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RESEARCH ARTICLE

PREVALENCE OF MALOCCLUSION AMONG YEMENI CHILDREN OF PRIMARY SCHOOLS

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Abstract

Objective: Malocclusion is every difference in the arrangement of teeth beyond the standard of regular occlusion illustrated by anomalies within the dental arches. The purpose of this study was to measure prevalence of malocclusion between primary school children in Sana'a city Yemen.

Methods: A cross sectional study was conducted on 1079 school children (546 girls and 533 boys), their age ranged from 7 to 12 years old from public and private schools selected randomly in Sana'a City, Yemen. The prevalence of malocclusion was investigated according to age, gender and school type based on Angle's classification.

Results: The study showed that the overall prevalence of malocclusion among school children was 81.1%, in which Class I normal molar association was found only in 18.9% of school children, while Class I malocclusion included the highest percentage of the sample 70.4%, followed by Class II relation 9.5%, and Class III involved only 1.1%. The most prevalent malocclusion trait was spacing 35.7%, whereas the crowding was present in 30.0% of the sample. The deep bite was present in 10.1% followed by anterior crossbite 8.8%, midline diastema 8.6%, anterior open bite 4.5%, posterior crossbite 4.0%, and the least noted malocclusion trait was posterior open bite 0.4%.

Conclusion: In conclusion, there was a high rate of malocclusion in school children and significantly increased with age, class I malocclusion was the most common followed by Class II malocclusion, while Class III was the rear. The most prevalent occlusal problem was spacing, followed by crowding. Thus, 7-12 year-olds can benefit from interceptive and preventive oral health procedures which may either entirely prevent or reduce the development of serious types of malocclusions afterward in their lives.

Keywords: Malocclusion, prevalence, primary school children, Yemen.

INTRODUCTION

Research and study of dental health problems in Yemen are still modest and limited, although there have been studies that have addressed the problems of tooth decay, gum infections, causes for extraction of permanent teeth and prevalence and pattern of third molar impaction in adults and children[1-5] but no research has touched upon malocclusion. Malocclusion is a problem of the oral cavity scattered around the world, from which the children and adults suffer, not less important than other oral problems. Although dental malocclusion is not a life-threatening condition[6], the poor periodontal conditions[7] and impaired mastication[8] associated with it provoke the need to explore the prevalence of malocclusion in different age groups. Furthermore, it is one of the most common dental problems, together with dental caries, gingival disease and dental fluorosis[9]. It is considered as dental public health problem, its impact psychologically and functionally is great, and its prevalence among children is high[10]. In addition to that, malocclusion is thought to be a risk factor information and progression of dental caries. Since pediatric patients with malocclusion have challenged the ability to practice effective oral hygiene, this may predispose them to malocclusion[11].

Concerning premature loss of primary teeth, it has been previously stated that the premature loss of primary teeth can affect the normal eruption time of the permanent successors by either retarding or accelerating their emergence[12].

It is considered a predisposing factor for occlusal and space discrepancies in the mixed and permanent dentitions[13]. Consistent with the World Health Organization, the main dental problems should be subjected to regular epidemiological evaluations. Knowledge of a population's epidemiological condition is vital for planning and offering prevention and treatment services[14]. The understanding of the epidemiological status of different characters of malocclusion among the special population is essential for planning the need and provision for orthodontic service to improve the quality of life[15].

Dental malocclusion prevalence among school children have been reported in most countries of the world. There were few studies on the prevalence of malocclusion in Yemen, and only two studies were conducted in Sana'a City in 2014 by Al-Zubair and Ghandour[16], and Al-Zubair and Al- Almulla[17]. It is clear to see the need to study prevalence of malocclusion in Yemeni school children during mixed dentition period to provide basic values for preventive measures. The importance of this study comes from the great effects of malocclusion defects on children's oral, systemic and psychological health.

