

Original Article

Open bites in a Saudi Arabian subpopulation presenting for orthodontic treatment: A retrospective study from Najran province

ABSTRACT

Background: Open bite (OB) is a vertical malocclusion and is considered the most challenging malocclusion to manage. The aim of this study was to find out the prevalence and describe the pattern of OB among patients presenting for orthodontic treatment.

Materials and Methods: Three hundred and twenty-six male and female patients who were presenting for orthodontic treatment of dental malocclusion were retrospectively reviewed. They were screened with cephalometric X-rays. Demographics and type of OBs were retrieved. Data were stored and analyzed using IBM SPSS Statistics for IOS Version 25 (Armonk, NY, USA: IBM Corp).

Results: Of the 326 cases who presented for the management of different types of malocclusion, 78 (23.9%) had OB. There were 23 (29.5%) males and 55 (70.5%) females with an M: F ratio of 1:2.4. Age ranged from 9 to 40 years with mean \pm standard deviation (19.5 \pm 6.9). Most of the patients (33, 42.4%) were cases of anterior OB (AOB), 20 (25.6%) were cases of posterior OB (POB), while 25 (32.0%) cases were combined OB (COB). Bulk of the patients had Class I molar relationship (42, 53.8%). Six (7.7%) patients reported being involved in oral habits.

Conclusion: A high prevalence of 42.4% of AOB, 25.6% of POB, and 32.0% for COB was reported. A population-based study is required in Najran province among preschool and early school children.

Keywords: Anterior open bite, malocclusion, posterior open bite

INTRODUCTION

The term open bite (OB) was first coined by Careveli in 1842.^[1] OB is a vertical malocclusion and considered the most challenging managing orthodontically because of the high risk of relapse. It can be anterior OB (AOB) or posterior OB (POB). AOB when there is no contact between the anterior teeth (canine to canine) and POB when no contact between the posterior teeth (premolar to molar). However, when OB extends from anterior to posterior teeth, then it is referred to as combined OB or complex OB (COB).^[2] OB may occur with Class I, Class II, or Class III skeletal pattern.^[3] Numerous etiological factors are involved in this category of malocclusion which includes digit sucking habits,

tongue-thrusting, mouth breathing, adenoid hypertrophy, syndromes, occlusal and facial growth pattern, eruptive forces, and dental ankylosis.^[4,5] Other factors such as severity and time of initial treatment can make OB rectification and stability more challenging.^[6] Difficulty in incising food is the

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main complaint of these groups of patients. Other symptoms include masticatory, speech, and esthetic problems.^[7] The esthetic problems are contributed by the adenoid facies or long face syndrome together with incompetence lips and nonexistence of overbite.^[8] OB can be managed by removing the cause, which allows the teeth to close normally without any intervention, or by orthodontic forces.

AOB was reported to be present in about 25%–38% of the orthodontically treated patients.^[9] In the United States, it is estimated to occur in 0.6% of the population. There are racial variations in the prevalence of OB; it was reported to be 16% among Blacks and 4% in White population.^[11] In the Arab countries, a study from Oman has reported a prevalence of AOB to be 2.2%,^[10] while in the Kuwaitis, the prevalence of AOB was reported to be 3.4%.^[11] In Saudi Arabian population, prevalence studies from northern region (AOB [7.7%^[12]], POB [0.6%^[12]], OB [11.1%^[13] and 4.6%^[14]]) and southern region (AOB 6.1%^[15] and 7.2%^[16]) have also been documented.

To the best of our knowledge, literature search did not reveal any study on the prevalence of OB in this part of Saudi Arabia. The aim of this current study, therefore, is to report the prevalence of OB in a Saudi Arabian subpopulation that is presenting for orthodontic treatment and to describe its pattern.

MATERIALS AND METHODS

After obtaining ethical approval from the Ethics and Research Committee of Dalma Clinics, Najran region of Saudi Arabia, 326 male and female patients were retrospectively reviewed. All patients who presented for orthodontic management of malocclusion were screened both clinically and radiographically (Cephalometric, Carestream Dosimetry of the 9500 3D Cone Beam System, Carestream Dental LLC, 3625, Cumberland Blvd. Ste. 700, Atlanta, GA 30339) for malocclusion patterns. Incomplete data were excluded from the study.

