PATTERNS AND DISTRIBUTION OF MALOCCLUSION AMONG GHANAIAN ORTHODONTIC POPULATION.

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ABSTRACT

BACKGROUND: Knowledge about the distribution patterns of the malocclusions in a population helps orthodontic practitioners plan orthodontic services and preventive programs.

AIM: To determine the distribution patterns of malocclusions in the Ghanaian orthodontic population.

MATERIALS AND METHODS: A cross-sectional study involving 70 orthodontic patients aged between 9 and 18 years was conducted at the University of Ghana Dental School. The participants were selected using consecutive sampling and recruited after they had signed a written consent or assent. The participants' facial profiles and lower anterior facial heights (LAFH) were determined. The incisor, canine, and molar relationships and open bite were assessed. Descriptive statistics were used to summarize the findings and finally presented in tables. The significance level was $p<0.05$.

RESULTS: 51% of the participants had orthognathic profiles. The incisor, canine, and molar relation more frequent were Class II div 1 for the incisors (40%) and Class I for canines and molars (47% and 88%, respectively). Only 11.4% of participants had an open bite.

CONCLUSIONS: Among the participants with orthognathic profiles, Angle's class I molar and canine relationship were most frequent, and class II division 1 for the incisal relationship was more prevalent. Open bites were not frequent among these patients.

KEYWORDS: Malocclusion, profile. Angle's classification, open bite.

INTRODUCTION

Malocclusion is defined as an imperfect alignment of the teeth or a mal-relationship of the dental arches beyond the range of what is accepted as normal.[1] This misalignment impacts dentofacial aesthetics, psychosocial well-being, and daily living[2]. The aetiology of malocclusions is multifactorial; it may be due to genetic or environmental factors[3]. Malocclusion features differ across various populations and ethnicities[4].

Knowledge about the distribution patterns of the different malocclusions in a population helps orthodontic practitioners plan orthodontic services and preventive programs[5], and provides essential data for the government's preventive strategies and early intervention plans of malocclusion[6]. The knowledge of epidemiological data on malocclusion across Africa can be relevant for educational purposes, help in determining priorities about orthodontic treatment need, and assist in the rational planning of preventive and therapeutic orthodontic treatment[7]. This study aims to determine the distribution patterns of malocclusions in the Ghanaian orthodontic population. This will give orthodontic practitioners a better understanding of the malocclusion problem in our locality and help them formulate excellent management or treatment goals.

MATERIALS AND METHOD:

A cross-sectional study involving 70 orthodontic patients aged between 9 to 18 years was carried out at the University of Ghana Dental School, Department of Orthodontics and Paedodontics, after institutional Review Board approval (KBTH-STC/IRB/000103/2020). The participants were selected using consecutive sampling and recruited after they had signed a written consent or assent. Only patients of Ghanaian origin with no previous history of orthodontic treatment, systemic disease, craniofacial deformities, or syndromes were recruited.

A well-structured questionnaire was used to record the participant's demographics, and extra-oral and intra-oral examinations were carried out. The participants' facial profiles and lower anterior facial heights (LAFH) were determined. The incisor, canine and molar relationships as well as open bites were assessed.

Questionnaires were coded, and data was captured with Microsoft Access 2013. Statistical analysis of the data was performed using the R Studio programming tool. The results of the demographics and other variables were summarized using descriptive statistics and finally presented in tables. A p-value of <0.05 was the significant level chosen.

RESULTS:

The demographic characteristics of participants are presented in Table 1. Seventy Ghanaians participated in this study, of which 41 (58.6%) were females and 29 (41.4%) were males. The ages of the participants were between 9 and 18 years. The mean age of boys was 12.99 years, girls was 12.95 years, and the overall mean age was 12.97 years.

Table 1: Number and percentages of males and females that participated in the study

Variables	Count (%)	Mean Age	SD
Gender			
Male	29 (41)	12.99	2.94
Female	41 (59)	12.95	2.63
Total	70 (100)	12.97	2.74

Extra-Oral Features

The participants' Extra-oral and static occlusal features are presented in Table 2 below.

Table 2. Extraoral and static occlusal features of the participants.

