Dental Research Journal

Original Article

Study of occlusal characteristics of primary dentition and the prevalence of maloclusion in 4 to 6 years old children in India

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Received: January 2012
Accepted: September 2012

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ABSTRACT

Background: To assess the prevalence of malocclusion and to determine the different occlusal characteristics in primary dentition of 4 to 6 years old children in India.

Materials and Methods: The target population comprised 4 to 6 years old children attending different nursery, kindergarten and primary schools of Bagalkot city. Stratified cluster random sampling procedure was executed to collect the representative sample. Each subject was assessed for various occlusal characteristics.

Results: Occlusal characteristic found were flush terminal plane (52.5%), class I canine relationship (84%), maxillary developmental spaces (35.4%), primate spaces in maxilla (47.6%), mandibular crowding (4.6%), mandibular midline shift (5.6%), anterior multiple tooth crossbite (1.3%), scissors bite (0.6%), anterior open bite (1%), over bite of 0-2 mm (81.6%) and overjet of 0-2 mm (84.5%). The age wise difference for the occlusal characteristics was statistically significant.

Conclusions: The data revealed that most of the children had malocclusion. This highlights the importance of identifying children who are in need of orthodontic treatment for dental health or aesthetic reasons.

Key Words: Occlusion, malocclusion, prevalence, primary dentition

INTRODUCTION

One of the most difficult tasks faced by a dentist who treats children is, identifying abnormal from normal occlusion in the primary dentition. The goal of every practitioner who provides dental care for children and adolescents should be to properly assess and manage the developing dental occlusion of their patients.[1]

The occlusion of primary dentition and its significant contribution towards the development of the permanent dentition is well proven fact. Different population groups and the ethnic differences present in them are the major determinants in deciding the course of the primary dentition and its influence in the development of permanent dentition.[1-7]

Most of the investigations on the prevalence of occlusal disharmonies have studied children over 6 years of age.[1,8-14] Current preventive procedures emphasize early recognition and treatment of malocclusion. It would be very helpful, therefore to have specific information regarding the disharmonies of the primary dentition. Furthermore, there is paucity of literature regarding the occlusal characteristics of primary dentition from Indian subcontinent, especially from the present study region. Thus, the study was undertaken to assess the prevalence of malocclusion and to determine different occlusal characteristics in primary dentition of 4 to 6 years old children in Bagalkot city, India.

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MATERIALS AND METHODS

The target population comprised 4 to 6 years old children attending different nursery, kindergarten and primary schools in different parts of India. Stratified cluster random sampling procedure was executed to collect the representative sample. Children without complete primary dentition and with premature loss of primary teeth, abnormal oral habits and erupted permanent teeth were excluded. Out of 1,257 children, 257 subjects were excluded as they did not fulfill the selection criteria. Out of 1,000, 583 (58.3%) were male and 417 (41.7%) were female.

Ethical approval was obtained from ethical committee of P.M.N.M dental college and hospital and written informed consent was obtained from parents of each subject.

Examination was performed by a single examiner (Deepak P B). Data collection technique and methodology were standardized with a series of sessions under supervision of the senior operator (Uma B Dixit).

A mouth mirror, a straight probe, graded stainless steel wire and a dental floss were used for intra and extra-oral examinations under natural day light and a portable light was used whenever required for proper illumination. Various occlusal characteristics were recorded for each child in a specially designed data record sheet.

Intra-examiner reliability test was performed by examining a cohort of 25 children at two different time periods of 1 week apart and the Kappa statistic accounted to 83%.

Prevalence rates of different occlusal characteristics assessed were calculated. To compare the proportions of these occlusal characteristics among different age groups, Chi-squared test was executed; a value of $P < 0.05$ was regarded as significant. Statistical analysis was done by using Statistical Package for Social Sciences (SPSS version 15.0).