SUBJECTS AND METHODS

This descriptive cross-sectional study was conducted to measure the prevalence of malocclusion among Yemeni school children of primary schools (Government and private) in Sana'a City, Yemen. A total of 1079 boys and girls aged between 7-12 years old from schools of Sana'a were randomly selected and examined, the schools are located in different regions of the city to avoid having children from the same area.

The data collection was performed by one examiner; the researcher (Tharwa), by using the standard method[18]. The clinical examination for each child with dental and medical history was formed by simple inspection under adequate light, sometimes if the natural light was insufficient, artificial light from a torch was utilized. All children were examined in a room of the school selected by the principles of the school. Those children who were selected and refused to participate were excluded replaced with new one.

Before starting the study, ethical considerations were taken after the approval of the study by the Faculty of Dentistry in Sana'a University, Yemen. The examination was conducted with permission from the concerned education authorities. Permission was obtained from the office of the region education and the principals of the targeted schools and after obtaining informed consent from parents of the participating children. The examination assessed the period of dentition and analysis of occlusal data, by using a separate registration chart designed to record the personal data of the subjects (all information and clinical examination).

Statistical Analysis

The data were analyzed by SPSS program (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Aromnk, NY: IBM Corp.) and presented by using tables. Percentage (%) was used to describe the qualitative variables. Chi-square with Yate correction and Fisher tests were used to show the significance of the association between the outcomes at the level of significance less than 0.05 (p).

RESULTS

The results in Table 2 indicate that the prevalence of total malocclusion among school children was 81.1%, and there was significant difference between malocclusion according to age group 7-9 years old (84.2%) and 10-12 years (78.1%). Also a similar prevalence of malocclusion was found in boys and girls, government schools, and private schools (Table 2). The results in (Table 3) indicate that class I malocclusion has the highest proportion of the sample 70.4%, with 73.2% in the 7-9 age group higher than the 10-12 age group (67.8%) (p<0.05).

Table 1: The distribution of school children participants in the study according to age, gender, school type and district (n=1079).

Variable		Frequency	%
Age	7-9yrs	527	48.8
	10-12yrs	552	51.2
Gender	Boys	546	50.6
	Girls	533	49.4
School type	Government	761	70.5
	Private	318	29.5
Districts	Al- Thawrah	669	62.0
	Old Sana'a	170	15.8
	Al- Safiah	240	22.2

Mean age ±SD= 9.5±1.7

Table 2: The prevalence of malocclusion according to age, gender and school type.

Variable		Malocclusion		Normal		p-value
		Frequency	%	Frequency	%	
Age (year)	7 - 9 yrs.	444	84.2	83	15.7	
	10 - 12 yrs.	431	78.1	121	21.9	0.010*
Gender	Boys	443	81.1	103	18.9	
	Girls	432	81.1	101	18.9	0.972
School type	Government	620	81.5	141	18.5	
	Private	255	80.2	63	19.8	0.624
Total (n=1079)		875	81.1	204	18.9	

* p<0.05 statistically significant

Table 3: Prevalence of Angle classification according to age, gender and school type.

Angle classification	Age (year)				Gender				School type				Total	
	7-9yrs		10-12yrs		Boys		Girls		Government		Private			
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Class I normal	83	15.8	121	21.9	103	18.9	101	18.9	141	18.5	63	19.8	204	18.9
Class I	386	73.2	374	67.8	384	70.3	376	70.5	540	71.0	220	69.2	760	70.4
Class II	52	9.9	51	9.2	53	9.7	50	9.4	70	9.2	33	10.4	103	9.5
Class III	6	1.1	6	1.1	6	1.1	6	1.1	10	1.3	2	0.6	12	1.1
p-value	0.085*				0.998				0.666					
X^2	6.24				0.035				1.57					

