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Research Article

Evaluation of Occlusal Characteristics and Spacing in Primary Dentition Among School Going Children of Shimla- A Cross-Sectional Study

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Abstract

Occlusal characteristics and spacing in primary teeth show different morphological features among different populations and races.

Aim: To assess and compare the occlusal characteristics and spacing in primary dentition among3–6-year-old children of Shimla district of Himachal Pradesh.

Materials and Methods: The study included 226 school going children. The primary molar relation, canine relation, overjet, and overbite were assessed using Foster and Hamilton criteria. Spacing conditions were registered according to Kisling and Krebs criteria.

Results: The data was analysed, and Chi square test was used to compare the measured variables. There was statistically significant difference (P value≤0.05) in the molar relation among male and females. Other's characteristics were not found to be statistically significant.

Conclusion: The study population has fewer deviations from normal occlusion which indicates decreased tendency for malocclusion in permanent dentition. However, further longitudinal studies are necessary.

Keywords: Occlusal; overjet; overbite; molar-relation

Introduction

Occlusal characteristics varies among different ethnic groups and races. Those changes which will occur between primary and permanent dentition can help a Pedodontist in assessing what type of occlusion a child will have in future. Normally primary dentition consists of spacing between anterior teeth, which includes primate spaces between lateral incisor and canine in maxillary arch while between canine and primary first molar in mandibular arch, flush terminal plane and U-shaped arches. Any deviations from the normal occlusion of primary dentition would lead to malocclusion in permanent dentition with more pronounced degree [1]. The proper eruption and alignment of the succedaneous permanent dentition greatly depends on the features of primary dentition. Based on these features of occlusion in the child's dento-alveolar system during the formative years, the characteristics of the permanent dentition occlusion can be predicted very well [2]. Serious malocclusion may cause both psychological and physiological conditions. Early intervention for children in, or before, the peak of growth and development can reduce not only the prevalence of malocclusion or the severity in permanent dentition, but also the psychological impact [3].

Materials and Method

A cross-sectional study was done to access the occlusal characteristics and spacing in primary dentition among 3–6-year-old children of Shimla district of Himachal Pradesh. Around 298 children participated in the examination conducted by a single examiner using mouth mirror and probe in broad daylight, among all 226 children were selected for the study in which 139 were males and 87 were females. Children with completely erupted primary dentition without any caries were included in the study. Children having grossly decayed teeth, teeth with inter-proximal caries that may affect the inter-occlusal relationship and arch length, children with any permanent teeth erupting, children with any systemic disease and who were unable to co-operate were excluded from the study. The primary molar relation, canine relation, overjet, and overbite were assessed using Foster and Hamilton criteria with the

teeth in centric occlusion. Terminal plane relationship of the second primary molars was evaluated and recorded as

a) **Class 1:** The distal surfaces of maxillary and mandibular primary second molars lie in the same vertical plan.

b) **Class 2:** The distal surface of the mandibular primary second molar is posterior to that of maxillary primary second molar and

c) **Class 3:** The distal surface of the mandibular primary second molar is anterior to that of the maxillary primary second molar [4].

Primary canine relationship was evaluated and recorded as

a) **Class 1:** The tip of the maxillary primary canine tooth is in the same vertical plane as the distal surface of the mandibular primary canine

b) **Class 2:** The tip of the maxillary primary canine tooth is mesial to the distal surface of the mandibular primary canine

c) **Class 3:** The tip of maxillary primary canine is distal to the distal surface of the mandibular primary canine [4].

Overjet was measured as the greatest distance between the incisal edges of the maxillary and mandibular primary incisors in the occlusal plane using a millimeter gauge and recorded as ideal, if a positive overjet was less than or equal to 2 mm; increased, if it was greater than 2 mm; and reversed, if there was anterior cross-bite and edge-to-edge relationship was also assessed [4]. Vertical occlusion was graded according to the coverage of mandibular incisor by the most protruded fully erupted maxillary incisor and was recorded as ideal: if the lower primary incisal edges were contacting the palatal surfaces of the upper primary central incisors in centric occlusion, increased, if the mandibular incisors were touching the palate, open bite, when a gap existed between the incisal edges of incisors along the occlusal plane, and reduced, if the incisal tips of the lower primary incisors were not contacting the upper incisors or the palate in centric occlusion but with positive overbite [4]. Spacing conditions were registered between all teeth in the mandible and maxilla and graded according to Kisling and Krebs criteria: overlapping of teeth, contact, no contact, and space 2 mm. Dental floss was used to confirm the presence/absence of contacts, when doubtful [5]. Statistics: The obtained data was stored in excel sheet and analyzed using statistical software (IBMSPSSversion20.0). Chi-square test was used to compare the variables assessed within the population. For all tests a *P* value of ≤ 0.05was set for statistical significance and a *P* value of ≤0.001 represented highly significant relation.

