlier than the posterior in all the populations compared .The the second maxillary molar ($M^2$) emerges last in all the populations compared followed by the Mandibular molar ($M_2$). Only the Khasi children deviate from this trend i.e. the last tooth to be emerged in the Khasi boys is the first maxillary premolar ($P^1$) and second mandibular premolar in the girls($P_2$).The eruption timing for the canine and the premolars falls in between the incisors and the molars .However, they do not show any pattern of eruption.

For dental pathology our present data have been compared with the available data on dental pathology from the populations of Northeastern region of India.

Table 82. Percentage frequency of caries affected Mongoloid boys of northeast India by age

| Age ( in years) | Populations | | | | |
|---|---|---|---|---|---|
| | Gallong (n=494) | Deori (n=217) | Biate (n=190) | Garo (n=287) | Khasi (n=1254) |
| 5 | 0.00 | 0.00 | 0.00 | 0.00 | 21.21 |
| 6 | 2.86 | 4.76 | 15.00 | 0.00 | 29.03 |
| 7 | 9.52 | 20.00 | 26.32 | 8.00 | 25.01 |
| 8 | 6.98 | 4.76 | 27.78 | 3.70 | 28.00 |
| 9 | 13.15 | 5.00 | 33.33 | 4.00 | 21.88 |
| 10 | 17.64 | 20.83 | 26.67 | 16.00 | 25.81 |
| 11 | 15.38 | 23.81 | 35.00 | 15.34 | 19.52 |
| 12 | 18.75 | 25.92 | 45.00 | 40.00 | 39.29 |
| 13 | 16.29 | 28.57 | 35.00 | 24.00 | 30.55 |
| 14 | 17.39 | 28.57 | 55.00 | 50.00 | 41.17 |
| 15 | 21.96 | - | - | 46.15 | 34.49 |
| 16 | 19.35 | - | - | - | 29.04 |

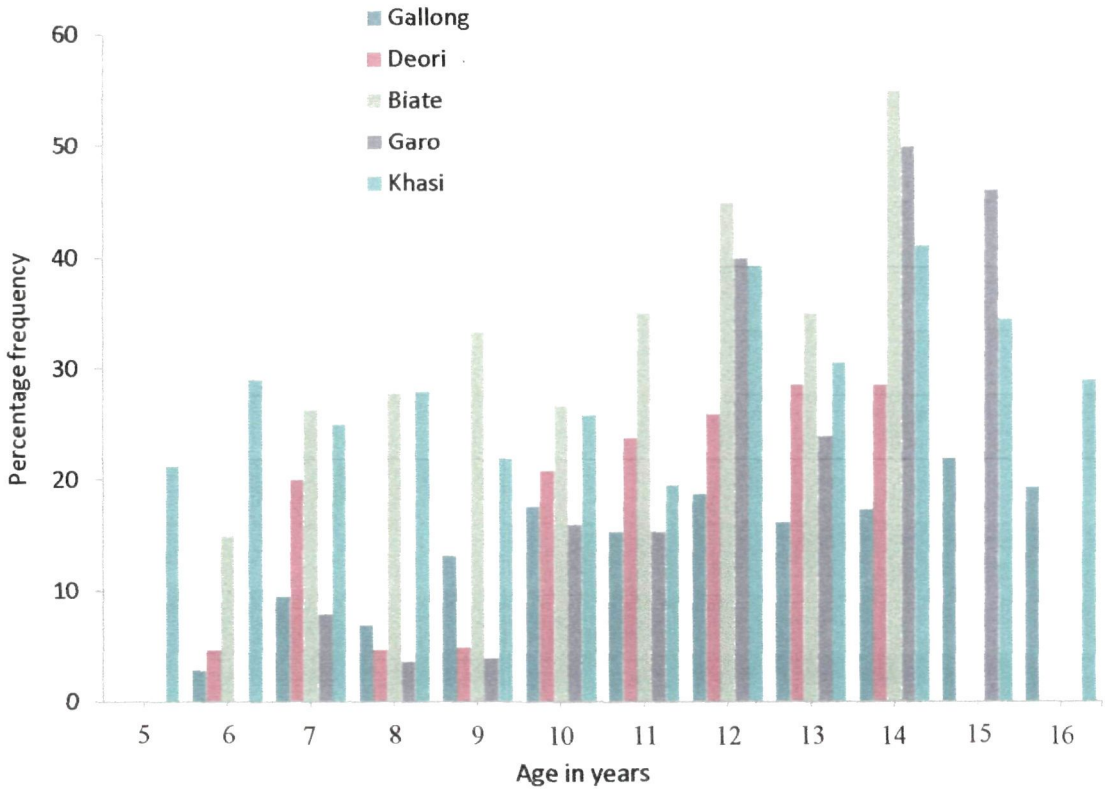



Fig 9. Percentage frequency of caries affected boys by age

Caries affected Mongoloid boys of northeast India for different age groups is presented in Table 82 .An overall scrutiny of the table reveals that generally the percentage of caries affected boys increases as they grow up. It is observed from the above table that at 5 years of age, caries was present only in the Khasi boys. Caries affected boys were recorded earliest in 6 years age in rest of the populations compared for the present study. By 14 years of age almost half of the Biate and Khasi boys are found with carious teeth. Prevalence of caries is found highest in the Biate and least among the Galllong boys. Fig.9 depicts the percentage frequency of caries affected boys by age.

Table 83 Percentage frequency of caries affected Mongoloid girls of northeast India by age

| Age( in years) | Populations | | | |
|---|---|---|---|---|
| | Gallong (n=515) | Mamgar (n=335) | Garo (n=303) | Khasi (n=1263) |
| 5 | 0.00 | 0.00 | 0.00 | 15.53 |
| 6 | 6.25 | 3.12 | 6.07 | 25.50 |
| 7 | 6.99 | 0.00 | 32.15 | 21.05 |
| 8 | 8.69 | 0.00 | 33.34 | 20.69 |
| 9 | 9.76 | 3.12 | 20.00 | 24.24 |
| 10 | 8.00 | 0.00 | 34.62 | 40.74 |
| 11 | 11.76 | 6.45 | 37.50 | 39.47 |
| 12 | 14.28 | 3.12 | 30.77 | 37.93 |
| 13 | 15.09 | 0.00 | 39.14 | 29.41 |
| 14 | 15.92 | 12.50 | 37.04 | 32.13 |
| 15 | 21.42 | 16.66 | 26.67 | 43.24 |
| 16 | 22.73 | - | - | 30.30 |

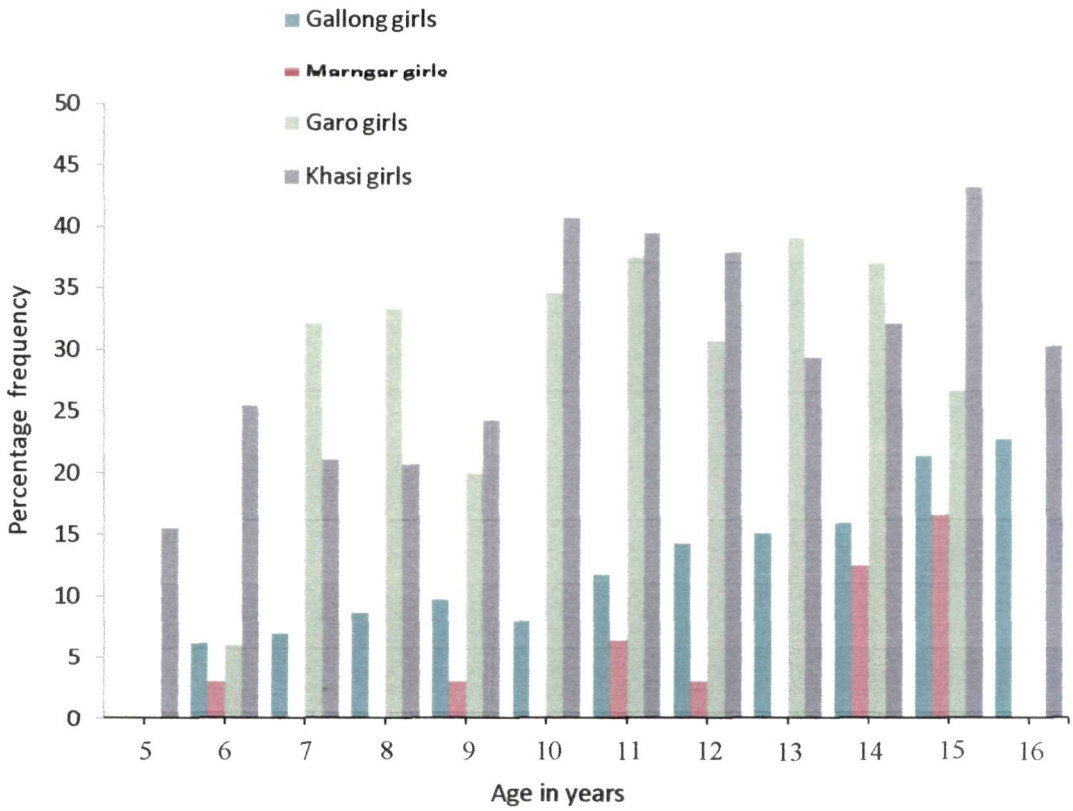



Fig.10 Percentage frequency of caries affected girls by age

Table 83 shows the Percentage frequencies of the caries affected Mongoloid girls of northeast India for different age groups for different populations compared. The carious teeth are recorded earliest in the Khasi girls at 5years of age and found absent in the rest of the populations. Like the boys, in the girls also the prevalence of caries increases as they grow. Caries affected girls are recorded highest among the Khasi followed by the Garo girls. Not a single or very less Marngar and the Gallong girls are found affected by caries in their lower age groups but increases as the age increases. Fig.10 depicts the percentage frequency of caries affected girls by age.

