PATTERN OF MALOCCLUSION IN ORTHODONTIC PATIENTS: A HOSPITAL BASED STUDY

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Background: Dental malocclusion is present in all societies but its prevalence varies. Identifying occlusal problems, their incidence and the need for treatment can help to determine the appropriate treatment plan and manpower needed in orthodontics. The aim of the study was to analyze the malocclusion pattern and to provide quantitative information on the pattern of dentofacial characteristics among orthodontic population. **Methods:** Varying dentofacial characteristics of 156 patients from June 2002 to April 2004, at the orthodontic unit of the Aga Khan University Hospital were analyzed. Cross tabulations of dentofacial characteristics with Angle's classes were evaluated using chi-square and Kruskal-Wallis tests. Chi-square test was used to find the association and Cramer's V for correlation between the skeletal and Angle's classes. **Results:** Mean age of the sample was 14 years & two months (SD±4.59) with majority 98 (62.8%) were females. The chief complaints in majority of the patients were 'upper front teeth forward' and 'malaligned teeth'. Angle's Class II (70.5%) and incisor Class II Division 1 (64.7%) were the typical features of the sample. There was an increased overjet in 75% of subjects as a major occlusal finding. No statistically significant differences were found in distribution of Angle's classes and dentofacial characteristics between males and females. Statistically significant association between skeletal and Angle's classes ($p< 0.01$) was found. **Conclusion:** The results give a detailed pattern of malocclusion in orthodontic patients and may provide a base line data for planning orthodontic services. There is a strong need of epidemiological survey to find out the prevalence of malocclusion in Pakistani population.

Key words: pattern of malocclusion, dentofacial characteristics, orthodontic services

INTRODUCTION

Occlusion is the relationship among all the components of masticatory system in their function, parafunction and dysfunction, whereas occlusion which is aesthetically and functionally not acceptable is referred to as malocclusion. Numerous features can describe the position and occlusion of teeth, but it has always been difficult to make reliable assessments of dentofacial characteristics, the main difficulties being the definition of criteria and standardization of examiners.[1] Nevertheless, breaking 'tooth position' down into discrete characteristics like crowding, spacing, molar relationship, individual tooth malposition and indices can help to solve this problem.[2] Methods of recording and measuring malocclusion can be broadly divided into two types i.e. qualitative and quantitative[3] while the severity or the extent to which a malocclusion deviates from the normal or ideal occlusion can be quantified by using an occlusal index.[4] Among the qualitative methods of recording malocclusion Angle's method of classifying malocclusion with or without modifications is probably the most widely used.[3]

Dental malocclusion is present in all societies but its prevalence varies. There have been several studies investigating the prevalence of various dentofacial characteristics[5–9] but only a few have been conducted on an orthodontic population.[10,11] Identifying occlusal problems, their incidence and the need for treatment can help to determine the appropriate manpower needed in orthodontics.[1]

This study was done to analyze malocclusion pattern among patients who presented for treatment at the orthodontic unit of the Aga Khan University Hospital, Karachi. The aim of the study was to provide quantitative information regarding the pattern of dentofacial characteristics in orthodontic patients, and to find the frequencies of Angle's classes and other dentofacial characteristics along with the gender differences if any. Finally the correlations of Angle's classes with skeletal classes were also derived.

MATERIALS AND METHODS

This cross-sectional study included orthodontic patients who visited the Department of Orthodontics, Section of Dentistry, Aga Khan University Hospital, Karachi, from June 2002 to April 2004. Pre-treatment orthodontic records of 156 patients fulfilling the selection criteria were obtained and used for the study.

The inclusion criteria for the sample included those with complete pre-treatment records and undergoing orthodontic treatment while patients who came for consultation only and had previously undergone orthodontic treatment were not included in the study.

Data collection was based on written case records, dental casts, cephalometric radiographs, and orthodontic photographs. A qualitative analysis with Angle's classification was used to describe the antero-posterior relationship of the maxillary and mandibular first molars during maximum intercuspation.[12,13] The incisor classification was described on the basis of British Standard Classification of Incisor relationship.[3]

The following dentofacial characteristics were recorded using initial records: Angle's malocclusion, arch length discrepancy (crowding and spacing; *0–1 mm normal, 2–3 mm mild, 4–6 mm moderate, >7 mm severe*),[9] chief complaint, habits, temporomandibular joint (TMJ) problems, centric occlusion and centric relation (CO/CR) discrepancy, facial type, facial profile, facial asymmetry, overjet (*1–2 mm normal, 3–4 mm mild, 5–6 mm moderate, >7 mm severe, reverse*) and overbite (*0–2 mm normal, 3–4 mm moderate, 5–7 mm severe, >7 mm extreme, reverse, open bite*),[9] crossbite and cephalometric skeletal analysis (*ANB= skeletal class I: 0–4°, skeletal class II: >4°, skeletal class III: <0°*).