* $p<0.05$ statistically significant

The class II malocclusion was at 9.5%, while the class III had the lowest incidence and was only present in 1.1% of the entire sample. According to age, there was significant difference with class II malocclusion ($p<0.05$). On the other hand, a normal class I occlusion was in 18.9% of the sample. 21.9% were found for age group 10-12 years older more than that of age group 7-9 years (15.8%), also the age difference was significant. The most prevalent malocclusion trait was spacing 35.7%. According to age groups, the highest rate of spacing was found in 7-9 years old 42.0%, comparing to age group 10-12 years old 29.7% ($X^2=17.76$, $p<0.001$), while non-significant difference of spacing malocclusion was found regarding gender and school type (Table 4). The proportion of school children with dental crowding was 30.0%, with a non-significant difference that in age groups, gender and school type ($p>0.05$) (Table 5). The most prevalent malocclusion trait was spacing 35.7%, whereas the crowding was present in 30.0% of the sample. The deep bite was present in 10.1% followed by anterior crossbite 8.8%, midline diastema 8.6%, anterior open bite 4.5%, posterior crossbite 4.0%, and the least noted malocclusion trait was posterior open bite 0.4% (Table 6).

DISCUSSION

The prevalence of malocclusion varies from country to country and between different age and nationality groups. Globally, epidemiological studies indicate that the prevalence of malocclusion is between 39% and 93%[18]. In the present study, malocclusion was demonstrated in 81.1% of the school children. By comparing the result of this study to other studies, there was almost an agreement with the following reported studies[14] 80.84%,[19] 86.6%, and[20] 83.3%.

Table 4: Prevalence of spacing according to age, gender and school type and the association of spacing with premature loss of teeth.

Variable		Present		Absent		χ^2	*p*-value
		Freq.	%	Freq.	%		
Age (year)	7 - 9 yrs.	221	42.0	306	58.0		
	10 - 12 yrs.	164	29.7	388	70.3	17.76	< 0.001**
Gender	Boys	203	37.2	343	62.8		
	Girls	182	34.1	351	65.9	1.08	0.298
School type	Government	268	35.2	493	64.8		
	Private	117	36.8	201	63.2	0.24	0.622
Premature teeth losing		104	33.5	206	66.5	0.862	0.353
Total		385	35.7	694	64.3		

** $p<0.001$ statistically significant

Alternatively, this result was slightly higher when compared to Almeida *et al.*,[21] 73%, (Reddy *et al.*,[22] 52%, Morais *et al.*,[23] 78.50%, Disha *et al.*,[24] 40.9%, Sultan,[25] 78.31%, and Yu *et al.*,[26] 79.4%. The variation in the prevalence of malocclusion can be attributed to the differences in the age ranges of the populations studied, the number of subjects examined and differences in the registration methods which are probably the most important factors explaining these variations9. Regarding gender, no statistical significant difference ($p>0.05$) was observed between boys and girls with respect to the prevalence of malocclusion (Table 2), coinciding with Das *et al.*,[27] ; Souza *et al.*,[28]; Narayanan *et al.*,[20]. According to age groups, the prevalence of malocclusion was more noticeable for the age group 7-9 years compared to the age group 10-12 years, with a statistical significant difference ($p<0.05$). This finding is consistent with Morais *et al.*,[23]. Variation in malocclusion can appear between age groups due to age and individual differences, or perhaps a shift from Class II malocclusion to the normal occlusion that occurs from the mesial movement of the first molars in the lower jaw where the second primary molars exfoliated[25]. The prevalence of normal occlusion was found low in the present study (18.9%) comparing with other studies by Alatrach *et al.*,[29] (38.5%), Reddy *et al.*,[22] (48.30%), Al-Zubair and Ghandour,[16] (69.4%), and Disha *et al.*,[24] (59.1%). However, this result almost corresponds with the data in some other studies by Souza *et al.*,[28] (22.3%), Morais *et al.*,[23] (21.50%), and by Narayanan *et al.*,[20] (16.7%). These disparities between the high malocclusion and low normal occlusion prevalence that was found in this study may explain the low preventive measure and treatment services. The results of this study showed that Class I malocclusion prevailed over