Variables	Gender		Count (%)	P-value
	Male (%)	Female (%)		
Facial Profile				
Orthognathic	9 (31%)	27 (66%)	36 (51%)	
Retrognathic	15 (52%)	5 (12%)	20 (29%)	0.001
Prognathic	5 (17%)	9 (22%)	14 (20%)	
Total	29 (100%)	41 (100%)	70 (100%)	
Canine Relationship				
Class I	23(40%)	43(53%)	66(47%)	
Class II	9(16%)	9(11%)	18(13%)	
Class III	4(7%)	1(1%)	5(4%)	0.091
No Records	22(38%)	29(35%)	51(36%)	
Total	58(100%)	82(100%)	140(100%)	
Incisal Relationship				
Class I	6(21%)	15(37%)	21(30%)	
Class II div I	17(59%)	11(27%)	28(40%)	
Class II div II	1(3%)	1(2%)	2(3%)	
Class III	5(17%)	14(34%)	19(27%)	0.056
Total	29(100%)	41(100%)	70(100%)	
Molar Relationship				
Class I	48(83%)	75(91%)	123(88%)	
Class II	9(15%)	4(5%)	13(9%)	
Class III	1(2%)	3(4%)	4(3%)	0.087
Total	58(100%)	82(100%)	140(100%)	
LAFH				
Average	16 (33%)	33 (67%)	49 (70%)	
Increased	13 (67%)	6 (32%)	19 (27%)	0.310
Decreased	0 (0%)	2 (100%)	2 (3%)	
Total	29(100%)	41 (100%)	70 (100%)	
Open Bite				
Present	1(3.4%)	7(17%)	8(11.4%)	
Absent	28(96.6%)	34(83%)	62(88.6%)	0.078
Total	29(100%)	41(100%)	70(100%)	

There were no significant differences in the distribution of extra-oral and static occlusion features among males and females except for the distribution of facial profiles.

Facial Profile

On assessing the facial profile of the participants from Table 2, 51% had orthognathic profiles, 29% had prognathic profiles, and 20% had retrognathic profiles. About two-thirds of the female participants had orthognathic profiles, while more than half of the male participants had retrognathic facial profiles. These results were highly significant. (P=0.001)

Lower Anterior Facial Height (LAFH)

The lower anterior facial height of 70% of the population was average; 27.1% was increased, while 2.9% was decreased. Increased lower anterior facial height was seen more in the male participants (67%).

Static Occlusion

Incisal Relationship

The incisor relation was examined and classified according to the British Standards Institute classification. The result showed that 21 (30%) of the participants had a Class I incisor relationship, 28 (40%) had a Class II div 1 incisor relationship, two (3%) had a Class II div 2 incisor relationship and 19 (27%) had a class III incisor relationship. Over half of the male participants had Class II div 1 incisal relationships.

Table 3 below recorded Class I molar and canine relationships as the most predominant. No full cusp Class III molar and canine relationships were recorded. All participants with Class III canine relationships recorded had Class I molars, and one-third of participants with Class II canine relationships also had Class I molars.

Table 3. Canine and molar relationship.

Canine Relationship*	Molar relationship			
	Class I N (%)	Class II N (%)	Class III N (%)	Total N (%)
Class I	65 (98.5)	1 (1.5)	0 (0.0)	66 (74.2)
Class II	12 (66.7)	6 (33.3)	0 (0.0)	18 (20.2)
Class III	5 (100)	0 (0.0)	0 (0.0)	5 (5.6)
Total	82 (87.9)	7 (9.3)	0 (0.0)	89 (100)

**** 36.4% of the canine relationship could not be assessed due to un-eruption or impaction.***

The canine relationship could not be recorded for about 36.4% of the participants due to impaction, missing or unerupted canines. The highest percentage was recorded for Class I, 47%, 13% had Class II, and only 4% had Class III canine relationships.

From Table 4 below, it is evident that 84%, 50%, and 92% of the participants presenting with Class II div I, Class II div 2, and Class III incisal malocclusions, respectively, had a Class I molar relationship.

Table 4. Molar and incisal relationships

Molar relationship	Incisal relationship				
	Class I N (%)	Class II div 1 N (%)	Class II div 2 N (%)	Class III N (%)	Sum
Class I	39 (32)	47 (38)	2 (2)	35 (28)	123 (100)
Class II	2 (15)	9 (69)	2 (15)	0 (0)	13 (100)
Class III	1 (25)	0 (0)	0 (0)	3 (75)	4 (100)
Total	42 (30)	56 (40)	4 (3)	38 (27)	140 (100)

The molar relationship was classified according to Angles classification, and the results showed that about 88% had Class I, 9% had Class II, and 3% had Class III molar relationships. Class I was the predominant molar relationship in both genders; however, the male (15%) participants with class II molar relationships were thrice that of the female (5%) participants (Table 4)

OPEN BITE

Only eight (11.4%) participants had an open bite present. More female participants had an anterior open bite (17%) than male participants (3.4%).

DISCUSSION

Various cosmetic, functional, and social reasons influence the decision to pursue orthodontic treatment[8]. More than half of the seventy participants in this study were females. This finding is not surprising because studies have shown that females actively demand orthodontic treatment as they give more consideration to the aesthetics of their teeth than males[9].

In a study by Amuasi et al.[9], 67% of the respondents who utilized orthodontic services in the Komfo Anokye Teaching Hospital in Ghana were females. This suggested that far more females were concerned about the aesthetics of their teeth than their male counterparts, who may care less about their appearance. It was also noted that parents tend to seek orthodontic treatment for their daughters more than their sons since the negative impact of malocclusion on quality of life is experienced more by females.