Descriptive statistics were calculated to find the means and standard deviations. Data collected were pooled to determine frequencies and cross tabulations of dentofacial characteristics with Angle's classes were evaluated using chi-square for *TMJ problem, facial type, asymmetry, facial profile, CO-CR* discrepancy and Kruskal-Wallis for *crowding, spacing, overjet, overbite and crossbite.* Mann-Whitney's U and chi-square tests were used to determine the possible gender differences. Chi-square test was also used to find the association and Cramer's V for correlation between the skeletal and Angle's classes. P value less than or equal to 0.05 was considered statistically significant. The software used for data analysis was SPSS version 10.

RESULTS

Out of 156 patients, 98 (62.8%) were females. Ages of the patients ranged from 8 years & 1 month to 39 years & six months with mean age of 14 years & two months (SD±4.59). The chief complaints in majority of the patients were 'upper front teeth forward' and 'malaligned teeth' as described in Figure-1.

No statistically significant differences of dentofacial characteristics were found between the genders. So the data collected were pooled to determine frequencies and cross tabulations of dentofacial characteristics with Angle's classes. The distribution of the malocclusion according to Angle's and incisor classifications is presented in Table-1. Angle's class II (70.5%) and Incisor class II Division 1 (64.7%) were typical features of the sample.

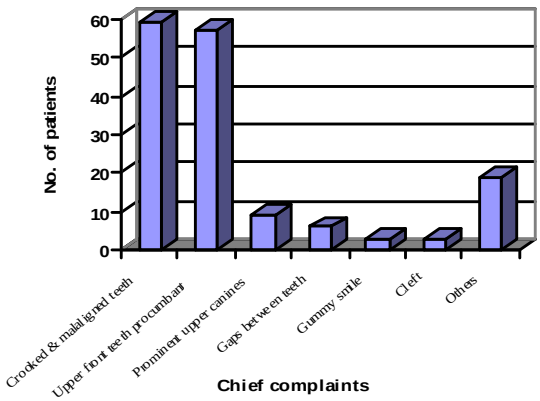

Figure-1: Chief complaints of the patients

Others: *Lower lip touches the upper gums(3), bite is not proper(2), rabbit teeth(2), reverse bite(2), missing tooth(2), lower jaw/teeth forward(2), difficulty in speech(2), out of alignment lower canine (1), non eruption of upper canines(1), TMJ pain(1), lack of incisor show(1).*

Table-1: Distribution of sample by Angle's & Incisor classifications

Angle's classification	n= 156 n (%)	Incisor classification	n= 156 n (%)
Class I	29 (18.6)	Class I	37 (23.7)
Class II	110 (70.5)	Class II Division 1	101 (64.7)
Class III	17 (10.9)	Class II Division 2	10 (6.4)
		Class III	8 (5.1)

There was an increased overjet in 75% of subjects as a major occlusal finding. A sum of 33.3% of patients presented with some types of habits with the most common being thumb sucking (14.7%). Most patients had retrognathic (55.8%) and normodivergent profiles (77.6%). The hyperdivergent profile (14.1% of the sample) was predominantly found in Class III patients, i.e., 41.2% while hypodivergent (8.3% of the sample) and retrognathic profile (55.8% of the sample) mainly existed in Class II patients, i.e., 10% and 65.5% respectively (Table-2). Increased spacing in maxillary arch was found in Class II malocclusion group (mean rank 41.70) (Table-3).

Statistically significant associations were observed between facial profile sagittal (χ^2=20.928, df=4, p <0.01), facial profile vertical (χ^2=16.681, df=4, p<0.01), spacing in maxilla (χ^2=9.053, df=2, p=0.01), overjet (χ^2=15.604, df=2, p<0.01), overbite (χ^2=8.282, df=2, p<0.01) and Angle's classes (Table-2 & 3).

Statistically significant association was observed between Angle's and skeletal classes (χ^2=26.949, df=4, p<0.01) whereas weak correlation was observed between the two (Cramer's V=0.336, p<0.01) (Table-4).

