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Prevalence of dental midline shifting among 7- to 15-year-old children in Babylon/Iraq

Omaima L. Salman, Sarah Y. Al Khafaji and Zahraa M. H. Wais

Abstract

OBJECTIVE: This study aimed to determine the prevalence of dental midline shifting in a group of children with mixed dentition aged 7–15 years in Babylon/Iraq and assess the association between different variables including gender, age stages, residency, and Angle's classes of malocclusions with midline shifting.

MATERIALS AND METHOD: A total of 300 dentate children aged 7–15 years (119 males and 131 females) were randomly chosen from children who visited the Department of Orthodontics, Pedodontics, and Prevention at the College of Dentistry/University of Babylon. The participants were from various environmental areas (162 urban and 88 rural area subjects). The dental midline shifting evaluation includes verifying the maxillary and mandibular dental midline positions with respect to the facial midline, taking philtrum as a guide. Statistical Package for the Social Sciences (SPSS) version 20.0 for Windows was used for data analyses using Pearson's Chi-square tests. The significance level was set at $P < 0.05$.

RESULTS: More than half of the total sample had dental midline shifting (55.66%), which was relatively more prevalent in the mandible than in the maxilla. The prevalence of dental midline shifting was more common in females (31.3%), subjects over the age of 12 years (20%), and subjects from urban areas (37%). The midline deviation was more frequent in Angle's class I (34%) and class II (13%) malocclusion than in Angle's class III malocclusion (9%) with statistically significant differences ($P = 0.028$). 63.47% of the sample had midline shifts of 2 mm or more.

CONCLUSIONS: About half of the studied sample showed a maxillary–mandibular dental midline shift. The dental midline shift is more commonly noticed in females and children over 12 years old. A statistically significant difference was found between the shift of the dental midline and Angle's classes of malocclusions, with class I having the greatest midline shift.

Keywords:

Dental midline shift, malocclusion, mixed dentition, prevalence

Introduction

In dentistry, one of the primary goals of dental treatment is to improve facial esthetics. The harmony of the dental midline with the facial components considerably contributes to esthetics.[1,2] The dentofacial asymmetries may lead to functional and esthetic problems. Perfect bilateral symmetries rarely exist in normal individuals and even in those with esthetically pleasing faces; slight right and left differences are present. This minor facial asymmetry is common, indiscernible, and does not require any treatment.[3]

The alignment of landmarks such as the philtrum, chin, and nose defines the facial midline. It should be in the middle of the face and align with the dental midline.[4,5] The dental midline is a midsagittal line that bisects the maxillary and mandibular dental arches when teeth are in maximum

Department of Preventive, Orthodontics and Pediatric Dentistry (P.O.P), College of Dentistry, University of Babylon, Babylon, Iraq

Address for correspondence:
Dr. Omaima L. Salman, College of Dentistry, University of Babylon, Aljamia Sq. 60 Street, Babylon, Iraq.
E-mail: omaimalateef@uobabylon.edu.iq

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intercuspation. Each arch has its own midline, and when the two do not match, the situation is referred to as a midline shifting or deviation.[6] It is one of the most frequent and persistent problems that dentists encounter and poses difficulties in both diagnosis and management.[7]

The likely match of the facial and dental midlines is the initial step in the esthetic rehabilitation of dental patients.[8,9] For better esthetic outcomes, the matching of the maxillary dental midline with the facial midline is more important in comparison with the mandibular dental midline coincidence with the facial midline. This may be enlightened by the fact that the maxillary anterior teeth are primarily visible during the smile and function.[4]

Midline deviation can have a single cause or multiple causes. It might be brought on by dental causes such as congenital tooth or teeth loss, early deciduous tooth loss, crowding, tooth rotation, and habits such as thumb sucking or mouth breathing. Skeletal asymmetry can affect several skeletal structures on one side of the face, as in hemifacial microsomia, cleft lip, and palate, or it can involve the size discrepancy or improper positioning between the maxilla and the mandible in relation to the facial skeleton.[10]

Another cause of midline deviation is the dental interferences that prevent proper intercuspation in the centric position and cause the mandible to functionally shift to one side upon closure; typically, to the symptomatic side, the mandible will shift back to its normal position with no deviation as soon as interferences are removed.[11]

When designing an orthodontic treatment, the assessment of the dental midline position to the facial midline is a crucial diagnostic component. Determining the midline position of the teeth can be challenging because other midline facial structures can occasionally be out of alignment.[12] The dental midlines can be assessed at open mouth, at centric relation, at initial contact, and at centric occlusion.

