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Malocclusion trait and the parafunctional effect among young female school students

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ABSTRACT

Extraneous activities of either the mouth, tongue or the jaw comprise the oral parafunctional habits of the stomatognathic system. This denominated habit is expressed through bruxism, digit sucking, nail biting to name a few, have led to hypothesizing the possible relationship of evolution of occluso-facial abnormalities such as malocclusion thereby hindering the conventional developmental process. Hence, the present study aimed to determine the prevalence and the possible relationship of parafunctional oral habits with the types of malocclusions among 12–16 years old females in Jeddah, Saudi Arabia. This cross-sectional study was conducted through questionnaire and clinical examinations, where the sagittal abnormalities within a randomly selected 672 participants who met the eligibility criteria were tabulated and analyzed. A positive history of the presence of parafunctional habit was recorded among all the participants with nasal and mouth breathing [46.6%], nail biting [39.6%] being predominant. 36.4% presented with significantly higher prevalence of bi-maxillary protrusion in mouth breathers while 17.1% with moderate overbite in participants with nail biting habit. Therefore, within the limitations of the present study, the findings do support the literature on the prevalence and the possible association of these habits with the malocclusion development thereby emphasizing on the importance of early recognition, management and prevention of them.

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1. Introduction

Parafunctional habits are defined as repetitive behavior that target the oral structures which include digit sucking, tongue thrusting, bruxism, mouth breathing and nail biting. The effect of parafunctional habits on the dentition is intensity, frequency, and duration dependent. Parafunctional oral habits are developmental abnormalities that occurs as a result of failure to breast feed or for a short period of time. These habits lead to development of occluso-facial abnormalities, that affects the craniofacial growth and developmental processes (del Valle et al., 2006; Perrotta et al., 2019; Thomaz et al., 2012).

Malocclusion are teeth irregularities or dental arch mal-relationship beyond it normal defined ranges. It is one of the most commonly encountered dental problems after dental caries and

periodontal disease (Mtaya et al., 2009). Evidence based studies suggest that there is a relationship between parafunctional oral habits and malocclusion (Perrotta et al., 2019; Farsi, 2003). These parafunctional oral habits that significantly impact by inducing malocclusion include bottle feeding, digit and pacifier sucking, mouth breathing, and bruxism. Additional factors like nail biting and producing sounds (snoring) while sleeping also are associated with malocclusion. In advance stages, it leads to temporomandibular joint disorders (Celić et al., 2002; Seraj et al., 2009).

Farsi et al., study conducted in Saudi Arabian children reported that parafunctional oral habits of nail biting, bruxism, and thumb sucking are common among girls as compared to boys in their primary dentition. Almost 26% of girls had nail biting habit as compared to 18% boys. Bruxism and thumb sucking habit was reported by 7.1% and 9.3% girls (Farsi, 2003). Similar results were found in children and adolescents with mixed and permanent dentition (Farsi, 2003), except nail biting that advanced to 33% among girls in Saudi Arabia. These parafunctional oral habits are a concern that leads to worse orthodontic outcomes and dentition development outcomes for children and adolescents as they advance to their adult life. A study of parafunctional oral habits found that oral parafunction was significantly associated with malocclusion and TMJ pain (Perrotta et al., 2019).

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For prevention and early management of parafunctional oral habits, it is necessary to induce behaviour change in children at a very start when a parafunctional oral habit is observed. Early management helps in reducing/avoiding permanent damage, improving clinical decision making, maintaining the self-esteem and quality of life, and in minimising the cost of care induced due to orthodontic and maxillofacial managements. Educational campaigns that target parents and adolescents are of prime importance to elevate the level of awareness with respect to potential destructive impact of parafunctional habits.

The rationale for this project was that Saudi Arabian children and adolescent have high prevalence of parafunctional oral habits, malocclusion and TMJ disorders, which could have worse outcomes in the later life. Thus, to encounter this problem and to plan for management solutions that improve quality of life, treatment planning and clinical decision making this study had following aims.

1. To determine the prevalence of parafunctional oral habits among 12 to 16 years old female attending public school at Jeddah, Saudi Arabia.
2. To determine the relationship between parafunctional oral habits and types of malocclusions in the Saudi Arabian school going females.

2. Materials and methods

2.1. Study design and eligibility criteria

A cross-sectional study was conducted on a random sample of 672 participants who met the eligibility criteria. Eligible participants were female participants; age group “12–18 year”; student at the private schools in the city of Jeddah; having negative past experience of orthodontic treatment. The parental informed consent were taken before the questionnaire was administered to the adolescents. The sample was bloated by 20% to account for absence of compliance.

