

## ERUPTION OF PERMANENT TEETH AMONG PEOPLE OF GULBARGA, KARNATAKA

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**Abstract:** A cross-sectional dental study has conducted on 2,564 children (M: 1,366; F: 1,198) of different income levels of Gulbarga, Karnataka, South India revealed that most permanent teeth of either jaw in general like deciduous teeth erupted earlier in females than males. The first tooth emerged as early as 4 years in children of either sex and all economic groups. Slightly over 50 per cent of the teeth erupted by the age of 10 years and majority of them by about 18—19 years irrespective of sex and economic status. The eruption of the full complement of teeth including the third molars appears to have completed after 24 years of age. The mean number of teeth erupted at given ages and the sequence of their eruption in the author's sample are more or less similar to those of other populations studied earlier. In eruption ages, however, his sample is ahead of majority of the populations with respect to all maxillary teeth, some of mandible like incisors, canines and first molars and majority of the female teeth of either jaw.

*Key words:* Eruption of teeth, permanent teeth, Gulbarga/India.

### Introduction

In a previous article the results of the deciduous teeth eruption pattern among the children of Gulbarga, Karnataka were presented (RAMI REDDY 1981). The study showed delayed eruption of teeth as in a few other Indian populations surveyed earlier although the order of eruption of different teeth, their eruption ages, and the mean number of teeth erupted at specified ages were found to be basically similar to other populations of this country or abroad. In the same town, investigation was conducted between 1971 and 1975 and data were gathered on the eruption pattern of permanent dentition also among the children of different endogamous groups which forms the subject of the present paper.

As in the case of deciduous teeth eruption, most of the previous studies on the permanent teeth eruption, longitudinal or cross-sectional, concerned with the British (JAMES—PITT 1912, AINSWORTH 1925, STONES et al. 1951, CLEMENTS—PICKET 1953, MILLER et al. 1965), and American (CATTELL 1928, COHEN 1928, KLEIN et al. 1938, STEGGARDA—HILL 1942, HELLMAN 1923, 1943, FULTON—PRICE 1954) children and some with those from New Zealand (LESLIE 1951), and China (LAU 1971). In addition to these, studies for the assessment of eruption have also been conducted among the American Negroes (STEGGARDA—HILL 1942, HELLMAN 1923, 1943, FULTON 1954, LESLIE 1951, LAU 1971, SUK 1919), American Indians (STEGGARDA—HILL 1942, HELLMAN 1923,

1943, FULTON 1954, LESLIE 1951, LAU 1971, SUK 1919, DAHLBERG—MENEGAZ-BOCK 1958), African Bantus (McKAY—MARTIN 1952), Gambians (BILLEWICZ—McGREGOR 1975), and Australian aborigines (BARRETT 1957, BARRETT et al. 1964). Data on the eruption of permanent teeth among the Indian populations are awfully missing excepting SHOURIE's (1946) pioneering work conducted on the Southern Indian boys and girls, and on Lahore boys over four decades after that of POWELL in Bombay. The most recent studies on these lines consist of those on the Magar and Gurung Gurkhas of Dehradun in U.P. by AWASTHI—KHARE (1978), on the Chandigarh school children by KAUL et al. (1975), and on the Kuluis of Himachal Pradesh by BHASIN et al. (1977).

In this paper it is proposed to describe the development of permanent teeth in Gulbarga children and to evaluate the relationship between the level of dentition attained at a given age in either sex and income status of the children.

### Materials and Methods

Gulbarga town in the Hyderabad-Karnataka area of Karnataka state is a taluk and district headquarter of the same name, with a population of 145,630 according to 1971 census. Brahmins and Lingayats characterise the dominant caste groups of the town besides the Muslims and Christians. Other castes with small population sizes inhabiting the town are Reddis, Vaisyas, Kshatriyas, Marathas, Jains, Kurubas, Harijans etc.

Most of the children for the study came from randomly chosen nurseries and primary schools, high schools and colleges. The rest of them were drawn from a random sample of houses. In any case, the selection of children was made in such a way that the socio-economic character of the town was maintained. Birth dates were recorded from school/college records, which were later cross-checked for correctness with those entered in the horoscopes and birth registers maintained by the parents of the children and the local municipal authorities. Cases with doubtful birth dates were excluded from the study. The materials for the study comprised 2,564 normal healthy boys (1,366) and girls (1,198) aged 3 to 25 years and above.

The survey was conducted with the help of an experienced dental surgeon attached to the local Medical College and Hospital. In all dental inspections alternate pairs of mouth mirrors and a probe were employed. Any tooth that had at least partly pierced the muco periostium was considered as erupted and was marked as present by the method of encircling the concerned numbers of the teeth on a specially developed proforma which was field-tested and standardised for entering the information for each subject. The eruption pattern has been studied on the basis of only those teeth that were present at the time of examination. All cases with history of extraction were dropped from the study. Based on the information collected on the family income of each child examined in rupees per annum, the children have been divided into three economic groups: Upper (with an income of Rs. 10,000 — and above), Middle (with an income of Rs. 5,000 to 10,000) and Lower (with an income of Rs. 5,000 and below). The results of teeth eruption have been studied according to these groups to assess the influence of the latter on the former.

Analyses of the data were made by the IBM-370/155 computer. In the tabulations, the mean number of teeth was calculated out of the total number of children examined by age, sex and economic status. From the tabulations on the number and per cent children with teeth erupted, the median eruption age for each tooth was calculated using the graphic method. Further the first and third quartiles were also calculated and presented along with the medians. To test the effects of region, side, sex and economic status, the analyses of variance were made. The cases have been grouped following the 'completed age' mode, i.e., as age of last birth days.