Table-2: Cross tabulations of dentofacial characteristics with Angle's classes

Dentofacial Characteristics		Class I 29 (18.6) n (%)	Class II 110 (70.5) n (%)	Class III 17 (10.9) n (%)	Total n=156 n (%)
TMJ	Pain or clicking	1 (3.4)	6 (5.5)	2 (11.8)	9 (5.8)
Facial type	Dolichofacial	6 (20.7)	17 (15.5)	5 (29.4)	28 (17.9)
	Mesofacial	20 (69.0)	80 (72.7)	10 (58.8)	110 (70.5)
	Brachyfacial	3 (10.3)	13 (11.8)	2 (11.8)	18 (11.5)
Facial asymmetry		0	9 (8.2)	2 (11.8)	11 (7.1)
Facial profile- S	Orthognathic	18 (62.1)	36 (32.7)	8 (47.1)	62 (39.7)
	Retrognathic	10 (34.5)	72 (65.5)	5 (29.4)	87 (55.8)
	Prognathic	1 (3.4)	2 (1.8)	4 (23.5)	7 (4.5)
Facial profile- V	Normodivergent	20 (69.0)	91 (82.7)	10 (58.8)	121 (77.6)
	Hyperdivergent	7 (24.1)	8 (7.3)	7 (41.2)	22 (14.1)
	Hypodivergent	2 (6.9)	11 (10.0)	0	13 (8.3)
CO-CR discrepancy		2 (6.8)	6 (5.4)	3 (17.6)	11 (7)

Table-3: Cross tabulations of dentofacial characteristics with Angle's classes

Dentofacial Characteristics			Class I 29 (18.6) n (%)	Class II 110 (70.5) n (%)	Class III 17 (10.9) n (%)	Total n=156 n (%)
Crowding (mm)	0-1 Normal	Mx	8 (44.4)	16 (35.6)	0	24 (35.3)
		Md	4 (20.0)	11 (16.4)	3 (25.0)	18 (18.2)
	2-3 mild	Mx	7 (38.9)	17 (37.8)	3 (60.0)	27 (39.7)
		Md	2 (10.0)	18 (26.9)	4 (33.3)	24 (24.2)
	4-6 moderate	Mx	3 (16.7)	6 (13.3)	2 (40.0)	11 (16.2)
		Md	7 (35.0)	20 (29.9)	4 (33.3)	31 (31.3)
	>7 severe	Mx	0	6 (13.3)	0	6 (8.8)
		Md	7 (35.0)	18 (26.9)	1 (8.3)	26 (26.3)
Spacing (mm)	0-1 Normal	Mx	2 (22.2)	9 (15.8)	6 (66.7)	17 (22.7)
		Md	2 (25.0)	11 (26.8)	1 (20.0)	14 (25.9)
	2-3 mild	Mx	5 (55.6)	16 (28.1)	2 (22.2)	23 (30.7)
		Md	2 (25.0)	18 (43.9)	2 (40.0)	22 (40.7)
	4-6 moderate	Mx	0	16 (28.1)	0	16 (21.3)
		Md	2 (25.0)	7 (17.1)	1 (20.0)	10 (18.5)
	> 7 severe	Mx	2 (22.2)	16 (28.1)	1 (11.1)	19 (25.3)
		Md	2 (25.0)	5 (12.2)	1 (20.0)	8 (14.8)
Overjet (mm)	1-2 normal		10 (34.5)	9 (8.2)	6 (35.3)	25 (16.0)
	3-4 mild		11 (37.9)	28 (25.5)	5 (29.4)	44 (28.2)
	5-6 moderate		4 (13.8)	26 (23.6)	2 (11.8)	32 (20.5)
	> 7 severe		2 (6.9)	46 (41.8)	0	48 (30.8)
	Reverse		2 (6.9)	1 (0.9)	4 (23.5)	7 (4.5)
Overbite (mm)	0-2 normal		13 (44.8)	20 (18.2)	7 (41.2)	40 (25.6)
	3-4 moderate		12 (41.4)	58 (52.7)	6 (35.3)	76 (48.7)
	5-7 severe		3 (10.3)	24 (21.8)	1 (5.9)	28 (17.9)
	> 7 extreme		1 (3.4)	5 (4.5)	0	6 (3.8)
	reverse		0	3 (2.7)	3 (17.6)	6 (3.8)
	Open bite		1 (3.4)	1 (0.9)	2 (11.8)	4 (2.6)
Crossbite			9 (31)	21 (19.1)	5 (29.5)	35 (22.4)

Table-4: Cross tabulation of Angle's and skeletal classes.

Skeletal classes	Angle's classes			Total N=156 n (%)
	Class I n (%)	Class II n (%)	Class III n (%)	
Skeletal class I	19 (65.5)	47 (42.7)	10 (58.8)	76 (48.7)
Skeletal class II	9 (31.0)	63 (57.3)	3 (17.6)	75 (48.1)
Skeletal class III	1 (3.4)	0	4 (23.5)	5 (3.2)

DISCUSSION

Angle's classification has been the topic of many discussions in the literature[14,15] it is still a fairly easy and rather accurate way of trying to categorize malocclusions, and is globally used in dental profession, therefore it is being used in this study as well. Results indicate that majority of patients were females, presenting with the chief complaint of 'upper front teeth forward' and 'malaligned teeth'. The population of this study is similar to that found in other surveys of orthodontic patients in terms of gender distribution and prevalence of molar relationship.[16,17,18] However, in view of the biased nature of the sample, the data of this orthodontic population cannot be extrapolated to the whole of the Pakistani population.