RESULTS

The overall prevalence and age wise prevalence of various occlusal parameters in primary dentition of the children aged 4 to 6 years is shown in the Table 1. Most prevalent occlusal characteristics in sagittal directions were flush terminal plane with 52.5% and class I canine relationship with 84%.

The developmental spaces and the primate space were more prevalent in maxilla in comparison to mandible by 35.4% and 47.6%, respectively. With respect to the above said finding crowding in maxilla was minimal in comparison to mandible, which was reported to be 4.6%. Small percentage of sample showed crowding, crossbite, scissor bite, and open bite. However, overjet and over bite were prevalent by 81.6% and 84.5%, respectively [Table 1].

The differences in the mesial step and distal step molar relationships in the three age groups were found to be statistically highly significant. Prevalence of class I canine relationship showed increase in 5 and 6 years old children from 4 years old children (86% and 84% when compared to 81%) and this difference was found to be significant. Prevalence of class II

Table 1: Age wise prevalence of occlusal parameters in the primary dentition in children between 4 to 6 years old

Occlusal parameters	Particulars	Prevalence by age %				*P* value
		4 years	5 years	6 years	Total	
Molar relationship	Flush terminal	58.1	49.1	53.1	52.5	*P*<0.001
	Mesial step	26.0	39.8.	42.9	36.9	
	Distal step	12.7	8.2	0.0	8.4	
	Asymmetric	3.2	2.9	4.0	3.2	
Canine relationship	Class I	81.0	85.9	83.7	84.0	*P*<0.01
	Class II	16.8	13.2	12.3	14.2	
	Class III	0.0	0.0	2.0	0.3	
	Asymmetric	2.2	0.9	2.0	1.5	
Developmental spaces	Maxillary	32.7	36.1	38.8	35.4	NS, 0.192
	Mandibular	23.2	27.0	26.5	25.7	
Primate spaces	Maxillary	45.4	50.2	42.9	47.6	*P*<0.01
	Mandibular	10.8	15.4	8.2	12.9	
Crowding	Maxillary	1.3	1.9	2.1	1.7	*P*<0.01
	Mandibular	6.0	2.2	10.2	4.6	
Crossbite	Anterior single	0	0.6	2.1	0.3	NS
	Anterior multiple	1.3	1.1	2.1	1.3	
	Post. Unilateral	0	0.6	0	0.3	NS
	Post. Bilateral	0	0	2.1	0.3	
Scissors bite	Present	0	0.6	2	0.6	*P*<0.05
Open bite	Anterior	0	1.3	2	1.0	NS, 0.07
Overbite	0-2 mm	79.4	82.9	81.6	94.4	*P*<0.001
	2-4 mm	16.2	15.2	16.3	15.7	
	>4 mm	4.4	1.9	2.1	2.7	
Overjet	0-2 mm	81.9	86.2	85.7	82.7	*P*<0.001
	2-4 mm	11.7	10.8	14.3	14.3	
	>4 mm	6.4	2.9	0	3.0	

Age-wise significance: χ^2= 64.9, *P*<0.001, highly significant, NS: Not significant

canine relationship decreased significantly with age (17%, 13%, and 12% for 4, 5, 6 years).

Significance of crowding prevalence increased in mandible then in maxilla as age progressed. On the other hand, presence of primate spaces was significant in mandible as the age progressed.

Anterior single tooth crossbite was found to be significant with increase in age. Whereas prevalence of scissors bite increased with the age and this was statically significant. Overbite in the range of 0-2 mm to 2-4 mm increased with the advancing age and was found to be highly significant. Prevalence of overjet of 2 to 4 mm showed significant increase in 6 years old children from 4 and 5 years old children (14.3% when compared to 11.7% and 10.8%).

DISCUSSION

The primary objective of our study was to evaluate the prevalence rates of different occlusal characteristics of primary dentition so that it would enable us to determine the prevalence of malocclusion in the present sample, as well as differences in these occlusal characteristics in different age groups in 4 to 6 years old school children in Bagalkot city.