## Analysis and Results

### *Teeth erupted at specified ages*

Means with standard errors for the numbers of teeth at various ages by sex and economic status are portrayed in Tables 1 and 2. The tables on the percentage distribution of children with a specified number of teeth at a specified age, which are not presented here, reveal the predominant occurrence of an even number of teeth as in the case of deciduous teeth. The first tooth erupted in either sex at the earliest age of four years. No teeth were observed in certain children till as late as seven years while all the teeth erupted in certain others by 15 years age.

Table 1

Mean  $\pm$  S.E. (sample size) of teeth erupted in Gulbarga (India) children by age and sex

Age groups (completed years)	Males	Females	Males and Females
3	0.0 $\pm$ 0.00 ( 65)	0.0 $\pm$ 0.00 ( 65)	0.0 $\pm$ 0.00 (130)
4	0.3 $\pm$ 0.16 ( 95)	0.2 $\pm$ 0.08 ( 69)	0.3 $\pm$ 0.17 (164)
5	1.6 $\pm$ 0.26 (120)	1.7 $\pm$ 0.35 ( 70)	1.6 $\pm$ 0.48 (190)
6	2.7 $\pm$ 0.38 ( 66)	3.8 $\pm$ 0.46 ( 58)	3.2 $\pm$ 0.59 (124)
7	6.4 $\pm$ 0.63 ( 55)	7.2 $\pm$ 0.47 ( 55)	6.8 $\pm$ 0.79 (110)
8	10.5 $\pm$ 0.69 ( 42)	10.6 $\pm$ 0.56 ( 70)	10.5 $\pm$ 0.89 (112)
9	13.2 $\pm$ 0.74 ( 55)	13.5 $\pm$ 0.36 ( 99)	13.4 $\pm$ 0.74 (154)
10	16.4 $\pm$ 0.75 ( 67)	16.8 $\pm$ 0.64 ( 82)	16.6 $\pm$ 0.98 (149)
11*	18.4 $\pm$ 0.72 ( 60)	22.8 $\pm$ 0.65 ( 65)	20.7 $\pm$ 1.04 (125)
12*	23.1 $\pm$ 0.65 ( 57)	25.6 $\pm$ 0.50 ( 68)	24.5 $\pm$ 0.84 (125)
13	26.0 $\pm$ 0.46 ( 58)	27.4 $\pm$ 0.26 ( 48)	26.6 $\pm$ 0.54 (106)
14	26.9 $\pm$ 0.35 ( 72)	27.9 $\pm$ 0.10 ( 44)	27.3 $\pm$ 0.46 (116)
15	27.9 $\pm$ 0.15 ( 57)	27.9 $\pm$ 0.11 ( 61)	27.9 $\pm$ 0.18 (118)
16	28.0 $\pm$ 0.11 ( 54)	27.9 $\pm$ 0.14 ( 61)	28.0 $\pm$ 0.18 (115)
17	28.7 $\pm$ 0.20 ( 46)	28.3 $\pm$ 0.15 ( 60)	28.5 $\pm$ 0.25 (106)
18	29.3 $\pm$ 0.21 ( 53)	28.9 $\pm$ 0.22 ( 47)	29.1 $\pm$ 0.31 (100)
19	29.8 $\pm$ 0.22 ( 54)	29.4 $\pm$ 0.25 ( 50)	29.6 $\pm$ 0.36 (104)
20-24	30.3 $\pm$ 0.11 (264)	29.9 $\pm$ 0.19 (101)	30.2 $\pm$ 0.18 (365)
25+	30.7 $\pm$ 0.36 ( 26)	31.2 $\pm$ 0.22 ( 25)	30.9 $\pm$ 0.43 ( 51)

\* Difference between sex is statistically significant ( $P < 0.05$ ).  
Not significant elsewhere.

Table 2

Mean  $\pm$  S.E. (sample size) of teeth erupted in Gulbarga (India) children by age and economic status

Age (completed years)	Upper income group	Middle income group	Lower income group
3	0.0 $\pm$ 0.00 ( 21)	0.0 $\pm$ 0.00 ( 70)	0.0 $\pm$ 0.00 (39)
4	0.1 $\pm$ 0.09 ( 44)	0.4 $\pm$ 0.23 ( 56)	0.3 $\pm$ 0.14 (64)
5	0.5 $\pm$ 0.43 ( 11)*	1.3 $\pm$ 0.26 (107)	2.2 $\pm$ 0.38 (72)*
6	4.5 $\pm$ 0.87 ( 18)	2.8 $\pm$ 0.52 ( 42)	3.1 $\pm$ 0.38 (64)
7	7.1 $\pm$ 0.92 ( 27)	6.6 $\pm$ 0.67 ( 43)	6.8 $\pm$ 0.51 (40)
8	11.3 $\pm$ 0.88 ( 21)	10.9 $\pm$ 1.04 ( 32)	10.2 $\pm$ 0.51 (59)
9	12.4 $\pm$ 0.82 ( 16)	13.5 $\pm$ 0.66 ( 53)	13.5 $\pm$ 0.47 (85)
10	17.7 $\pm$ 1.31 ( 23)	16.7 $\pm$ 0.80 ( 51)	16.2 $\pm$ 0.70 (75)
11	20.9 $\pm$ 1.05 ( 28)	19.4 $\pm$ 0.89 ( 39)	21.4 $\pm$ 0.79 (58)
12	26.1 $\pm$ 0.45 ( 27)*	24.7 $\pm$ 0.67 ( 49)	23.3 $\pm$ 0.75 (49)*
13	27.1 $\pm$ 0.56 ( 22)	26.2 $\pm$ 0.50 ( 50)	26.9 $\pm$ 0.31 (34)
14	27.3 $\pm$ 0.51 ( 28)	27.6 $\pm$ 0.20 ( 34)	27.1 $\pm$ 0.38 (54)
15	28.1 $\pm$ 0.14 ( 31)	27.8 $\pm$ 0.12 ( 47)	27.8 $\pm$ 0.19 (40)
16	28.0 $\pm$ 0.07 ( 34)	28.0 $\pm$ 0.14 ( 56)	27.8 $\pm$ 0.24 (25)
17	28.5 $\pm$ 0.20 ( 30)	28.1 $\pm$ 0.14 ( 44)	29.0 $\pm$ 0.28 (32)
18	29.2 $\pm$ 0.26 ( 42)	28.9 $\pm$ 0.21 ( 39)	29.0 $\pm$ 0.36 (19)
19	29.7 $\pm$ 0.27 ( 42)	29.7 $\pm$ 0.28 ( 36)	29.4 $\pm$ 0.32 (26)
20-24	30.3 $\pm$ 0.15 (143)	30.3 $\pm$ 0.15 (131)	30.0 $\pm$ 0.19 (91)
25+	30.9 $\pm$ 0.39 ( 17)	30.6 $\pm$ 0.53 ( 11)	31.0 $\pm$ 0.28 (23)

