

Occlusion of primary dentition in preschool children of Chennai and Hyderabad: A comparative study

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Abstract

Objective: To provide information on the state of occlusion and the spaces available after complete eruption of the primary dentition and to compare the characteristic features of the primary dentition in Chennai and Hyderabad, two of the metropolitan cities in South India. **Materials and Methods:** Children in the age range between 3 and 5 years were selected from different schools of both Chennai and Hyderabad, with a complete set of primary dentition. Study casts were obtained and assessment of spacing in the primary dentition and the primary molar relationship were recorded in centric occlusion. The data obtained was subjected to statistical analysis. **Results:** The mean values and standard deviations for the primary molar relationship and spacing in primary dentition are given in the tables. **Conclusion:** Bilateral flush terminal plane relationship of the second primary molars and spaced dentition was most frequent in primary dentition of the children in both Chennai and Hyderabad groups. Significant differences were not found among both groups and genders.

Keywords: Primary molar relation, spacing, terminal plane

Introduction

Childhood is the mirror that reflects the propensity of adulthood. An ideal primary dentition likewise is an indicator of potentially perfect permanent dentition. Functions of the primary dentition include maintenance of the occlusion and space for the permanent dentition in addition to mastication.^[1]

The primary dentition is complete with the eruption of the second primary molars, which means that the location for eruption of the permanent teeth in the future has already been determined at this stage.^[2] The dental arch circumference that connects the most distal surfaces of the right and left second primary molars should be preserved for the permanent dentition after the exchange of primary teeth. The relation between the distal surfaces of the maxillary and mandibular second primary molars is, therefore, one

of the most important factors that influence the future occlusion of the permanent dentition. The mesial–distal relation between the distal surface of the upper and lower second primary molars is termed as terminal plane when the primary teeth contact in centric occlusion. The terminal plane was classified by Baume in 1950 into three types, viz. *Flush terminal plane*: When the distal surfaces of the upper and lower second primary molars were in the same vertical plane in centric occlusion; *Distal step*: When the distal surface of the lower second primary molar is more distal to that of the upper in centric occlusion; and *Mesial step*: When the distal surface of the lower second primary molar is more mesial to that of the upper in centric occlusion.^[2] This terminal plane relationship is used to forecast the future interocclusal relation of the erupting first permanent molars. While functionally insignificant at this time, this relationship can greatly influence the position of the first permanent molars later, as the eruption path of the first permanent molars is guided by the distal surface of the distal root and tooth crown of the second primary molar.

It is not unusual to find physiological spaces in the primary dentition. The prevalence of spaced dentitions varies among different ethnic groups, ranging from 42% to 98%.^[3] Spacing often presents between all primary anterior teeth, the most marked spaces present being mesial to canines in the maxilla and distal to canines in the mandible. These are termed primate or anthropoid spaces.^[4,5] Another form of space in the primary dentition is the secondary or developmental spaces, which are usually found between the incisors. Such dental spaces are termed “physiological spaces.” These spaces are significant later for the alignment of erupting permanent teeth and establishment of occlusion. Absence of these spaces in the primary dentition (non-spaced dentition) is an expression of disproportion between jaw/tooth size.

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This study was carried out in order to provide information on the state of the occlusion and the spaces available at the time of completion of the eruption of the primary dentition in Chennai and Hyderabad (South India).

Aims and objectives

The present study was carried out on children from Chennai and Hyderabad, two of the metropolitan cities in South India that have different communities and cultures to compare the characteristic features of their primary dentition.

To appraise the presence or absence of spaces existing in the upper and lower arches of both groups, and To assess the primary molar relationship in centric occlusion for both the groups.

Materials and Methods

This study was planned in the Department of Pedodontics and Preventive Dentistry, Meenakshi Ammal Dental College, Chennai, to compare the occlusal characteristics of primary dentition of school children from two cities, Chennai and Hyderabad. This study sample consisted of 890 children in the age range between 3 and 5 years from different schools. Eleven schools in Chennai and seven schools in Hyderabad had participated in this study. Age proof of each child was obtained from the school records and also from parents. Informed consent was taken from the parents and school authorities and was approved by the Institutional Ethical Committee of Meenakshi Ammal Dental College.