2.2. Sample size estimation

The G-estimate formula was used for the sample size estimation of the study participants. Based on the outcomes of previous study conducted by Farsi et al., it was estimated that a sample size of 600 participants will be enough for the survey [0.8 power and 95% Confidence Interval]. To recover the loss of participants during recruitment phase an extra 10% sample was collected making the sample size to 670+ participants.

2.3. Ethics approval

The research committee at King Abdul-Aziz University, Faculty of Dentistry approved the study. The ethical principles were followed based on the National guidelines on Ethical conduct and the Declaration of Helsinki. The information obtained from the participants was de-identified to preserve confidentiality, privacy and ethical values.

2.4. Procedure

An education session was delivered to the school staff prior to the oral clinical examination. The general dentists and oral hygienists after verification of eligibility delivered an educational seminar. The educational seminar focused on values of orthodontic treatment. Furthermore, they educated students about various forms of malocclusion. Information flyers were distributed to the

school staff that explained malocclusion types and their associated problems.

2.5. Questionnaire

A self-administered computer-based questionnaire was distributed to recruited participants. The questionnaire recorded information on participant's demographic characteristics and obtained information of their parafunctional habits.

2.6. Clinical examination

Intraoral Scanning and Clinical examination were carried out by trained and calibrated general dentists. Participants whom found to need urgent orthodontic consultation were provided an email to the parents for referral to orthodontic clinics. Data on malocclusion were reported using a pre-designed malocclusion chart (Bjork et al, 1964, Murshid et al, 2010) as follow:

- Sagittal abnormalities
 - o Para-maxillary protrusion was defined based on Angle's classification of malocclusion; Angle's class II malocclusion; post normal occlusion or distocclusion, and Angle's class III malocclusion, pre-normal occlusion or mesiocclusion.
 - o Maxillary over-jet was defined as (i) edge to edge = 0 mm; (ii) moderate: 4–6 mm; (iii) severe >6 mm.
 - o Vertical anomalies: overbite which is classified into (i) 0 mm = edge to edge; (ii) 4–6 mm = moderate; (iii) >6 = severe.

2.7. Data analysis

SPSS, version 27 (SPSS Inc., Chicago, IL, USA) was used to validate and analyze the data. Descriptive analysis was carried out to determine measures of central tendency and dispersion. Descriptive analysis allows building proper understanding of the general characteristics of the study population. Bivariate analysis was constructed using chi-square test to understand association between various parafunctional habits and malocclusion.

3. Results

Table 1 illustrates the characteristics of participants [N = 672]. The participants were female, with age ranging from 12 years to 16 years [mean age 14.3 years]. A total of 672 participants reported about their history of having parafunctional habits. More than 48% participants reported they were nose breathers, while around 3.9% participants reported that they breathe through the mouth. Around 46.6% participants reported they were both mouth breathers and nose breathers. The prevalence of people who were engaged in parafunctional habit of nail biting was 39.6%. While finger sucking was found uncommon amongst the participants [6.8%]. Almost 12.2% participants reported that they produced sound while sleeping and 4.2% participants reported they had a large tongue.

Of the 672 participants who responded to self-reported questionnaire 452 participants [who underwent clinical examination] reported that they experienced some form of malocclusion. Bimaxillary protrusion was found amongst 11.1% females. More than 66% participants had normal overjet. The second most common overjet was moderate “22.6%”. Edge to edge, severe overjet and cross-bites were reported by 6.6%, 3.1% and 1.3% participants respectively. For overbites, normal overbite was common amongst 74.3% participants. The moderate overbite was prevalent amongst 12.8% females, followed by edge to edge bite [7.1%], open bite [3.1%] and severe overbite [2.7%].

Table 1
Characteristics of participants.

Characteristics	Levels	n	%
Parafunctional Habits (N = 672)			
Breathingmode	Nose	326	48.5
	Mouth	26	3.9
	Both	320	46.6
Nail bite	Yes	266	39.6
	No	324	48.2
	I can't remember	82	12.2
	Yes	46	6.8
Figure sucking	No	506	75.3
	I can't remember	120	17.9
	Yes	82	12.2
Sound while sleeping	No	430	64.0
	No one told me	160	23.8
	Yes	28	4.2
Large tongue	No	510	75.9
	I am not sure	134	19.9
	Yes	28	4.2
Malocclusion (N = 452)			
Bi-maxillary protrusion	Yes	52	11.1
	No	402	88.9
Overjet	Normal	300	66.4
	Edge to edge	30	6.6
	Moderate	102	22.6
	Sever	20	3.1
	Cross bite		1.3
Overbite	Normal	336	74.3
	Edge to edge	32	7.1
	Moderate	58	12.8
	Sever	26	2.7
	Open bite		3.1

Fig. 1 shows the prevalence of different modes of breathing and other parafunctional habits in female students. Nasal and mouth breathing [46.6%], nail biting [39.6%], and sound while sleeping [12.2%] were common parafunctional habits amongst female intermediate students.