Table 84. Percentage frequency of caries affected teeth in Mongoloid boys of northeast India by age.

| Age (in years) | Populations | | | | |
|---|---|---|---|---|---|
| | Gallong (n=494) | Deori (n=217) | Biate (n=190) | Garo (n=287) | Khasi (n=1254) |
| 5 | - | 0.00 | 0.00 | 0.00 | 7.21 |
| 6 | 4.65 | 1.18 | 4.71 | 0.00 | 12.50 |
| 7 | 2.58 | 2.79 | 3.45 | 0.90 | 5.11 |
| 8 | 0.95 | 0.72 | 4.67 | 0.33 | 4.03 |
| 9 | 2.43 | 0.66 | 3.28 | 0.27 | 1.89 |
| 10 | 2.66 | 1.03 | 2.40 | 1.58 | 2.22 |
| 11 | 2.48 | 2.19 | 2.51 | 0.73 | 1.71 |
| 12 | 1.78 | 1.11 | 3.19 | 2.49 | 1.19 |
| 13 | 1.65 | 2.24 | 2.53 | 1.15 | 0.90 |
| 14 | 1.86 | 3.57 | 3.04 | 3.43 | 1.04 |
| 15 | 2.27 | - | - | 2.33 | - |
| 16 | 2.31 | - | - | - | - |

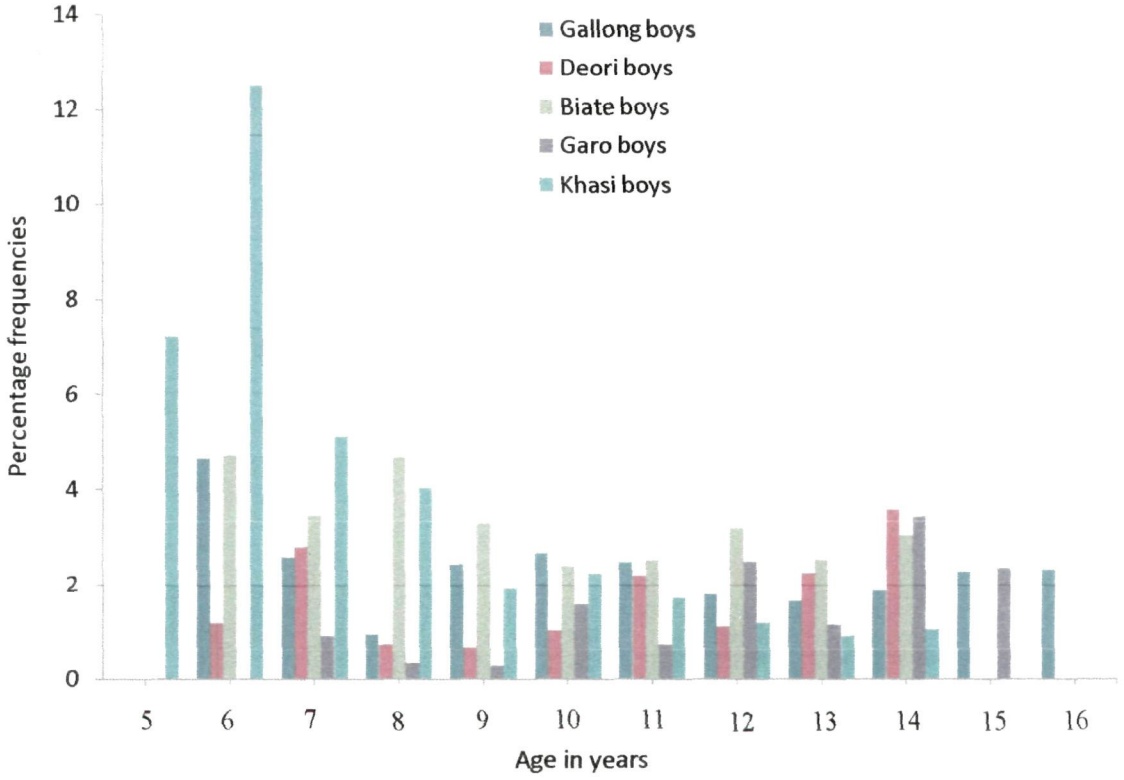



Fig. 11. Percentage frequency of caries affected teeth in boys by age

The percentage frequency of caries affected teeth in Mongoloid boys of northeast India by age is given in Table 84 which shows that the frequency of carious teeth do not follow any pattern of their distribution. Their prevalence is recorded earliest in the Khasi girls i.e. 5 years of age, whereas it is recorded earliest at 6 years of age in the rest of the populations compared. It is seen from the above table that the percentage frequency of caries affected teeth are high among the Deori and the Garo girls. Fig.11 depicts the prevalence of caries affected teeth in boys by age.

Table 85. Percentage frequency of caries affected teeth in Mongoloid girls of northeast India by age.

| Age( in years) | Populations | | | |
|---|---|---|---|---|
| | Gallong (n=515) | Mamgar (n=335) | Garo (n=303) | Khasi (n=1263) |
| 5 | - | 0.00 | 0.00 | 1.57 |
| 6 | 4.88 | 0.33 | 3.27 | 6.61 |
| 7 | 1.98 | 0.00 | 6.59 | 3.45 |
| 8 | 2.17 | 0.00 | 4.02 | 4.20 |
| 9 | 1.90 | 0.24 | 2.55 | 3.27 |
| 10 | 1.81 | 0.00 | 4.10 | 2.40 |
| 11 | 1.73 | 0.69 | 2.64 | 0.96 |
| 12 | 1.74 | 0.12 | 2.47 | 1.22 |
| 13 | 1.71 | 0.00 | 3.59 | 1.37 |
| 14 | 1.95 | 0.44 | 2.26 | 1.27 |
| 15 | 2.14 | 0.71 | 1.67 | - |
| 16 | 2.03 | - | - | - |