Demographics were retrieved and whether AOB, POB, or COB was present or not. Based on severity of OB, when vertical separation between the teeth either anterior or posterior is within 0–2 mm, then it is recorded as moderate OB, and when it is within 3–4 mm, then its severe OB, while it is extreme OB when greater than 4 mm.^[17]

Data were analyzed using IBM SPSS Statistics for IOS Version 25 (Armonk, NY: IBM Corp) and the results were presented as simple frequencies and descriptive statistics. Pearson's Chi-square was used to evaluate the association

and level of significance among categorical variables such as age group of patients, gender, and type of OB, with $P \leq 0.05$ considered as statistically significant.

RESULTS

Of the 326 cases who presented for the management of different types of malocclusion, 78 (23.9%) had OB. There were 23 (29.5%) males and 55 (70.5%) females with an M: F ratio of 1:2.4. Patients' age ranged from 9 to 40 years with mean \pm standard deviation (19.5 ± 6.9). Among the 78 cases of OB, most of the patients (33, 42.4%) were cases of AOB, 20 (25.6%) were cases of POB, while 25 (32.0%) cases were COB with no significant difference [Table 1 and Figure 1]. Majority of the cases of OB were observed in the age group 11–20 years (47, 60.2%) although this did not attain statistical significance [Table 2]. When types of OB were compared with molar relationship seen the patients, bulk of the patients had Class I molar relationship (42, 53.8%) that was not significant. This was followed by Class III molar relationship (28, 35.9%). Class II

Table 1: Distribution of gender of patients according to age group and types of open bite

	Gender		Total (%)	Statistics (χ^2 , df, P)
	Male (%)	Female (%)		
Age group (years)				
1-10	0 (0.0)	2 (2.6)	2 (2.6)	3.881, 3, 0.275
11-20	11 (14.1)	36 (46.1)	47 (60.2)	
21-30	10 (12.8)	13 (16.7)	23 (29.5)	
31-40	2 (2.6)	4 (5.1)	6 (7.7)	
Total	23 (29.5)	55 (70.5)	78 (100.0)	
Types of OB				
AOB	14 (18.0)	19 (24.4)	33 (42.4)	4.604, 2, 0.100
POB	4 (5.1)	16 (20.5)	20 (25.6)	
COB	5 (6.4)	20 (25.6)	25 (32.0)	
Total	23 (29.5)	55 (70.5)	78 (100.0)	

OB: Open bite, AOB: Anterior OB, POB: Posterior OB, COB: Combined OB

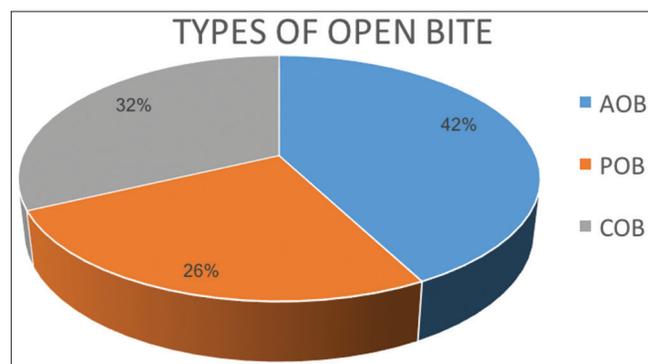


Figure 1: Pie chart showing the percentage distribution of types of open bite. (*AOB = Anterior open bite, *POB = Posterior open bite, *COB = Combined open bite)

molar relationship had the least number of patients with OBs (8, 10.3%) [Table 3].

With respect to oral habits, only 6 (7.7%) patients reported being involved in oral habits in all cases. Within the AOB group ($n = 33$), thumb sucking was reported in 3 (9.1%) patients, in the POB group ($n = 20$), 1 (5.0%) patient reported tongue-thrusting, while in the COB group ($n = 25$), 2 (8.0%) patients reported tongue-thrusting.