A bivariate analysis of association between malocclusion and way of breathing and finger sucking habit was established for female intermediate students (Table 2). Females who were mouth breathers “36.4%” had significantly higher prevalence of bi-maxillary protrusion [p < 0.05]. No significant association was found between breathing ways and variables of overjet and overbite. Girls who engaged in finger sucking habit had higher moderate overjet and open bite as compared to girls who did not had finger sucking habit.

Table 3 illustrates the results of bivariate analysis of the association between malocclusion and behaviours of nail biting, sound while sleeping, and having a large tongue [macro-glossia] among female intermediate students. The results suggested that nail bit-

ing habit was significantly associated with vertical anomalies of overbite. People who had nail biting habit had significantly higher prevalence of moderate overbite “17.1%, p < 0.05]. Factors of producing sound while sleeping and having macro-glossia [large tongue] had no significant associations with the parafunctional habits.

4. Discussion

Parafunctional oral habits result in facial disfigurement, malocclusion, TMJ disorders, increase in distress, lack of confidence and reduced self-esteem among children and adolescents (Melchior et al., 2012). There were two key finding of this study. First, the parafunctional oral habits of mouth breathing “36.4%” had significantly higher prevalence of bi-maxillary protrusion [p < 0.05]. Second, the parafunctional oral habit of nail biting had significantly higher prevalence of moderate overbite “17.1%, p < 0.05]. The other habits were not significantly associated with malocclusion.

Mouth breathing is a parafunctional oral habit most commonly occurring as a result of conditions like Allergic rhinitis and adenotonsillar hypertrophy (Valera et al., 2003; Skoner, 2001). It occurs as a result of obstruction of the airway, at nose and pharynx level, forcing an individual to breathe via mouth (Bresolin et al., 1983). Mouth breathing and malocclusion relationship is essential for planning of early treatment craniofacial growth disorders. A cross-sectional study amongst 3017 children that used ROMA index found an increased mouth breathing was significantly associated with bi-maxillary protrusion, overjet and open bite (Grippaudo et al., 2016).

Nail biting was the most common parafunctional habits that led to malocclusion. This finding contrast with a recent study that support that nail biting is a common parafunctional habit (Perrotta et al., 2019). Nail biting is common among young children and usually is psychologically driven (Illingworth, 2014). Females tend to bite their nails more than males especially during the adolescents. This outcome was suggested by this study and the study by Farsi et al., in Saudi Arabian population (Farsi, 2003). Nail biting is very common parafunctional oral habit amongst children, adolescents and young adults. The prevalence of nail biters among children of 7–10 years is 33% and amongst adolescents is 45% (Ghanizadeh and Shekoochi, 2011). Etiological factors associated with nail biting are psychological distress, imitation, genetics, and thumb sucking transference (Illingworth, 2014). Nail biting leads to bacterial infection and orofacial complications. Management of nail biting is possible by positive reinforcement and behavioral modification (Schneider and Peterson, 1982). The relatively high prevalence of moderate overjet and overbite is supported by previous studies (Naik et al., 2014).

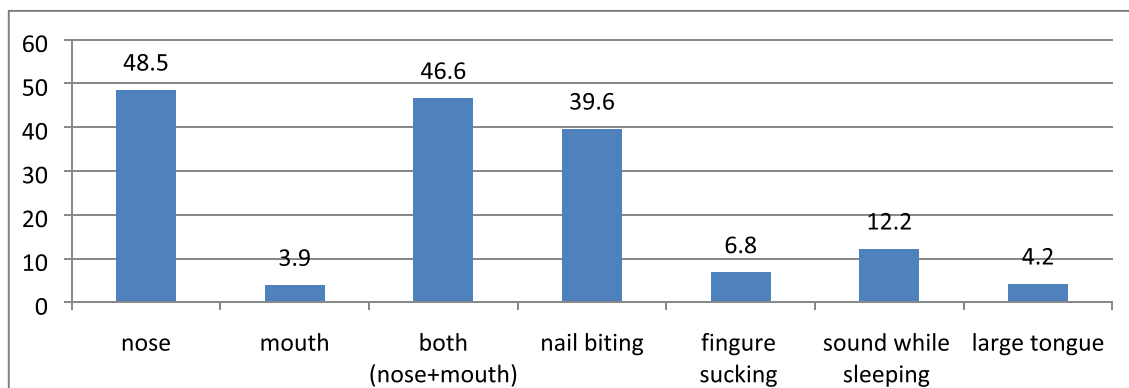


Fig. 1. The prevalence of different mode of breathing and different parafunctional among sample (N = 672).