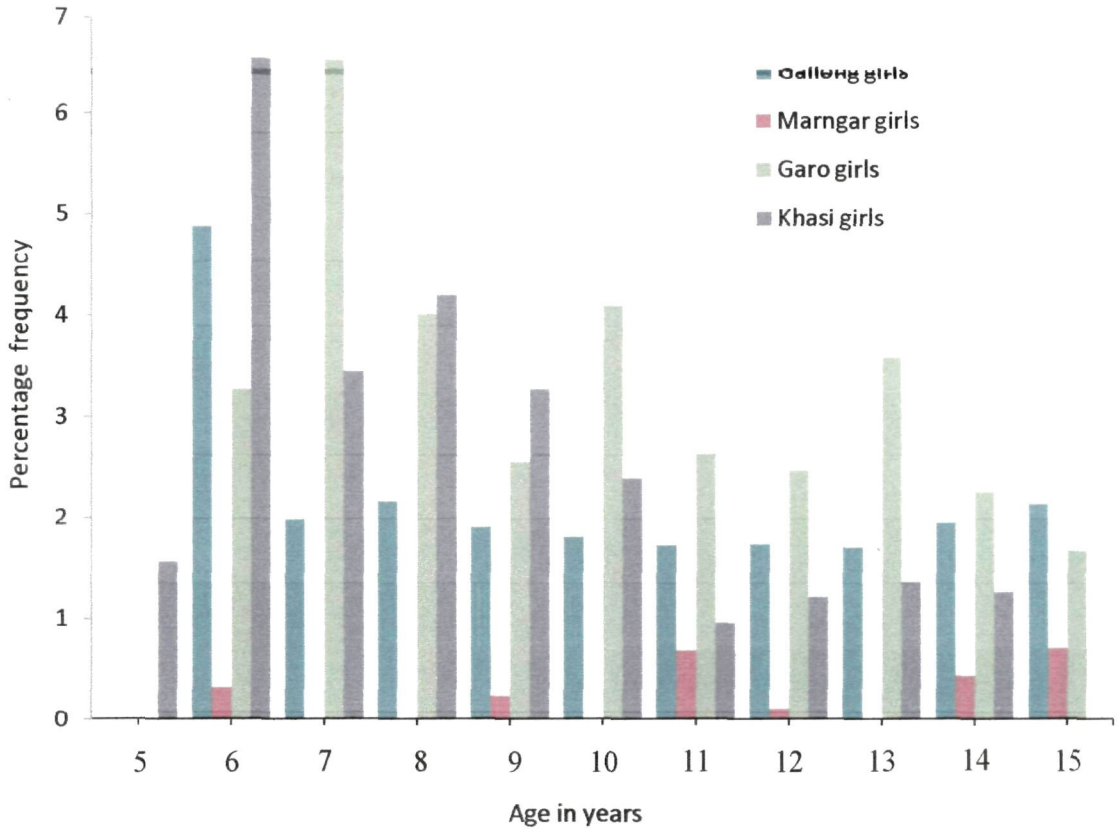



Fig.12. Percentage frequency of caries affected teeth in girls by age.

Table 85 shows the percentage frequency of caries affected permanent teeth in the Mongoloid girls of northeast India by age. This table does not follow any pattern of their distribution. The caries affected teeth are recorded earliest in the Khasi girls (5years), whereas, in the remaining populations carious teeth are observed earliest at 6years of age. The percentage frequency of caries affected teeth observed to be low in almost all the female populations. Among all the populations compared for the present study, the least prevalence is observed in the Marngar girls. Fig.12 depicts the prevalence of caries affected teeth in girls by age.

Other than the time of eruption and morphology of their teeth, Present study in relation to their socioeconomic traits could reveal certain facts about their dental health.

It was expected that the incidence of dental caries and oral pathology is low in high income group, smaller family size, higher education and, high in the low income group, large family size, low education and chewing habits of *Kwai*, tobacco, etc. which it is not always true. Present study reveals that the low incidence of dental caries, calculus and oral pathology may be found among the low income group, large family size and *Kwai* and tobacco chewers also.

# CHAPTER-VIII

## SUMMARY

"Dental anthropology is defined as a study of people (and their close relatives) from the evidence provided by teeth" (Hillson, 2002). Dental anthropology is a subfield of physical anthropology under the broad discipline of anthropology which is concerned with the study of human teeth-one of the anatomical systems of man. One of the main themes of dental anthropology has been a study of variation in size and shape of the teeth, as recorded in casts of living mouths or seen in the skulls of archaeological and fossil collections. Dental anthropology includes a study of the development of teeth in relation to age, their appearance in the mouth, and the processes of wear and other changes that occur once they are in place. It also includes the microscopic traces, preserved inside the tissues of the teeth, of the growth and ageing processes. Yet another area of interest is the study of the biochemistry of dental tissues (Hillson, 2003). Many contributors to this area of research come from fields outside of anthropology, notably dentistry, genetics, anatomy, and paleontology. It encompasses a broad range of subjects which, in turn, have finer levels of specialization. Some workers concentrate on developmental aspects of the dentition, from tooth germ formation to developmental defects of crown. Others focus on post-eruptive changes such as ordinary crown wear and culturally-prescribed dental modification. The study of dental pathologies, in particular caries, patterns of tooth loss, and periodontal disease, provides yet another avenue of research. Researchers interested in those elements of human dentition that have some underlying genetic basis of study of tooth size and morphology (Cadien, 1972).

Kirk (1973) has very rightly pointed out that the main purpose of the contemporary physical anthropology and human population genetic researches has been

to expound the nature and extent of biological variations in different human populations and the meaning of these differences in the understanding of the ongoing evolutionary process at both micro and macro levels. The systems used have been varying from time to time, and among the other systems regularly studied in this context, human dentition is of special interest and occupies important place. The special interest evinced on dentition may be due to its diachronic capability, to know about our species and racial origins, ease of direct comparison with living and also past human populations facilitating of a much greater time depth in micro and macro evolutionary investigations and number of synchronic proposes (Rami Reddy, 1986). Teeth being the hardest and most durable materials of all parts of the body due to the presence of enamel and dentine in them preserve well and hence account for a large proposition of the human and pre-human fossils remains available for study. The environment has revealed by many a study postulating modes of inheritance for different dental traits (Kraus, 1951; Turner, 1967). They are the least biased to subjectivity and hence greatly help in comparison and classification of populations as the biogenetic markers like blood groups, red cell enzymes, dermatoglyphics, etc. do. The different dental aspects of study which attracts the attention of human biologists are crown morphology, metrics, health, evolution, growth, genetics usage, forensic and ethnographic treatment, all of which can be used as research tools and areas of studies (Rami Reddy, 1986).

Dental anthropology is academically located within the human bone biology studies. Its main goal is to recognize attributes in the teeth form which can help us create bicultural dynamics of human populations, specially related to health–illness state,

feeding habits and micro evolutionary transformations, related themselves to the ethno genesis of current and ancient times. In Dental anthropology, teeth are used to obtain information on culture, health, diet, variability and evolutionary trends as well as eruption and dental pathologies in the past and modern populations.

Dental *eruption* is generally defined as the time when any part of the crown has emerged through the gingival surface (Rami Reddy, 1986).The term *emergence* refers to the moment any portion of the crown piers the gingiva. Actual penetration of the gingiva is merely a transitory stage in the total process of tooth eruption. It refers to the movement of a tooth towards its final occlusal position.

Dental anthropology began in the eighties of the eighteen century when physical anthropological investigations centered mainly round the analysis of the morphology of the skeletons and teeth, though as a subject of academic research, its importance was not recognized until 1900. The root of the dental anthropology lay in the seventies of the $19^{th}$ century as shown by a number of investigations, when the subject got its breakthrough for the first time.

Following Krogman's work, research on dental anthropology proliferated in numerous anthropological and dental research journals. In addition, there were a number of special journal issues, dissertations, monographs, and books developed to this subject (e.g. Moorrees, 1957; Brothwell, 1963; Wolpoff, 1971; Kurten, 1982; Reddy, 1985). In the American Journal of Physical Anthropology alone, annual report of the editorial notes that dental papers comprised about 11% of the total manuscripts submitted in 1985. This

is not a new trend, but rather a continuation of interest that has existed since the early days of the journal.

While anthropology was very much alive on the individual level, there was no forum in which to communicate with others in the field to facilitate the exchange of ideas. The Dental Anthropological Association (DAA) was officially, created in 1986 during the American Association of Physical Anthropologists (AAPA) meeting in Albuquerque, New Mexico, and established the 'Dental Anthropology Newsletter' as its official publications. Since its inception, the DAA has sponsored symposia and scientific sessions where it exemplifies the diversity in dental anthropology, including interest in recent and archaeological populations as well as variation in methodological approaches and scientific results.

The term Dental anthropology first appears in the title of an article published in1900 by George Buschan, although Klatsky and Fisher are credited with its formal introduction. The field is rooted in French, German, and English encyclopedic mammalian deontological treatises of the past two centuries. That teeth poses qualities valuable for anthropological study (i.e. they are durable; evolutionary conservative and yet adaptable; rich with genetically determined traits; and reflective of behavior, ecology, and diet) was recognized by such 19$^{th}$ century natural historians.

In the early 20$^{th}$ century, scholars began to pay attention to teeth as an additional system that began to provide insight into human variation. Most of the emphasis was on human skeletal remains because techniques for making impressions of the living were limited. Ales Hrdlicka, who had access to an enormous sample of Native American

skeletal remains at the Smithsonian Institution, was among the first to note interesting dental morphological distinctions between major human groups. In particular, Hrdlicka (1911, 1920) noted that American Indians were distinguished from other human populations by the development of pronounced marginal ridges on the lingual surface of the upper incisors (i.e. shoveling). W.K. Gregory (1922), in his opus the origin and evolution of the human dentition, also noted morphological attributes of recent humans, but he did not feel that intergroup variation was pronounced or significant.

