

Prevalence of malocclusion in urban libyan preschool children

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ABSTRACT

Objectives: This cross-sectional observational study aimed at quantifying primary dentition parameters and exploring differences in those parameters between included age groups.

Materials and Methods: The examined sample comprised 800 preschool children, 3- to 5-year-old in Benghazi city, of which 500 fulfilled the inclusion criteria. Primary canine relationship, spacing/crowding, overjet (*OJ*) and overbite (*OB*), occlusal relationship was carried out using Federation Dentaire Internationale (1973), modified to the primary dentition.

Results: The prevalence of bilateral Class I, Class II, and Class III canine relationship was 69.6%, 22.4%, and 4.4%, respectively. The prevalence of asymmetric canine relationship was 3.6% with no significant difference between gender and age groups. Spacing, closed dentition, and crowding were observed in: 81.6%, 13.4% and 5% respectively in the upper arch, and 58.5%, 24.8%, and 16.7% correspondently in the lower arch. *OJ* and *OB* ranging between 1 and 3 mm were found in 82.6% and 56.5%, respectively. An *OJ* and *OB* of >3 mm was observed in 11.4% and 35%, respectively, and of edge to edge incisal relationship anteroposteriorly and vertically in 4.6% and 6% in this order. Anterior crossbite and anterior openbite were noted in 1.4% and 2.6%, respectively. There was no significant correlation between *OJ* and *OB* and age ($P \geq 0.241$). Additionally, there was no significant sex difference in the value of *OJ* ($P = 0.561$). But, the mean *OB* value in boys was significantly greater than in girls.

Conclusions: The current findings provide an insight into the prevalence of occlusal traits in urban Libyan preschool children and highlight the significance of early detection of malocclusion to assist in achieving effective and individualized long-term treatment planning.

Key words: Libyan, malocclusion, preschool children, prevalence

INTRODUCTION

Understanding the characteristic features of primary dentition as well as the changes that take place in the transitional stage from primary to permanent dentition for a particular population is essential for dentists involved in planning early preventive and interceptive orthodontic treatment. The intraarch and interarch tooth relationships are established by the interaction of teeth and their related structures throughout the stage of formation, growth, and postnatal alterations.^[1] Malocclusion can be defined as an occlusion in which there is a mal-interarch relationship in a vertical, horizontal, or transversal dimension or in which there are anomalous tooth positions beyond the acceptable range of normal limits.^[2] Published research showed that the prevalence of normal occlusion and malocclusion varies among

different ethnicities and societies.^[3-25] This is especially true for the primary dentition because of the significant number of children with oral habits such as thumb sucking, which can lead to posterior crossbite or anterior openbite, as well as proclination of the upper incisors.^[6,7] However, it has been reported that prediction of the characteristics of malocclusion from the study of primary dentition is not reliable.^[4] The interarch anteroposterior relationship of the lateral segment can be assessed by several methods such as the intermolar occlusal relationship and the intercanine relationship, but Raven^[5] has stated that, in primary dentition, interarch canine occlusion is a more reliable than the inconsistent primary intermolar relationship.

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There has been limited interest in the literature in the occlusal characteristics of primary dentition, and this is especially true for the Libyan population: there is no information about the prevalence of malocclusion or its characteristic features in the primary dentition of Libyan subjects. Thus, the aim of the present study was to quantify primary dentition parameters in five hundred (500), 3-5-year-old urban Libyan children attending public nurseries in Benghazi, Libya. An additional objective was to investigate whether occlusal features in the permanent dentition of the same population could be predicted from the occlusal characteristics of the primary dentition.

MATERIALS AND METHODS

The survey was undertaken in Benghazi city. Benghazi is the second largest city in Libya with approximately 1,000,000 inhabitants. Ethical approval was secured from the Ministry of Health in Benghazi, Libya, and parents of students were informed.

A total of 800 children 3-5 years of age (427 males and 373 females) attending 10 randomly selected representative nurseries based in five geographic regions in Benghazi city were examined. The participants were of Libyan descent for at least two generations with no craniofacial abnormalities and none had undergone previous orthodontic treatment. All deciduous dentitions were fully erupted, with no proximal or advanced caries that might influence the required measurements. None of the permanent teeth had erupted, and there were no tooth abnormalities or supernumerary teeth. Only children whose parents agreed to enroll in the survey were examined. A total of 500 children (282 males with a mean age of 4.1 years, SD=1.1, and 218 females with a mean age of 4.3 years, SD=0.7) fulfilled the reported requirements.