Class II and Class III (Table 3), in agreement with the majority of the previous studies[23-28]. On the other hand, few studies by Gonçalves *et al.*,[33]; Freitas *et al.*,[34]; and by Yu *et al.*,[26] emphasized the predominance of Class II, in comparison with relation Class I and Class III. This variation of results may be explained by the regional differences, age and sample size, or by the fact of considering normal occlusion as being Class I and maybe by the diversity of the used methodology[26]. Furthermore, Class I malocclusion included the highest proportion of the sample 70.4% (Table 3). This finding resembles[32] who found that the most common malocclusion was Class I 70.4%.

Table 5: Prevalence of crowding according to age, gender and school type.

Variable		Present		Absent		χ^2	*p*-value
		Freq.	%	Freq.	%		
Age (year)	7 - 9yrs.	163	31.0	364	69.0		
	10 - 12yrs.	161	29.2	391	70.8	0.43	0.514
Gender	Boys	155	28.4	391	71.6		
	Girls	169	31.7	364	68.3	1.41	0.234
School type	Government	222	29.2	539	70.8		
	Private	102	32.1	216	67.9	0.90	0.343
Total		324	30.0	755	70.0		

This finding also coincides with results of other studies, where malocclusion of Class I was found to be the predominant one by Brito *et al.*,[14] (76.7%), Bourzgui *et al.*,[31] (61.4%), Narayanan *et al.*,[20](69.8%) and by Sultan,[25] (65.87%). In contrary Class I malocclusion in this study was higher than that found by Souza *et al.*,[28] 47.6%, Almeida *et al.*,[21] (55.25%), Romano *et al.*,[19] (55.7%), Reddy *et al.*,[22] (30.3%), Alatrach *et al.*,[29] (30%), and by Disha *et al.*,[24] (36.4%) studies.

In terms of Class II malocclusion, a prevalence of 9.5% was found in the present study. This result is almost similar to the findings of Narayanan *et al.*,[20] (9.3%) in contrast higher rate of Class II in that reported by Brito *et al.*,[14] (19.2%), Almeida *et al.*,[21] (38%), Bourzgui *et al.*,[31] (24%), Reddy *et al.*,[22] (13.9%), Sultan[25], (21.93%), and by Alajlan *et al.*,[32] (21.3%), while current result was higher than that reported by Disha *et al.*,[24] (3.9%).

Table 6: The association of occlusal problem with age groups, gender and school type.

Variable	Age				Gender				School type				Total	
	7 - 9 years		10- 12 years		Boy		Girl		Government		Private			
Angle classification	Fre	%	Fre	%	Fre	%	Fre	%	Fre	%	Fre	%	Fre	%
Class1 normal	83	15.8	121	21.9	103	18.9	101	18.9	141	18.5	63	19.8	204	18.9
Class I (malocclusion)	385	73.2	374	67.8	384	70.3	376	70.5	540	71.0	220	69.2	760	70.4
Class II	52	9.9	51	9.2	53	9.7	50	9.4	70	9.2	33	10.4	103	9.5
Class III	6	1.1	6	1.1	6	1.1	6	1.1	10	1.3	2	0.6	12	1.1
Spacing	221	42.0	164	29.7	203	37.2	182	34.1	268	35.2	117	36.8	385	35.7
Crowding	163	31.0	161	29.2	155	28.4	169	31.7	222	29.2	102	32.1	324	30.0
Deep bite	45	8.6	46	11.6	53	9.7	56	10.5	83	10.9	26	8.2	109	10.1
Cross-bite (Anterior)	60	11.4	34	6.2	47	8.6	48	9.0	65	8.5	30	9.4	95	8.8
Midline diastema	51	9.7	42	7.6	27	4.9	66	12.4	76	10.0	17	5.3	93	8.6
Open bite (Anterior)	37	7.0	12	2.2	17	3.1	32	6.0	39	5.1	10	3.1	49	4.5
Cross-bite (Posterior)	17	3.2	26	4.7	22	4.0	21	3.9	30	3.9	13	4.1	43	4.0
Open bite (Posterior)	1	0.2	3	0.5	1	0.2	3	0.6	2	0.3	2	0.6	4	0.4

