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### RESEARCH ARTICLE

#### ETIOLOGY AND PREVALENCE OF MALOCCLUSION IN THE KINGDOM OF SAUDI ARABIA – A CROSS SECTIONAL QUESTIONNAIRE STUDY

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#### Abstract

**Objective:** We attempted to assess the prevalence of malocclusion, in terms of age and gender in the Kingdom of Saudi Arabia. We also attempted to identify the predominant risk factors for malocclusion and consequences of the same.

**Methods:** A cross-sectional questionnaire study was conducted. Patients were questioned on heredity, childhood adverse oral habits and feeding habits. Questions pertaining to dental history and current oral health were also asked. Recorded data was analysed using SPSS version 17.

**Results:** Malocclusion was more prevalent in males and below 20 years of age. Tongue thrusting increased the risk of malocclusion by 59%, bottle feeding by 18%, while heredity increased malocclusion risk by 98%. Malocclusion increased the chances of developing dental caries or periodontal disease by 26%, while the risk of dental or facial trauma was increased by 86%.

**Conclusion:** Heredity and tongue thrust habit are the most significant risk factors for malocclusion. Patients with malocclusion are at high risk of developing dental or facial trauma, and are at slight risk of developing caries or periodontal problems.

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#### Introduction:-

Malocclusion is an increasingly common dental concern which is no longer considered to be merely esthetic. It can have functional, emotional and psychosocial effects, and untreated malocclusion has been shown to impact the oral

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health-related quality of life.<sup>1</sup>Prevention and early interventions can help improve these factors and can also cut down on overall health costs. This can be achieved only if the etiological factors behind malocclusion are addressed.

**Etiology of malocclusion:**

The etiology of malocclusion has been classified in several different ways. Moyers classified the etiology of malocclusion into six categories, namely, hereditary, trauma, habits, diseases, physical agents, and defects of unknown origin.<sup>2</sup> On the other hand, Proffit suggested a simpler classification involving genetic factors, environmental factors and specific known causes.<sup>3</sup> Graber suggested that all etiological factors fell under just two categories – general and local factors.<sup>4</sup>The etiological factors studied by researchers has varied widely in literature. Studies conducted on children in Thailand have reported that acquired etiological factors are more responsible for causing malocclusion<sup>5</sup>, while a study in Brazil documented that thumb and pacifier sucking during childhood was most commonly associated with malocclusion.<sup>6</sup>

**Prevalence of malocclusion:**

The prevalence of malocclusion and etiological factors has also shown to vary with geographical location. For instance, the prevalence of malocclusion among patients in India has been reported at 34%,<sup>7</sup> while another study in Brazil reported that the rate of malocclusion was as high as 87%.<sup>6</sup>In the Kingdom of Saudi Arabia, the reported malocclusion rate is 45.5%, with a higher incidence of crowding. Despite this high incidence, there have not been any cross-sectional studies conducted to date that attempted to identify the key etiological factors.

**Aim of the current study:**

Keeping the above factors in mind, the aim of the current study was to identify the key etiological factors that contributed to the development of malocclusion in patients belonging to the Kingdom of Saudi Arabia.

**Material and Methods:-**

The current study was a cross-sectional, questionnaire study. This study was conducted in accordance with the STROBE guidelines for cross-sectional studies,<sup>8</sup> and ethical approval was obtained from the Institutional Review Board prior to beginning the study.

**Sampling, inclusion and exclusion criteria:**

The sample size needed for the study was calculated using OpenEpi software, using a cross-sectional study conducted in another population as a reference.<sup>6</sup>The source of samples for the study included patients who attended the Dental Department of Orthodontics and Dentofacial Orthopedics at King Abdulaziz University in the Kingdom of Saudi Arabia, as well as patients from the general population. There was no age limit on patients being enrolled in the study. Patients who reported to the department for correction of malocclusion were enrolled in the study. Patients were also randomly selected from the general population. Patients who had cleft lip and palate, craniofacial syndrome, or other congenital conditions that were clearly the cause of malocclusion were excluded from the study. Patients who were not comfortable answering the questionnaire, or who refused to give consent were also excluded.

