Incidence and evaluation of open bite malocclusion and their management

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ABSTRACT

Introduction: Open bite malocclusion is one of the most difficult dentofacial deformities to treat. Although this type of malocclusion can occur unilaterally or bilaterally in the buccal segments. It is mostly seen in the anterior segment where there is no incisal contact and vertical overlap of the lower incisors by the uppers.

Objectives: The study was aimed to find out the incidence of open bite malocclusion and their pre and post treatment evaluation of the treated cases and also compare the result of two study groups (skeletal open bite and dental open bite).

Methods: A total number of 31 patients with open bite malocclusion out of 1372 patients reported to Department of Orthodontics, Dhaka Dental College and Hospital for treatment. Out of them 21 patients were included in this study with mean age 22±5.4, who successfully completed treatment. Of them 14 were included in the dental group and 07 in the skeletal group. Pre treatment history, clinical examination along with pre and post-treatment photographs, study models and lateral cephalograms were used to compare the treatment outcome between the two study groups.

Results: The incidence of open bite was 2.3%. Out of 21 open bite samples 14 were of dental type and the rest 07 were of skeletal type. 47.6% open bite had Angles Class I malocclusion, 42.9% were Class II and 9.5% were Class III. Cephalometric analysis of vertical measurements showed that the mandibular plane angle, palatal plane angle and SNA angle significantly decreased from pre-treatment to post-treatment ($p<0.05$) in both groups . Gonial angle remains unchanged. Cephalometric analysis of the linear and dental measurements showed increased upper face height, posterior facial height and inter-incisal angle. Soft tissue evaluation on cephalometry showed significant decrease of esthetic plane and interlabial gap. A statistically significant mean difference was found in case of negative overbites among the patients with dental group ($p<0.001$). Less time was required for completion of treatment in dental group and prognosis was significantly better ($p<0.05$)

Conclusion: The result of the present study indicates that the treatment period and wear time of appliance in dental type was shorter than skeletal type. Both groups showed significant improvement though prognosis was better in dental type of open bite cases.

Key words: Open Bite malocclusion, Skeletal, Dental. (Bangladesh Journal of Orthodontics and Dentofacial Orthopedics, Vol. 2, No. 2, April 2012, p 1-7).

INTRODUCTION

The open bite malocclusion is one of the most difficult dentofacial deformities to treat. The complexity of this malocclusion is attributed to a combination of skeletal, dentoalveolar, functional, and habit related factors. Accurate diagnosis is essential for proper treatment planning, which, in combination with patient-specific mechanics, is needed to achieve stable result.[1-14]

The incidence of anterior open bite varies among races and with dental age. It is more common in Americans (6.6%) than in Caucasians (2.9%) or Hispanics (2.1%).[15] Other studies in different countries show 8% in Kenya,[16] 6.6% in Saudi Arabian adolescents,[17] 9% in Bogota, Columbia,[18] 4% in Pakistan.[19] In Bangladesh a study report states1% incidence of open bite malocclusion in 1994[20] and another study reports 4.5% in 2007.[21] Chronological, as children develop dentally, the incidence of

anterior open bite decreases, as it tends to self correct during the mixed dentition phase.

Although the term open bite typically refers to a dental malocclusion, it can be the result of a dental discrepancy, skeletal discrepancy, or a combination of the two. Terms such as skeletal open bite, vertical growth, hyperdivergent and long-face pattern have been used to describe open bites that may be caused, at least partially, by a skeletal problem. Most of the skeletal and dental characteristics commonly seen in open bite patients were initially described by Bjork.[22] These skeletal and dental characteristics include: distal condylar inclination, short ramus, antegonial notching, obtuse gonial angle, excessive maxillary height, straight mandibular canal, thin and long symphysis, long anterior facial height, short posterior facial height, steep mandibular plane, divergent occlusal planes, acute intermolar and interincisal angulation, anteriorly tipped up palatal plane, and extruded

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molars. Of all these characteristics, the steepness of the mandibular plane has been considered the skeletal finding associated with a skeletal anterior open bite.[23-27]

In terms of soft tissue characteristics, most parallel those of hard tissues (long lower facial height, steep mandibular plane, and short posterior facial height). In addition a large interlabial gap is most evident on clinical examination of a skeletal open bite patient.[28,29]

Open bites associated with craniofacial malformations are much more difficult to treat and tend to relapse.[30-34] Early treatment of vertical dysplasia during the primary or the mixed dentition period has been advocated to reduce the need of treatment in the permanent dentition. A series of treatment approaches to be made regarding treatment of open bite. These treatment modalities include mainly functional appliances, multi bracket techniques, headgears , bite blocks, magnets, implants and orthognathic surgeries etc.[35-45]

