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Website: www.jorthodsci.org
DOI: 10.4103/jos.JOS_83_18

# Prevalence of malocclusion among school children of Southern Saudi Arabia

Moshabab A. Asiry and Ibrahim AlShahrani<sup>1</sup>

## Abstract

**OBJECTIVE:** To evaluate the status of occlusion among school children in city of Abha, Saudi Arabia.

**MATERIALS AND METHODS:** The current study was based on the clinical examination of 1998 Saudis (mean age  $14.13 \pm 0.99$  years) who were randomly selected by a multi-stage random sampling technique from the city of Abha. The occlusal parameters recorded in this study were molar and canine relationships, overbite, overjet, crowding, spacing, anterior open bite, anterior crossbite, posterior crossbite, and scissors bite using gloves, light source, mouth mirror, and ruler.

**RESULTS:** Class I molar relationship was observed in 1219 (61%) of the total sample, while Class II and III molar relationships were observed in 326 (16.3%) and 154 (7.7%), respectively. Class I–III canine relationships were seen in 1255 (62.8%), 231 (11.6%), and 112 (5.6%) of the sample, respectively. Normal overbite was found in 1490 (74.6%) of cases, while 1515 (75.8%) had normal overjet. The most prevalent malocclusion trait was crowding (26.6%), followed by spacing (20.6%), increased overjet (19.5%), increased overbite (19.4%), posterior crossbite (8.5%), and anterior open bite (6.1%).

**CONCLUSIONS:** Crowding was the highest occlusal trait in frequency followed by spacing, increased overjet, and increased overbite. Class I molar and canine relationships, normal overjet, and normal overbite were frequent findings among Saudi adolescents in Abha city.

## Keywords:

Angle's classification, malocclusion, occlusal traits

## Introduction

Malocclusion is defined as an irregularity of the teeth or a malrelationship of the dental arches beyond the range of what is accepted as normal.<sup>[1]</sup> Malocclusion ranks the third highest prevalence among oral pathologies.<sup>[2]</sup> A wide number of factors are implicated in the development of malocclusion and can have significant physical and psychological effects on the affected individual owing to poor esthetic appearance, impaired oral function, frequent dental caries, speech difficulties, temporomandibular joint disorders, traumatic occlusion, and periodontal pathologies.<sup>[3]</sup>

Studying the prevalence of malocclusion helps to establish the appropriate preventive and orthodontic treatment programs. The prevalence of malocclusion has been reported for different populations.<sup>[2,4-13]</sup> These reports show great variations, including those conducted in the same population.<sup>[6]</sup> These variations could be related to the differences in ethnicity, sample size, recording methods, or subjects' age.<sup>[14]</sup> The prevalence of malocclusion in Saudi Arabia was studied by a few authors previously. Asiry revealed that 60.11% of individuals in Riyadh had Class I molar relationship while Class II and III molar relationships were reported in 7.12% and 10.13% of Saudis, respectively.<sup>[11]</sup> About 45.4%, 26.9%, and 16.4% of Saudi adolescents in Riyadh city have crowding,

Department of  
Pediatric Dentistry  
and Orthodontics,  
College of Dentistry,  
King Saud University,  
Riyadh, <sup>1</sup>Department  
of Pediatric Dentistry  
and Orthodontics,  
College of Dentistry,  
King Khalid University,  
Abha, Saudi Arabia

## Address for correspondence:

Dr. Ibrahim Alshahrani,  
Department of  
Pediatric Dentistry  
and Orthodontics,  
College of Dentistry,  
King Khalid University,  
Abha, Saudi Arabia.  
E-mail: ishahrani@kku.  
edu.sa

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**How to cite this article:** Asiry MA, AlShahrani I. Prevalence of malocclusion among school children of Southern Saudi Arabia. J Orthodont Sci 2019;8:2.

spacing, and increased overjet, respectively. In addition, Al-Emran *et al.* found that malocclusion was encountered in 62.4% of Saudi children with 40% of them required fixed orthodontic appliances.<sup>[12]</sup> Further, Nashashibi *et al.* reported that fixed orthodontic appliance was indicated in 57% of the children in Saudi Arabia.<sup>[15]</sup> On the other hand, Farsi and Salama concluded that Saudi children have lower malocclusion prevalence when compared to Caucasians.<sup>[13]</sup>

Periodic estimation of prevalence and related indicators produce objective and reliable data that not only serve as a guide to formulate policies aimed at early intervention and prevention of malocclusion, but also equip the concerned authorities to diagnose and address specific challenges in the geographic location of interest. The aim of the present study was to determine the prevalence of malocclusion in permanent dentition among adolescents in the city of Abha, Saudi Arabia.