Results

Bilateral mesial step molar relationship 73% was the most prevalent molar relation and there was a statistically significant difference (P≤0.05)in molar relation among males and females (Table 1). The most common type of canine relation was bilateral class1 which was 96% whereas bilateral class [3] was least prevalent (Table 2). There was not any statistically significant difference found among male and female with respect to canine relation ($P \leq 0.05$). An ideal overjet was observed among children 84.5% followed by increased overjet and edge-to-edge bite, while the least frequent type was reverse overjet (1.1 in females%) (Table 3). The evaluation of overbite showed that 76.5% children had ideal overbite, 22.1% had increased bite while 0.9% had anterior open bite, and 0.4% had others (Table 4). Similar trend of prevalence was observed among both the sexes with respect to overjet and overbite. No statistically significant difference was found among the sexes with respect to overjet ($P \leq 0.05$) and overbite ($P = 0.781$). (Table 4) The most frequent site of spacing (Table 5) in the maxillary arch coincided with the anthropoid space between the lateral incisor and canine (42%); however, in mandibular arch it did not coincide with primate spaces; instead, spacing was found at two sites, that is, between canine and lateral incisor(35%) and lateral incisor and central incisor(34.5%). The spaces greater than or equal to 2mm were found most commonly in relation to maxillary primate spaces (1.8%). The sites of contact of teeth were found most frequently between first and second primary molar in both maxilla (100%) and mandible (100%). No statistically significant difference was found between the sexes (Table 6) with respect to spaces between first molar and canine, canine and lateral incisor, and central and lateral incisor.

Table 1: Gender wise distribution of molar relation.

Type of Molar Relationship	Male		Female		Total	
	n	%	n	%	N	%
Flush terminal plane –bilateral	39	28.1	12	13.8	51	22.6
Distal step –bilateral	6	4.3	3	3.4	9	4
Mesial Step – bilateral	94	67.6	71	81.6	165	73
Unilateral flush terminal plane with distal step	0	0	0	0	0	0
Unilateral flush terminal plane with mesial step	0	0	1	1.1	1	0.4
Unilateral mesial step with distal step	0	0	0	0	0	0
Posterior cross –bite	0	0	0	0	0	0
Total	139	100	87	100	226	100

Chi-square value = 7.957, P value = 0.047 ≅ 0.05; Significant

Table 2: Gender wise distribution of canine relationship.

Type of Canine Relationship	Male		Female		Total	
	n	%	n	%	n	%
Class I -bilateral	132	95	85	97.7	217	96
Class 2- bilateral	6	4.3	2	2.3	8	3.5
Class 3-bilateral	1	0.7	0	0	1	0.4
Unilateral class I with class 2	0	0	0	0	0	0
Unilateral class I with class 3	0	0	0	0	0	0
Unilateral class 2 with class 3	0	0	0	0	0	0
Posterior cross bite	0	0	0	0	0	0
Total	139	100	87	100	226	100

Chi-square value =1.283, P value = 0.526: Not significant

Table 3: Distribution of overjet variations.

Overjet	Male		Female		Total	
	n	%	n	%	n	%
Ideal	116	83.5	75	86.2	191	84.5
Increased	21	15.1	11	12.6	32	14.2
Edge-to-edge	2	1.4	0	0	2	0.9
Reversed	0	0	1	1.1	1	0.4
Others	0	0	0	0	0	0
Total	139	100	87	100	226	100

Chi-square value =3.127 P value = 0.372; Not Significant.

Table 4: Distribution of overbite variations.

Overbite	Male		Female		Total	
	n	%	n	%	n	%
Ideal	107	77	66	75.9	173	76.5
Increased	30	21.6	20	23	50	22.1
Anterior open bite	2	1.4	0	0	2	0.9
Reduced	0	0	0	0	0	0
Others	0	0	1	1.1	1	0.4
Total	139	100	87	100	226	100

Chi-square value =2.906 P value = 0.406; Not Significant.

Table 5: Arch wise prevalence of spacing.

