Original Article

Frequency of Malocclusion in 3 to 5-Year-Old Children in Isfahan, Iran: A Cross-Sectional Study

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ABSTRACT

Background and Aim: Occlusion analysis in the primary dentition period can predict the occlusion of permanent dentition. This study aimed to assess the frequency of malocclusion in primary dentition period in 3 to 5-year-old preschoolers in Isfahan city, Iran.

Materials and Methods: This descriptive, cross-sectional study analyzed the occlusion of primary teeth in 400 children between 3 to 5 years who were selected from 8 kindergartens in Isfahan city during 2019-2020. The dentition of children was clinically examined by a dental mirror and a tongue blade after obtaining consent from the parents. The children had all the primary teeth with no permanent tooth, and had no extraction in their treatment plan. The primary molar relationship, canine relationship, and anterior or posterior crossbite, overbite and overjet were all assessed and recorded. Data were analyzed using the Chi-square, Kruskal-Wallis, and Fisher's exact tests.

Results: Of all, 82.75% of the children had flush terminal plane (FTP), 10.25% had distal step, and 6% had mesial step. Class I canine relationship had the highest prevalence (87%) followed by class II (8.25%) and class III (4%). The frequency of increased overjet was 14.25%. Deep bite (15%) was the most prevalent malocclusion. Anterior and posterior crossbite had 6.25% prevalence.

Conclusion: Relatively high prevalence of malocclusion in our study population calls for in-time assessment of primary occlusion for timely detection and management of malocclusions in the primary dentition period to prevent their aggravation.

Keywords: Dental Care; Dental Occlusion; Malocclusion

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Introduction

Dental and skeletal anomalies in preschoolers may have a genetic origin, or may be acquired due to some habits or alterations in forces applied to the primary dentition. Occlusion in primary dentition period may predict the occlusion in permanent dentition period, and some malocclusions in primary dentition may continue to the mixed and permanent dentition if not properly managed in-time.(1)

Thus, it is imperative to assess the primary dentition and analyze the possible malocclusions to prevent their aggravation and continuation to permanent dentition. Occlusion analysis of primary dentition should include assessment of the leveling and alignment of primary teeth, and anterior and posterior occlusal relationships. Zhou et al.(2)

Reported high prevalence of malocclusion (83.9%) in children in Shanghai, China. Jamal

et al.[3] evaluated Iraqi children and reported the prevalence of flush terminal plane (FTP) to be 69.4%. Also, they reported that class I canine relationship had maximum frequency, and the prevalence of increased overbite was 31.6%. Yilmaz et al.[4]

Reported the prevalence of FTP to be 88.29% in Turkish children and demonstrated that class I canine relationship had maximum frequency. However, another study on Brazilian children reported that mesial step molar relationship was the most common.[5] Considering the variability in reported prevalence rates, and the significance of early detection of malocclusion for proper and timely management, studies on different populations and geographical areas are required to provide clinicians with accurate and up-to-date information regarding the prevalence of malocclusion in each region and population. Thus, this study aimed to assess the frequency of malocclusion in primary dentition period in 3 to 5-year-old preschoolers in Isfahan city, located at the center of Iran.

Materials and Methods

This descriptive, cross-sectional study analyzed the occlusion of primary teeth of 400 children between 3 to 5 years of who were selected from 8 kindergartens in Isfahan city during 2019-2020. The inclusion criteria were 3 to -5-year-old cooperative children with complete primary dentition, no permanent tooth, and no extraction in their treatment plan, whose parents consented to their participation in the study. Children with severe dental caries, tooth extraction in their treatment plan, and history of orthodontic treatment or tooth extraction were excluded.

Sample size was calculated to be 200 girls and 200 boys assuming 95% confidence interval, maximum error of 0.07, power of 80%, mean difference of 0.14, alpha=0.05, and d=0.07.

For selection of kindergartens, 2 kindergartens were randomly selected from each of the northern, southern, eastern and western districts of Isfahan city (a total of 8), and around 45 to 55 children between 3-5-years were enrolled from each kindergarten (equal number of girls and boys) using convenience sampling.