## Materials and Methods

This cross-sectional study was conducted at Abha, Saudi Arabia from October 2016 to May 2017. Following approval by the Scientific Research Committee (Approval no. SRC/ETH/2015-16/016), a pilot study was carried out involving 50 school children who were not included in the final study. Expected prevalence of malocclusion was achieved from the pilot study to estimate the sample size for the final study. The sample size estimation was 1887 participants according to the following formula:

$$n = \frac{Z^2 p(1-p)}{d^2}$$

$n$  = sample size

$Z$  =  $z$  statistics for given level of confidence = 1.96 [for 95% confidence interval (CI)]

$p$  = expected prevalence = 63.8% (obtained from the pilot study)

$d$  = precision = 2.1%.

As a result, a total of 1998 Saudi citizens (998 males and 1000 females) of mean age  $14.13 \pm 0.99$  years were randomly selected by a multi-stage random sampling technique. Abha city was divided into five zones; center, north-east, north-west, south-east, and south-west zones. Then, three schools were randomly selected from each zone. A written informed consent was obtained from the participants parents. Students undergoing orthodontic treatment or with a history of previous orthodontic treatment, previous history of permanent teeth extraction, and craniofacial deformities or syndrome were not included in the sample.

All the data were obtained through clinical examination by two well-trained general dental practitioners using gloves, light source, mouth mirror, and calibrated ruler. The occlusal parameters recorded by examiners include molar and canine relationship, overbite, overjet, anterior open bite, spacing, crowding, anterior crossbite, scissors bite, and posterior crossbite.

Angle's classification system was used for evaluating molar relationship. Bilateral canine relationships were evaluated according to the relationship between the tip of the maxillary canine and the embrasure between the mandibular canine and first premolar. Patients with different sagittal molar and canine relationships on the left and right sides were categorized as asymmetric molar and canine relationship, respectively. When one of first permanent molars or canines was missing or unerupted, the molar and canine relationship was recorded as not applicable, respectively. Overbite or the vertical overlap of incisors was recorded (to the nearest half millimeter) by measuring the vertical distance from the incisal edge of the maxillary central incisor to the incisal edge of the corresponding mandibular incisor. Overjet or the horizontal overlap of incisors was recorded (to the nearest half millimeter) by measuring the greatest distance between the incisal edges of the maxillary central incisor and the labial surface of the corresponding mandibular incisors. Crowding and spacing were scored subjectively when the sum of the labio-lingual contact point displacements or spaces of adjacent teeth were at least 2 mm in each segment, respectively. Anterior crossbite was scored as present when one or more of the maxillary incisors occluded lingual to the mandibular incisors. Anterior open bite was recorded (to the nearest half millimeter) when there was no vertical overlap between the maxillary and mandibular incisors. Posterior crossbite and scissors bite were scored if one tooth, more than one tooth, or whole segment was abnormally malposed buccally or lingually with reference to opposing teeth.

Statistical analysis was conducted using the Statistical Package for the Social Sciences (Version 16.0; SPSS Inc., Chicago, IL, USA). Simple descriptive statistics of occlusal parameters were reported. A Student's  $t$ -test and one-way analysis of variance (ANOVA) were used to evaluate for any significant differences between males and females where a  $P$  value  $<0.05$  was considered significant.