Site		Count	Normal contacts	No contacts	Overlapping	Spacing	Chi-square value	P value
Second molar - first molar	Maxilla	n	226	0	0	0	0	1 NS
		%	100	0	0	0		
	Mandible	n	226	0	0	0		
		%	100	0	0	0		
First molar – canine	Maxilla	n	217	0	0	9	0	1 NS
		%	96	0	0	4		
	Mandible	n	217	0	0	9		
		%	96	0	0	4		

Canine - lateral incisor	Maxilla	n	130	0	1	95	3.89	0.143 NS
		%	57.5	0	0.4	42		
	Mandible	n	143	0	4	79		
		%	63.3	0	1.8	35		
Lateral incisor - central incisor	Maxilla	n	137	0	1	88	4.624	0.099 NS
		%	60.6	0	0.4	38.9		
	Mandible	n	144	0	6	76		
		%	63.7	0	2.7	33.6		
Between central incisor	Maxilla	n	142	1	3	80	1.029	0.794 NS
		%	62.8	0.4	1.3	35.4		
	Mandible	n	141	1	6	78		
		%	62.4	0.4	2.7	34.5		

Statistical Analysis: Chi-square test. Statistically significant if P<0.05.

Table 6: Arch wise and gender wise prevalence of spacing.

Site		Count	Normal Contacts		No Contacts		Overlapping		Spacing		Chi-Square Value	P value
		M	F	M	F	M	F	M	F			
Second molar - first molar	Maxilla	n	139	87	0	0	0	0	0	0	0	1 NS
		%	61.5	38.5	0	0	0	0	0	0		
	Mandible	n	139	87	0	0	0	0	0	0		
		%	61.5	38.5	0	0	0	0	0	0		
First molar - canine	Maxilla	n	132	85	0	0	0	0	7	2	0.287	0.963 NS
		%	58.4	37.6	0	0	0	0	3.1	0.9		
	Mandible	n	133	84	0	0	0	0	6	3		
		%	58.8	37.2	0	0	0	0	2.7	1.3		
Canine - lateral incisor	Maxilla	n	80	50	0	0	0	1	59	36	5.108	0.403 NS
		%	35.4	22.1	0	0	0	0.4	26.1	15.9		
	Mandible	n	84	59	0	0	2	2	53	26		
		%	37.2	26.1	0	0	0.9	0.9	23.5	11.5		
Lateral incisor - central incisor	Maxilla	n	79	58	0	0	0	1	60	28	5.066	0.408 NS
		%	35	25.7	0	0	0	0.4	26.5	12.4		
	Mandible	n	84	60	0	0	3	3	52	24		
		%	37.2	26.5	0	0	1.3	1.3	23	10.6		
Between central incisor	Maxilla	n	81	61	1	0	0	3	57	23	1.575	0.954 NS
		%	35.8	27	0.4	0	0	1.3	25.2	10.2		
	Mandible	n	82	59	1	0	1	5	55	23		
		%	36.3	26.1	0.4	0	0.4	2.2	24.3	10.2		

Statistical Analysis: Chi-square test. Statistically significant if P<0.05.

Discussion

Four important features usually described while considering a normal occlusion are spacing of incisors, deep incisor overbite and relationship of the distal surface of the upper and lower second primary molars and the primate spaces [6-12]. Primate spaces are normally present from the time teeth erupt. Bilateral mesial step molar relationship 73% was the most prevalent molar relation (67.60% in males and 81.60% in females) and there was a statistically significant difference (P≤0.05) in molar relation among males and females. These findings concurrent with the study of Bahadure et al. [7], Shah et al. [12], in which mesial step was most commonly observed and distal step molar relationship was least common. Studies done by Bhayya et al. [9] contradict the finding of our study and found that majority of the children had a flush terminal molar relationship (52.5%), followed by mesial step (36%) and disatal step (8.4%). Other contradictory studies related to our study are those of Vegesna M, Chandrasekhar R, ChandrappV, the flush terminal plane molar relation (80.3%) was the most

common primary molar relation. The distal step molar relation was more frequently found in female children (12.8%) than in males (8.6%) [1]. Hegde S, Panwar S, Bolar DR, Sanghavi MB found that the most common molar relationship in the 3-4year age group (Group A) was the flush terminal plane (52%), while in the 4-5year age group (Group B), mesial step was most commonly seen (54%) [2]. Zhou X et al. found that the most common molar relationship at the 3–5 years of age was the flush terminal plane (38.7%), followed by mesial step3. Study by Bhat et al. concluded that flush terminal molar relationship was seen in 67.9% of children. Statistically significant (x^2 = 47.835, p = 0.001) increase in mesial step molar relationship was seen with age10.Lochib et al. found that flush terminal molar relationship of deciduous second molar was noted in 65.1% children followed by 12.8% (mesial step relationship) and 2.4% (distal step relationship) [13].