The inclusion criteria were:

- Children with complete set of primary dentition.
- Age of the child being between 3 and 5 years.
- Exclusion criteria were:
- Children with missing teeth (due to any reason).
- Children with extensive caries/proximal caries.
- Permanent first molars erupted.
- Children with dental deformities like fusion, germination, hypodontia/oligodontia and hypoplasia.

Children who fulfilled the inclusion criteria were identified during the initial examination and recorded. During the second visit, maxillary and mandibular impressions were made by the principal examiner with alginate in the hall/room provided by the school authorities. These impressions were washed with water, models were poured with dental stone plaster immediately and study casts were prepared [Figures 1-4].

The primary molar relationship and whether the dentition is spaced or non-spaced were recorded in centric occlusion, in a proforma [Figures 5-8].

The data recorded was subjected to statistical analysis comparing group-wise and gender-wise distribution of various occlusal characteristics using the chi-square (X^2) test.

$$\sum \frac{(O - E)^2}{E}$$

Where O = observed frequency

Row total X Column total

E = expected frequency = $\frac{\text{Row total} \times \text{Column total}}{\text{Grand total}}$

Grand total

If $X^2 > 3.84$, then $P < 0.05$, which is significant.

Results

Distribution of total sample based on gender for both the groups is given in Table 1. The mean values and standard deviation for all the parameters and the respective P -values for group I, group II and boys and girls of both the groups are given in Table 2.

In group I (Chennai group), the mean values of the bilateral flush terminal plane (75.1%), bilateral distal step, unilateral 1and2 and unilateral 1and3 are significantly higher in boys than in girls. However, the mean value for the bilateral mesial step primary molar relationship in group 1 is significantly higher in girls than in boys [Table 3].

Mean values of spaced dentition in group 1 (Chennai group) are common in girls (76.9%) than in boys (71.5%), whereas non-spaced dentition is significantly higher in boys (28.5%) than in girls (23.1%) [Table 3].

In group 2 (Hyderabad group), the mean values of bilateral flush terminal plane were significantly higher in girls (77.7%) than in boys (69.2%). Similarly, the unilateral relationship of 1and3 was higher in boys (1.8%) than in girls (1.1%). But, the mean values of bilateral mesial step, bilateral distal step and unilateral 1and2 were higher in boys than in girls [Table 4].

In group 2, the mean values of spaced dentition was higher in girls (75.9%) than in boys (73%), whereas the mean values of non-spaced dentition were higher in boys (27%) than in girls (24.1%).

When comparing the mean values of different primary molar relationships, spaced dentition and non-spaced dentition, between groups 1 and 2, the mean values of bilateral flush terminal plane were significantly higher in group 1 (Chennai group, 74%) than in group 2 (Hyderabad group, 72.5%). Similarly, the mean values of unilateral 1and2 were higher in group 1 (9%) than in group 2 (7%), whereas the mean values of

Table 1: Sex-wise distribution of sample in group I

Group-I Chennai group	Males	Females	Total
	277	173	450

Table 2: Sex-wise distribution of sample in group II

Group-II Hyderabad group	Males	Females	Total
	270	170	440



Figure 1: Armamentarium



Figure 2: Impression trays



Figure 3: Study casts Chennai



Figure 4: Study casts Hyderabad



Figure 5: Flush terminal plane



Figure 6: Mesial step

bilateral mesial step and bilateral distal step were higher in group 2 than in group 1 (BMS 14.1%, BDS 4.5% vs. BMS 12.4%, BDS 3.3%); unilateral 1and3 and 2and3 were statistically not significant. When the spaced and non-spaced dentition between the two groups were compared, the mean values of spaced dentition were higher in group 2 (74.1%) than in group 1 (73.6%), whereas non-spaced dentition were higher in group 1 (26.4%) than in group 2 (25.9%) [Table 5].