The results showed an increased overjet in 75% of the subjects as a major occlusal finding, with an increased frequency and severity in Class II patients. This trend in overjet values is in agreement with the earliest surveys of orthodontic population.[10,11,19,20] however, 48.7% of the sample

showing moderate increase in overbite which is not similar to the finding of other local studies.[17, 20]

Angle's Class II (70.5%) and Incisor Class II Division 1 (64.7%) were the most frequent pattern of malocclusion found in the sample. Similarly, Ijaz A[18] reported Angle's Class II Div 1 and skeletal Class II as the most common pattern of malocclusion, also Hameed *et al*[21] reported skeletal Class II as the most common antero-posterior pattern of malocclusion. On the contrary, the local studies by Shehzad *et al*[16] and Afzal *et al*[22] reported Angle's Class I as the most frequent pattern of malocclusion, i.e., 46% and 59.4% respectively. It may be because of the fact of different population group in study by Shehzad *et al*[16] while in study by Afzal *et al*[22] data collected was based on Dental OPD patients as opposed to orthodontic OPD patients in other studies. However, international literature[23] reported Class II malocclusion as more frequent than Class I & III malocclusion in Asian men.

Different studies representing different population groups have been done on prevalence of malocclusion such as the research of Proffit *et al*[9] who found for untreated White American subjects between 8 and 50 years old a much higher incidence of Class I malocclusions, i.e., 52.2%, only 42.4% Class II and less than 5% Class III malocclusions. Although the available data by Proffit *et al*[9] was not as extensive as the American populations; it seems clear that Class II problems are more prevalent in people of white descent while Class III problems are most prevalent in Oriental populations[24] (3–5% in Japan and nearly 2% in China with another 2–3% pseudo Class III).

Another study on the pattern of malocclusion in Africa (Nigeria)[19] showed the molar relationship among those as: Class I 76.5%, Class II 15.5% and Class III 8.0%. Unfortunately, not even a single study has been done in Pakistan on the prevalence of malocclusion; however, the epidemiological investigation conducted in India[25] on 3164 rural children was found to have malocclusion 29.2%, among them Class I malocclusion was found to be 14.4%, Class II 13.5% and Class III 1.35% of the whole sample.

The results of the study showed that most patients had retrognathic, normodivergent profiles. While the hyperdivergent profile was predominantly found in Class III and hypodivergent, retrognathic profile mainly existed in Class II patients. Ijaz A[18] reported normodivergent vertical pattern as the most frequent one in all skeletal groups. Hameed *et al*[21] reported majority of patients with orthognathic profile, and among vertical malocclusion the skeletal open bite was the most frequent pattern of malocclusion. The differences in the results may be because of the patient's pool from different regions of the country and the small sample size of the mentioned local studies. However, Siriwat *et al* while correlating malocclusion and facial morphology concluded that 'hypodivergent pattern is dominant in Class II and Class III malocclusions'.[26]

Increased spacing in the maxillary arch of Class II patients (mean rank 41.70; χ^2=9.053, df=2, p=0.01) was may be because of the increased dimension of the upper jaw in Class II as compared to Class III individuals. Similarly, increased overbite and overjet frequencies in Class II malocclusion dentally expressing the hypodivergent and retrognathic pattern.

Although Angle's classification of malocclusion is based on antero-posterior relationship of the maxillary and mandibular first molars during maximum intercuspation, it can also be utilized for clinically evaluating skeletal sagittal relationship, as the statistically significant correlation was observed between Angle's and skeletal classes (Cramer's V=0.336, p <0.01).

This study for the first time has incorporated number of variables while evaluating pattern of malocclusion in a hospital setup. Differences in malocclusion characteristics between Pakistan and other countries would be expected because of differences in racial and ethnic composition. Results cannot be representative of the whole of the Pakistani population and thus expected to varying degree of prevalence of dental anomalies.

CONCLUSIONS

In this hospital based study, the frequency of Class I, Class II and Class III malocclusion was found to be 18.6%, 70.5% and 10.9% respectively. Out of the entire dentoalveolar problem studied, increased overjet was found to be the most common feature. Angle's classification of malocclusion can also be utilized for clinically evaluating skeletal sagittal relationship. Identifying occlusal problems, their incidence and the need for treatment can help to determine the appropriate treatment plan and manpower needed in orthodontics. The results may also provide a base line data for planning orthodontic services but still there is a strong need of analyzing the prevalence of malocclusion in the Pakistani population.

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