In the present study the most common type of canine relation was bilateral class 1 which was 96% (95% in males and 97.7% in females) whereas bilateral class [3] was least prevalent (Table 2). Study conducted by Bugaighis I concluded that prevalence of bilateral Class I, Class II, and Class III canine relationship was 69.6%, 22.4%, and 4.4%, respectively [8]. These findings were similar to the previous studies conducted in different populations [1-13]. Canine and molar relationship together can be a diagnostic aid to predict changes in occlusal relationship. In clinical situations like flush terminal plane with class II canine relationship indicates a higher risk to develop a distal occlusion in permanent dentition. Therefore, both the molar and canine relationships are taken into consideration to make a reliable prediction of the inter-maxillary relationship in the permanent dentition [1]. An ideal overjet was observed among children 84.5% (83.5% in males and 86.2% in females) followed by increased overjet (15.1% in males and 12.6% in females) and edge-to-edge bite (1.4% in males), while the least frequent type was reverse overjet (1.1 in females %) (Table 3). This finding is consistent with the study conducted by Vegesna M, Chandrasekhar R, ChandrappV, who demonstrated ideal overjet in 84.3% children, increased overjet in 8.9%, edge-to-edge bite in 3.5%, and reversed overjet in 1.7% of the children [4]. These findings were similar to the previous studies conducted in different populations [2,9,13].

The evaluation of overbite showed that 76.5% (77% in males and 75.9% in females) children had ideal overbite, 22.1% (21.6% in females and 23 % in males) had increased bite while 0.9% had anterior open bite, and 0.4% had others (Table 4). Similar trend of prevalence was observed among both the sexes with respect to overjet and overbite. No statistically significant difference was found among the sexes with respect to overjet ($P \leq 0.05$) and overbite (P = 0.781) (Table 4). These findings were akin to the study of Vegesna M, Chandrasekhar R, Chandrapp V in which ideal overbite was found in 72.7% of children while 19.4% had increased bite. These findings were similar to the previous studies conducted in different populations [2,9,11,13]. Study conducted by Zhou X concluded that the prevalence of deep overbite (63.7%) was the highest in children with malocclusion, followed by deep overjet (33.9%), midline deviation (26.6%), anterior crossbite (8.0%), and anterior crowding (6.5%) [3]. Spaces in the primary teeth are described as physiological or developmental spaces. Anterior spacing appears to be a common finding in our study population1. The spacing around the canines is termed as the simian gap, primate space, or anthropoid space, since they are prominent in dentitions of certain lower primates. Based on spacing between the teeth, Baume has classified the arrangement of primary dentition into two forms: open or type I and closed or type II [1] . The most frequent site of spacing (Table 5) in the maxillary arch coincided with the anthropoid space between the lateral incisor and canine (42%); however, in mandibular arch it did not coincide with primate spaces; instead, spacing was found at two sites, that is, between canine and lateral incisor (35%) and lateral incisor and central incisor (34.5%). The sites of contact of teeth were found most frequently between first and second primary molar in both maxilla (100%) and mandible (100%). No statistically significant difference was found between the sexes (Table 6) with respect to spaces between first molar and canine, canine and lateral incisor, and central and lateral incisor. Primate spaces were frequently found in the maxilla, but it does not coincide with the primate spaces in mandible. Male children demonstrated more frequency of primate spaces than females both in the maxilla and mandible. These findings were in accordance with the findings of study done by Vegesna M, Chandrasekhar R, Chandrapp V. Study conducted by Shah P,Acharya J, Khanal S found that most frequent spacing in the maxillary arch was both canine space and interdental space which was present in 61.6% of the population however in mandibular arch the presence of both canine and interdental space was found to be in just 29.6% of population.

Conclusion

The present study is a cross-sectional study. The current findings provide an insight into the prevalence of occlusal traits among school going children of Shimla. To summarize, mesial step molar relation, class I canine relation, ideal overjet, ideal overbite, and spaced arches prevailed among majority of the study population without any gender variations. These findings suggest desirable occlusal pattern. Lower prevalence of open bite is suggestive of lower prevalence of abnormal sucking habits in Shimla population. However, future longitudinal studies are needed to observe whether the transition of these occlusal characteristics will lead to favorable occlusion in the permanent dentition.

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