

OCCLUSION CHARACTERISTICS OF PRIMARY DENTITION BY AGE IN A SAMPLE OF SAUDI PRESCHOOL CHILDREN

¹LAILA BAIDAS, BDS, MSc, FDSRCS (Edin)

ABSTRACT

The aim of this study was to describe occlusion characteristics of primary dentition by age in a sample of Saudi children aged 3–5 years. By using standardized and validated recording criteria, a single operator measured (the primary molar and canine relationships, overjet, overbite, anterior open bite, and anterior and /or posterior crossbites), in 323 Kindergarten children (49.7% boys and 50.3% girls). Descriptive and comparative (Chi-square, t-test) statistics, were used to investigate the occlusal relationship by age of the children. In terms of the molar relationship; flush terminal plane was present in 75% of the children followed by mesial step (13.9%) and distal step (11.1%). The canine relationship was Class I in 90.1% of the sample, followed by Class III (7.4%), and Class II (2.5%) relationship. Fifty seven percent of the children had normal overbite, with significantly higher percentage in older children. Open bite tendency was greater in younger children. Fifty two percent of the children had an overjet between 0-2 mm, 30.3% ranged between 2.1-4 mm, 15.8% >4 mm, and only 1.9% had reverse overjet. Posterior crossbite was present in 8.7% of the children examined. The differences and correlations between the age and the occlusal relationships were not significant. The prevalence of malocclusion was found to be less than those reported in other populations

INTRODUCTION

The occlusal relationship in deciduous dentition is known to have an important bearing on the establishment of the normal occlusal relationship in the permanent dentition.¹ Studies on the occlusion of primary dentition have been carried out widely among children with different age groups in various regions of the world.²⁻¹² Few such studies have been published in Arab population including Saudi, and Jordanian children.¹³⁻¹⁴ These studies revealed that the characteristics of primary dentition varied among population and ethnic groups. Several studies^{2,3,6} found that the most prevalent occlusal molar relationship in primary dentition in North American children was flush terminal occlusion. Nanda et al⁴ conducted a study on Indian children and found that the normal occlusal patterns for the deciduous dentition were class I and class III molar and canine relationships. The frequency of class I molar and canine relationship decreased with increased age, whereas those with class III increased

with age. In Israeli preschool children⁵, flush terminal occlusion was reported to be 2.4 times more frequent than the mesial step occlusion. Kisling and Kerbs⁷ studied the occlusion in 3-year-old children living in Copenhagen. Open bite was found much more frequently in children with maxillary overjet greater than 4 mm. Valente and Mussolino⁸ assessed the distribution of overjet, overbite and open bite in deciduous dentition in Brazilian white children, and they concluded that the degree of overjet and open bite decreased with the increasing age of the children. Kabue et al⁹ found that the straight terminal plane of the deciduous second molars was presented in 53% of the Kenyan children, mesial step in 43% and distal step occlusion in one percent; he concluded that more than half of the children were found to have some form of malocclusion. Ferreira et al¹¹ stated the most prevalent occlusal relationship between primary canine and primary molar among Brazilian children was class I. Otuyemi et al¹⁰ found that 74.5 % of the three to four year old Nigerian children had class I primary second

¹ Assistant Professor, Division of Orthodontics, Department of Pediatric Dentistry and Orthodontics, King Saud University College of Dentistry, Riyadh, Saudi Arabia

Correspondence: P O Box 5967, Riyadh 11432, Saudi Arabia Email: lbaidas@ksu.edu.sa or lailabaidas2003@yahoo.com Tel: +96614784524

molar relationship, 1.9% class II relationship and 20.9% class III relationship. They also observed that primary canine relationship was class I in 73.3% of the children, class II in 3%, and class III 14.7%.