In this study, the females were significantly more orthognathic, while the males were retrognathic (52%). More than half of the participants presented with orthognathic facial profiles, the most preferred facial profile among many ethnic groups[10, 11]. The prognathic facial profile was the least recorded in this study, as seen in other studies[5,11]. A significant proportion of females showed an orthognathic, and a significant number of males had a retrognathic facial profile. Other studies have shown, however, that slightly convex profiles with prominent upper and lower lips are preferred by Africans[12].

The LAFH was assessed by measuring the vertical distance between the base of the nose and the chin and compared to the distance between the glabella and the base of the nose. If the distance is the same, then LAFH is average. In this study, more than half of the participants had average LAFH, increased LAFH in one-third of the total sample, and decreased by only 2.9%. In a study by Abu Arqoub and Al-Khateeb[13] on the perception of facial profile attractiveness of different anteroposterior and vertical proportions, they found that the males with average and females with reduced lower facial heights were ranked most attractive. They also observed in their study that as the vertical dimensions diverged from normal, attractiveness decreased[13]. In this study, most participants had average LAFH and showed no significant difference among the sexes.

The Class II div 1 incisor relationship was the most recorded in this study, followed by Class I, then Class III, and lastly, class II div 2, which was less than 3% of the total sample. The result of this current study differs from other studies done in Africa. In a study completed in Kenya on the "prevalence of malocclusion for Moi University Dental Students," 70% had Class I, 7.5% had Class II division 1, 5% had Class II division 2, and 5% had Class III incisor relationship[14]. The Class II div I and Class III incisal malocclusion seem higher in the present study than in other African studies[15,16]. The disparity in the results could be due to racial and geographical differences[1,17]. Cenzato et al.1 considered that for most malocclusion types, the prevalence varied widely, considering different countries, and sometimes even within the same country but in distinct and distant geographical areas. This suggests a role for genetics and environmental influences, typical of each population, in determining dental problems.

In this study, out of 56 participants with class II div 1 malocclusion, 84% had Class I molars, while only 16% had Class II molars. It shows that among the Ghanaian orthodontic population, the diagnosis of class II skeletal malocclusion cannot be based only on the patient's incisal relationship.

The canine relationship could not be recorded for 36.4% of the participants due to impaction or unerupted canines. Among those recorded, Class I (47%) was the highest, followed by Class II(13%), and only 4% had Class III canine relationships. A similar observation where the canine relationship mainly was Class I in both genders was made by Salim et al.[5] and Yin et al.[6]

More than two-thirds of the sample had a Class I molar relationship; 9% had Class II, while only 3% had a Class III molar relationship. The predominant molar relationship in both genders was Class I. However, male participants with class II molar relationships were three times more than their female counterparts.

A systematic review and meta-analysis study on the prevalence of malocclusion in Africa, [7] showed a wide range of distributions of Class I, Class II, and Class III malocclusions with an average prevalence of 76.7%, 9.7%, and 4.0%, respectively.

In their study, Onyeaso et al.[18] had 76.5% Class I, 15.5% Class II and 8.0% Class III molar relationships. The trend is similar to that in this current study; however, a relatively higher percentage of participants had Class I, while relatively lower percentages were recorded for Class II and III molar relationships. In this study, over 80% of participants with class II div 1 and class III incisal relationships had Class I molar relationships. About half of the Class II div 2 participants also had Class I molar relationships. This suggests that the majority of Class II incisal relationships in this population may not be related to discrepancies of the jaws but instead may have been caused by more forward positioning of the maxillary anterior teeth due to soft tissue issues such as lip trap, full lips, from genetic predisposition or reduced corpus length of the mandible and increased proclination of upper incisors. The trend recorded in this study seems consistent with the distribution patterns of malocclusions globally.[19]

About 11.4% of open bite malocclusion was recorded among the participants. This finding is slightly higher than the 4.93% reported globally [19], and those recorded in other African studies: Onyeaso et al. [18] reported 5.2%, Anosike et al.[15] recorded 7%, and Otuyemi et al.[16] reported 10.2%. However, our result is low compared with a study done in northwest Ethiopia by Tefera et al. (21,6%)[20]. The open bite was more prevalent in females than in male participants. Open bite and reverse overjet are reported to be one of the least prevalent malocclusion traits globally.[19]

CONCLUSION

Among the participants, more than half of the total sample had orthognathic profiles; however, the females had predominantly prognathic profiles, while the males had predominantly retrognathic profiles. Angle's Class I molar relationship and canine Class I were most prevalent, but Class II division 1 was more prevalent for the incisal

relationships. Most participants had average LAFH, and about one-third had increased LAFH; consequently, only a few open bite cases were recorded.

The results of this study will help plan and provide orthodontic services in the UGDS Department of Orthodontics and Paedodontics. The results will also serve as baseline data and aid in planning orthodontic services and instituting preventive measures. It can also be used to develop evidence-based guidelines for orthodontic treatment. However, further studies with a larger sample size will be required to assess the prevalence and patterns of distribution of malocclusion in the Ghanaian population.

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