\* Difference between economic groups is statistically significant ( $P < 0.05$ ). Not significant elsewhere.

Table 1 shows the eruption of higher mean numbers of teeth in females than males at five to 14 and 25+ years of age ending in an equal number at 15 years, and the difference ranging between 0.1 tooth at five and eight years and 4.4 teeth at 11 years. At four and 16-24 years, the male means precede the female ones, the difference being 0.1 and 0.4 teeth respectively. Between five and 13 years age, the number of teeth erupted increases rapidly in either sex (M: 1.7-4.7, F: 1.5-6.0) while from 14 years and above the increase is negligible but consistent (M: 0.1-0.9, F: 0-1.3). The mean number of teeth in either sex fluctuates between 25 and 30 during a long period of 12-24 years. The onset of eruption though occurred at the same age (four years) in either sex, the time of their completion appears to be earlier in females than males.

The data when examined by economic status as in Table 2 reveals the prevalence of higher mean number of teeth in upper income group children than in those of other groups at all ages but 4-5 and 9 years; the intergroup difference being 0.2 to 1.7 teeth. However, the yearly increase in teeth eruption rate and the period with maximum number of teeth erupted are the same in different income group children as in sex. The times of onset as well as completion of eruption are nearly the same in all economic groups.

#### Age at eruption

Tables 3 and 4 show eruption ages by sex and economic status at 25th, 50th and 75th percentiles. The combined figures of sexes as in table 3 indicate earlier eruption ages for mandibular lateral incisors and third molars at all percentiles,

*Table 3*  
Age (years) at eruption of teeth by sex — 25th, 50th and 75th percentiles

Type of Tooth	Percentile	Upper Jaw						Lower Jaw					
		Male		Female		Total		Male		Female		Total	
		R	L	R	L	R	L	R	L	R	L	R	L
Central incisor	25th	5.50	5.75	5.50	5.50	5.50	5.50	5.25	5.25	5.50	5.00	5.25	5.00
	50th	6.25	6.50	6.75	6.25	6.50	7.00	7.00	7.00	6.75	6.75	6.75	6.75
	75th	8.00	7.25	7.75	7.25	7.75	7.25	8.50	8.75	8.50	8.75	8.50	8.75
Lateral incisor	25th	6.25	6.50	6.25	6.50	6.25	6.50	6.00	5.75	5.75	5.75	5.75	5.75
	50th	8.25	8.00	8.00	8.00	8.00	8.00	7.25	7.00	6.75	7.00	7.00	7.00
	75th	9.25	9.25	8.50	8.75	8.75	9.00	8.25	8.00	8.00	8.25	8.00	8.25
Canine	25th	9.00	9.75	9.00	9.75	9.00	9.75	9.50	9.50	8.75	8.75	9.25	9.00
	50th	11.25	11.25	10.25	10.50	10.75	10.00	10.00	10.75	10.00	10.00	10.50	10.50
	75th	12.00	12.00	11.00	11.25	11.50	11.75	11.50	12.25	10.75	11.00	11.50	12.00
First premolar	25th	9.00	9.00	9.00	9.25	8.75	9.00	9.25	9.50	9.25	9.25	9.25	9.25
	50th	9.75	10.25	10.25	10.00	10.00	10.00	10.75	10.50	10.00	10.00	10.50	10.25
	75th	11.25	11.25	10.75	10.50	11.00	10.75	11.75	11.75	11.00	11.00	11.50	11.50
Second premolar	25th	10.00	10.00	9.75	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
	50th	10.75	11.25	11.25	10.75	11.00	11.00	11.75	11.75	11.00	11.00	11.50	11.50
	75th	12.00	12.00	11.50	11.75	11.75	11.75	12.50	12.75	11.50	11.50	11.50	12.00
First molar	25th	5.50	5.25	5.50	5.00	5.25	5.50	5.00	5.25	5.50	5.25	5.50	5.50
	50th	5.75	5.75	5.75	5.75	5.75	5.75	5.50	5.50	5.50	5.50	5.50	5.50
	75th	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
Second molar	25th	11.25	11.00	10.00	10.00	10.25	10.50	10.50	10.25	10.00	9.75	10.00	10.00
	50th	12.00	12.25	11.00	11.00	11.50	11.50	12.00	12.00	10.75	10.50	11.00	11.25
	75th	13.00	13.00	12.00	12.00	12.50	12.50	12.75	12.75	11.75	11.75	12.50	12.50
Third molar	25th	17.50	18.00	18.00	19.00	17.50	18.50	17.00	17.25	18.00	18.25	17.00	17.50
	50th	20.25	20.00	22.00	22.00	21.00	2.00	19.00	19.00	20.75	20.00	19.75	19.25
	75th	25.75	25.00	26.00	25.75	27.50	26.00	26.25	25.50	25.00	24.75	25.25	25.50

R = Right L = Left

Differences in the mean number of teeth erupted between sex, region (Upper/Lower) and side (Right/Left) are not significant ( $P < 0.05$ ) as shown by the 'F' test.