Of the 33 cases of AOB, 10 (30.3%) cases were mild, 21 (63.6%) were moderate, and 2 (6.1%) were severe. In the POB, 9 (45.0%) were mild, 10 (50.0%) were moderate, while only 1 (5.0%) case was severe [Figure 2]. Patients with COB had 11 (44.0%) mild cases, 12 (48.0%) moderate cases, and 2 (8.0%) severe cases [Figure 2].

DISCUSSION

OB is a malocclusion in the vertical axis and involves both AOB and POB. Orthodontically, OB malocclusion is considered one of the most difficult conditions to treat because of the multifactorial etiological factors ranging from genetic and/or environmental.^[18-21] Generally, OB can be classified into two: skeletal and dental OBs.^[3] While dental OB often caused by nonnutritive pacifiers can be managed by orthodontic mechanics,^[22] skeletal OB usually caused by genetic and environmental factors that facilitate vertical growth in the molar region without compensatory growth at the condyle or the ramus may require both surgical and orthodontic

treatment because of its severity.^[3] Established environmental factors include digit sucking,^[3,4] enlarged adenoids with mouth breathing,^[23] and tongue-thrusting.^[7]

There is huge variation in the epidemiological data on the prevalence of OB worldwide. It has been reported to range from 6.2% to 50.0%.^[24] This wide variation has also been

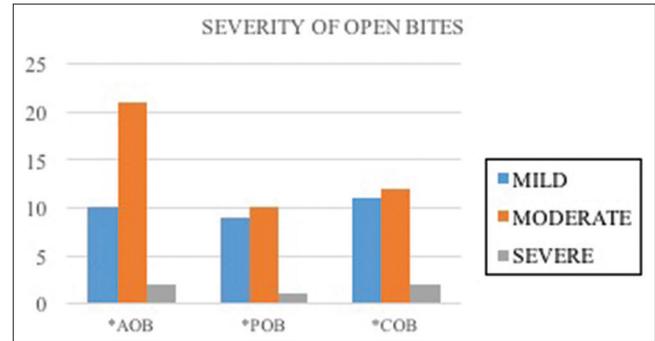


Figure 2: Bar chart showing the percentage distribution of severity of AOB, POB, and COB. (*AOB = Anterior open bite, *POB = Posterior open bite, *COB = Combined open bite)



Figure 3: Clinical photograph showing a case of anterior open bite with open bite extending to canines only



Figure 4: Clinical photograph showing a case of posterior open bite with open bite within the premolars and molars

Table 2: Distribution of types of open bite according to age group of patients

Age group (years)	Types of OB			Total (%)
	AOB (%)	POB (%)	COB (%)	
1-10	1 (1.4)	0 (0.0)	1 (1.4)	2 (2.6)
11-20	19 (24.4)	9 (11.5)	19 (24.4)	47 (60.3)
21-30	10 (12.8)	8 (10.3)	5 (6.4)	23 (29.5)
31-40	3 (3.8)	3 (3.8)	0 (0.0)	6 (7.6)
Total	33 (42.4)	20 (25.6)	25 (32.0)	78 (100.0)

$\chi^2=7.498$, $df=6$, $P=0.277$. OB: Open bite, AOB: Anterior OB, POB: Posterior OB, COB: Combined OB

Table 3: Distribution of anterior open bite and posterior open bite according to molar relationship

Types of OB	Molar relationship			Total (%)
	Class I (%)	Class II (%)	Class III (%)	
AOB	18 (23.1)	4 (5.1)	11 (14.1)	33 (42.4)
POB	12 (15.4)	2 (2.6)	6 (7.6)	20 (25.6)
COB	12 (15.4)	2 (2.6)	11 (14.1)	25 (32.0)
Total	42 (53.9)	8 (10.3)	28 (35.8)	78 (100.0)

$\chi^2=1.251$, $df=4$, $P=0.870$. OB: Open bite, AOB: Anterior OB, POB: Posterior OB, COB: Combined OB