On the other hand, Class III malocclusion was found only in 1.1% (Table 3). This result was higher when compared to finding of Disha *et al.*,[24] 0.6%, and lower as compared to that of Souza *et al.*,[28] (8.2%), Brito *et al.*,[14] (4.2%), Lux *et al.*,[30] (3%), Almeida *et al.*,[21] (6.75%), Bourzgui *et al.*,[31] (10%), Romano *et al.*,[19] (6.0%), Reddy *et al.*,[22] (7.8%), Alatrach *et al.*,[29] (12%), Narayanan *et al.*,[20] (4.1%), Sultan,[25] (12.18%), Alajlan *et al.*,[32] (8.3%), Yu *et al.*,[26] (5.9%).

In the present study, the most prevalent malocclusion trait was spacing 35.7% (Table 4). This result higher when compared to Al-Zubair and Al- Almulla[17] (25.8%). This large number of school children with spacing is due to the fact that most of them had a premature loss of teeth mostly the primary teeth losing. There was statistic significant difference between the two age groups, which was found higher for age group 7-9 years old 42.0%, compared to the 10-12 years old 29.7%. By comparing with other studies, this result is

much higher than that found by Disha *et al.*,[24] (6.5%) and by Yu *et al.*,[26] (9.5%). The second most common type of malocclusion trait in this study was crowding seen in 30.0% of school children (Table 5). This finding is almost in agreement with that of Almeida *et al.*,[21] (31.59%), Al-Zubair and Ghandour,[16] (31.4%), Al-Zubair and Al- Almulla,[17] (30.4%), and by Yu *et al.*,[26] (28.4%). However, the number of crowding in this study is much lower than that reported by Souza *et al.*,[28] (49.6%), Brito *et al.*,[14] (45.5%), and by Romano *et al.*,[19] (52.6%).

According to gender, a non-significant difference in crowding was observed ($p>0.05$) (Table 5). This finding is in agreement with Brito *et al.*,[14] and in disagreement with Souza *et al.*,[28] who found a significant difference between genders ($p<0.05$) in which the dental crowding in girls was higher than in boys. On the other hand, the results has shown that there is a higher prevalence of dental crowding for age group 7-9 years old than for age group 10-12 years old (Table 5). This result is in agreement with that found by Morais *et al.*,[23]. This may be partially explained by the fact that some dental crowding may have, spontaneously, resolved. Mixed dentition crowding, known as temporary primary crowding, may resolve spontaneously during the stage of mixed dentition[35,36].

CONCLUSIONS

There was a high rate of malocclusion in school children and significantly increased with age, class I malocclusion was the most common followed by Class II malocclusion, while Class III was the rear. The most prevalent occlusal problem was spacing, followed by crowding. This study could open the field of specific studies to determine the means for the proper identification, control, and guidance of the environmental factors that could affect the craniofacial structures, which would be the main target of the preventive programs. Thus, 7-12 year-olds can benefit from preventive and interceptive oral health measures, which may totally either prevent or lessen the development of severe forms of malocclusions later in their lives.

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AUTHOR'S CONTRIBUTION

This research work is part of a Master's thesis. **AL-Awadi TAM:** conduct clinical work and thesis writing. **AL-Haddad KA:** editing, revision. **Al-labani MA:** methodology, investigation. **Al-Shamahy HA:** review, supervision. **Shaga-aldeen HM:** writing, review, and editing. All authors revised the article and approved the final version.

DATA AVAILABILITY

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

CONFLICT OF INTEREST

No conflict of interest associated with this work.

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