All measurements were carried out by a single investigator (the author) using disposable metric rulers to the closest millimeter (mm). Measurements of the occlusal traits were conducted following the adaptation of the principles introduced by Federation Dentaire Internationale^[26] and modified for assessment of the primary dentition.^[6] For each child, the following measurements were undertaken:

Intraarch Measurements

Spacing and crowding were recorded in the upper and lower anterior segments comprising the four incisors in each arch.

Interarch Measurements

The evaluation was undertaken in habitual maximal intercuspation. Sagittal interarch relationship for both right and left segments was assessed by recording the interarch canine occlusion instead of the intermolar relationship to avoid inaccuracy. The canine occlusion was evaluated as follows: The relationship was considered to be Class I when the tip of the upper deciduous canine was at the same vertical plane as the distal surface of the lower canine with the teeth in the habitual

maximum occlusion. When the tip of the upper canine was mesial to the distal surface of the lower canine, the relationship was considered to be Class II or distal occlusion, and when the tip of the upper canine was distal to the distal surface of the lower canine, the relationship was considered to be Class III, and any asymmetric differences were assessed.

Posterior openbite was defined when there was no overlap between upper and lower posterior cusps, leading to the presence of noticeable vertical space when observed perpendicular to the lateral segment.

Incisal Segment

Overjet

The horizontal distance between the incisal edge of the upper incisors and the labial surface of the lower incisors.

Overbite

The vertical overlap of the upper incisors on the lower incisors. The measurement was made by marking the vertical level of the upper incisal edge on the labial surface of the lower incisor, and measure the distance with a metric ruler to the closest mm.

Openbite

The vertical space between the upper and lower incisal edges when the posterior teeth are in their habitual maximum occlusion.

Transverse Relationship of the Posterior Segment

The interarch transverse relationship of the posterior segment was assessed either as a normal relationship, or buccal crossbite, or lingual crossbite when one or more teeth are involved.

Statistical Analysis

Statistics Package of the Social Sciences Software (SPSS) version 17.0 was used. Chi square and independent Student *t*-test were used whenever the sample size was sufficiently large. The level of statistical significance was set at $P < 0.05$.

Method Error

To assess consistency and reproducibility, 30 children were re-examined 1 week after the first measurements were made. A paired *t*-test revealed no significant differences between both sets of measurements ($P > 0.05$). The Intraclass Correlation Coefficient (ICC) was found to be greater than 0.90, indicating an excellent level of reproducibility between both trials.

RESULTS

The sample was normally distributed in relation to age and sex [Table 1] and the differences between the number and age of males (282) and females (218) was not statistically significant ($P = 0.275$). Additionally, there was no significant difference in the sex distribution of age among the group at $P = 0.391$.

Intraarch Measurements

There were no significant differences in upper and lower spacing or crowding in the anterior segments between males and females ($P \geq 0.299$; Table 2). Additionally, there were no significant differences between age groups in relation to the upper and lower crowding or spacing ($P \geq 0.344$). In the upper arch, spacing was observed in 81.6% of the examined children, 69.2% with spacing ranging between 1 and 5 mm, and 12.4% with ≥ 5 mm spacing. Crowding was found in 5%, and closed dentition in 13.4%, of the upper arches of the examined children. In the lower arch, spacing was found in 58.5% of children, 56.1% with spacing ranging between 1 and 5 mm, and 2.4% with spacing in excess of 5 mm. Crowding was noticed in 16.7%, and closed dentition in 24.8% of the lower arches.

Interarch Measurement

Lateral Segments

The prevalence of Class I, Class II, and Class III canine relationships was 69.6%, 22.4%, and 4.4%, respectively, while an asymmetric canine relationship was found in 3.6% of the examined children. Class I, Class II, and Class III, and asymmetric canine relationships in males were observed in 71.0%, 23.7%, 2.8%, and 2.5% of cases, respectively, and in females were found to be 67.9%, 20.6%, 6.4%, and 5.1% in that order. There were no significant differences between males and females or different age groups in the distribution of canine relationships ($P \geq 0.084$). Additionally, there was no significant asymmetric distribution of Class I and Class II on the right or left side, according to Cochran-Mantel-Haenszel statistics.^[27]

Incisal Segment

Overjet

An *OJ* value ranging between 1 and 3 mm was observed in 82.6% of cases, while 11.4% of children had an *OJ* exceeding 3 mm. Anterior crossbite was noted in 1.4% of the sample, while 4.6% of the group had an edge-to-edge incisal relationship. A tendency of decreasing trend in the mean *OJ* value with increasing age was not observed in this sample ($P < 0.241$). Additionally, there was no sex difference in the value of *OJ* ($P = 0.561$).