Although Hrdlicka authored many books, he never wrote one devoted entirely to teeth. The task was left to other pioneers in this field, including T.D. Campbell (1925) in Austria and J.C.M. Shaw (1931) in South Africa. These workers studied the size, morphology, number, wear, and pathology of Australian aboriginals and South African black populations, respectively. Given the paucity of Comparative data, their books were largely descriptive in nature. To complement these early dental monographs, other significant contributors during this period include R.W. Leigh's (1925) analysis of oral pathology under varied environmental conditions , W.M. Krogman's (1927) paper on anthropological aspects of human teeth , C. Nelson's (1938) study of the Pecos Pueblo population , and M.S. Goldstein's (1948) work on the teeth of Texas Indian crania. Other key contributions at this time were Percy Butler's (1937, 1939) articles on the field effect in the mammalian dentition one of the most influential papers in the history of dental anthropology, A.A. Dahlberg's (1945). "The changing dentition of man" applied Butler's concept of dental fields to human teeth, forever changing the minor in which

anthropologists would analyze metric, morphologic, and numeric variation in the dentition.

G.W. Lasker's (1950) paper "Genetic analysis of racial traits of the teeth" set the stage for new ways of thinking about the inheritance and utility of dental morphological variation. In the late 1940's, Dahlberg (1951) initiated a major dental casting project among the Pima Indians of Arizona. After modest beginning with plaster casts made from wax bite impressions, Al and Thelma Dahlberg went on to collect over 8000 Pima Indian casts. From this foundation, Dahlberg was able to build up some of the first characterizations of the extant American Indian dentition.

The 1950's saw a flurry activity in the anthropological uses of the teeth. C.F.A. Moorrees (1957) published The Aleut Dentition, which covered all facets of dental anthropology, from size, morphology, and number to pathology and oral tori. T. Murphy (1959a, 1959b) developed new standards for scoring tooth crown wear based on the pattern of dentine exposure, a scheme that provided for more information on wear than the Broca scale of the late 19th century. Lasker (1957) discussed the potential uses of dental morphology in the interpretation of forensic remains, while Bertran Kraus (1951, 1957; Kraus and Jordan, 1965; Kraus et.al; 1959) conducted pioneering work in dental genetics and odontology. S.M. Garn, along with his colleagues at the Fels Institute, began publishing dozens of articles that focused on dental variation, development, and interactions between variables.

Following the publication of dental Anthropology, the field greatly expanded in terms of practitioners and publications. From 1963 to the present, many articles and

dissertations have dealt with various aspects of the human dentition. Topical trends include an ever increasing emphasis on methodologically standardized studies of tooth crown and root morphology dimensions, increased interest in oral health concerns, especially the negative impacts of agriculture, and a greatly expanded interest in the study of developmental stresses measured by growth defects, in particular linear enamel hyperplasia. The International Symposium of Dental Morphology, which met in 1965, would meet on regular basis across the next decades, leaving in its wake a number of significant edited volumes that highlighted current research on dental ontogeny, genetics, and variation (Butler and Joysey, 1978; Dahlberg, 1971; Kurten, 1982).

Recent development in the fields, since 1991 ,there has been at least 3 broadly influenced developments in the fields (1) the Dental Anthropology Association founded in 1986,enlarged the size of the its small Newsletter, changed name to Dental Anthropology, and adopt at the standards and styles of a professional journal, all carried out under the editorship by Alice M. (Sue) Haeussler, (2) English translations were made for the large and largely unread body of dental anthropology studies written in Russia , and a dental anthropological research programme was initiated in the People's Republic of China, (3) the publication of several books designed to be used as textbooks, as well as scientific references, in dental anthropology. There are, of course, many other advances since 1991, including increased course offerings in dental anthropology in a number of universities and colleges, continued publication of the assembled papers for the International Dental Morphology meetings, development of new methods, descriptions of

new fossil dentitions, and new synthesis on human and non-human dental variation, among other subjects.

This thesis has been divided into eight chapters. The first chapter gives the general introduction relating to the scope and the importance of the study. The chapter will also deal with the statement of the problem and objectives of study along with a brief description of the area of study as well as the study population. The second chapter will contain the review of literature. This chapter will also examine the research work carried out by anthropologists and other scientists outside India and in India with special reference to populations in Northeast India. The third chapter will include the nature, sources and methods of data collection. This chapter will also deals with the methods of data analysis. The fourth chapter will describe the results of the data analysis on dental eruption. The fifth chapter will also describe the results of the data analysis on dental and oral pathology. The sixth chapter will describe the results of the data analysis on dental morphology. The seventh chapter will deal with interpretations of the findings given in chapters – IV, V and VI, taking into consideration the findings on other populations as well. The eight chapter will summarize the methodological aspects and the findings of the study.

**Objectives of the study**

1. To study the impact of *Kwai* (betel nut and leaf with lime) and tobacco chewing, on dental health of the Khasis.
2. To access the eruption pattern of permanent teeth, their eruption age and other, in both boys and girls.
3. To access the prevalence of dental caries and periodontal diseases, in both sexes.
4. To record the various morphological patterns prevailed among the Khasis of Shillong.
5. To find out the relationships of eruption pattern, prevalence of dental caries, periodontal diseases and frequency occurrence of various morphological traits with certain demographic and socio-economic variables such as age, sex, income and education.
6. To compare the findings of the present study with those reported for other populations.

**Materials and Methods**

**Study Area and population**

The present study was carried out in Shillong, which is the capital of Meghalaya. Shillong is the only urban agglomeration in Meghalaya. It consists of Shillong Municipality, Shillong cantonment, Mawlai, Nongthymmai, Pynthorumkhrah and

Madanritimg. The present study was conducted among the Khasis of Malki. It is one of the oldest Khasi dominated localities under Shillong municipality.

The data for the present study was collected from the Khais subjects of Malki, Shillong. Malki is divided into eigth different localities viz, Nongshilliang, Lumbalang, Nongpyngrope, Khliehshnong, Kharmalki, Dhankheti, Chinapatty and Pdengshnong. For the prsent study, 1254 males and 1263 female Khasi subjects of the age group 5 months to 75+ years were examined.

The subjects were drawn only from the Khasi households. The educational background, the number of family members, income of the family and food habits of the subjects was also recorded.

The Khasis, a mongoloid tribe, inhabit Khasi and Jaintia Hills of Meghalaya. There are four subgroups of Khasi-namely, the Khynriam, Pnar, War and Bhoi. Khynriams live in the middle ranges of the Khasi hills, while the Pnars accupy the Jaintia hills lying on the eastern side. The Bhoi inhabit the low hills towards north and North West of the area. The wars are met with on the slopes and deep valleys towards south.

The Khasis form a matrilineal society which is casteless and which gives the women a rightful place in the home and in the community. In a family authority is vested on the mother. Descent is always through the female line. Succession is also through the female line.

The Khasi are the only tribal group in North-East India who speak a dialect of the Monkhmer group of Austro-Asiatic sub-family of linguistic group in the midst of an encircling population, all belonging to the Tibeto-Burman linguistic family.

The staple food of the Khasi is rice, vegetables, fish and all kinds of meat specially beef and pork. The Khasis ordinarily do not use milk as part of their food. The usually eat biol, unspiced food. Man, woman and children are chewers of *Kwai* (areca nuts and betel-lef with lime).

**Socio-economic categories**

In the present study, certain socio-economic variables were classified arbitrary into different groups with a view to understanding their influence on demographic variables. Our classifications may be briefly describe as follows:

Income Groups: Data on household income were collected directly from the heads of the households. The per capita income of the household was classified as follows:

Above 75$^{th}$ pencentile ($\geq$ Rs. 1501) = High Income Group

50$^{th}$ to 75$^{th}$ percentile (Rs. 1126 to 1500) = Middle Income Group

Below 50$^{th}$ percentile ($\leq$ Rs. 1125) = Low Income Group

**Educational Level**: Data on educational attainment of individuals in the present study were arbitrarily classified as follows: Three categories illiterate includes those individuals who were unable to read and write and those who had no education. The individuals who

attended school upto standard V were grouped into Primary level of education. The individuals with educational level from V-VIII were in Middle level, IX-X is High and XI-XII were grouped into Higher Secondary level of education. Graduate, Post-Graduate andd Technical education were grouped into another category.

**Family Size**: The family size was classified into three categories. The individuals who live in a household with less than 5 family members were considered as having a Small family size. The Medium family size includes those individuals who lived in a household with 5-6 family members. The individuals who lived in a houshold with more than 6 family members were grouped in Large family size.

**Dental Eruption**

Special care was taken to determine the actual ages of the subjects. Parents of the subjects were asked the actual date of birth of their wards. The subjects whose parents failed to give the correct information were not included in the sample. The sample comprises of only those subjects whose both parents were from the same tribe. Age of an individual was calculated according to the decimal calendar given by Weiner and Lourie (1981) from his/her birthday to the date of his/her dental and oral examination. The sample of males and females were distributed over 35 age groups. The 4.500 to 5.499 years were placed in the age group of 5-year, subjects ranging in age from 5.500 to 6.499 formed 6-year age group, and so on.