According to Miller *et al*.,[13] only one-fourth of people have the maxillary and mandibular midlines coincide. The maxillary midline is located exactly in the center of the mouth in about 70% of individuals. The midline deviation can be present in most types of cases, but perhaps class II malocclusions are where it is most frequently observed.[14]

Dental midline deviations greater than 2 mm are typically regarded as a cause for concern because they are more noticeable and less likely to enhance facial attractiveness than shifts between 1 and 2 mm or less.[7,15]

Beyer and Lindauer[16] conducted a study to determine the permissible range of dental midline deviation. One hundred and twenty people were chosen to review pictures of two different subjects. Digitally modified versions of the images were used to create various amounts of midline deviation. The average midline deviation that was deemed to be esthetically acceptable was found to be 2.2 mm. Zhang *et al*.[1] conducted another study to determine the midline deviation threshold that was considered acceptable. The study used facial images of six subjects with various facial types. The dental midline was digitally moved around in the images, and they underwent evaluation. The midline deviation was considered acceptable if it fell below a mean value of 2.4 mm.

Instead of being considered a static condition, occlusion is thought of as a dynamic functional relationship. It is affected by every part of the masticatory system and changes constantly throughout life.[17] Dentists must closely supervise the details of the developing dentition from the patient's first year of life until they reach adulthood.[18] To understand dentition, it is essential to take into account any observations a clinician may have and recognize any malocclusion early so they can intervene or refer to a specialist. Clinical observations have revealed that midline shift can happen around the time that the first permanent molars erupt. This study aimed to determine the prevalence of dental midline shifting in the mixed dentition period (7–15 years old) of a group of children in Babylon/Iraq.

Materials and Methods

A cross-sectional study was conducted in the Orthodontics, Pedodontics, and Prevention Department at the College of Dentistry/University of Babylon from November 2021 till June 2022. Informed written consent was obtained from all participants after elucidating the objectives and the nature of the study in detail.

This study was conducted in accordance with the ethical principles that have their origin in the Declaration of Helsinki. Ethical approval for this study was provided by the Central Committee for Scientific Research Ethics, Iraq, according to document number 256 on November 2021.

A total of 300 dentate children with mixed dentition aged 7–15 years (119 males and 131 females) were randomly chosen from children who visited the Department of Orthodontics, Pedodontics, and Prevention, College of Dentistry/University of Babylon. There was no suggested ratio of males to females. The participants were from various environmental areas (162 urban and 88 rural area subjects).

Subjects with a history of previous orthodontic treatment or who had undergone any orthodontic treatment were excluded from the study, as were those with prosthetic treatment for the anterior teeth, trauma, surgery, and significant local/systemic problems that affected the growth and development of facial structures or the body, such as cleft lip and palate, acute traumatic injury, facial palsy, neuropathy, craniofacial syndromes, and neoplasia.

Personal information and clinical examination had been recorded for each participant. The information gathered included the age, residency, malocclusion classification, presence or absence of dental midline deviation, and degree of deviation.

To conduct the midline dental examination, each participant was given instructions to sit in the dental chair and look forward with back straight in a sitting posture without using the headrest. The participants were told to close their mouths in maximum intercuspation. The evaluation takes into account the maxillary and the mandibular dental midline regarding the facial midline using the philtrum as a guide. By stretching a piece of dental floss vertically between the soft-tissue nasion until the pogonion, including the center of the philtrum, the facial midline was identified. The maxillary midline is taken as the line passing between the upper central incisors, and the mandibular midline is taken as the line passing between the lower central incisors. The shifting of the maxillary and mandibular dental midlines was observed. Any shift in the dental midline either to the right or left was evaluated and quantified using a vernier as <2 mm or >2 mm. Each participant's midline evaluation form was completed by a single investigator, and to eliminate intra-observer error, the same investigator double-checked each recording.