**Table 4**  
Age (years) at eruption of teeth by economic status — 25th, 50th and 75th percentiles

Type of Tooth	Percentile	Upper Jaw						Lower Jaw					
		Upper income group		Middle income group		Lower income group		Upper income group		Middle income group		Lower income group	
		R	L	R	L	R	L	R	L	R	L	R	L
Central incisor	25th	5.25	5.25	6.00	5.75	5.75	5.50	5.00	5.00	5.50	5.25	5.00	5.00
	50th	6.00	6.25	6.50	6.75	6.50	6.50	6.00	6.25	6.75	6.25	7.00	6.25
	75th	7.25	7.00	8.25	7.75	8.00	7.50	7.00	7.00	8.50	7.00	8.50	7.25
Lateral incisor	25th	6.25	6.00	7.25	7.25	6.75	6.50	5.50	5.50	5.75	6.00	6.00	5.75
	50th	7.50	7.25	8.50	8.50	8.75	8.00	6.50	5.75	7.00	6.25	7.00	6.00
	75th	9.00	9.00	9.00	9.00	9.00	9.00	7.50	8.00	8.50	8.50	8.25	8.25
Canine	25th	9.50	9.50	9.75	9.75	10.00	10.00	9.25	9.25	9.00	9.00	9.00	9.00
	50th	10.50	10.50	10.75	11.25	11.25	10.75	9.75	10.00	10.25	10.25	10.25	10.25
	75th	11.75	11.75	11.75	12.00	11.75	12.00	11.00	10.75	11.25	11.50	11.50	11.25
First premolar	25th	8.75	9.50	9.00	9.25	9.00	9.50	9.50	9.25	9.50	9.25	9.50	9.50
	50th	10.50	10.00	10.00	10.00	10.00	10.00	9.75	9.75	10.25	10.25	10.25	10.50
	75th	11.50	10.75	11.00	11.00	11.00	11.00	11.25	11.00	12.25	11.50	11.75	11.75
Second premolar	25th	9.50	9.75	9.75	10.00	9.00	10.25	9.50	9.75	10.25	10.00	10.00	10.00
	50th	10.25	11.00	11.50	11.25	9.75	10.75	11.25	11.00	11.50	11.25	11.00	11.00
	75th	11.50	11.75	12.75	11.75	12.50	12.50	11.75	11.50	11.75	12.00	12.00	12.75
First molar	25th	5.50	5.25	5.00	5.00	5.50	5.25	5.50	5.50	5.75	5.25	5.50	5.50
	50th	6.00	6.00	6.50	6.50	7.25	6.00	7.25	6.25	6.50	6.75	6.00	7.00
	75th	7.25	7.00	9.50	7.75	8.75	7.50	9.75	8.25	8.75	9.25	8.75	8.75
Second molar	25th	10.25	10.50	11.00	11.00	10.25	10.50	10.50	10.25	10.25	10.00	10.00	10.00
	50th	11.50	11.50	12.00	11.75	12.00	12.00	11.50	11.25	11.50	11.25	10.75	10.75
	75th	12.00	12.25	12.50	13.25	13.00	13.00	12.25	12.00	12.50	12.50	12.50	12.25
Third molar	25th	17.50	18.00	18.00	18.75	17.75	19.25	17.25	17.50	18.25	17.75	16.75	17.00
	50th	20.25	19.50	21.50	21.25	21.50	21.75	20.25	19.75	20.25	18.75	20.25	19.75
	75th	27.25	25.25	27.25	27.50	27.25	26.00	24.75	24.00	26.00	24.25	26.50	24.50

R = right L = left

Differences in the mean number of teeth erupted between economic status, region, (Upper/Lower) and side (Right/Left) are not significant ( $P < 0.05$ ) as shown by the 'F' test.

second molars at 25th and 50th percentiles, and first molars at 50th percentile respectively than their counterparts in the maxilla. Among the rest, maxillary central incisors show earlier eruption ages at 50th and 75th percentiles, first premolars at all percentiles and second premolars at 50th percentile respectively, while the canines present inconsistent figures. There are differences in eruption times at all percentiles between the homologous male maxillary central incisors and third molars, and mandibular lateral incisors, and female maxillary canines, first and second premolars, and mandibular third molars respectively. The only teeth without any differences are female mandibular first and second premolars and maxillary second molars while the rest vary at different percentiles. Teeth with earlier eruption values than their counterparts at all percentiles consist of the mandibular lateral incisors and second molars of either sex, male mandibular canines and maxillary first premolars, female maxillary second premolars and mandibular third molars. Earlier eruption times have also been shown at 25th and 50th percentiles by female maxillary central incisors, and male mandibular canines, and at 50th and 75th percentiles by the first and third molars respectively. The rest of the teeth show very negligible differences. In general the female teeth of either jaw erupt earlier than the male ones excepting the male maxillary first premolars and third molars. The female teeth advanced over the male at all percentiles are second molars in either jaw, maxillary central and lateral incisors, and mandibular canines and first premolars. In the remaining teeth the magnitude of difference in eruption times between the sexes is negligible.

As could be seen from Table 4, children of different economic groups present interside differences in eruption time at all percentiles for the following teeth: central incisors of either jaw of middle income group, maxillary first premolars of upper income group, second premolars of either jaw of upper and middle income groups, maxillary first molar of lower income group and its counterpart of mandible of middle income group and third molars of either jaw of all the economic groups. The other teeth either show differences at different percentiles or not at all. Considering the eruption times by jaw and sex, we find earlier eruption values at all percentiles for the mandibular lateral incisors and canines in children of all economic groups, and second and third molars in those of middle and lower income groups while mandibular first premolars in middle and lower income groups and first molars of upper and middle income groups erupt later than their counterparts. The centile values of the rest of the teeth are inconsistent. When the data in either jaw have been viewed by economic groups, we find earlier eruption trend at all percentiles for most teeth of children of upper income group which can be clearly seen in the central incisors of either jaw, mandibular lateral incisors, maxillary canines, mandibular second premolars and maxillary third molars respectively. The trend is inconsistent in other teeth.