The recommendation of Wheeler (1988) for morphological fetures was followed to study differences between deciduous and permanent teeth. The observations were

made with the aid of dental mirror, dental probe and spatula in sufficient day light. If any part of the crown had pierce the gum to become visible, the tooth was considered emerged. Some missing permanent teeth was counted as erupted when the subject could recall their emergence and/or extraction, and if the cavity were present. The coding of teeth is as follows: I, C, P, and M stands for incisor, canine, premolar and molar respectively. The numeral signifies the tooth's position. Positioning of the numeral on lower or upper end of the latter signifies mandibular or maxillary tooth, respectively. The other additional background information in each subject was gathered, which includes their income, education and personal habits such as smoking, tobacco and *Kwai* chewing. Eruption status of permanent dentition for each and every subject was recorded.

**Dental Pathology**

For dental pathology samples were collected from all the age groups of both the sexes.

A. **Dental caries**: Since dental caries had to be assessed for entire dentition, all the teeth of the subjects were examined. Following WHO's (1977) recommendations, the teeth in either type of dentition were examined and diagnosed sound when were un-effected by caries, and decayed, filled and missing owing to caries. Dental probe, dental mirror, spatula and torch were used to examine the subject's teeth. The method of direct visual observation was followed during the investigation. The dental caries was noticed in the labial, buccal, lingual, mesial as well as in the occlusal sides of the teeth. For its

correct observation and assessment, each of the subjects was asked to open his/her mouth, a torch was focused and entire dentition was screened as thoroughly.

**B. Periodontal Diseases**: The method detailed by Russell (1976) was used to score periodontal index per person.

**C. Oral Hygiene**: Simplified oral hygiene index given by Greene and Vermillion (1964) was applied.

**Dental Morphology**

Thee occurrence of supernumerary teeth or hyperdontia, carabelli's trait, shovel-shaped incisors, diastema, crowding, cingulum, occlusion of teeth, was recorded as suggested by Weiner and Lourie (1981).

**Data analysis**

The entire data was tabulated for statistical analysis, like percentage frequencies and median ages. To complete the median emergence time for each individual tooth, probit transformation was used (Fisher and Yeats, 1948; Mayhall et. al., 19978). Accordingly, for each tooth the proportion of emergence at various age levels was transformed into probits. The calculations were done for the two sides' pooled data. The probit values were then plotted on graph paper, and the visually best fitted slope was obtained through a series of iterations. The regression line thus obtained was used to determine the estimated age of emergence (read as a projection of the probit value 5 on the horizontal scale) and estimated standard deviation (difference between the projection of the probit values 5 and 4). To find out the association, if any, between the prevalence

of dental pathology and variables such as sex, income, eating habits, and dental pathology, chi-square test was used.

**Findings of the present study**

The present thesis consists of eight chapters. The findings of the present study are presents in three chapters. Chapter IV deals with the dental eruption of the Khasis of Shillong. Dental pathology and morphology are presented in Chapters V and VI respectively.

**Dental eruption:**

1. In both the sexes of the Khasis, the first permanent tooth erupts at 6 years of age.
2. Except the third molar (M3), all the permanent teeth complete eruption by 14 years of age in both boys and girls.
3. The third molar (M3) starts emerging by 17 years of age.
4. By 25 years, 96.05% and 95.46% of permanent teeth completes in the Khasi males and females respectively.
5. The median of their counterparts age of eruption of various teeth in girls is lower than that of their counterparts.
6. The eruption of all permanent teeth except the third molar takes place between the median ages 5.85 years to 12.20 years in girls and 6.55 years and 12.30 years in the boys.
7. The order of eruption of the permanent teeth is as follows:

Both the jaws combined

In males-$M_1$>$M^1$> $I_1$> $I^1$>$I_2$>$I^2$>$C_0$>$P_1$>$C^0$> $P^2$ >$P^1$>$P_2$ .>$M_2$>$M^2$>$M^3$>$M_3$

In females-$M_1$>$M^1$>$I_1$>$I_2$> $I^1$>$I^2$ >$C_0$>$C^0$ > $P^1$>$P_1$ > $P^2$>$M_2$>$P_2$>$M^2$>$M_3$>$M^3$

**Dental Pathology**

1. Prevalence of caries was observed earliest at 2 years of age group.
2. The mild, moderate and the severe forms of caries affected Khasi children were recorded earliest in the age group of 2 years, 3 years and 4 years respectively.
3. The frequency of caries affected posterior teeth (premolar and molar) is higher than the anterior teeth (incisor and canine).
4. Prevalence of caries affected teeth is significantly higher in the illiterate compared to the literate Khasi ($x^2$=20.87, df=1, p>0.05, significant).
5. Prevalence of the caries is significantly low among the *Kwai* chewers compared to the non chewers ($x^2$=80.21, df=1, p>0.05, Significant).
6. The difference between the smokers and the non-smokers is insignificant ($x^2$=0.44, df=1, p<0.05, Insignificant) in respect of the prevalence caries.
7. Difference between the tobacco chewers and non-chewers ($x^2$=1.03, df=1, p<0.05, insignificant) is insignificant in respects of the prevalence of caries.
8. Incidence of gingivitis increases as the age group increases.
9. Upto the age of 5 years not a single subject was found affected by gingivitis.
10. The percentage of higher periodontal index score increases with the increase of age.

11. The prevalence of periodontal disease is high among the illiterate (54.71%) compared to the literate (44.64%) Khasis. They differ significantly ($x^2$=4.34, df=1, p>0.05, Significant).

12. The poor form of OHI (DI-S) debris index is more frequent among the males is (13.00%) than the females (15.00%). In general, the percentage frequency decreases as the age group increases.

13. The OHI (CI-S) increases in the higher age groups in both the sexes.

14. The prevalence of gingivitis found to be highest in the high income group, i.e., (82.40%) in males and (85.37%) in females.

**Dental Morphology:**

1. Supernumerary teeth could be observed only in the permanent teeth. Males has slightly higher incidence of supernumerary teeth compared to their counterparts.

2. In both the sexes, the occurence of supernumerary teeth are absent in the lowest and the highest age groups. In males the highest frequency of this trait was observed in the age group 11-15 years whereas in females, 16-20 years.

3. The incidence of carabelli's anomaly is highest among 11 year age group in biy7s and 10 years in the girls. However, this trait does not follow any specific pattern regarding its distribution.

4. The occurrence of carabelli's anomaly is slightly higher in males compared to the females.

5. The incidence of carabelli's anomaly decreases with the increase of the age group.

6. The incidence of shoveling is found to be higher in the males (8.30%) than that of the females (5.36%).

7. The incidence of shovel-shaped incisors are high in the maxillary incisor compared to the mandibular in both the jaws and sexes.

8. No diastema was observed upto the age of 2 yerars. Females have higher incidence of diastema compared to the males in both the types teeth.

9. The incidence of crowding is high in the lower age groups. After 50 years of age, the occurrence of crowding is almost absent.

10. The individuals with normal bite are high in both the sexes compared to the mal-occlusion. However the percentage of the overbite is slightly high compared to the underbite subjects.

11. The percentage frequency of the subjects with normal occlusal pattern decreases with the increase of the age.

12. Bisexual variation of mal-occlusion is insignificant ($x^2$=1.88, df=1, $p<0.05$, insignificant), however the incidence of mal-occlusion is slightly high in females than the males.

**Conclusion**

The present study was conducted to examine the dental eruption, dental and oral pathology and morphology of the Khasis of Shillong. The eruption is recorded earliest mandibular teeth of girls and slowest in the maxillary jaws of boys. However, by 14 years of age, eruption of all teeth except the M3 completes. All the teeth erupt early in girls than in boys. The first tooth to emerge is the first molar and the last is the third molar

teeth in the dental arcade of both the sexes of the Khasis. When compared with some Mongoloid children of Northeast India, the eruption time is found to be late among the Khasi children. The percentage frequency of the caries affected children is found to be highest in all population when compared with some other Mongoloid populations of Northeast India. Incidence dental and oral pathology was compared between the age groups, sexes, income groups, etc. The incidence of caries is high among both the sexes of the illiterate Khasis compared to the literate. However, it is found that the incidence of caries is less among the *Kwai* and the tobacco chewers compared to the non-chewers. But the smokers have higher frequency of caries. It is expected that the prevalence is inversely proportional to the income. But the finding of the present study shows that the trend is opposite, i.e., the higher income group people have high incidence of dental caries. Similarly, the *Kwai* chewing also decreases the frequency of the periodontal diseases.