Statistical analysis

The analyses were conducted using Statistical Package for Social Sciences (SPSS version 20.00, Chicago, Inc.) for Windows. Descriptive statistics and Pearson's Chi-square tests were used to statistically evaluate the obtained data. Any values of P-level less than 0.05 were regarded as statistically significant.

Results

In the studied group, the dental midline shift was seen in 30.66% (n = 92) of subjects in the mandibular arch and 18% (n = 54) of subjects in the maxillary arch, and 7% (n = 21) in both the maxilla and the mandible, resulting in 55.66% (n = 167) of the subjects having the dental midline shift [Figure 1, Table 1].

Dental midline shift was more common in females (31.3%, n = 94) than in males (24.3%, n = 73). In comparison with subjects from rural areas (18.6%, n = 56), those from urban areas were more affected (37%, n = 111) [Figure 2, Table 1].

The percentage of children with this anomaly increased with age: 16.3% (n = 49) of the children at 7–9 years, 19.3% (n = 58) of the children at 10–12 years, and 20% (n = 60) of the children at age 13–15 years [Figure 3 and Table 1].

The dental midline shift was observed in 34% (n = 110) of children with Angle's class I malocclusion, 13% (n = 36) of children with Angle's class II malocclusion, and 9% (n = 27) of those with Angle's class III malocclusion, as shown in Figure 4, Table 1.

In the study group, the shift of dental midline, which is greater than or equal to 2 mm, was 63.47% (n = 106) of the children who had this anomaly, while 36.53% (n = 61) of the children had a shift of dental midline less than 2 mm [Table 2].

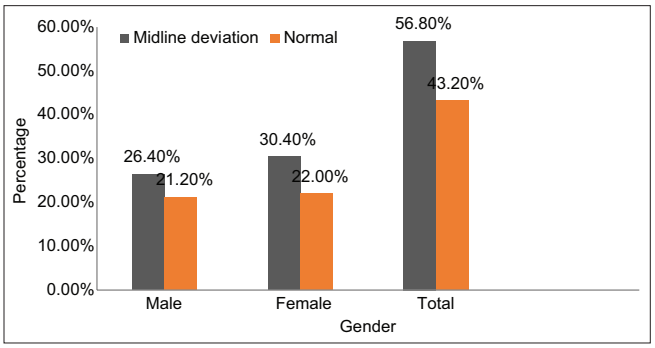

Figure 1: Prevalence of dental midline deviation according to gender

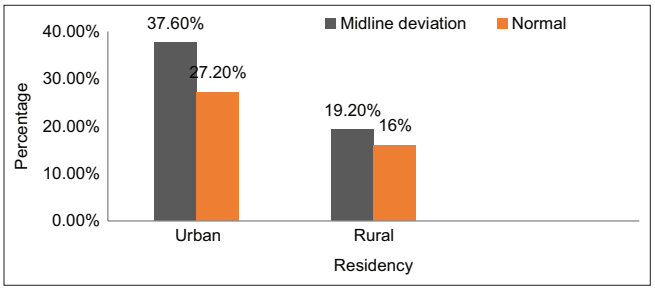

Figure 2: Prevalence of dental midline deviation according to residency

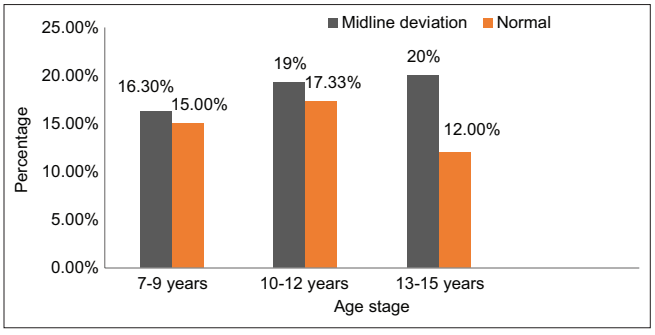

Figure 3: Prevalence of dental midline deviation according to age stage

Table 1: Correlations between dental midline deviation of children and statistical variables