Table 2

Bivariate analysis of the association between malocclusion and way of breathing among female intermediate students. *P < 0.05 (Significant).

Characteristic		Breathing			Finger sucking habit		Can't remember (n = 120) %
		Nose (n = 326) %	Mouth (n = 26) %	Both (n = 320) %	Yes (n = 46) %	No (n = 506) %	
Bi-maxillary protrusion	Yes	8.9	36.4	10.7	18.2	11.4	7.5
	No	91.1	63.6	89.3*	81.8	88.6	92.5
Overjet	Normal	68.8	54.5	65.0	54.5	66.9	67.5
	Edge to edge	6.3	9.1	6.8	9.1	6.3	7.5
	Moderate	21.4	27.3	23.3	36.4	23.4	15.0
	Sever	1.8	9.1	3.9	0.0	2.9	5.0
	Cross bite	1.8	0.0	1.0	0.0	0.6	5.0
Overbite	Normal	72.3	72.7	76.7	63.6	76.0	70.0
	Edge to edge	6.2	9.1	7.8	9.0	6.9	7.5
	Moderate	15.2	9.1	10.7	18.2	12.6	12.5
	Sever	3.6	0.0	1.9	0.0	2.9	2.5
	Open bite	2.7	9.1	2.9	9.1	1.7	7.5

Table 3

Bivariate analysis of the association between malocclusion and behaviours of nail biting, sound while sleeping, and large tongue among female intermediate students. * P < 0.05 (Significant).

Characteristic		Nail biting			Sound while sleeping			Large tongue		
		Yes (n = 266) %	No (n = 324) %	Can't remember (n = 82) %	Yes (n = 82) %	No (n = 430) %	No one told me (n = 160) %	Yes (n = 28) %	No (n = 510) %	I am not sure (n = 134) %
Bi-maxillary protrusion	Yes	10.2	12.4	8.0	9.4	9.9	18.8	22.2	9.2	15.9
	No	89.8	87.6	92.0	90.6	90.1	81.3	77.8	90.8	84.1
Maxillary overjet	Normal	68.2	65.5	64.0	58.5	68.8	68.8	55.6	70.5	52.3
	Edge to edge	8.0	7.1	0.0	13.2	5.0	3.1	0.0	6.9	6.8
	Moderate	20.5	23.0	28.0	22.6	22.0	25.0	44.4	18.5	34.1
	Sever	2.3	2.7	8.0	5.7	2.1	3.1	0.0	3.5	2.3
	Cross bite	1.1	1.8	0.0	0.0	2.1	0.0	0.0	0.6	4.5
Vertical anomalies (overbite)	Normal	72.7	77.1	68.0	69.8	74.5	81.2	88.9	71.7	81.8
	Edge to edge	9.1	7.1	0.0	11.3	6.4	3.1	0.0	6.9	9.1
	Moderate	17.0*	8.8	16.0	11.3	13.5	12.5	11.1	14.5	6.8
	Sever	0.0	2.7	12.0	3.8	2.1	3.1	0.0	3.5	0.0
	Open bite	1.1	4.4	4.0	3.8	3.5	0.0	0.0	3.5	2.3

Normal overjet and overbite were the most common feature of the study population. These findings support previous studies findings that concluded normal overjet and overbite are the most common occlusal feature.

5. Limitations

Limitations of this study were the following. First, this study used a cross-sectional study design that limits the ability to determine the cause-effect relationship. Second, the questionnaire used for measurement of the self-reported oral parafunctions were not validated in children and adolescents in Saudi Arabian population. Third, in this study response bias might have ensued due to the assistance provided by the data collection officer to the participants in reading the questionnaire, for correctly understanding the questions. Finally, this study did not record on participants who were currently undergoing orthodontic treatment. This could have helped in doing a case control analysis for people under orthodontic care as compared to people who were not under orthodontic care.

6. Conclusion

Scientific literature documented a well-established relationship between parafunctional habits and malocclusion. In this study, we found that nail biting is most common parafunctional habit among

12–16 years female students and is association with moderate overbite. Nevertheless, mouth breathing, although was not common, was significantly associated with bimaxillary protrusion. Therefore, it is necessary to interfere early on these etiological factors of malocclusion to prevent its progress or worsening and, if already developed, solve it by early orthodontic treatment. Further studies at a larger sample size is essential to confirm our findings.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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