**Data acquisition:**

A written informed consent was obtained from all patients who met the inclusion criteria and consented to be a part of the study. These patients were asked to complete a questionnaire, which was administered in a one-on-one manner through dental students. The questionnaire asked for demographic details which included age, gender and nationality, after which patients were asked about the kind of malocclusion they suffered from. Patients were also questioned specifically about various etiological factors responsible for acquired malocclusion, including familial malocclusion, thumb sucking, feeding habits, tongue thrusting and trauma. The incidence of key dental problems, including caries and periodontal disease, was also documented.

**Data analysis:**

Information from the questionnaire study was collected and extracted onto a digital spreadsheet. Descriptive analysis of all the data was performed. The strength of association between the etiological factor and malocclusion was determined using risk ratios. Different etiological factors were compared using the chi square test or Mc Nemar's exact test. All data analysis was carried out using SPSS version 17.

**Results:-**

A total of 637 patients were sampled for the study. Of these, 409 patients were male and 228 female. There was no age bar, and patients ranging from below 20 years to above 35 years were recruited and categorized accordingly. 257 patients in the present sample had some form of malocclusion, indicating that the prevalence rate of malocclusions is 40.4%.

**Prevalence of malocclusion:**

A summary of the demographic characteristics of patients with and without malocclusion is given in Tables 1 and 2. Male patients appeared to have 35% higher risk of developing malocclusion as compared to female patients. The prevalence of malocclusion was highest in patients below 20 years of age (72%) and was lowest in patients between 26 and 30 years of age. Chi-square testing showed that the difference in distribution among the different age groups was statistically significant.

**Risk factors for malocclusion:**

In the current study, we found that sucking on a thumb or pacifier did not increase the risk of malocclusion. The most significant risk factor was heredity, which was associated with almost double the risk of developing malocclusion. Tongue thrusting was a more significant risk factor, being associated with a 59% risk of developing malocclusion. Bottle feeding, as compared to breast feeding, was associated with only a slight risk of developing malocclusion (18%). These findings are summarized in Table 3.

**Consequences of malocclusion:**

Patients who had malocclusion appeared to be at higher risk of developing dental problems, including caries and periodontal disease. As given in Table 4, the risk of developing these conditions was increased by 26% in patients who had malocclusion, as opposed to patients who did not. More significantly, patients with malocclusions were more prone for facial trauma; the risk of trauma in patients with malocclusion was estimated to be 86% higher than patients without malocclusion.

**Discussion:-**

The current cross-sectional study attempted to pin down the epidemiology and etiology of malocclusion among people living in the Kingdom of Saudi Arabia. In the current study, it was determined that the male gender had a higher incidence of malocclusions as compared to the female gender. This is in line with one previous study conducted in this geographical region, which stated that Class I occlusion was more common in females than in males.<sup>9</sup> In the current study, patients below 20 years were commonly identified with malocclusions. Malocclusions can form during the eruption and settling of the permanent dentition. The lowered incidence in older age groups could be attributed to the fact that some malocclusions had already been treated in early adulthood.

**Influence of adverse oral habits:**

Non-nutritive sucking habits, including thumb and pacifier sucking, have been established as risk factors for malocclusion. In the present study, however, thumb and pacifier sucking were not significantly associated with malocclusion. Previous studies have shown that non-nutritive sucking habits mostly affect the deciduous dentition and not the permanent one.<sup>10</sup> This is because, in most patients, the habit regresses spontaneously between two to four years of age, well before the eruption of permanent teeth. In the current study, only permanent dentitions were evaluated for malocclusion.