Variable	Dental midline deviation		Normal		Total		Pearson's Chi-square test	*P*
	No.	%	No.	%	No.	%		
Gender	167	55.6	133	44.33	300	100	0.79	0.37
Male	73	24.3	65	21.66	138	46		
Female	94	31.3	68	22.66	162	54		
Age stages	167	55.6	133	44.33	300	100	2.67	0.26
7–9 years	49	16.3	45	15	94	31.33		
10–12 years	58	19.3	52	17.33	110	36.66		
13–15 years	60	20	36	12	96	32		
Residency	167	55.6	133	44.33	300	100	0.99	0.31
Urban	111	37	81	27	192	64		
Rural	56	18.6	52	17.33	108	36		
Angle's classification	167	55.6	133	44.33	300	100	7.14	0.028*
Class I	102	34	96	32	198	66		
Class II	39	13	27	9	66	22		
Class III	27	9	9	3	36	12		

*Statistically significant differences when $P<0.05$.

Table 2: Counts and percentages of children with midline deviation greater than or equal to, or less than, 2 mm

Midline deviation	No.	Percentage
Greater than or equal to 2 mm	106	63.47%
Less than 2 mm	61	36.53%
Total of subjects with midline deviation	167	100%

Pearson's Chi-square test revealed no statistically significant results between the shift of the dental midline and the gender difference and residency ($p > 0.05$), as shown in Table 1, and no significant difference was observed between dental midline deviation and age stages ($P = 0.032$).

A statistically significant correlation was found between the deviation of the dental midline and Angle's classes of malocclusions ($P = 0.028$). The Cramer coefficient (value of 0.009) indicates a weak relation [Table 1].

Discussion

This study statistically evaluated a group of children aged 7–15 years to determine the prevalence of dental midline deviation according to gender, age stages, residency, and Angle's classes of malocclusions. Based on the data collected, around half of the total sample (55.6%) had dental midline shifting or deviation, which was relatively greater in the mandible than in the maxilla. Thilander and Bjerklin[19] conducted a study on children from different developmental stages, resulting in a (13.2%) midline deviation in the sample of their study. Jayalakshmi *et al*.[20] observed maxilla–mandibular dental midline discrepancy in almost 80% of Indian students. A study by Khan *et al*.[2] observed that midline deviation in the Pakistani population was 17.2%. Bhateja *et al*.[21] also reported that 32.6% of their sample did not have coinciding dental midlines.

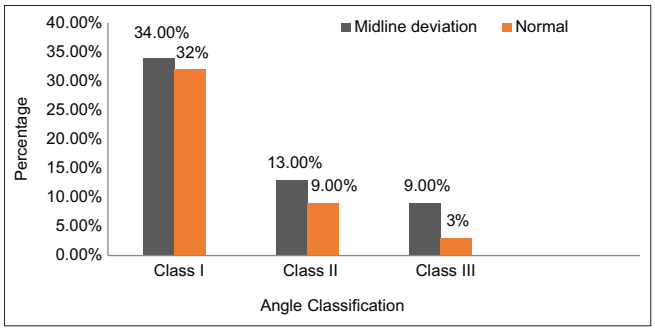

Figure 4: Prevalence of dental midline deviation according to Angle's classification