Yilmaz et al¹² evaluated the primary canine and the primary molar relationship in three to six year-old Turkish children. The rate of ending on Flush terminal plane in primary second molar, and class I primary canine occlusion were stated to be the highest. They also found positive correlation among different age groups and both the canine and molar relationships. Farsi, and Salama¹³ conducted a study among 3-5-year-old Saudi children, finding that majority of the children had flush terminal relationship and Class I canine relationship, followed by mesial step and class II relationship. The degree of overbite was significantly less in the 5-year-olds than in the 3-year-olds. The majority of their sample had an overjet of 0-2 mm, and that overjet of 2-3 mm was significantly lower in the older age group. Anterior and posterior crossbite were found in 2% and 4% respectively. In a study conducted by Abu Alhaija, and Qudeimat¹⁴ among 3-6 years Jordanian children, mesial step molar relationship was found in 47.7% of children followed by flush terminal molar relationship in 37% and distal step in 3.7%. Class I canine relationship was found in 57% of children, followed by 29% Class II and 3.7% Class III. Normal overbite was seen in 44.3% of the children. Posterior and anterior crossbite was seen in 7% and 11.8% of the sample respectively.

The above mentioned studies show that the characteristics of primary dentition vary among different populations. The status of primary occlusion also affects the development of permanent occlusion.¹ Baume² reported that the primary dentition remains unchanged until the first permanent molar begins to erupt. Nanda et al⁴ and Bishara et al¹⁶ found high percentage of children with distal step in primary dentition proceed to develop Class II molar relation. However, Infante¹⁷ claimed that the class II occlusion in primary dentition decrease from 2 to 6 years of age. Nanda et al⁴ stated that there was an increase in prevalence of Class III occlusion with age. This brief review indicates conflicting findings. The aim of the present study was to investigate the occlusal relationship characteristics of primary dentition by age in a group of 3-5 year old Saudi children.

METHODOLOGY

A cross sectional study was conducted through clinical examination and completion of a simple questionnaire. The study sample consisted of 323 Saudi children aged 3-5 years, attending 8 Kindergartens which were randomly selected to represent the four academic regions of Riyadh city, the capital of Saudi Arabia. Letters explaining the nature of the study and informed parental consent for the child's participation were sent to the parents through school's principal, in addition to the questionnaire inquiring about child's age, gender, medical history, past or present non-nutritive sucking habits (yes/no), and previous orthodontic treatment (removable appliance, expansion etc). Children with past or presence sucking habits were excluded from the study.

All children were assessed while sitting in an upright position and biting in maximal intercuspation, using pen light, mouth mirror, metal millimeter rulers, gloves and masks in compliance with the international standards of infection control protocol. The criteria of Foster & Hamilton¹⁵ were used for defining the occlusion

Dental examination of children

Clinical evaluation was performed on all Saudi children in a classroom setting based on the following criteria:

- Signed informed consent form.
- Child aged between 3-5 years.
- Health and age-appropriate intellectual development (within normal limit).
- Presence of all 20 deciduous teeth with no erupted permanent teeth.
- No missing primary tooth.
- No sucking habit.
- Free of carious lesions that could result in decreased arch length.
- No previous orthodontic treatment.

Evaluation criteria

1 Terminal plane relationship

- *Flush terminal plane:* The distal surfaces of maxillary and mandibular primary second

molars lie in the same vertical plane in centric occlusion.

- *Mesial step*: The distal surface of the mandibular primary second molar is mesial to that of the maxillary primary second molar in centric occlusion.
- *Distal step*: The distal surface of the mandibular primary second molar is distal to the distal surface of the maxillary primary second molar in centric occlusion.

2 Primary canine relationship

- *Class I*: The cusp tip of the maxillary primary canine tooth is in the same vertical plane as the distal surface of the mandibular primary canine.
- *Class II*: The cusp tip of the maxillary primary canine tooth is mesial to the distal surface of the mandibular primary canine.
- *Class III*: The cusp tip of the maxillary primary canine tooth is distal to the distal surface of the mandibular primary canine.

In the determination of primary second molar relationship, if one side ends with distal or mesial step while the other side ends with flush terminal plane, it was recorded as flush terminal plane. In the determination of canine relationship, if there was a Class II or Class III relationship on one side and a Class I on the other, it was recorded as a Class I relationship. In the determination of the occlusal relationship of both primary second molars and primary canines, the children with mesial step on one side and distal step on the other were left out of assessment.