### *Median eruption ages*

In the median eruption ages by sex, the magnitude of differences between the individual members of the tooth pairs on the right and left sides of either jaw is negligible; it ranges between 0.25 years in a number of teeth of either jaw and sex and 1.50 years in the maxillary first premolars. In males, the upper and lower lateral incisors, lower first premolars and upper third molars of the

left segment have precedence over the right, while the upper central incisors, second premolars and second molars, and lower canines of the latter side precede the former. The rest of the teeth show the same eruption values. In females, the upper central incisors, lower lateral incisors, first and second premolars, and lower second and third molars of the left side show precedence over the right ones. Right preceding the left side is found only in upper canine. The rest of the teeth present no differences at all. The most frequent range of difference in either jaw of either sex is 0.25 years.

Excepting the maxillary central incisors of either sex, and male first and second premolars which erupt earlier than their mandibular counterparts, and female second molars whose eruption values are the same in either jaw, all the teeth erupt earlier in mandible than in maxilla. The median eruption time between the male homologous teeth ranges between 0.25 to 1.25 years and in females between 0.25 and 2.00 years which occurs in the left third molars.

In either jaw, male medians are larger than the female ones for lateral incisors, canines and second molars, while the females show larger values with respect to only third molars. The other teeth with larger values are male mandibular and female maxillary central incisors, first premolars and female mandibular third molars. The intersex maxillary difference lies between 0.25 and 2.00 years and mandibular difference between 0.25 and 1.75 years. First molar is the only tooth that presents no sex difference in either jaw, while in all other teeth but the central incisors and third molars, the dental development of girls is advance of boys. The pooled values of the sexes reveal that all mandibular teeth excepting the central incisors and first premolars show earlier eruption than maxillary ones. The teeth that erupt earlier than others irrespective of sex, side and jaw are central and lateral incisors among the front teeth and first molars among the posterior teeth. The analyses of variance carried out showed that the effect of sex, region and side are statistically not significant indicating the superficial nature of differences given above.

Viewing the data by economic status, we find median eruption time differences between all teeth of the right and left segments of either jaw and all economic groups, excepting the maxillary central incisors, and first premolars, mandibular canines and second premolars and second molars of either jaw of lower economic group children; maxillary lateral incisors, and first molars, mandibular canines, and first premolars of either jaw of middle income group children; and maxillary canines, first and second molars and mandibular first premolars of upper income group children, where the eruption times are the same. In the rest of the teeth irrespective of economic groups, the left side precedes the right in eruption. The mandibular lateral incisors, canines and second molars erupt earlier in children of all income groups. The other mandibular teeth erupted earlier are central incisors of middle income group, first premolars of upper income group, first molars of lower income group and third molars of middle and lower income groups. The rest of the teeth erupt later than their maxillary counterparts excepting central incisors in upper income group, and second premolars in middle income group which erupt simultaneously in either jaw. The effects of economic status, region and side were found to be statistically not significant when the analysis of variance was done.



## Order of eruption

The order of eruption abridged from the median eruption time shows that the mandibular right and left molars were the first to erupt simultaneously earlier in females than in males, while the maxillary ones emerged simultaneously in either segment of either sex about 0.3 years later than the former. The maxillary central incisors which erupted almost at the same age in either sex come next in order followed by mandibular and maxillary lateral incisors respectively. Then the maxillary first premolars erupted followed by the mandibular ones and canines. After about 0.4 years have elapsed, the maxillary second premolars following which the mandibular ones and second molars erupted. The last to erupt after a long period of about 8—9 years were mandibular and maxillary third molars. The order of eruption in maxilla and mandible of both sexes is shown separately and together as below.

ORDER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Males:	$\bar{6}$	$\bar{6}$	$\bar{1}$	$\bar{1}$	$\bar{2}$	$\bar{2}$	$\bar{4}$	$\bar{3}$	$\bar{4}$	$\bar{5}$	$\bar{3}$	$\bar{5}$	$\bar{7}$	$\bar{7}$	$\bar{8}$	$\bar{8}$
Females:	$\bar{6}$	$\bar{6}$	$\bar{1}$	$\bar{1}$	$\bar{2}$	$\bar{2}$	$\bar{3}$	$\bar{4}$	$\bar{4}$	$\bar{7}$	$\bar{3}$	$\bar{5}$	$\bar{7}$	$\bar{8}$	$\bar{8}$	
Combined:	$\bar{6}$	$\bar{6}$	$\bar{1}$	$\bar{1}$	$\bar{2}$	$\bar{2}$	$\bar{4}$	$\bar{4}$	$\bar{3}$	$\bar{3}$	$\bar{5}$	$\bar{7}$	$\bar{5}$	$\bar{7}$	$\bar{8}$	$\bar{8}$
Simply:	6	>	1	>	2	>	4	>	3	>	5	>	7	>	8	

## Discussion

The eruption patterns of teeth in our as well as other samples are given in Tables 5 to 7. In Table 5 the mean number of teeth erupted at given ages in Gulbarga children is compared with that of only New Zealand children for whom data are available. The first teeth erupted as early as 4 years in children of either sex of our sample unlike in New Zealand children. The mean numbers

Table 5

Number of teeth erupted at specified ages in children of New Zealand and Gulbarga (India)