## Results

No gender differences were detected of any occlusal parameters ( $P > 0.05$ ). Therefore, the combined data were analyzed. Table 1 shows that symmetric molar

and canine relationships had the highest frequency of 1728 (85%) and 1678 (79.4%) subjects, respectively. A symmetric Class I molar relationship was observed in 1219 (61%) of the total sample, while Class II and III molar relationships were observed in 326 (16.3%) and 154 (7.7%) subjects, respectively. The molar relationship was not applicable in 29 (1.5%) of cases. Class I, II, and III canine relationships were seen in 1255 (62.8%), 231 (11.6%), and 112 (5.6%), respectively.

Table 2 revealed that 1490 (74.6%), 321 (16.1%), and 65 (3.3%) of cases had overbite of 1–3 mm, 4–6 mm, and >6 mm, respectively. Anterior open bite was found in 122 (6.1%) of subjects and the most frequent finding was an open bite of 1–3 mm (5%). Our findings exhibit that overjet of 1–3 mm, 4–6 mm, and >6 mm were encountered in 1515 (75.8%), 328 (16.4%), and 61 (3.1%) of the sample, respectively. Anterior crossbite was found

**Table 1: Prevalence of molar and canine relationships**

Parameter	n	Percentage
Molar relationship		
Class I	1219	61.0
Class II	326	16.3
Class III	154	7.70
Asymmetric relationship	270	13.5
Not applicable	29	1.50
Canine relationship		
Class I	1255	62.8
Class II	231	11.6
Class III	112	5.60
Asymmetric relationship	320	16
Not applicable	80	4

**Table 2: Distribution of overjet, overbite, open bite, and crossbite in the study sample**

Parameter	n	Percentage
Overjet		
Negative - 0 mm	94	4.7
1-3 mm	1515	75.8
4-6 mm	328	16.4
>6 mm	61	3.1
Overbite		
1-3 mm	1490	74.6
4-6 mm	321	16.1
>6 mm	65	3.3
Open bite		
1-3 mm	99	5.0
4-6 mm	20	1.0
>6 mm	3	0.2
Total	122	6.1
Anterior crossbite	109	5.5
Posterior crossbite		
Unilateral	113	5.7
Bilateral	56	2.8
Scissors bite	0	0
Total	169	8.5

in 109 (5.5%) of cases. Other malocclusion traits including unilateral posterior crossbite and bilateral posterior crossbite were encountered in 113 (5.7%) and 56 (2.8%) of the sample, respectively. No scissors bite was registered in the sample of the current study.

Crowding and spacing occurred in 532 (26.6%) and 411 (20.6%) of the sample, respectively. The frequency of crowding was more frequent in maxillary anterior segment (6.4%) and mandibular anterior segment (11%), while 11.8% of subjects had spacing of upper anterior segment [Table 3].

## Discussion

To obtain a well-defined and large representative sample of Abha population, the city was divided into five zones; center, north-east, north-west, south-east, and south-west zones. Then, a sample of 1998 adolescents of mean age  $14.13 \pm 0.99$  years was selected using a multi-stage random sampling technique. Students with a history of previous orthodontic treatment, previous history of permanent teeth extraction, and craniofacial deformities or syndrome were not included in the sample. In the current study, occlusal parameters in different planes were recorded to provide detailed descriptions for occlusion status and malocclusion traits. Angle's classification and canine relationship were recorded to assess anteroposterior inter-arch relationship. The occlusion was also assessed transversely, horizontally, vertically, and within the arch by recording spacing, crowding, overjet, overbite, anterior open bite, and crossbite. Information on prevalence of different occlusal traits is helpful in formulating successful plans of orthodontic services.

The results of the current study show that Class I molar and canine relationships were encountered in 61% and 62.8% of the sample, respectively. These findings were comparable to results reported by Asiry who indicated that the prevalence of Class I molar and canine relationships were 60.11% and 54.13% of Riyadh population, respectively.<sup>[11]</sup> Class I molar relationship was also reported as a frequent feature among Northern Saudis (52.8%),<sup>[16]</sup> Kuwaitis (57.8%),<sup>[5]</sup> Nigerians (80.7%),<sup>[17]</sup> Iranians (52%),<sup>[14]</sup> Moroccans (61.4%),<sup>[18]</sup> Brazilians (76.7%),<sup>[2]</sup> Tanzanians (93.6%),<sup>[3]</sup> Pakistanis (59.9%),<sup>[9]</sup> and Nepalese (54.7%).<sup>[10]</sup>