3 The degree of overbite was recorded as

- Normal: the upper primary central incisors covering of less than or equal to 50% of lower primary incisors in centric occlusion
- Increased: the upper primary central incisors covering of more than 50% of lower primary incisors in centric occlusion
- Edge-to-edge upper and lower primary incisors relation
- Anterior open bite: there is no vertical overlap between upper and lower primary incisors in centric occlusion.

4 *Overjet*: Amount of overjet measured from the lingual surface of the mesial corner of the most protruded maxillary incisor to the facial surface of the corresponding mandibular incisor recorded in millimeters.

5 *Anterior crossbite*: One or more of the maxillary incisors occluded lingual to the opposing mandibular incisors in centric occlusion.

6 *Posterior crossbite*: One or more of the maxillary primary canine or molars occluded palatally to the buccal cusps of the opposing mandibular teeth in centric occlusion (either unilateral or bilateral).

Examiners reliability: An orthodontist performed all dental examinations in order to avoid inter-operator bias. Examiner reliability was checked through an assessment of the occlusal characteristics of 20 orthodontic study models which had been trimmed in their centric occlusion relationship, on two occasions separated by at least two weeks.

Statistical analysis: Data were collected and entered into computer utilizing FoxPro Program for Windows. Statistical Package for Social Sciences (SPSS version 13) was utilized for all statistical computations. Frequency distribution was used for the descriptive analysis. A chi-square test was used to compare the proportions of different occlusal characteristics among different age groups. Paired t-test was used to determine the differences of occlusal characteristics within the same age group. The significant level was set at 0.05.

RESULTS

The intra-examiner reliability test showed a high level of agreement (kappa statistic 0.90). Table 1 shows the distribution of children examined in term of age and gender. The study sample consisted of 49.7 % boys and 50.3% girls. Boys and girls were pooled in each age group as there were no significant differences between them with respect to occlusion. Out of the 323 children examined, 75% had flush terminal plane, 11.1% distal step and 13.9% mesial step molar relation. Table 2 shows the percentage and correlation of the occlusal relationship of primary second molar for every age group. The flush terminal plane was the most predominant molar relation for each age group. It was observed

that the molar relation with mesial step was 13.9 % in 3 years olds, 13.1 % in 4 years olds and 11.5 % in 5 years olds. When the groups were compared in pairs, no statistical significant difference was found ($P>0.05$). There was slight decrease in the proportion of children with distal step from age 3-5 years old 11.1%, 7.6% respectively, but the differences in their occurrence was not statistically significant. When the ages of the children were compared regarding the primary second molar relationship, it was found that the differences was not significant and no association ($P=0.524$) was found between different terminal plane relationship and age group.

Regarding canine relationship, it was found that 90.1% of the children had Class I, 7.4% Class III, and 2.5% Class II relationship. Table 3 shows the percentage and correlation of occlusal relationship of canine for every age group. The most common primary canine relationship was observed to be Class I relationship, no statistically significant difference was found between different age groups. Class II canine relation was not observed at 3 years of age. However in children 4-5 years olds, it showed fluctuation.. Class III canine relationship among 3 and 5 year olds were found to be higher than in children aged 4 years. However, when the groups were compared in pairs, the difference were not statistically significant at ($P> 0.05$). Similar to relationship in primary molars, the differences be-

tween the primary canine relationship also showed no association with age ($P=0.456$).

The results indicate that 57% of children had normal overbite, 28.8% increased overbite, 7.1% edge-to-edge, and 7.1% anterior open bite. The distribution of overbite by age is presented in Table 4. The percentage of children with normal overbite increased significantly from age 3 to 5 years ($P=0.03$), and from age 3 to 4 years ($P=0.029$). The increased overbite percentage decreased in older age group. The overall differences between the various age groups were not statistically significant. Open bite tendency, represented by edge-to-edge relationship and anterior open bite combined together was greater in the younger age group than the older age group.

The majority of children (52.3 %) had an overjet between 0-2 mm followed by >2-4 mm (30.3 %) and >4mm (15.8%); only 1.9 % of the children had reverse overjet. Overjet ranged from 0 to 7 mm with a mean of 1.9 mm. Increased overjet (e" 6 mm) was observed in 1% of the sample. Table 5 shows the distribution of overjet among the sample by age. There was slight reduction in the prevalence of Increased overjet (>4mm) with age, but it was not statistically significant. Anterior crossbite was found only in six children (1.9%), the number of children in each age group were too small to permit any valuable comparison with age.