When the characteristics of boys between group 1 and group 2 are compared, the mean values of bilateral flush terminal plane, unilateral 1and2, 1and3 and non-spaced dentition are higher in boys of group 1. However, the mean values of bilateral mesial step, bilateral distal step and spaced dentition are higher in boys of group 2 [Table 6].

When the characteristics of girls are compared, the mean

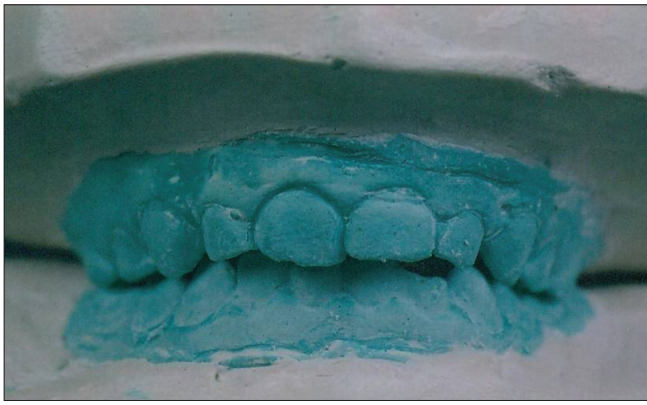


Figure 7: Non-spaced dentition



Figure 8: Spaced dentition

Table 3: Distribution of different characteristics for total, male and female for Chennai group

Characteristics	Total (n = 450)		Male (n = 277)		Female (n = 173)		Male vs. female P-value*
	No.	%	No.	%	No.	%	
Primary molar relationship							
Bilateral flush terminal plane	333	74	208	75.1	125	72.3	0.75 (NS)
Bilateral mesial step	56	12.5	30	10.8	26	15.0	
Bilateral distal step	15	3.3	9	3.2	6	3.5	
Unilateral 1 and 2	40	8.9	26	9.4	14	8.0	
Unilateral 1 and 3	6	1.3	4	1.5	2	1.2	
Unilateral 2 and 3	0	0	0	0	0	0	
Spaced dentition							
Yes	331	73.5	198	71.5	133	76.9	0.25 (NS)
No	119	26.4	79	28.5	40	23.1	

*Chi-square test was used to calculate the P-value

Table 4: Distribution of different characteristics for total, male and female for Hyderabad group

Characteristics	Total (n = 440)		Male (n = 270)		Female (n = 170)		Male vs. female P-value*
	No.	%	No.	%	No.	%	
Primary molar relationship							
Bilateral flush terminal plane	319	72.5	187	69.2	132	77.7	0.25 (NS)
Bilateral mesial step	62	14	41	15.1	21	12.3	
Bilateral distal step	20	4.5	13	4.8	7	4.1	
Unilateral 1 and 2	31	7	24	8.8	7	4.1	
Unilateral 1 and 3	6	1.3	3	1.1	3	1.8	
Unilateral 2 and 3	2	0.4	2	1	0	0	
Spaced dentition							
Yes	326	74	197	73	129	75.9	0.57 (NS)
No	114	25.9	73	27	41	24.1	

*Chi-square test was used to calculate the P-value

values of bilateral flush terminal plane, bilateral mesial step, unilateral 1and2 and spaced dentition are significantly higher in group 1 than in group 2, whereas the mean values of bilateral distal step, unilateral 1and3 and non-spaced dentition are higher in group 2 than in group 1 [Table 7].

Discussion

Ideal occlusion is not easy to learn, as it is not static. It is

changing all the time as the individual grows and develops. Dr. North Croft was the first to use the term “ideal” in connection with occlusion. The nomenclature committee of the American Association of Orthodontics recently defined “ideal occlusion” as “basically a myth; it is a figment of the imagination.” Ideal occlusion does occur in nature, but in decreasing numbers as the final stage of development is reached, and it is the most important form of occlusion to be known. The developmental changes in occlusal relationships

Table 5: Comparison of different characteristics for between Chennai and Hyderabad for total sample