The present study showed that the majority of the children in the sample had a flush terminal molar relationship (52.5%), followed by mesial step (36%) and distal step (8.4%). The literature survey shows that the results on deciduous molar relationship are not unison. In a study by Yilmaz *et al.,* on Turkish children, the percentage of children having flush terminal plane remained high for all the age groups between 3 to 6 years.[5] But, in the study of Aderson AA, mesial step relationship was predominant in both the African American and European children.[7] However, increased percentage of distal step (33.1%) is been reported in the study of Keski-Nisula *et al.,* on Finland children.[15] Our findings, although based on a cross-sectional study, showed significant reduction in the prevalence of flush terminal molar relationship and increase in the mesial step molar relationship with advancing age. Similar changes in the molar relationships with increasing age have been found in the previous studies on different population.[2,5] Such changes may be attributed to forward growth of the mandible and erupting first permanent molars.

We also found that prevalence of distal step molar relationship decreased significantly with advancing age and same was supported by other studies[2,5] with the increase in age the initial second deciduous molar relationship can be the best predictor for the identification of the permanent molar relationship.[2] However, few studies have reported no change in molar relationship patterns in the deciduous arches throughout the period of deciduous dentition.[6] High prevalence of flush terminal and mesial step relationships in our study predictably may result in high prevalence of class I molar relationship.

Class I canine relationship (84%) was highly prevalent in the present study group and the results were in agreement with the similar studies in the literature.[2,5] Contrasting results can be appreciated in the study of Keski-Nisula *et al.,* where the prevalence of class II canine relationship was more prevalent then the class I.[15] There was increase in prevalence of class I canine relationships and reduction in the class II canine relationships with advancing age. Such changes in the canine relationships with increasing age have also been reported by Hegde *et al*.[2] These changes may be attributed to the forward growth of the mandible and erupting force of first permanent molars.

The prevalence of developmental spaces in maxilla was high in comparison mandible, which is similar to the findings of Ferreira *et al.*[16] No significant change was found in developmental spaces with increasing age in the present study. However, Onyeaso and Isiekwe, found that developmental spaces varied with age and the reason citied behind this finding was the utilization of the generalized spacing in the primary dentition by the eruption of permanent incisors during the early mixed dentition stage.[6] Developmental spaces in most of the children were found anteriorly between incisors. It can be suggested that the mesial force of erupting mandibular molar did not cause significant arch-length loss in the anterior region.

Quiet a number of studies in the literature show higher prevalence of primate spaces in the maxilla than that of the mandible[4,6] and our findings on primate space was in similar line. Age wise prevalence of primate spaces indicated decrease in primate space (8.2%) in mandibular arch at 6 years of age, but maxillary primate spaces did not reveal any significant changes with age. Decrease in both maxillary and mandibular primate spaces with increasing age has been reported by Ferreira *et al*.[3]

Nevertheless, in a study by Hedge *et al.,* on the Indian children of age 3 to 5 years, reported a higher

prevalence of both primate and the developmental space in both maxillary and mandibular arches, which was quite high when compared to the findings of our study.[2] This major difference might be due to the difference in the ethnicity of the children being examined.

Low prevalence of crowding was seen in both maxillary and mandibular primary dental arches, but there was significant increase in the prevalence of crowding in the mandibular arch with advancing age. This warrants the increase in the need of early check-up and treatment. Previous studies have shown more crowding in the mandibular arch than in the maxillary arch in children between ages 3 to 6 years.[2,13,15-17] Similar to over finding. Ferreira *et al.,* reported no change in the degree of crowding in both the maxillary and mandibular arches with increasing age. However, logistic regression model in their study suggested that the crowding prevalence in mandible was significantly different between Japanese, Brazilian and Caucasians.[16] This emphasizes the importance of ethnicity in deciding occlusal trait development. Onyeaso and Isiekwe[6] have shown a positive correlation for the crowding in between the primary dentition and the early mixed dentition and owing to this fact, It can be impressed that low incidence of crowding can be anticipated in the permanent dentition stage in the present population. Interestingly, it was reported in the previous study that the prevalence of crowding was less in high fluoride area children then the low fluoride area children and the difference was significant.[18]