TABLE 1: DISTRIBUTION OF CHILDREN IN TERMS OF AGE AND GENDER

Age (Years)	Girls		Boys		Total	
	No. (162)	%	No. (161)	%	No. (323)	%
3	17	10.5	19	11.8	36	11.15
4	65	40.1	65	40.4	130	40.25
5	80	49.3	77	47.8	157	48.6

TABLE 2: OCCLUSAL RELATIONSHIP OF PRIMARY SECOND MOLAR BY AGE

Age Years	Second Primary Molar Relationship						Total	P-value
	Flush Terminal Plane (253)		Distal Step (30)		Mesial Step (40)			
	No.	%	No	%	No	%		
3	27	75	4	11.1	5	13.9	36	0.524
4	99	76.2	41	10.8	17	13.1	130	
5	127	80.9	12	7.6	18	11.5	157	

TABLE 3: OCCLUSAL RELATIONSHIP OF PRIMARY CANINES BY AGE

Age Years	Canine Relationship						Total (323) No	P-value
	Class I (291)		Class II (8)		Class III (24)			
	No	%	No	%	No	%		
3	33	91.7	0	0	3	8.3	36	0.456
4	119	91.5	5	3.8	6	4.6	130	
5	141	89.8	3	1.9	13	8.3	157	

TABLE 4: VERTICAL INCISOR RELATIONSHIP BY AGE

Age (Years)	Degree of Overbite								Total (323)	P-value
	Normal (184)		Increased (93)		Edge-to-edge (23)		AOB* (23)			
	No	%	No	%	No	%	No	%		
3	15	41.7	14	38.9	2	5.6	5	13.9	36	0.180
4	77	59.2	40	30.8	7	5.4	6	4.6	130	
5	92	58.6	39	24.8	14	8.9	12	7.6	157	

*AOB: Anterior Open Bite

TABLE 5: DEGREE OF OVERJET BY AGE

Age (Years)	Degree of Overjet (mm)								Total No (323)	P-value
	-1 to -2		0 to 2		>2 to 4		>4			
	No (6)	%	No (169)	%	No (98)	%	No (51)	%		
3	2	5.7	17	45.9	11	29.7	7	18.9	36	0.25
4	0	0	69	53.1	39	30	22	16.9	130	
5	4	2.5	83	52.9	48	30.6	22	14	157	

TABLE 6: POSTERIOR CROSSBITE BY AGE

Age (Years)	Posterior Cross-bite					P- value
	Bilateral No	%	Unilateral No	%	Total No	
3	1	2.9	3	8.8	4	0.322
4	2	1.6	6	4.7	8	
5	7	4.5	9	5.8	16	

Twenty-eight children (8.7%) presented with posterior crossbite. Only 3% had bilateral crossbite, and 5.7% exhibited unilateral crossbite. Table 6 presents the distribution of posterior crossbite. Unilateral crossbite was higher in 3 years old children, whereas the bilateral crossbite was higher in 5 years old children. There were no significant differences in

the prevalence of posterior crossbite in different age groups.

DISCUSSION

The present study investigated the occlusal relationship characteristics of primary dentition in 3-5 years old Saudi children. Normal occlusal relationships of the primary dentition parallel those in permanent dentition. The development of malocclusion starts from the primary dentition, so it is very important to know the occlusion in the primary dentition, as well as the changes of occlusal pattern during the period of deciduous dentition. Several epidemiological studies have assessed the occlusion of primary dentition among preschool children in different population of the world²⁻¹², few of which have been conducted in Arab countries.^{13,14}