Age in years.	New Zealand (LESLIE 1951)				India (Present study)			
	Males (1427)		Females (1335)		Males (1366)		Females (1198)	
	Mean	S. D.	Mean	S. D.	Mean	S. D.	Mean	S. D.
4	—	—	—	—	0.3	0.16	0.2	0.08
5	0.27	1.90	0.64	1.52	1.6	2.88	1.7	2.94
6	2.96	2.65	3.78	3.95	2.7	3.05	3.8	3.47
7	7.56	2.93	8.83	2.26	6.4	4.70	7.2	3.47
8	10.52	2.34	11.59	1.55	10.5	4.46	10.6	4.67
9	12.33	2.29	13.86	3.19	13.2	5.52	13.5	3.62
10	14.95	4.14	17.52	4.61	16.4	6.15	16.8	5.83
11	19.26	5.04	22.14	4.85	18.4	5.56	22.8	5.26
12	23.03	4.75	25.16	3.57	23.1	4.93	25.6	4.12
13	25.76	2.98	26.78	1.93	26.0	3.48	27.4	1.82

of teeth present at specified ages are more or less the same in both samples, although children of certain ages of either sex and population tend to show higher means than their counterparts with the exception of 5 years group

Table 6

Comparison of eruption ages (in years) by economic status

Teeth	Jaw	America (HELLMAN 1923)				Whites	
		Males		Females		Males	
		Wealthy	Poor	Wealthy	Poor	Wealthy	Poor
I1	U	7.41	7.45	6.80	7.37	7.12	7.40
	L	6.48	6.77	6.05	6.48	6.23	6.37
I2	U	8.76	8.99	8.21	8.62	8.10	8.51
	L	7.68	7.90	7.15	7.65	7.34	7.54
C	U	12.02	12.16	11.15	11.13	11.12	11.45
	L	11.04	11.17	9.98	9.80	10.46	10.61
PM1	U	10.91	10.37	10.52	9.91	10.67	10.63
	L	11.26	11.33	10.54	10.70	10.57	10.79
PM2	U	12.06	11.25	11.47	10.69	11.30	11.17
	L	12.03	12.07	11.57	11.29	11.53	11.47
M1	U	6.77	6.50	6.14	6.47	6.24	6.47
	L	6.89	6.35	6.39	6.23	6.35	6.36
M2	U	12.84	12.69	12.48	12.31	12.52	12.45
	L	12.52	12.07	12.09	11.65	11.98	12.05

which shows a markedly higher mean in both sexes of our samples than the New Zealanders. However majority of the teeth have erupted in children of either sample by 13 years age.

Table 6 provides eruption ages of different teeth by economic status in the children of Gulbarga in relation to those of America and Whites and Blacks. All the front teeth in either jaw show earlier eruption ages in wealthy children of all the populations including ours excepting the upper central incisors of Blacks, upper lateral incisors of Whites, and canines of either jaw of Americans which erupt slightly earlier in poor. The eruption pattern of the posterior teeth is inconsistent. The upper first and second premolars erupt earlier in the poor children of our sample as in Americans and Whites, while the lower first premolar erupts earlier in the wealthy individuals as in American and White males. The lower second premolars show earlier times in poor children as in Whites, and poor American and Black females. The upper first and second molars erupt earlier in wealthy children of our sample as in Whites, and American and Black males while lower ones erupt earlier in the poor as in Americans and Blacks of either sex.

Table 7 gives the comparison of eruption ages of teeth in different populations with those of our sample. A careful examination of the data reveals that in none of the populations including ours the sequence of eruption of teeth is common to both sexes excepting the New Zealand children. The comparison of the sequences indicates certain variations between our sample and others. As in majority of the populations studied earlier, in either sex of our sample too the lower first molars are the earliest to erupt followed by the upper ones the exceptions being the Kulis, British, Americans, New Zealand children and Chinese girls. In the case of central incisors, our sample shows precedence

in American, white, black and Gulbarga children

GARN et al. 1973		Blacks GARN et al. 1973				India, Present study	
Females		Males		Females		Males	Females
Wealthy	Poor	Wealthy	Poor	Wealthy	Poor	Wealthy	Poor
6.77	7.02	6.79	6.96	6.77	6.75	6.13	6.50
5.92	6.29	5.56	6.11	5.66	5.87	6.13	6.63
7.99	7.95	7.74	7.97	7.26	7.64	7.13	8.38
7.05	7.15	6.82	6.98	6.82	6.55	6.13	6.50
10.49	10.78	10.42	10.97	10.28	10.66	10.50	11.50
9.69	9.84	10.21	10.38	9.01	9.81	9.88	10.25
10.23	10.18	10.20	10.45	10.05	10.06	10.25	10.00
10.15	10.15	10.43	10.40	9.41	10.09	9.75	10.38
10.83	10.87	10.82	11.22	10.69	10.73	10.63	10.25
11.07	10.96	10.73	11.18	10.93	10.75	11.13	11.00
6.30	6.35	6.12	6.25	6.61	5.95	6.00	6.63
6.13	6.15	5.89	6.10	6.57	5.67	6.75	6.50
12.01	12.01	12.59	12.32	11.71	11.61	11.50	12.00
11.49	11.50	12.38	11.96	11.25	11.21	11.38	10.75

of the upper ones over the lower unlike in many populations excepting the above population groups and a few others such as the girls of America, Gambia and Bantu. The lower lateral incisors precede the upper ones as in all populations excepting the U.P. Gurungs, Kuluis, and the girls of South India, China, Gambia and Bantu. In the males of Gulbarga the upper first premolar precedes the canine as in their counterparts of Lahore, Chandigarh, Britain, America, Gambia and girls of China. In the females of our series, both the lower canine and first premolar erupt at the same age as the male upper first premolar unlike in all the other series. In the boys of our study, the lower first premolar precedes the upper second premolar as in their counterparts of U.P. Gurung, America, Britain and Gambia and unlike in all other populations. In females on the other hand, the upper first premolars precede the lower second molars unlike in children of all other samples. In the eruption of the upper canine preceding the lower second premolars the males of our sample agree with those of U.P. Gurung, and Gambia unlike in most other populations. In the boys of our study the lower second molars precede the upper ones as in majority of the populations, whereas in girls the upper second molars, although have precedence over the lower third molars as is expected, they erupt at the same time as the upper and lower second premolars. This trend is comparable to that found only in Chandigarh girls. On the whole the order of eruption of teeth in either jaw and sex is nearly similar to that noticed in all other populations studied earlier.