First, the children were briefed about the significance of primary teeth, and the correct tooth brushing technique in an informatory session. After obtaining written informed consent from the parents and ensuring them about the confidentiality of information, the children underwent clinical examination by a dental mirror and a wooden tongue blade. All examinations were performed by one single examiner. Prior to the examination, an orthodontist taught trained the examiner on the examiner all the steps, and how to diagnose measure the overjet and, overbite, and how to detect crossbite including and canine and molar relationship. Following the dentist'sdental examination, a number20% of children from every each kindergarten were re-examined by an orthodontist, and the secondary examination data were compared with the primary examination data to ensure data accuracy. The occlusion of children was analyzed by assessing the following five parameters: primary canine relationship and primary molar relationship,[6]overjet and overbite,[7] and crossbite.[8] To measure the overjet, a tongue blade was placed in contact with the labial surface of the mandibular central incisors and the incisal edge of the most anterior maxillary central incisor in centric occlusion, and the amount of overjet was marked on the tongue blade with a pencil. To measure the overbite, ,this was graded according tothe coverage of the mandibular incisor by the most protruded fully- erupted maxillary incisor was measured. The value was then measured and recorded. ForC measure the crossbite, this was recorded when one or more of the maxillary primary molars occluded the lingual to the buccal cusps of the opposing mandibular teeth. For recognitionThe primary canine relationship and the primary molar relationship (equal to Angle's classification) were determined by observation was used.

Data were analyzed using SPSS version 22 (SPSS Inc., IL, USA). The Fisher's exact test was used to analyze the molar and canine relationships, overjet and crossbite separately for male and female students. The Fisher's exact test and the Kruskal-Wallis test were applied to analyze the abovementioned data based on age. The Chi-square test was used to analyze the overbite based on gender while the Chi-square test and Kruskal-Wallis test were used to analyze the overbite based on age. $P<0.05$ was considered statistically significant.

abovementioned data based on age. The Chi-square test was used to analyze the overbite based on gender while the Chi-square test and Kruskal-Wallis test were used to analyze the overbite based on age. P<0.05 was considered statistically significant.

Results

Of 400 children, 200 (50%) were males and 200 (50%) were females. Table 1 presents the distribution of children based on their age and gender.

Table 1. Distribution of children based on their age and gender

Gender / Age	Female	Male	Total	Percentage
3 yrs.	57	52	109	25.27
4 yrs.	68	70	138	34.5
5 yrs.	75	78	153	38.25
Total	200	200	400	100

Molar relationship:

Table 2 shows the frequency distribution of different types of molar relationship in the study population.

Among all children, FTP was the most common molar relationship (82.75%) followed by distal step (10.25%), mesial step (6%), and distal step at one side, and FTP at the other side (1%). Based on gender, FTP was the most common molar relationship in both girls and boys. The Fisher's exact test revealed no significant difference in molar relationship between girls and boys (P=0.755). Based on age, bilateral FTP was the most common molar relationship in all three age groups of 3, 4 and 5 years, followed by distal step, and mesial step. The Fisher's exact test revealed no significant difference in molar relationship between different age groups (P=0.494).

Canine relationship:

Table 3 shows the frequency distribution of different types of canine relationship in the study population. As shown, bilateral class I canine relationship had the highest frequency in the study population (87%), followed by bilateral class II (8.25%) and class III (4%) relationships.

Table 2. Frequency distribution of different types of molar relationship in the study population

Frequency / Molar relationship	Number	Percentage
Bilateral FTP	331	82.75
Distal step	41	10.25
Mesial step	24	6
Distal step at one side and FTP at the other side	4	1
Total	400	100

Based on gender, class I canine relationship was the most common in both males (88.5%) and females (85.5%). According to the Fisher's exact test, the frequency of different types of canine relationship was not significantly different between males and females (P=0.794). Based on age, bilateral class I canine relationship was the most common in all three age groups followed by class II and class III. The Fisher's exact test revealed no significant difference in canine relationship between different age groups (P=0.917). Also, the Kruskal-Wallis test revealed no significant difference in age between different classes of canine relationship (P=0.586).