Overbite

An *OB* value ranging between 1 and 3 mm was found in 56.5% of cases (50% of girls; 61% of boys), while 35.6% of children had an *OB* exceeding 3 mm (39% of girls; 31.1% of boys). An edge to edge incisal relationship (zero *OB*) was present in 6% of the examined children (6.4% of girls; 5.7% of boys), and an openbite was observed in 2.6% of the sample (3.8% of girls; 1.8% of boys). There was no correlation between *OB* and age at $P = 0.254$, but a significant difference in the *OB* value between both sexes was observed at $P = 0.048$.

Transverse Relationship of the Posterior Segment

Posterior crossbite was noted in 5.6% of children, asymmetric in 4.6% and symmetric in 1.0%. Scissors bite existed in 0.2%

of the subjects. There was no correlation between sex and crossbite ($P = 0.225$), and also no correlation between age and crossbite at $P = 0.838$ [Table 3].

DISCUSSION

The current study examined 3- to 5-year-old urban Libyan preschool children living in Benghazi city to provide information about the prevalence of malocclusion in primary dentition. Thus, the results are considered preliminary and more studies are required on larger groups across the whole of the country.

Intraarch Measurements

In the present study, closed dentition and crowding were found in 18.4% and 41.5% of the upper and lower arches, respectively. These subjects are more prone to develop crowding in the permanent dentition although space might be provided by increased intercanine width, more proclined incisors position, and leeway space. The prevalence of crowding is found to increase at later stages in Caucasian subjects,^[16,19-21] but the opposite seems to occur in Libyan subjects from the study community; in the permanent dentition of the upper and lower arches crowding occurs in 13.6% and 12.2% of subjects respectively, but appears to be less prevalent than in the primary dentition. This might suggest that dental crowding in urban Libyan children is mostly a transient feature that is eventually resolved during the transitional stage from primary to permanent dentition by deriving space from a slight increase in arch width across the canines, a slight labial positioning of the central and lateral incisors and distal shift of the permanent canines^[28].

Table 1: Sex and age distribution and mean age of the examined group. There was no significant differences in the male female distribution among age groups ($P = 0.391$)

Sex	Number	Mean age
Boys	282	4.1
Girls	218	4.2
Total	500	4.1

Table 2: Distribution of canine anteroposterior relationship among males and females ($P = 0.087$)

Sex	Class I	Class II	Class III	Asymmetric
Males ($n=282$) 56%	71	23.7	2.8	2.5
Females ($n=218$) 44%	67.9	20.6	6.4	5.1
% of the total	69.6	22.4	4.4	7.6

Table 3: Distribution of transverse interarch relationships for lateral segments in males and females. Crossbite was more observed in girls. However, the difference was not significant ($P = 0.225$)

Sex	Normal	Crossbite	Scissors bite
Males ($n=282$) 56%	95.4	4.2	0.4
Females ($n=218$) 44%	92.7	7.3	0
% of the total	94.2	5.6	0.2

Interarch Measurements

A number of previous studies reported the prevalence of malocclusion in primary dentition in different populations.^[5-13,22,24,25] The category distribution for Class I, Class II, and Class III canine relationships in the present study was 69.6%, 22.4%, and 4.4%, respectively [Table 3]. A similar distribution (66.5%, 25.4%, and 3.7%, respectively) was also observed in the permanent dentition of Libyan subjects^[14] from the same community as the present research, but to date there has been no cross-sectional observational study of the patterns of occlusal relationship in urban Libyan preschool children, and how these change with age. The frequency of a Class I and Class II canine relationship in males was greater than in females (71% and 23.7%, against 67.9% and 20.6%, respectively), while a Class III canine relationship in females at 6.4% was found to be more frequent than in males at 2.8%.