Characteristics	Chennai (n = 450)		Hyderabad (n = 440)		Chennai vs. Hyderabad P-value*
	No.	%	No.	%	
Primary molar relationship					
Bilateral flush terminal plane	333	74	319	72.5	
Bilateral mesial step	56	12.4	62	14.1	
Bilateral distal step	15	3.3	20	4.5	0.50 (NS)
Unilateral 1 and 2	40	9	31	7.0	
Unilateral 1 and 3	6	1.3	6	1.4	
Unilateral 2 and 3	0	0	2	0.5	
Spaced dentition					
Yes	331	73.6	326	74.1	0.92 (NS)
No	119	26.4	114	25.9	

Chi-square test was used to calculate the P-value

Table 6: Comparison of different characteristics for between Chennai and Hyderabad for males

Characteristics	Chennai (n = 277)		Hyderabad (n = 270)		Chennai vs. Hyderabad P-value*
	No.	%	No.	%	
Primary molar relationship					
Bilateral flush terminal plane	208	75.1	187	69.2	
Bilateral mesial step	30	10.8	41	15.1	
Bilateral distal step	9	3.2	13	4.8	0.34 (NS)
Unilateral 1 and 2	26	9.4	24	8.8	
Unilateral 1 and 3	4	1.5	3	1.1	
Unilateral 2 and 3	0	0	2	1	
Spaced dentition					
Yes	198	71.6	197	73	0.83 (NS)
No	69	28.5	73	27	

Chi-square test was used to calculate the P-value

Table 7: Comparison of different characteristics for between Chennai and Hyderabad for females

Characteristics	Chennai (n = 173)		Hyderabad (n = 170)		Chennai vs. Hyderabad P-value*
	No.	%	No.	%	
Primary molar relationship					
Bilateral flush terminal plane	125	72.3	132	77.7	
Bilateral mesial step	26	15.0	21	12.3	
Bilateral distal step	6	3.5	7	4.1	0.51 (NS)
Unilateral 1 and 2	14	8	7	4.1	
Unilateral 1 and 3	2	1.2	3	1.8	
Unilateral 2 and 3	0	0	0	0	
Spaced dentition					
Yes	133	76.9	129	75.9	0.93 (NS)
No	40	23.1	41	24.1	

Chi-square test was used to calculate the P-value

are of considerable clinical interest throughout the periods of primary and mixed dentition; an understanding of them is essential for proper diagnosis and treatment of the developing dentition.

However, to appreciate the growth phenomena, it is useful to observe the interarch relationships from infancy onwards. Several authors have studied gumpad relationships in infancy.^[6] Soft tissue landmarks such as the lateral sulci were

identified, which permitted anteroposterior orientation of dental casts. Various relationships have been described. Clinch found that 70% of 400 newborn children exhibited a gumpad relationship that placed the mandibular lateral sulcus slightly anterior to the maxillary lateral sulcus. Silimann indicated that the lateral sulcus was located in the same position as the distal surface of the primary canine. Hence, the interarch relationship reported by Clinch was comparable to the normal occlusion of the succeeding primary dentition.

Humphreys and Leighton found that in the primary dentition, 73% of 2711 children had a normal occlusion as measured by the relationship of the primary canines.^[6]

The primary dentition is completely established by the age of 3 years, and ends with the eruption of the first permanent tooth. From 3 to 4 years of age, dental arches are relatively stable and changes very slightly. From 5 to 6 years of age, the size of the dental arch begins to change due to the eruptive force of the first permanent molar. During this period, one must observe changes in the primary dentition carefully because these changes are indicative of what may be the prototype of the future permanent dentition.^[2]

The occlusal characteristics of the primary dentition vary among populations. Most studies relating to the spacing and occlusion of the primary dentition have been carried out in different geographic zones. There is very minimal literature available about the primary dentition and the prevalence of malocclusion of Indian children. This study aimed to examine the occlusal characteristics of primary dentition and differences in two groups of the children of south India. This present study was carried out in 890 children between the age group of 3 to 5½ years from different schools in Chennai and Hyderabad.