Table 3. Frequency distribution of different types of canine relationship in the study population

Frequency / **Canine relationship**	**Number**	**Percentage**
Class I	348	87
Class II	33	8.25
Class III	16	4
Class I at one side and class I at the other side	3	0.75
Total	400	100

Overjet:

Table 4 shows the frequency distribution of different types of overjet in the study population. Of all, 78.25% had normal overjet, 14.25% had increased overjet, 7% had edge-to-edge, and 0.5% had reverse overjet.

Based on gender and age, normal overjet had the highest frequency in both boys (77.5%) and girls (79%) and all three groups, followed by increased overjet, edge-to-edge, and reverse overjet. According to the Fisher's exact test, the frequency of different types of overjet was not significantly different between males and females (P=0.966) and between different age groups (P=0.791).

Table 4. Frequency distribution of different types of overjet in the study population

Overjet	Number	Percentage
Normal	313	78.25
Increased	57	14.25
Edge-to-edge	28	7
Reverse	2	0.5
Total	400	100

Overbite:

Table 5 shows the frequency distribution of different types of overbite in the study population. Of all, 74% showed normal overbite followed by deep bite (15%), edge-to-edge (7%), and open bite (4%). Based on gender and age, normal overbite had maximum frequency in both males (75%) and females (73%) and all three age groups, followed by deep bite, edge-to-edge, and open bite. The Chi-square test showed no significant difference in the frequency of different types of overbite between males and females (P=0.738) and between different age groups (P=0.929). Also, the Kruskal-Wallis test found no significant difference in age between children with different types of overbite (P=0.721).

Crossbite:

Table 6 shows the frequency distribution of different types of crossbite in the study population. Of all children, 6.25% had crossbite; among which, posterior unilateral crossbite had the highest frequency (2.5%) while anterior bilateral crossbite had the lowest frequency (1%).Based on gender, 6% of boys and 6.5% of girls had crossbite.

Table 5. Frequency distribution of different types of overbite in the study population

Overbite	Number	Percentage
Normal	296	74
Deep bite	60	15
Edge-to-edge	28	7
Open bite	16	4
Total	400	100

The Fisher's exact test showed no significant difference in the frequency of crossbite between males and females (P=0.9). Based on age, posterior crossbite had a higher frequency than anterior crossbite in all three age groups.

Table 6. Frequency distribution of different types of crossbite in the study population

Type	Frequency	Number	Percentage
Crossbite	Anterior	9	2.25
	Posterior	16	4
	Total	25	6.25
Anterior crossbite	Unilateral	5	1.25
	Bilateral	4	1
	Total	9	2.25
Posterior crossbite	Unilateral	10	2.5
	Bilateral	6	1.5
	Total	16	4

However, the difference in frequency of crossbite was not significant among the three age groups (P=0.954). The Kruskal-Wallis test showed no significant difference in age between different types of crossbite either (P=0.711).

Discussion

Considering the gap of information regarding the occlusal status of preschoolers in Iran, this study assessed the frequency of malocclusion in primary dentition period in 3-5-year-old preschoolers in Isfahan city. The results showed that FTP was the most common molar relationship in the study population (82.75%), which was in agreement with the results of Sahebalam et al,[9]

in Mashhad city, and Jamal et al,[3] on Iraqi children, reporting 69.4% prevalence of FTP. FTP can be converted to edge-to-edge or class I occlusion in permanent dentition.[10] Abuaffan and Abd-Alrahman[11] reported the prevalence of FTP to be 72% in Sudanese children in Khartoum state. Sriram et al.[12] reported the prevalence of bilateral FTP to be 74% in Chennai and 72.5% in Hyderabad, India. Yilmaz et al.[4] indicated that FTP was the most common molar relationship in their study population with a prevalence rate of 88.29%. Anu et al.[13] reported the prevalence of FTP to be 54.05%, mesial step to be 43.73% and distal step to be 2.08%.