Considering the eruption status of the different teeth of our series in relation to those from other parts of India and abroad, we find that the eruption ages of Gulbarga children are compatible with those of Bantus for female maxillary central incisors, male maxillary lateral incisors, mandibular canines,

Table 7

Comparison of eruption ages (in years) of teeth

Teeth Studies:	1	2	3	4	5	6	7
Males							
Upper jaw.							
I1	7.01	7.27	7.33	7.49	7.26	7.36	6.90
I2	8.18	8.39	8.42	8.62	8.32	8.60	8.10
C	11.46	11.33	11.50	11.80	11.40	11.03	10.70
PM1	10.41	10.34	10.33	10.42	10.01	9.83	10.00
PM2	11.52	11.02	11.08	11.18	11.74	10.67	10.90
M1	6.11	6.22	6.33	6.64	6.47	6.27	5.40
M2	11.97	11.90	12.16	12.70	12.47	12.12	11.30
M3	—	—	—	—	—	—	—
Lower jaw.							
I1	6.08	6.50	6.25	6.50	6.38	6.51	5.80
I2	7.30	7.66	7.58	7.64	7.42	7.37	6.90
C	10.51	10.42	10.66	10.70	10.78	10.38	10.30
PM1	11.35	10.80	10.58	10.75	11.34	10.04	10.20
PM2	12.32	11.88	11.33	11.45	12.18	11.02	11.00
PM1	6.14	6.12	6.16	6.44	6.46	6.04	5.40
M2	11.41	11.64	11.66	12.20	11.89	11.33	11.20
M3	—	—	—	—	—	—	—
Females							
Upper jaw.							
I1	6.62	6.94	7.08	7.20	6.83	7.23	6.50
I2	7.82	8.04	8.00	8.15	7.86	8.19	7.70
C	10.67	10.72	11.08	11.05	10.82	10.26	10.20
PM1	9.79	10.04	9.92	10.00	10.52	9.47	9.60
PM2	11.06	10.91	10.92	10.82	11.24	10.48	10.30
M1	5.94	6.12	6.16	6.54	6.38	6.29	5.30
M2	11.49	11.68	12.08	12.40	12.20	11.80	10.80
M3	—	—	—	—	—	—	—
Lower jaw.							
I1	5.77	6.17	6.08	6.19	6.19	6.28	5.80
I2	7.01	7.35	7.25	7.31	7.16	7.13	6.40
C	9.41	9.60	9.66	9.85	9.74	9.51	9.50
PM1	10.53	10.26	10.08	10.20	10.54	9.55	9.60
PM2	11.63	11.25	11.08	11.00	11.73	10.44	10.70
M1	5.84	5.97	6.00	6.12	6.30	5.85	5.10
M2	11.18	11.35	11.42	11.90	11.36	10.95	10.50
M3	—	—	—	—	—	—	—

1: British, CLEMENTS et al. 1953; 2: British, MILLER et al. 1965; 3: American, CATTELL 1928; 4: American, KLEIN et al. 1938; 5: New Zealand, LESLIE 1951; 6: Chinese, LAU 1971; 7: Bantu, MCKAY—MARTIN 1952; 8: Gambia, BILLEWICZ—MCGREGOR 1975; 9: South India,

and first premolars of either jaw; those of U.P. Magars for male maxillary lateral incisors; those of Chandigarh for male maxillary lateral incisors, and male mandibular second premolars; those of Britain for female maxillary lateral incisors, and male maxillary second premolars; those of Americans

of Gulbarga children with other series\*

8	INDIA						K (P. S.)
	9	10	11	12	13	14	
7.38	7.34	6.87	7.36	7.30	7.08	7.10	6.38
8.59	8.34	8.56	8.12	7.57	8.13	8.60	8.13
11.33	11.13	11.02	11.78	11.54	10.97	11.90	11.25
10.37	10.59	10.44	10.48	10.30	10.47	6.20	10.00
11.25	10.52	11.11	11.18	11.45	11.48	12.70	11.00
5.99	6.63	6.06	6.42	6.30	6.41	3.40	5.75
11.93	12.37	11.91	12.84	12.66	12.02	12.90	12.13
—	—	—	—	—	—	—	20.13
6.22	7.13	6.79	6.72	6.57	6.61	6.30	7.00
7.47	7.86	8.11	7.72	7.00	7.59	7.20	7.13
10.58	11.22	10.45	10.72	10.30	10.71	11.90	10.38
10.73	10.88	10.48	10.67	10.78	10.97	5.20	10.63
11.39	11.76	13.18	11.60	11.90	11.75	12.20	11.75
5.71	6.59	5.92	6.00	5.90	6.17	5.20	5.50
11.62	12.08	11.34	12.66	12.30	11.18	12.60	12.00
—	—	—	—	—	—	—	19.00
7.11	7.27	—	—	—	6.92	6.70	6.50
8.10	7.51	—	—	—	8.13	7.20	8.00
10.53	10.87	—	—	—	10.47	11.40	10.88
9.79	10.55	—	—	—	10.23	5.90	10.13
10.59	11.47	—	—	—	11.22	10.80	11.00
5.78	6.91	—	—	—	6.03	5.30	5.75
11.18	11.86	—	—	—	11.22	11.80	11.00
—	—	—	—	—	—	—	22.00
6.08	7.23	—	—	—	6.46	6.40	6.75
7.07	7.54	—	—	—	7.59	7.80	6.88
9.70	10.52	—	—	—	9.77	10.20	10.00
9.95	10.07	—	—	—	10.47	5.40	10.00
10.66	11.42	—	—	—	11.22	10.90	11.00
5.48	6.81	—	—	—	5.82	5.10	5.50
10.93	11.59	—	—	—	10.72	11.90	10.63
—	—	—	—	—	—	—	20.38

SHOURIE 1946; 10: Lahore, SHOURIE 1946; 11: U.P. Magar, AWASTHI—KHARE 1978; 12: U.P. Gurung, AWASTHI—KHARE 1978; 13: Chandigarh, KAUL et al. 1975; 14: Kuluis, BHASIN et al. 1977; K (P.S.): Karnataka, *Present study*.

for female maxillary lateral incisors and mandibular second premolars; those of Chinese for male mandibular canines, and second molars; those of south Indians for female maxillary canines; those of U.P. Gurung for male mandibular first premolars; and those of Gambia for female first molars of either jaw.