Figure 5: Clinical photograph showing a case of combined open bite with open bite extending from anterior to the molars

reported within the same region and country.^[25-27] The current study has reported a prevalence of 42.4% for AOB [Figure 3], 25.6% for POB [Figure 4], and 32.0% for COB [Figure 5], which is in tandem with the literature. On the contrary, lower prevalence rates have been reported in Saudi Arabian studies^[12,13,16,28] and other Arab communities.^[10,11] Customary, regional, and socioeconomic variations of each municipality have been considered the most probable explanation for the diverse prevalence rates of AOB.^[3,24,29] In a recent Brazilian population-based study, multivariate analysis revealed that preschool children living in southern part of Brazil had an increased probability of 1.8 more times of having AOB and posterior crossbite as compared to other regions of the country.^[24] This situation can be explained by diverse cultural habits that may expose the child to risk factors associated with AOB.^[24,27] Examples of such habits include breastfeeding time, variations in nonnutritive sucking habits, and type of diet.^[18,30]

The current study showed a female predilection for OB. This finding is in agreement with several studies reporting a female predilection.^[31-33] On the contrary, higher male predilection of ratio 4:1 has been reported among Yemeni adults^[34] and Sudanese University students.^[35] Variations in the prevalence of AOB among genders can be partially attributed to the fact that parents in Islamic communities are more concerned about the appearance of girls than boys and try to observe, prevent, and treat all kinds of the abnormalities, concerning the teeth and face that can affect the smile of their daughters at early age.^[35]

Studies have reported age variations in the incidence of AOB.^[3,36] In the United Kingdom, for example, the incidence of 2%–4% was identified in the children.^[36] This incidence drops between 9 and 13 years as a result of normal occlusal development, stoppage of oral habits, reduction in size of adenoids, and the establishment of full adult swallowing

pattern.^[36] After 13 years of age, the incidence spikes again probably as a consequence of late vertical growth or continuation and/or noncessation of oral habits.^[37] In the current study, higher frequency of AOB was observed in the age group of 11–20 years, which coincides with the age group where spikes in the incidence of AOB have been reported.^[36,37] To our surprise, this condition persisted into adulthood (21–40 years) where 37.2% of the total number of patients investigated was reported. This trend showed that probably oral habits persisted or there exists some genetic background that may need further investigation in the Najran province of Saudi Arabia. From the current study, only 6 (7.7%) patients ($n = 78$) reported oral habits of thumb sucking and thumb-trusting. This low incidence of oral habits suggests that probably, a genetic background may be responsible for the etiology of OB in Najran patients presenting for orthodontic treatment. Another possibility of the low reported oral habits is that these patients were already adults and might have forgotten they practiced such habits when they were young. Tongue-thrusting has been described as an endogenous habit or adaptive behavior^[3] to prevent food/water/saliva from leaking from anterior part of the mouth during swallowing.^[38] Literature has also documented that thumb sucking for >6 h a day and most importantly during the night will result in a severe AOB.^[3] This is because the digit acts as an impediment to the erupting incisors while permitting over eruption of the molars, resulting in OB.^[3] Population-based study on oral habits and nonnutritive pacifiers among preschool and early schoolchildren in Najran province will unravel this mystery since strong association between oral habits and OB has been established hitherto.^[18,39]

In terms of severity of OB, most studies have reported moderate OB as the most common type, while severe types were described to be rare.^[17] This study has validated this position as most of the cases were moderate types in the AOB, POB, and COB cases. COB has been described as OB extending from anterior region to the molars.^[2]

CONCLUSION

This current study has reported a prevalence of 42.4% for AOB, 25.6% for POB, and 32.0% for COB in patients presenting for orthodontic treatment, which is in tandem with the literature. Very low number of patients (7.7%) reported having engaged in oral habits. We postulated a genetic background of OB in Najran province, or rather, probably, most patients did not remember the oral habits they were engaged in when young. To unravel this unknown, a population-based study on oral habits and nonnutritive pacifiers is required in Najran

province among preschool and early school children. Such data are important for the strategic planning of government programs targeted at prevention, interception, and treatment of OB.

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Conflicts of interest

There are no conflicts of interest.

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