In our study, distal step (10.25%), and mesial step (6%) ranked next after FTP in terms of frequency. Sahebalam et al,[9] in their study conducted in Mashhad reported the most common molar relationship to be straight similar to our study. However, mesial step was more common than distal step. These differences indicate the necessity to conduct extensive research in different regions of a country for a more accurate assessment. Abuaffan and Abd-Alrahman[11] reported the prevalence of mesial step and distal step to be 23% and 3.1%, respectively. Distal step molar relationship can lead to class II or edge-to-edge occlusion in permanent dentition while the mesial step can result in class I or class III relationship in permanent dentition.[10] Yilmaz et al. [4] reported higher frequency of distal step, compared with mesial step. In a study conducted by Candido et al,[5] in Brazil the most common molar relationship was mesial step, followed by straight, and then distal step. This contradicted the results of our study, which could be attributed to racial differences.

Regarding the canine relationship, class I was the most frequent type (87%) in our study followed by class II (8.25%) and class III (4%). Also, 0.75% had unilateral class I and class II relationship. These results were in line with the findings of Jamal et al,[3] on Iraqi children and Santos Junior et al, [14] on Brazilian children. Bugaighis [15] evaluated 800 urban Libyan preschool children and reported that class I canine relationship was the most common followed by class II, and class III; their results were in accordance with our findings.

In assessment of overjet, normal overjet had the highest frequency (78.25%) followed by increased overjet (14.25%), edge-to-edge (7%), and reverse overjet (0.5%). These results were in line with the findings of Bugaighis[15] who reported that 82.6% of the population had normal overjet; increased overjet ranked second (11.4%). In the study of Zhou et al,[2] based in Shanghai, China, an inverted overjet of 8% was reported, which may be due to racial differences with higher mandibular growth tendency in East Asia. This study also reported an increase of 33.9% of overjet. Moreover, overjet in numerous studies over different regions yielded similar results which is because in age groups between 3-5, mandible enlargement has not occurred yet but it becomes distinct during the subsequent years. Even those who may have different growth tendencies at this age show similar overjets. Even those who have different growth tendencies at this age show similar overjets.

In assessment of overbite, normal overbite had the highest prevalence (74%) in our study, which was in agreement with the results of Jamal et al,[3] In their study, normal overbite had the highest prevalence of 67.3%. Bugaighis[15] reported the prevalence of normal overbite to be 56.5%, which was the highest among different types, and confirmed our results. After normal overbite, deep bite (15%), edge-to-edge (7%) and open-bite (4%) had the highest prevalence. In the study of Jamal et al,[3] a higher percentage of children (67.3%) showed normal overbite and 31.6% showed deep bite. The results of this study were almost in line with our study, but due to the difference in sample size, the percentages obtained differed from our study. Bugaighis[15] reported similar results (normal overbite followed by deep bite).

In the study of Zhou et al.[2] conducted in Shanghai, China, deep overbite had a prevalence of 63.7% and normal overbite had a prevalence of 35.9%, contradicting the results of our study, possibly due to racial differences. In the present study, crossbite had a prevalence of 6.25%; of children with crossbite, 2.25% had anterior and 4% had posterior crossbite. In the study by Santos Junior et al,[14] posterior crossbite had a higher prevalence than anterior crossbite, which

was in agreement with our results. Regarding crossbite, in the study of Zhou et al,[2] the rate of anterior crossbite was 8% and posterior crossbite was 0.3%. Bhat et al,[16] In India mentioned the rate of anterior and posterior crossbite to be 0.4% each. The results of both studies did not agree with our findings. The difference in the prevalence of posterior crossbite may be due to the difference in the prevalence of sucking habits. Children who are accustomed to such habits are more likely to have posterior crossbite; however, scientific evidence cannot precisely confirm the type of malocclusion most commonly associated with non-nutritional sucking habits. In the study of Duraisamy et al.[17] the prevalence of crossbite was 10.7% but they did not mention the percentage of anterior and posterior crossbite.

Future studies on different cities and provinces of Iran are required to more accurately assess the prevalence of malocclusion in primary dentition in the Iranian population. Also, future studies should use standard definitions for malocclusions particularly overjet and overbite because a wide variation exists in definitions of these malocclusions.

Conclusion

Deep bite was the most common malocclusion in our study population. Relatively high prevalence of malocclusion in our study population calls for in-time assessment of primary occlusion for timely detection and management of malocclusions in primary dentition period to prevent their aggravation.

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Conflict of interest: The authors have no conflict of interests to declare.

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