Among the remaining teeth, it is only the maxillary central incisors of either sex of our sample that are found ahead of all the populations excepting the Bantu females. In the case of all other male maxillary teeth and mandibular lateral incisors, canines and first molars the eruption ages of Gulbarga children are earlier than those of most of the foreign and some Indian populations such as U.P. Magars with respect to either jaw and children of South India, Lahore and Chandigarh with respect to mandible only. The eruption ages of the mandibular teeth for the boys of our study are somewhat retarded as compared to those of other populations. In the females, barring the mandibular central incisors, canines of either jaw and maxillary first and second premolars, all the other teeth of either jaw of Gulbarga children show earlier eruption ages than those of majority of the Indian and foreign populations.

#### REFERENCES

- AINSWORTH, N. J. (1925): Dental diseases in children. — Med. Res. Council, Great Britain, Special Report Series, No. 97.
- AWASTHI, S. C.—KHARE, B. P. (1978): Sequence and age of eruption of permanent dentition among Gurkhas of Dehradun (U.P.). — Presented at the Fourth Ann. Conf. of Ethnographic and Folk-Culture Society, U.P. held at Ahmedabad.
- BARRETT, M. J. (1957): Dental observations of Australian aborigines: tooth eruption sequence. — Austral. Dent. J. 2; 217—227.
- BARRETT, M. J.—BROWN, T.—CELLIER, K. M. (1964): Tooth eruption sequence in a tribe of central Australian aborigines. — Am. J. Phys. Anthropol. 22; 79—90.
- BHASIN, M. K.—SHARMA, A. K.—SINGH, I. P. (1977): Permanent dental emergence in the Kuluis of Himachal Pradesh. — The Anthropologist, 21; 9—14.
- BILLEWICZ, W. Z.—MCGREGOR, I. A. (1975): Eruption of permanent teeth in West African (Gambian) children in relation to age, sex and physique. — Ann. Hum. Biol. 2; 117—128.
- CATTELL, P. (1928): *Dentition as a measure of maturity*. — Harvard Monographs in Education, No. 9, Boston.
- CLEMENTS, E. M. B.—DAVIES-THOMAS, E.—PICKET, K. G. (1953): Order of eruption of the permanent human dentition. — Brit. M. J. 1; 1425—1427.
- COHEN, J. T. (1928): The dates of eruption of the permanent teeth in a group of Minneapolis children: A Preliminary Report. — J. Am. Dent. Ass. 15; 2337—2341.
- DAHLBERG, A. A.—MENEGAZ-BOCK, R. M. (1958): Emergence of the permanent teeth in Pima Indian children: A critical analysis of method and an estimate of population parameter. — J. Dent. Res. 37; 1123—1140.
- FULTON, J. T.—PRICE, B. (1954): Longitudinal data and attack of the permanent teeth. — J. Dent. Res. 33; 65—79.
- GARN, S.—NAGY, J. M.—SANDUSKY, S. T.—TROWBRIDGE, F. (1923): Economic impact on tooth emergence. — Am. J. Phys. Anthropol. 39; 233—238.
- HELLMAN, M. (1923): Nutrition, growth and dentition. — Dent. Cosm. 65; 34—49.
- (1943): The phase of development concerned with erupting the permanent teeth. — Am. J. Orthodont. and Oral Surg. 29; 507—526.
- JAMES, W. W.—PITT, A. T. (1912): Some notes on the date of eruption in 4,850 children aged 12. — Proc. R. Soc. Med. 5; Sect. Odont. 80.
- KAUL, S.—SAINI, S.—SEXENA, B. (1975): Emergence of permanent teeth in school children in Chandigarh, India. — Archs. Oral Biol. 20; 587—593.
- KLEIN, H.—PALMER, C. E.—KRAMER, M. (1938): Studies in dental caries: II. The use of the normal curve for expressing the age distribution of eruption of the permanent teeth. — Growth. 1; 385.
- LAU, W. H. (1971): The eruption time of the permanent teeth in Chinese. — J. Formosan Med. Assoc. 70; 159—165.
- LESLIE, G. H. (1951): *A biometrical study of the eruption of the permanent dentition of New Zealand Children*. — Wellington, New Zealand, Govt. Printer.
- MCKAY, D. H.—MARTIN, W. J. (1952): Dentition and physique in Bantu children. — J. Trop. Med. & Hyg. 55; 265—275.

- MILLER, J.—HOBSON, P.—GASKELL, T. J. (1965): A serial study of the chronology of exfoliation of deciduous teeth and permanent teeth. — *Archs. Oral Biol.* 10; 805—818.
- RAMI REDDY, V. (1981): Eruption of deciduous teeth among the children of Gulbarga, South India. — *Ind. J. Med. Res.* 73; 772—781.
- SHOURIE, K. L. (1946): Eruption age of teeth in India. — *Ind. J. Med. Res.* 34; 105—118.
- STEGGARDA, M.—HILL, T. J. (1942): Eruption time of teeth among Whites, Negroes and Indians. — *Am. J. Orthodont.* 28; 361—370.
- STONES, H. H.—LAWTON, F. E.—BRANSBY, E. R.—HARTLEY, H. O. (1951): Time of eruption of permanent teeth and time of shedding of deciduous teeth. — *Brit. D. J.* 90; 1—7.
- SUK, V. (1919): Eruption and decay of permanent teeth in Whites and Negroes. — *Am. J. Phys. Anthropol.* 2; 351.

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