The results of the present study showed that the majority of the children in the sample (74% in Chennai group and 72.5% in Hyderabad group) had a bilateral flush terminal plane relationship followed by bilateral mesial step (12.4% in Chennai group and 14.1% in Hyderabad group) and bilateral distal step (3.3% in Chennai group and 4.5% in Hyderabad group). There were no significant differences between males and females in both groups as well as within the group. The findings of the study correlated with the following studies: Baume (1950) found that 76% of 3-year-old children had flush terminal plane relationship, 14% had mesial step and only 10% displayed distal step molar relationship. Farsi and Salama^[7] examined 520, 3–5-year-old Saudi children and found that 80% of the children had flush terminal plane relationship, 12% had mesial step and 8% had distal step. Otuyemi^[8] *et al.* reported that the majority of Nigerian children had a flush terminal molar relationship. Kerosno compared occlusion in the primary dentition in a group of Tanzanian (Black Africans, Asian and Arab) and Finnish children. He reported that flush terminal relationship was more common in the African/Asian groups (97% and 94%) compared with the Finnish group (84%). The following two studies correlated with the present study in flush terminal plane relationship but were contrary in mesial step relationship. Kaufmann^[9] found that 72% had a flush terminal plane relationship, 25% had mesial step and 3% had distal step. However, Nanda^[10] *et al.* reported that 65.5% of the Indian children had a flush terminal plane relationship, 25.5% had mesial step and 9% had distal step. But, these findings were contrary in all aspects to the views of Clinch, who found that 14% of the children examined had a flush terminal plane relationship, 33% had mesial step and

10% had distal step relationship, while 43% had asymmetric molar relationship. Abu Alhaja^[11] reported that 47.7% of the children had mesial step followed by flush terminal plane relationship in 37%, bilateral distal step in 3.7% and 11.6% had asymmetric molar relationship.

In this study, it was found that unilateral flush terminal plane with mesial step was 9% in the Chennai group and 7% in the Hyderabad group, and unilateral flush terminal plane with distal step was 1.3% in the Chennai group and 1.4% in the Hyderabad group. Unilateral mesial step with distal step was 0% (no case found in Chennai group) and 0.5% in Hyderabad group. This study was analyzed according to sex, and the results showed that there were no significant differences between the males and females within the group and between two groups in the molar occlusal relationships.

The findings of the present study indicated that spaced dentition was a common feature of the normal primary dentition in the Chennai and Hyderabad groups of both sexes. Spaced dentition in the Chennai group was 73.6% and was 74.1% in the Hyderabad group. These observations were consistent with the observation of Baume,^[4] who reported that it was common to have spacing (67%) in the primary dentition and that most spacing was located in areas mesial to upper canines and distal to lower canines. Findings of the present study were contrary to those of Treimann and Byoko,^[3] whose studies reported a prevalence of spaced dentition as 42% and 98%, respectively.

Results of the present study showed that non-spaced dentition in the Chennai group was 26.4% and was 25.9% in the Hyderabad group. These findings were contrasting with the study done by Kisling and Krebs.^[12] They reported the prevalence of non-spaced dentition to be 37% in their study. The findings of this study showed that there were no significant differences in distribution of spaced and non-spaced dentition between both groups and between males and females in the two groups and within the group.

The present investigation provides an insight into the patterns of occlusal relationships and of spacing in the primary dentition in Chennai and Hyderabad (South India).

Summary and Conclusions

This study aimed to record various primary dentition parameters in 890, 3–5-year-old school children from two cities, Chennai and Hyderabad. The findings of the present study can be summarized as:

- The bilateral flush terminal plane relationship of the second primary molars was most frequent, i.e. 74% in Chennai and 72.5% in Hyderabad groups. No significant differences for the flush terminal plane were noted between the two groups and between boys and girls.
- Spaced dentition was the most common in primary

dentition of the children in Chennai (73.6%) and Hyderabad (74.1%) groups. There were no significant differences between both groups and between both sexes.

It can be concluded that this study had provided prevalence of occlusal characteristics and spacing in the primary dentition of south Indian children. Future longitudinal studies are needed to follow-up the dental development of children throughout the whole growth period to ascertain changes that may occur during the transitional periods of the dentition.

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