It was expected that the incidence of dental caries and oral pathology is low in high income group, smaller family size, higher education and, high in the low income group, large family size, low education and chewing habits of *Kwai*, tobacco, etc. which it is not always true. Present study reveals that the low incidence of dental caries, calculus and oral pathology may be found among the low income group, large family size and *Kwai* and tobacco chewers also.

# REFERENCES

Adler, P. and E. Godeny. 1952. Studies on the eruption of permanent teeth. *Acta Geneet Stat. Med.* Vol. 3: pp. 30-49.

Banerjee.A.R, P.Banerjee and K. Dutta. 1984. "Eruption of Permanent Teeth Among the Bengalee Girls and Boys". Presented at the *UGC National Seminar on Dental Anthropology*: Applications and Methods held at Tirupati from March 10-12.

Barksdade, J.T. 1972. "Appendix III: A Descriptive and Comparative investigation of Dental Morphology". *In Physical Anthropology of the Eastern Highlands of New Guinea,* Vol-II. R.A. Littlewood, Seattle and London, University of Washington Press. pp. 113-174.

Barmes, D.E. 1981. "Oral health in the year 2000". *World Health* (The Megazine of the WHO), June: 3-5.

Barnard, P.D. 1956. "Dental Survey of State School Children in New South Wales". *Special Report Series* No. 8., Canberra, National Health and Medical Research Council.

Brothwell, D.R. 1963. Dental Anthropology, Vol-V, Pergamon Press, London.

Bhasin, M.K., A.K. Sharma and I.P. Singh. 1977. "Permanent dental emergence in the Kuluis of Himachal Pradesh". *The Anthropologist,* XXI, pp. 9-14.

Bhasin, M.K., A.K. Sharma and I.P. Singh, 1979. "A study on dental traits among the Jats of Haryana, North India". *Indian Journal of Physical Anthropology and Human Genetics*, 5: 7-18.

Boyd II, R.C. 1972. "Appendix IV: An odontometric and observational assessment of the dentition". In *Physical Anthropology of the Eastern Highlands of New Guinea,* Vol –II, R.A. Littlewood, University of Washington Press, Seattle and London: pp. 175-212.

Butler, P.M. 1939. Studies in the mammalian dentition- and of differentiation of post canine dentition, *Proceedings of the Zoological Society,* London, B, 107: pp. 103-132.

Butler, P.M. and K.A. Joysey. 1978. *Development, function and evolution of teeth,* London: Academic Press.

Cadien, J.D. 1972. "Dental variation in man". *In perspective on Human Evolution,* Vol. 2, S.L. Washburn and P. Dolhinow, Eds. New York: Holt, Rinehart and Winston, Inc., pp. 199-222.

Campbell, T.D. 1925. *Dentition and Palate of the Australian Aboriginal,* University of Adelaide, Publication No. 1, Adelaide: Hassel Press.

Clements, E.M.B., E. Davies-Thomas and K.G. Pickett. 1953. Time of eruption of permanent teeth in British children 1947-1948. *British Medical Journal,* 1: pp. 1421-1424.

Corruccini, R.S., S. S. Kaul, S.R.K. Chopra., J. Karosas, M.D. Larsen and C. Marrow. 1982. "Epidemiological survey of occlusion in North India". *British Journnal of Orthodontics.*

Dahlberg, A.A. 1945. "The Changing dentition of man". *Journal of American Dental Association*, 32: pp. 676-690.

Dahlberg, A.A. 1949. "The dentition of the American Indian". In *Papers on the Physical Anthropology of the American Indian*, New York, Viking Fund: pp.138-175.

Dahlberg, A.A. 1951. "The dentition of the American Indian". In The Physical Anthropology of the American Indian, W.S. Laughlin, (ed.), New York: Viking Fund Inc, pp. 138-176.

Dahlberg, A.A. 1963. "Analysis of the American Indian Dentition", In *Dental Anthropology*, D.R. Brothwell, ed. New York: Pergamom Press: pp. 149-177.

Dahlberg, A.A. 1971. *Dental morphology and evolution*, Chicago: University of Chicago Press.

Dahlberg, A. and R. Menegaz-Bock. 1958. Emergence of the permanent teeth in Pima Indian children. *Journal of Dental Research*, Vol. 37: pp. 1123-1140.

Dahlberg, A.A. 1945. Paramolar tubercle (Bolk), *American Journal of Physical Anthropology*, Vol. 3: pp. 97-103.

Dietz, V.H. 1944. "A commom dental morpho-metric factor: The Carabelli's cusp". *Journal of American Dental Association*, 31: pp. 784-789.

Fisher, R.A. and F. Yates. 1948. Statistical Tables for Biological, Agricultural and Medical Research. Oxford: Oliver and Boyd.

Friedlaender, J.S. and H.L. Bailit. 1969. Eruption times of the deciduous and permanent teeth of natives of Bongainville Island, territory of New Guinea: A study of racial variation. *Human Bioliology* Vol. 41: pp. 51-65.

Ganguly, P. 1982. "Palmaris longus muscle with incompletely penetrant dominant gene". *Man in Indai*, 62: pp. 321-342.

Garn, S.M. and A.B. Lewis. 1963. Phylogenetic and intraspecific variations in tooth sequence polymorphism. Contribution to symposia of the society for the study of Human Biology. In D.R. Brothwell (ed.): *Dental Anthropology*, Vol. V. Pergamon Press, London.

Garn, S.M., M.N. Jerrold, S.T. Sandisky and T. Frederick. 1973. Economic impact on tooth emergence. *American Journal of Physical Anthropology*, Vol. 39: pp. 233-237.

Goldstein, M.S. 1948. "Dentition of the Indian crania from Texas". *American Journal of Physical Anthropology., Vol. 6: 63-84.*

Goose, D.H., D.G. Thomson and F.C. Winter. 1957. "Malocclussion in school children of the west Midlands". *British Dental Journal*, 102: pp. 174-178.

Greene, J.C., and Vermillion, J.R. 1964. The simplified oral hygiene index. *Journal of American Dental Association*, 68(7).

Gregory, W.K. 1922. *The origin and evolution of the human dentition*, Baltimore: Williams & Watkins.

Hellman, M. 1923. "Nutrition , growth and dentition". *Dental Cosmos*, 65: pp. 34-49.

Hellman, M. 1943. "The phase of development concern with erupting the permanent teeth". *American Journal of Orthodontics and Oral Surgery*, 29: pp. 507-726.

Helm, S. and B. Seidler. 1974. Timing of permanent tooth emergence in Danish Children. *Community Dent. Oral Epidemoil.* Vol. 2: pp. 122-129.

Hilson, S. 2002. Dental Anthropology. Cambridge University Press, Cambridge.

Hrdlicka, A. 1911. "Human dentition and teeth from the evolutionary and racial standpoint". *Dominion Dental Journal,* Vol. 23: pp. 403-417.

Hrdlicka, A. 1920. "Shovel-shaped teeth". *American Journal of Physical Anthropology,* Vol. 3: pp. 429-465.

Hurme, V.O. 1957. Time and sequence of tooth eruption. *J. Forensic Sci.* Vol. 2: pp. 377-388.

Jaswal, S. 1983. "Age and Sequence of Permanent-Tooth Emergence Among Khasis". *American Journal of Physical Anthropology,* Vol. 62: pp. 177-186.

Jelliffe, D.B. and E.F.P. Jelliffe. 1973. "Practical conclusions". *Journal of Tropical Pediatrics and Environmental Child Health,* June- XIX: pp. 247-248.

Jelliffe, E. F. P. and D.B. Jelliffe. 1973. "Deciduous dental eruption, nutrition and age assessment". *Journal of Tropical Pediatrics and Environmental Child Health,* June: XIX: p. 194.

Joshi, M.R., R.N. Godiawala and A. Bhutia. 1972. "Carabelli trait in Hindu children from Gujarat". *Journal of Dental Research,* 51: p. 705.

Kasar, S. 2006. Eruption of permanent teeth and prevalence of dental caries among the Garo boys of Rangsakona and Dehalbagan villages of Ri-Bhoi district of Meghalaya and Ambher village of Kamrup district of Assam. *MSc. Dissertation,* Shillong, NEHU.

Kaul, S.S. and R.K. Pathak. 1989 "Estimation of calendar age from the emergence times of permanent teeth in Punjabi children in Chandigarh, India". *Annals of Human Biology,* Vol. 15(4): pp. 302-309.

Kaul, V. and S. Prakash. 1982. "Eruption of permanent teeth in Jats of Haryana". III *International Congress of Auxology,* Belgium, Abstract No. 002.

Kaul, S.S. and Sushma and S. Bindu. 1975. "Emergence of permanent teeth in school children in Chandigarh, India". *Archives of Oral Biology,* Vol. 20: pp. 587-593.