In a study conducted by Jain *et al*.,[10] it was found that orthodontic patients showed midline deviation in about 77% in routine clinical examination, 21% of patients showed maxillary dental midline shift, and 43% of patients showed mandibular dental midline shift, which is nearly twice of maxillary dental midline shift. A study conducted by Anistoroaei *et al*.[12] and Hamid *et al*.[22] reported that midline deviation in a sample of orthodontic patients was 20.70% and 49.41%, respectively, and it was slightly greater in the maxilla than in the mandible. The reason for these vast differences in the result of the current study from other previous studies is probably because of differences in the size, criteria of the sample, methods of examination, and racial differences. However, this study highlights the results of other studies that show the lack of maxillary and/or mandibular dental midline coincidence with each other or with the facial soft-tissue midline. Bishara *et al*.[23] and Nanda and Margolis[24] revealed that this may be due to skeletal asymmetries in which the maxilla or mandible is in malposition relative to the facial skeleton, or due to dental asymmetries resulting from displacement or distortion of the upper or lower dental arches, congenital missing tooth, early loss of deciduous teeth, and habits such as thumb sucking.

In females, the deviation of the dental midline was more frequent than in males with no statistically significant difference ($P = 0.37$). This finding is in agreement with the studies of Anistoroaei *et al*.[12] and Hamid *et al*.[22]

This current study agrees with the study conducted by Anistoroaei *et al*.,[12] in that the subjects from the urban area show more frequent dental midline deviation than those from a rural area with statistically insignificant differences ($P = 0.31$). The deviation of dental midline changed with age, and the prevalence of midline deviation increased after age 12 years but without statistically significant correlations. The increase in midline shift after this age may relate to the fact that after the age of 12 years, dental anomalies of the number, shape, dental size, position, dental crowding, spacing, and the consequences of premature loss of primary teeth cause the establishment of deviation of the maxillary and mandibular dental midlines.[12]

The prevalence of dental midline shift was higher in subjects with Angle's class I and class II than in those with Angle's class III malocclusion with a statistically significant difference. The study conducted by Anistoroaei *et al*.[12] showed that the prevalence of midline shifting is observed mostly in patients with class I and class II malocclusions with statistically significant high correlations. Patients with Angle's class III malocclusion were found to have a maximum midline shift as reported by Jain *et al*.[10] This is in disagreement with the present study, and it was found that class I cases have the maximum midline shift.

In the current study, the deviation of dental midline, which is greater than or equal to 2 mm, was 63.47% (n = 106) of the children who had this anomaly, while 36.53% (n = 61) of the children had a deviation of dental midline less than 2 mm. These findings are in contrast to the study of Al-Huwaizi *et al*.[25] that reported that the midline shifts in 44.8% of the sample were mostly of 1 mm, while midline shifts of 2 mm or more were found in 18.7% of the sample. People consider dental midline discrepancies a factor in plummeting smile attractiveness; it is found that the higher the deviations, the more it is easier to detect. Discrepancies of 2 mm or more have a 56% chance of being noticed by laypeople (nonprofessionals),[26] but it is also considered that the minor discrepancy in the midlines can be acceptable.[20]

Conclusions

More than half of the 300 dentate children (55.6%) have midline shifts. The midline shift was detected more in the mandible than in the maxilla. The shift of the midline in females is more frequent than in males. The urban area was more affected than the rural area. There were no statistically significant results between the shift of the dental midline with gender and residency. Dental midline shift increased with age, more frequent after 12 years of age, but without significant differences.

A statistically significant correlation was found between the deviation of the dental midline and Angle's classes of malocclusions, and it was more seen in children with Angle's class I malocclusion.

Coincident midlines are an important component of functional occlusion and can be used as a clinical guide for establishing ideal intercuspation.

Limitations of the study

The limitation of this study is that it included a comparatively small sample size. Subjects of other geographic locations were not able to be included in this study.

Recommendations

To better understand the cause of midline deviation, it is recommended to repeat the study on a larger scale on children transitioning from primary dentition to permanent dentition. Another recommendation for future research is to observe the occlusal changes that arise upon transitioning from the mixed dentition stage to the permanent dentition stage and find whether the existing problems resolve or persist.

Declaration of patient consent

All participants in the study agreed to the research and publication of the study.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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