In this study, crowding was the most frequent malocclusion feature (26.6% of the sample). Spacing came in second rank with frequency of 20.6 among the sample of current study. Crowding was more frequent in mandibular anterior segment (11%) than other segments, while the highest frequency of spacing was observed in maxillary anterior segment (11.8%). Crowding was

**Table 3: Distribution of spacing and crowding in the study sample**

Parameter	n	Percentage
Crowding	127	6.4
Anterior segment - maxilla	220	11.0
Anterior segment - mandible	41	2.1
Posterior segment - maxilla	65	3.3
Posterior segment - mandible	10	0.5
Posterior and anterior - maxilla	6	0.3
Posterior and anterior - mandible	8	0.4
Posterior maxilla and anterior mandible	6	0.3
Posterior mandible and anterior maxilla	5	0.3
Posterior maxilla and mandible	44	2.2
Anterior maxilla and mandible	127	6.4
Total	532	26.6
Spacing		
Anterior segment - maxilla	235	11.8
Anterior segment - mandible	42	2.1
Posterior segment - maxilla	56	2.8
Posterior segment - mandible	37	1.9
Posterior and anterior - maxilla	3	0.2
Posterior and anterior - mandible	5	0.3
Posterior maxilla and anterior mandible	3	0.2
Posterior mandible and anterior maxilla	5	0.3
Posterior maxilla and mandible	0	0
Anterior maxilla and mandible	25	1.3
Total	411	20.6

also reported as the most common malocclusion feature among Riyadh population, Northern Saudis, and different world populations.<sup>[2,3,5,9-11,14,16]</sup> However, the frequency of crowding show great variations between these populations. These variations could be due to influences of differences in ethnicity, participants' age, sample size, or recording methods. In addition, the lower prevalence of crowding in specific population could be linked with quality of dental care which minimizes crowding prevalence by controlling local etiological factors of crowding such as caries and early loss of primary teeth.

Most adolescents in the present study had normal overjet and overbite. Normal overjet and normal overbite were also prevalent among Northern Saudis (66.4% and 64.4%), Jeddah population (69.6% and 59%), Riyadh population (67% and 76%), Tanzanians (73.3% and 65.9%), Nigerians (68.3% and 81.8%), Iranians (67.7% and 60.4%), and Pakistanis (58.4% and 61.4%).<sup>[3,9,11,14,16,17,19]</sup> In this study, anterior open bite was encountered in 6.2% of the sample, which was comparable to the results of Riyadh population, Northern Saudis, Brazilians, Nepalese, Nigerians, and Iranians.<sup>[2,10,11,14,16]</sup> The results in the current study regarding anterior and posterior crossbite was in accordance with results reported by Asiry<sup>[11]</sup> among Riyadh population, Gudipani *et al.* among Northern Saudis,<sup>[16]</sup> Behbehani *et al.*<sup>[5]</sup> among Kuwaitis, Abu Alhaija *et al.*<sup>[4]</sup> among Jordanians,

Ajayi<sup>[7]</sup> among Nigerians, and Nadim *et al.*<sup>[9]</sup> among Pakistanis. On the other hand, the frequency of posterior crossbite was higher among Brazilians (19.2%),<sup>[2]</sup> Nepalese (23.3%),<sup>[10]</sup> and Iranians (36%).<sup>[14]</sup> The influence of variations in recording methods, sample size, or ethnicity might explain these differences.

Although the objective of the current study was achieved, further study is needed on a large sample size from different parts of Saudi Arabia to formulate a national policy aimed at early intervention and prevention of malocclusion.

## Conclusions

There was no statistically significant difference between males and females in the prevalence of malocclusion traits. The most prevalent occlusal trait was crowding followed by spacing, increased overjet, and increased overbite, posterior crossbite, anterior open bite, and anterior crossbite. Class I molar and canine relationships, normal overjet, and normal overbite were dominant features among Saudis. These findings will help in understanding the occlusion status and planning for prevention and treatment of malocclusion in Abha city.

## Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.

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