Kelley, M.A. and C.S. Larsen. 1991. Advances in dental anthropology, New York: Wiley-Liss.

Kirk, R.L. 1973. Serum protein and enzyme groups in physical anthropology with special reference to Indian populations. *In Physical Anthropology and its Extending Horizons.* A. Basu, A.K. Ghosh, S.K. Biswas nad R. Ghosh (eds). pp. 198-209. Orient Longman, Calcutta.

Kraus, B.S. 1951. "Carabelli's anomaly of the maxillary molar teeth observations on Mexicans and Padago Indians and an interpretation of the inheritance". *American Journal of Human Genetics,* Vol. 3: pp. 348-355.

Kraus, B. S. and Jordan, R. E. 1965. *The Human Dentition Before Birth.* Philadelphia: Lea and Febiger.

Krumholt, L., B. Roed-Peterson and J.J. Pinborg. 1971. Eruption times of the permanent teeth in 622 Ugandan children. *Archs. Oral Biol.* Vol. 16: pp. 1281-1288.

Kunzru, B.H. and B. Krishna Reddy. 1984. "Dental caries among two caste groups of Chittoor district, Andhra Pradesh". Presented at the UGC, *National Seminar on Dental Anthropology: Application and Methods* held at Tirupati from March 10-12.

Kurten, B. 1982. *Teeth: form, function, and evolution,* New York: Columbia University Press.

Kuski, K. and S.M. Garn. 1957. Tooth eruption sequence in fossil and modern man. *American Journal of Physical Anthropology.* Vol. 15: pp. 469-488.

Lalrammuana, C. 2006. Eruption of permanent teeth and prevalence of dental caries among the Garo girls of Rangsakona and Dehalbagan villages of Ri-Bhoi district of Meghalaya and Ambher village of Kamrup district of Assam. *MSc. Dissertation,* Shillong, NEHU.

Lasker, G.W. 1950. "Genetic analysis of racial traits of the teeth". Cold Spring Harbor Symposia on Quantitative Biology, pp. 191-203.

Lavelle, C.L.B. 1973. "Variation in the secular changes in the teeth and dental arches". *Angle Orthodontist*, 43: pp. 412-421.

Leigh, R.W. 1925. Dental Pathology of Indian tribes of varied environmental and food conditions, *American Journal of Physical Anthropology*, Vol. 8: pp. 179-199.

Limbu, D.K. 1996. "Eruption of permanent teeth among the Gallong of Arunachal Pradesh". *Journal of Human Ecology.*, Vol. 7: pp. 221-222.

Lotha, T. 2009. Eruption of permanent teeth among the Sakachep children of Saitsama village of Jaintia Hills district, Meghalaya. *MSc. Dissertation*, Shillong, NEHU.

Lotha, Z. 2005. Eruption of permanent teeth and dental caries among the Biate boys of Saipung Village, Meghalaya. *MSc. Dissertation*, Shillong, NEHU.

Mayhall, J.T., P.L. Belier and M.F. Mayhall. 1978. Canadian Eskimo Permanent tooth emergence timing. *American Journal of Physical Anthropology* ,Vol. (49: pp. 211-216.

Miller, W. 1983. "Agency of micro-organisms in decay of human teeth". *Dental Cosmos*, 25: pp. 1-12.

Milner, G.R. and C.S. Larsen. 1991. Teeth as artifacts of human behaviour: International mutilation and accidental modification, in Kelley, M.A. & Larsen, C.S. (eds.). *Advance in dental anthropology*, New York: Wiley-Liss: pp. 357-378.

Moorrees, C.F.A. 1957. *The Aleut Dentition: A Coorelative study of Dental characteristics in an Eskimoid people*, Cmabridge, Harvard University Press.

Murphy, T. 1959b. Gradients of dentine exposure in human molar tooth attrition, *American Journal of Physical Anthropology,* Vol. 17, pp. 179-186.

Nanda, R.S. and F.N. Chawla. 1966. "Growth and Developmenet of dentition in Indian Children. I. Development of permanent teeth. *American Journal of Orthodontics,* Vol. 52: pp. 837-853.

Nelson, C.T. 1938. "The teeth of the Indians of Pecos Pueblo". *American Journal of Physical Anthropology,* Vol. 23: pp. 261-293.

Niswander, J.D. and C. Sujaka. 1960. Dental eruption, stature and weight of Hiroshima children. *Journal of Dental Research.* Vol. 39: pp. 959-963.

Pal, A. 1964. "Observations on the dentition of crania from Eastern India". *Bulletin of the Anthropological Survey of India,* 13(1-2): pp. 9-18.

Pal, A. 1978. "Carabelli's anomaly in Eastern India". *Man in India,* 58. Pp. 179-188.

Pathak, R.K., S. Jaiswal and S. Kaul. 1984. "Association of permanent dental maturity status with stature and weight in Punjabi children of Chandigarh, India", Presented at UGC *National Seminar on Dental Anthropology: Application and Methods* held at Tirupati from March 10-12.

Pedersen, P.O. 1949. "The East Greenland Eskimo dentition". *Meddelelser Om Greenland,* 142: pp. 1-244.

Powell, A. 1902. "Medical examination in cases of rape". *Indian Medical Gazette,* 37: pp. 230-234.

Rami Reddy, V. 1981. "Eruption of permanent teeth among the people of Gulbargar, Karnataka"' Presented at the *III International Symposium on Human Biology: Variation in Human Growth and Physique* held at Bozsak (Hungary) from May 26-30).

Rami Reddy, V. 1981a. "Eruption of deciduous teeth among the children of Gulbarga, South India". *Indian Journal of Medical Research,* 73: pp. 772-781.

Rami Reddy, V. 1982a. "Impact of caste and religion on the permanent dental eruption in India". Presented at the *III International Congress of Auxology: Growth and Development teeth* held at Brussels (Belgium) from August 26-30).

Rami Reddy, V., P. B. Vijayalakshmi and B. K. Chandrasekhar Reddy. 1982b. "Some dental features among the Muslims of southeastern Andhra Pradesh". *Man in India*, 62 (4): pp. 395-404.

Rami Reddy, V., P. B. Vijayalakshmi and B. K. Chandrasekhar Reddy. 1982c. "Dental caries among the Muslims of southeastern Andhra Pradesh". *Indian Journal of Physical Anthropology and Human Genetics,* 8 (1): 47-56.

Rami Reddy, V. 1983a. "Impact of caste and religion on the deciduous dental eruption in India". Presented at the *70th Session of the Indian science Congress* held at Tirupati from January 3-8.

Rami Reddy. V. 1983b. "Dental eruption in India: A review". Presented at the *XI International Congress of Anthropological and Ethnological Sciences* held at Quebec City and Vancouver, Canada from August 14-25.

Rami Reddy. V. 1984. "Indian dental anthropology in retrospect and prospect". Presented at the *Seminar on Anthropological Studies in India,* held at Calcutta under auspices of the Asiatic Society at its bi-centenary celebrations on September 22 and 23.

Reddy, V.R. 1986. Dimensions of Anthropology, Vol. I, B.R. Publishing Corporation, New Delhi.

Robinow, M. 1973. "The eruption of deciduous (factors involved in timing)". *Journal of Tropical Pediatrics and Environmental Child Health,* June (Special Issue), XIX: 200-205.

Shourie, K. L. 1946a. "Flourine and dental caries in India". *Indian Journal of Medical Research,* 34 (1): 97-104.

Shourie, K. L. 1946b. "Eruption age of teeth in India". *Indian Journal of Medical Research,* 34 (1): 105-118.

Sinclair, B. Y., D. A. Cameron and N. E. Goldsworthy. 1947. *Report on the New Guinea Nutrition Survey Expedition: Observations on Dental Conditions among Native People in Papua, New Guinea,* Sydney, Pettifer.

Segal, A. H. 1963. *Morphology and Anatomy of the Human Dentition.* Chicago Year Book Medical Publishers Inc.

Sidhu, S. S., K. L. Shourie and S. H. Shaikh. 1970. "The facial skeletal and dental pattern in India- A cephalometric study". *Journal of Indian Orthodontic Society,* 11 (2): 1-13.

Saini, S. 1972. "Order and eruption times of permanent teeth, state of dental health, height and weight of school-going boys in Chandigarh". *MSc. Dissertation, Punjab University*, Chandigarh.

Singh, S.P. 1980. "Eruption of permanent teeth in Gaddi Rajput males of Dhaula Dhar Range of the Himalayas". *Zeitschrift fur Morphologic and Anthropologic*, Vol. 70: pp. 293-301.