On the other hand, the tongue thrust habit was significantly associated with malocclusion. This again, is in line with previous literature studies. For instance, Urzal et al reported that patients tongue thrust had a nine-fold increase in odds of malocclusion.<sup>11</sup> Kolawole et al evaluated patients with oral habits using the Dental Aesthetic index, and found that patients with tongue thrust had significantly worse malocclusions as compared to patients with other oral habits.<sup>12</sup>

**Effect of malocclusion on oral health:**

Dental malocclusion is not just an esthetic problem, it can cause several functional problems as well. Malocclusion favours accumulation of plaque, and may hence lead to dental caries and periodontal disease. A recent systematic review and meta-analysis, performed by Sa-Pinto et al, indicated that a definite association existed between malocclusion and dental caries.<sup>13</sup> The association between malocclusion and periodontal disease has been more

controversial, with previous systematic reviews reporting only a weak association.<sup>14</sup> However, a recent study by Bernhardt et al indicated that the morphological characteristics of malocclusion had a definite association with periodontal health.<sup>15</sup> The authors stated that malocclusion could cause up to half the attachment loss that smoking was capable of causing. The current study is in line with these findings, as the incidence of caries and periodontal disease was 26% higher as compared to patients without malocclusion. The current study also showed that the incidence of dental or facial trauma was significantly increased in patients with malocclusion. This has been reported in previous studies as well; patients who have anterior open bite and increased overjet seem to be more prone to trauma as compared to patients with other kinds of malocclusions.<sup>16</sup>

#### Study limitations and future directions:

The main limitation of the current study is that it is of a cross-sectional design. More meaningful data could be obtained using a longitudinal study design, where the same group of patients could be followed from childhood into early adulthood. However, this method is both time and resource intensive. Another drawback is that a detailed analysis of oral habits – such as their duration and frequency, was not performed. Future studies can focus on detailed habit analysis and their correlation to specific types of malocclusion.

#### Tables:

**Table 1:-** Gender distribution of patients with malocclusion.

	PATIENTS WITH MALOCCLUSION	PATIENTS WITHOUT MALOCCLUSION	TOTAL	RELATIVE RISK
MALE	182	227	409	1.35
FEMALE	75	153	228	

**Table 2:-** Age distribution of patients with malocclusion.

AGE GROUP	PATIENTS WITH MALOCCLUSION	PATIENTS WITHOUT MALOCCLUSION	TOTAL	CHI SQUARE STATISTIC	P VALUE
BELOW 20	36	14	50	24.38	0.000067
20-25	69	102	171		
25-30	56	111	167		
31-35	44	69	113		
ABOVE 35	52	84	136		

**Table 3:-** Risk factors associated with malocclusion.

RISK FACTOR FOR MALOCCLUSION		PATIENTS WITH MALOCCLUSION	PATIENTS WITHOUT MALOCCLUSION	TOTAL	RELATIVE RISK
THUMB/PACIFIER SUCKING	PRESENT	135	227	362	0.84
	ABSENT	122	153	275	
TONGUE THRUSTING	PRESENT	100	82	182	1.59
	ABSENT	157	298	455	
BOTTLEFED	PRESENT	69	82	151	1.18
	ABSENT	188	298	486	
HEREDITY	PRESENT	99	54	153	1.98
	ABSENT	158	326	484	
TRAUMA	PRESENT	73	58	131	1.53
	ABSENT	184	322	506	
		73	58		
		184	322		

**Table 4:-** Risk of developing dental pathology if malocclusion is present.

	PRESENCE OF PROBLEM	OF	ABSENCE OF PROBLEM	OF	TOTAL	RELATIVE RISK
<b>CARIES/ PERIODONTAL DISEASE</b>						
PATIENTS WITH MALOCCLUSION	163		94		257	1.26
PATIENTS WITHOUT MALOCCLUSION	191		189		380	
<b>PATIENTS WHO SUFFERED FACE TRAUMA</b>						
PATIENTS WITH MALOCCLUSION	73		184		257	1.86
PATIENTS WITHOUT MALOCCLUSION	58		322		380	

**Conclusions:-**

The current cross-sectional study established that heredity and tongue thrust habit were significant risk factors for malocclusion. Patients with malocclusion were at slight risk of developing caries and periodontal disease, but were at high risk of sustaining dental or facial trauma. Well-designed longitudinal studies are needed to validate the findings of this study.

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