Anterior crossbite, posterior crossbite and scissors bite are surly are rare malocclusion traits (1.9%, 0.6% and 0.6%, respectively) in our study group. However, higher prevalence of anterior and posterior crossbite was reported in the earlier literature.[6,8,15] KIrzIoğlu *et al.*, in their study of occlusal traits in low and high fluoride area have shown that the high fluoride area children showed increased prevalence of crossbite.[18] This shows the influence of fluoride on the occurrence of occlusal traits. The traits related to transverse dimension need early attention and treatment, otherwise the severity of malocclusion may increase. The study revealed that the prevalence of anterior single tooth crossbite and scissors bite increased significantly from 0.6% at 5 years to 2.1% at 6 years. This may be related to lingually erupting mandibular permanent dentition putting pressure on the labially or buccally placed mandibular primary dentition. Age wise difference in scissors bite in primary dental arches has not been reported in the literature.

Even anterior open bite was scant in present population (1%) and its prevalence increased significantly from 1.3% at 5 years to 2% at 6 years. However, higher prevalence rates of anterior open bite have been reported in the previous studies.[6,15,18]

Majority of the children (94.4%) studied showed the overbite between 0 to 2 mm, Similar results were noticed in the low fluoride areas of Turkey and in Nigerian children.[6,18] Higher prevalence rates of overbite (mandibular incisors covered by maxillary incisors completely) have also been reported in the literature.[15,18] In our study, prevalence of overbite greater than 4 mm decreased significantly with age. This may be attributed to continued eruption of primary molars.

Our study showed that the majority of children in the sample had overjet in the range of 0 to 2 mm (84.5%), followed by 11.4% children showing overjet in the range of 2-4 mm and 3.6% showing overjet greater than 4 mm. Similar findings was reported by Onyeaso and Isiekwe, they also found a positive correlation between primary dentition and the early mixed dentition for the overjet.[6] Our findings showed significant increase in the prevalence of overjet between 0 to 2 mm and 2 to 4 mm and there was significant decrease in the overjet greater than 4 mm with advancing age.

In a study by Dhar *et al.,*[19] on prevalence of malocclusion in Indian children, 26.06% children of age group 5 to 7 years had malocclusion and there was significant difference in the age wise prevalence. These results are in line with our study, where we can notice significant difference in the prevalence of different occlusal parameters.

Many studies have described the distribution of occlusal characteristics in diverse populations, reporting large differences in the prevalence that may depend on ethnicity, registration methods, and sample composition.[4,20] Therefore, the influence of the above factors must be taken into account when comparing findings from different surveys. There also exists a variation in the morphological pattern of teeth, which might be the reason for variable pattern of occlusal trait in different ethnic groups.[21]

There was scarcity of the published material on the occlusal trait in Indian children of similar age group, thus there was obvious lack in the comparison

possibilities pertaining to different ethnic groups in India. This necessitates studies of similar stature in different parts of India.

CONCLUSION

The present study showed that there was higher prevalence of malocclusion and there was significant difference in the prevalence of malocclusion between different age group. This finding suggests early treatment of developing malocclusion, so that severity of occlusal trait is going to get reduced during the permanent dentition stage.

Further research is recommended to find the difference in the gender wise prevalence of different occlusal characteristics, along with the facial soft tissue examination.

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How to cite this article: Bhayya DP, Shyagali TR, Dixit UB, Shivaprakash. Study of occlusal characteristics of primary dentition and the prevalence of maloclusion in 4 to 6 years old children in India. Dent Res J 2012;9:619-23.

Source of Support: Nil. **Conflict of Interest:** None declared.