Saxena, B. "Eruption of permanent teeth, state of dental health and body size of school-going girls in Chandigarh. *MSc. Dissertation, Punjab University*, Chandigarh.

Shaw, M.J.C. 1931. *The Teeth, the Bony Palate and the Mandible in Bantu Races of South Africa*, London, John Bale Sons and Deniels Son.

Sidhu, L.S. and Gupta. 1973. "Sequence and age of eruption of permanent teeth in the Punjabi populations of Patiala. *The Eastern Anthropologist*, Vol. 26: pp. 260-270.

Steggerda, M. and T.J. Hill. 1942. Eruption time of teeth among Whites, Negroes and Indians. *American Journal of Orthodontics*, Vol. 28: 361-370.

Syiemlieh, S. 2004. Eruption of permanent teeth and dental caries among the Deori boys of Mahadevpur Deori villages, Arunachal Pradesh. *MSc. Dissetation*, Shillong, NEHU.

Tanner, J. M. 1962. *Growth at Adolescence*, Second edition. Oxford: Blackwell Scientific Publications.

Tsochu, R. 2002. Eruption of permanent teeth and dental caries in the Marngar girls of Ri-Bhoi district, Meghalaya. *MSc. Dissertation*, Shillong, NEHU.

Turner, II, C.G. 1967. Crystalline organization of dental mineral, in Miles, A.E.W. (Ed.) *Structural and chemical organization of teeth*, London: Academics Press, Vol. 2, pp. 165-200.

Turner, C. G. 1967. Dental Genetics and Microevolution in Prehistoric and Living Koniag Eskimo. *Journal of dental research*, 46 (suppl. to no. 5), 911-917.

Wallace, J.A. 1977. Gingival eruption sequences of permanent teeth in early hominids. *American Journal of Physical Anthropology*. Vol. 46: pp. 483-494.

Wolpoff, M.H. 1971. *Metric trends in humanid dental evolution*, Cleveland: Case Western Reserve University Press.

World Health Orgonization, 1975.*Oral Health Surveys-Basic methods*, Second Edition, Geneva.

# APPENDIX

SCHEDULE

INTERVIEW SCHEDULE

For the Doctoral Thesis on

Dental anthropology of the Khasis of Shillong

Investigator_____

Department of Anthropology

NEHU, Shillong

BACKGROUND INFORMATION

Sl. No. .....

1. Name of the Subject: _____
2. Sex: _____ Date of Examination: _____
3. Sub-Tribe: _____ Date of Birth: _____
4. Religion: Christianity/ Muslim/ Niam
5. Village/ Town/ Locality: _____ District: _____
6. Class: _____ School: _____
7. Subject's Occupation: _____
8. Income (per month): _____
9. Subject's Education and Qualification: _____
10. Father's Education and Qualification: _____
11. Mother's Education and Qualification: _____
12. Father's Occupation: _____

13. Mother's Occupation: _____

14. Father's Income: _____

15. Mother's Income: _____

16. Total Family Income (per month): _____

17. Total Family Member: _____

ERUPTION

| $M^3$ | $M^2$ | $M^1$ | $P^2$ | $P^1$ | $C^0$ | $I^2$ | $I^1$ | $I^1$ | $I^2$ | $C^0$ | $P^1$ | $P^2$ | $M^1$ | $M^2$ | $M^3$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $M_3$ | $M_2$ | $M_1$ | $P_2$ | $P_1$ | $C_0$ | $I_2$ | $I_1$ | $I_1$ | $I_2$ | $C_0$ | $P_1$ | $P_2$ | $M_1$ | $M_2$ | $M_3$ |

CARIES

| $M^3$ | $M^2$ | $M^1$ | $P^2$ | $P^1$ | $C^0$ | $I^2$ | $I^1$ | $I^1$ | $I^2$ | $C^0$ | $P^1$ | $P^2$ | $M^1$ | $M^2$ | $M^3$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $M_3$ | $M_2$ | $M_1$ | $P_2$ | $P_1$ | $C_0$ | $I_2$ | $I_1$ | $I_1$ | $I_2$ | $C_0$ | $P_1$ | $P_2$ | $M_1$ | $M_2$ | $M_3$ |

| $m^2$ | $m^1$ | $c^0$ | $i^2$ | $i^1$ | $i^1$ | $i^2$ | $c^0$ | $m^1$ | $m^2$ |
|---|---|---|---|---|---|---|---|---|---|
| $m_2$ | $m_1$ | $c_0$ | $i_2$ | $i_1$ | $i_1$ | $i_2$ | $c_0$ | $m_1$ | $m_2$ |

PI (Periodontal Index)

| $M^3$ | $M^2$ | $M^1$ | $P^2$ | $P^1$ | $C^0$ | $I^2$ | $I^1$ | $I^1$ | $I^2$ | $C^0$ | $P^1$ | $P^2$ | $M^1$ | $M^2$ | $M^3$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $M_3$ | $M_2$ | $M_1$ | $P_2$ | $P_1$ | $C_0$ | $I_2$ | $I_1$ | $I_1$ | $I_2$ | $C_0$ | $P_1$ | $P_2$ | $M_1$ | $M_2$ | $M_3$ |

| $m^2$ | $m^1$ | $c^0$ | $i^2$ | $i^1$ | $i^1$ | $i^2$ | $c^0$ | $m^1$ | $m^2$ |
|---|---|---|---|---|---|---|---|---|---|
| $m_2$ | $m_1$ | $c_0$ | $i_2$ | $i_1$ | $i_1$ | $i_2$ | $c_0$ | $m_1$ | $m_2$ |

OHI (Oral Hygiene Index)

DI-S

| $M^1$ | $I^1$ | | $M^1$ |
|---|---|---|---|
| M | | $I_1$ | $M_1$ |

($M_1$, $M_1$ = Lingual

(Others = Facial)

| $m^1$ | $i^1$ | | $m^1$ |
|---|---|---|---|
| $m_1$ | | i | $m_1$ |

CI-S

| $M^1$ | $I^1$ | | $M^1$ |
|---|---|---|---|
| M | | $I_1$ | $M_1$ |

| $m^1$ | $i^1$ | | $m^1$ |
|---|---|---|---|
| $m_1$ | | i | $m_1$ |

1. Numerical Variations:

   A. Hyperdontia : Yes No

   If yes, which are the regions of each occurance

   _____

   B. Hypodontia : Yes No

   If yes, which are the regions of each occurance

   _____

2. Diastema : Yes (Maxilla or Mandible) No

   If yes, (i) Medial diastema

   (ii) Lateral diastema

3. Crowded : Yes No

4. Failed to developed : Yes No

   If yes, which tooth _____

5. Caraballi's Cup : $M^1$ | $M^1$ $m^1$ | $m^1$ (L/M/S)

6. Shovel-shaped incisors : $C^0$ $I^2$ $I^1$ $I^1$ $I^2$ $C^0$

   $C_0$ $I_2$ $I_1$ $I_1$ $I_2$ $C_0$

7. Cingulum : $C^0$ $I^2$ $I^1$ | $I^1$ $I^2$ $C^0$

   $C_0$ $I_2$ $I_1$ | $I_1$ $I_2$ $C_0$

8. Occlusion : Normal/Overbite/Underbite

1. Habits:

A. Smoking : Yes No

(Bidi, Cigarette, Pipe, or any Other)

If yes, how much per day? _____

B. Chewing :

(i) Tobacco : Yes No

(ii) Betel Leaf and nut : Yes No

C. Any Other (Drugs):

2. Dental Care :

A. Brushing teeth : Yes No

If yes, how? Tooth paste and brush, twig, charcoal, sand, any other _____

If twig, which species _____

B. Frequency : Daily, Alternate day, Bi-weekly, Weekly.

C. Do you wash your mouth after eating? : Yes No

D. Do you wash your mouth before sleeping at night? : Yes No

E. Have you ever visited dentist/ traditional medicine man? : Yes No

3. Diet : Meat, Fish, Rice, Milk, Pulses, Grenn leafy vegetables, Sweets, Chocolate, etc.

## CANDIDATE'S BRIEF BIO-DATA

1. Name : Ms. Samali Saikia
2. Father's name : Shri. Dimbeswar Saikia
3. Date of birth : 21st Oct. 1973
4. Nationality : Indian
5. Marital status : Married
6. Educational Qualifications:

| Name of the Examinations | Year of passing | Board/University |
|---|---|---|
| H.S.L.C. | 1990 | A.I.S.S.E. |
| H.S.S.L.C. | 1993 | A.I.S.S.C.E. |
| BSc. | 1996 | Dibrugarh University |
| MSc. | 1999 | Dibrugarh University |

7. Area of Research : Dental Anthropology of the Khasis of Shillong.