The published range of the prevalence of Class II malocclusion in primary dentition in different communities is 19-36%.^[5-13] Moreover, there is a wide discrepancy in the reported Class II malocclusion in the permanent dentition ranging between 15% and 33%.^[14,17,18] The prevalence of Class II malocclusion in the present study (22.4%) was slightly lower than in French subjects^[6] (25.8%), and lower than in Danish^[13] (31%), British^[10] (45%), Saudi^[7] and Jordanian^[9] children (29%). The similarity of the Class II malocclusion rates in the primary and permanent dentition of Libyan subjects might suggest that the permanent dentition interarch sagittal relationship is determined at an early age and remains stable. In turn, this might indicate that early recognition of such discrepancies is required to prevent the development of malocclusion or propose early treatment.

OJ within the normal range (1-3 mm) is more prevalent in Libyan children (82.6%) than in French^[6] (76%), Jordanian^[9] (63.5%), and 3-year-old Finnish children^[22] (2.1%). An *OJ* exceeding 3 mm was noticed in 11.4% of the present group, which is similar to the value observed in Saudi^[7] (13.5%), Nigerian^[7] (14.7%), and French^[6] (16.7%) children, but less than that found in Jordanian^[9] (24.7%) children. The prevalence of *OJ* measurements in the primary dentition of Libyan children does not reflect the *OJ* frequency observed in the permanent dentition of Libyan subjects, where a reduced number of subjects presented with *OJ* within normal range^[14] (51%). Moreover, *OJ* exceeding 3 mm was seen in 48.7% of subjects, suggesting that increased *OJ* in the primary dentition is not a precise indicator of a similar increase in the permanent dentition. A reverse *OJ* was observed in 1.4% of children, while the prevalence is only 0.6% in the permanent dentition.^[14]

Posterior crossbite was found in 5.6% of the group [Table 3]. This figure is similar to the reported prevalence in Jordanian^[9] and Swedish^[23] children (7%), but less than observed in Belgian^[24] (10%), Finnish^[21] (13%), and French^[6] children (15.5%). Saudi^[7] and Nigerian^[8] children presented with crossbites less frequently at 4% and 4.8%, respectively. Examining subjects with permanent dentition from the same

community in Benghazi city revealed increased prevalence of crossbite at 13.5%.^[14] This suggests that transverse discrepancy of the dental arches in the primary teeth might worsen at a later age. However, longitudinal studies of the same subjects are required to explore these findings. Scissors bite was observed only in one child, accounting for 0.2% of the sample. Scissors bite was not observed in Saudi children.^[7] Kisling *et al.*,^[25] observed only 14 cases with this discrepancy in a group of 1396 Danish children. Additionally, scissors bite occurred in only 0.3% of a group of 343 subjects with permanent dentition,^[14] which reflects a similar trend in the scissors bite occlusal trait in both the primary and permanent dentition.

The prevalence of normal overbite in this study (56.5%) was greater than in Jordanian^[9] (44.3%), Saudi^[7] (44.3%), and less than in French^[6] (60.8%) children. The frequency of anterior openbite (2.6%) was similar to that observed in an Indian population^[29] (2.75%), but less than that in Jordanian^[9] (5.7%), Saudi^[7] (9.5%), and Finnish^[12] (11%) children, and significantly less than western European children where over one third of subjects had anterior openbite.^[5,6] This difference might be due to the reduced frequency of non-nutritive sucking habits, such as dummy and finger sucking habits among Libyan children. This might be especially true as the prevalence of openbite in Libyan permanent dentition from the same community found to be at a similar percentage^[14] (2.8%). Further studies of the relationship between sucking habits and the presence of openbite in Libyan children are currently underway. This research showed that there is no significant difference in the mean overbite with age, suggesting that there are no changes as children develop in the functional constraints influencing the vertical relation of the incisors.

It seems clear that the development of occlusion is a continuum from primary to permanent dentition for a number of traits, and that malocclusion can be detected early on. If factors that predispose to the development of malocclusion in the primary dentition are recognized at a young age, early management options may be considered, especially for the treatment of posterior crossbites. However, such early intervention is a controversial subject in orthodontics.^[30,31] Further longitudinal studies are required to evaluate the changes in occlusal pattern from deciduous to permanent dentition. Moreover, nationwide studies on Libyan preschool children with larger sample sizes are recommended to help obtain a clearer picture about occlusal traits in deciduous dentition.

CONCLUSION

The current findings provide an insight into the prevalence of occlusal traits in urban Libyan preschool children and highlight the significance of early detection of malocclusion to assist in achieving effective and individualized long-term treatment planning. Furthermore, it shows that the development of occlusion is a continuum from primary to permanent dentition for a number of traits.

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