In the present study, most of the children (75%) had flush terminal plane molar relation, which was consistent with the findings of several previous studies.^{1,6,10,12,13} The normal molar relation of primary dentition is flush terminal plane until the eruption of the permanent first molars.³ However other investigators^{4,2} report that flush terminal plane or mesial step molar relationship are both normal and our result support this finding. The findings of this study showed a slight reduction in the prevalence of mesial step molar relation from 13.9% in age 3 years to 11.5% in age 5 years. The findings did not coincide with the views of Ravan⁶ and Nanda et al⁴ who observed increase in the Class III relationship of molars with age. However Baume², and Clinch³ reported that molar termination pattern remained unchanged through the primary dentition stage. The prevalence of distal step was 11.1 %. There was a reduction in the prevalence of “distal step” from three to five years old children. The reduction in the prevalence of “distal step” was in agreement with previously reported studies^{1,10,13}. The age changes in the terminal plane relation of the molar results from a combination of mesial migration of the lower arch and a mesial shift of the mandible, which is probably caused by growth.⁴

Considering the canine relationship, the most common occlusal relationship was found to be Class I relation (90.1 %). The prevalence of Class II canine and Class III canine relationship was 2.5% and 7.4% respectively. Class II canine relationship was not observed at 3 years of age. In four and five years old children, a significant decrease in the Class II canine relationship was observed. An increase in the Class III canine relationship was observed with age, but it was not statistically significant. The most common canine relationship has been found to be Class I in various ethnic groups,^{6,10-14} which is consistent with our findings. In our study, the prevalence and frequency of Class II and III canine relationships were consistent with the findings of Qtuyemi et al¹⁰ but not with the findings of some other studies.^{11,12-14} The differences in research methods used in assessing the prevalence of malocclusion should be considered when comparing various studies. In the present study, the prevalence of distal step molar relation and Class II canine relationships were lower than those reported by other studies, since all children with sucking habit were excluded from the present sample. In addition to, the prevalence of terminal plane

and canine relationship were based on bilateral occurrence.

The prevalence of normal overbite was observed in 57% of children, 7.1% had an edge-to-edge, and 7.1% had an anterior open bite. Increased overbite was found in 28.8% of the sample with lower prevalence in 5 years-olds than 3 years-olds. These findings were consistent with previous studies.^{10,13,14} The finding of the present study showed that the normal overbite increased significantly from younger to the older age. The age changes in overbite are probably caused by downward growth of the mandible. A higher incidence of anterior open-bite was found in 3 year olds compared to 5 year olds, which coincide with the findings of Farsi and Salama.¹³

The present study revealed that 52.3% of children had overjet ranged between 0 to 2 mm, 30.3% between >2 to 4 mm and in 15.8% more than 4 mm. The present findings were in accordance with those reported by Farsi and Salama¹³, but slightly lower than the study on Nigerian children by Qtuyemi et al¹⁰ who reported ideal overjet in 68.7% children, increased overjet in 14.7% and reduced overjet in 9.7 % children. There was a slight decrease of overjet with age, which was consistent with the studies by Nanda et al⁴ and Farsi and Salama.¹³ The age changes in overbite and overjet could result because of the growth of the mandible in both anterior-posterior, and vertical direction.⁴

The prevalence of posterior crossbite was 8.7%, which was in accordance with that reported by Abu Alhaija and Qudeimat¹⁴ (7% for Jordanian children), and Infante¹ (7.1% for the white children), but higher than that reported by Qtuyemi et al¹⁰ (4.8% in Nigerian children), and Farsi and Salam¹¹ (4% in Saudi children). Keruso¹⁸ suggested ethnic difference in the prevalence of posterior crossbite. He reported that crossbite was more frequent in Finish than Black African children. Infante¹⁷ also reported that the prevalence of posterior crossbite was significantly greater in White children than Black and Indian Children.

The present investigation attempted to provide an insight into pattern of occlusal relationships in primary dentition of Saudi children. Future longitudinal studies are needed to follow up the dental development of children to observe the changes that may occur during the transitional period of the dentition.

CONCLUSIONS

Our findings indicate the following:

- 1 There were no gender differences in Saudi children in terms of occlusal relationship characteristic of primary dentition.
- 2 The flush terminal plane and Class I canine relationships were the predominant occlusal relationship.
- 3 The percentage of children with normal overbite was higher in younger children. Open bite tendency was also greater in younger children.
- 4 More than half of children had normal overjet.
- 5 The prevalence of anterior and posterior crossbite was 1.9% and 8.7% respectively.

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