MATERIALS AND METHODS

The study was conducted in the Department of Orthodontics and Dentofacial Orthopaedics, Dhaka Dental College and Hospital, Dhaka from July 2006 to December 2009. The diagnosis of anterior open bite of skeletal or dental origin was made based on clinical findings, model analysis and cephalometric evaluation. A number of 21 patients were selected with no age and sex limit. Of them 7 were classified in skeletal group and 14 were in dental group. Accordingly, treatment plan was made and executed. After starting the treatment, the subjects were advised to report every 28 days for follow-up and activation. All were motivated to maintain optimum oral hygiene.
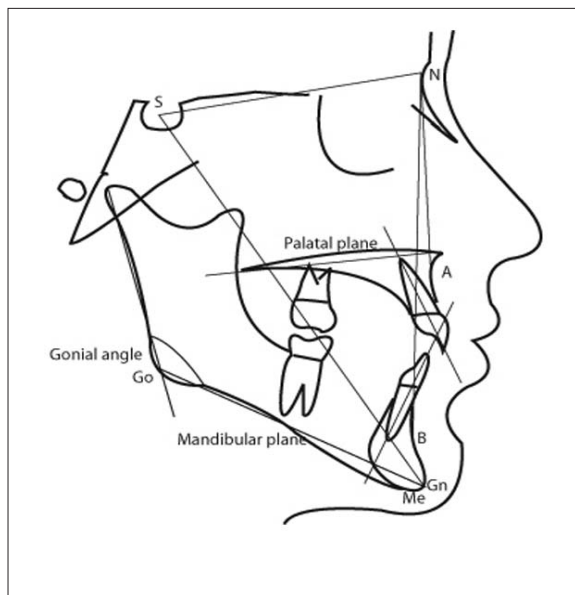

Fig.1: Measurements used in lateral cephalogram

Data were collected from pre and post treatment photographs, study models and lateral cephalograms and a case history sheet for each patient was filled. The collected data was subjected to statistical analysis using the Statistical Package for Social Sciences (SPSS for windows, version 17).

RESULTS

The prospective study was conducted in the Department of Orthodontics and Dentofacial Orthopedics, Dhaka Dental College and Hospital with a view to assess the incidence of open bite malocclusion among the patients attending for treatment and their post treatment outcome between two groups of patients viz. skeletal and dental. A total of 21 patients were studied, 7 were in skeletal group and 14 patients in Dental group.

Table 1. Year wise distribution of orthodontic patients with openbite

Year	No. of orthodontic patients	No. open-bite cases	%
July 2006-December 2006	180	3	1.7
January 2007-December 2007	385	9	2.3
January 2008-December 2008	397	10	2.5
January 2009-December 2009	410	9	2.2
Total	1372	31	2.3

Among the attended cases, 2.3% had open bite. The year wise distribution indicated that the percentage of open bite was more or less consistent from 2007 to 2009, but in 2006, the percentage of open bite was lower than the subsequent year.

Table 2. Age distribution of the patients

Age in years	Patient's group				Total n=21		p value
	Dental n=14		Skeletal n=7				
	No.	%	No.	%	No.	%	
<20	6	42.9	1	14.3	7	33.3	
≥20	8	57.1	6	85.7	14	66.7	
Mean ± SD	22.1±6.2		21.7±3.6		22.0±5.4		0.913
Range	14.0-36.0		16.0-36.0		14.0-36.0		

*value reached from Mann-Whitney U test

The mean age of the patients were 22.0±5.4 years ranging from 14 to 36 years. The mean age of the skeletal group was 21.7±3.6 years and that dental group was 22.1±6.2 years. No statistically significant mean difference was found between two groups of patients $p>0.05$.

Table 3. Sex distribution of the patients

Sex	Patient's group				Total n=21		p value
	Dental n=14		Skeletal n=7				
	No.	%	No.	%	No.	%	
Male	2	14.3	3	42.9	5	23.8	0.280§
Female	12	85.7	4	57.1	16	76.2	

§p value reached from Fisher exact test

Statistically significant sex difference was found between skeletal and dental patients' $p>0.05$.

Table 4. Distribution of patients by type of malocclusion

Type of malocclusion	Patient's group				Total n=21	
	Dental n=14		Skeletal n=7			
	No.	%	No.	%	No.	%
Class I	9	42.85	1	4.76	10	47.6
Class II	3	14.28	6	28.56	9	42.9
Class III	1	4.76	1	4.76	3	9.5

Data shows that class I patients were found to be high in both group of patients 47.6% followed by class II 42.9% and class III 9.5%.

Table 5. Distribution of the patients by causes of open bite

Causes of open bite	Number	%
Tongue thrust	11	52.3
Hereditary	3	14.4
Short upper lip	2	9.5
Nasal obstruction	1	4.8
Thumb sucking	4	19

Causes of the open bite indicated that highest percentage had tongue thrust 52.3%

Table 6. Distribution of the patients by treatment modality

Treatment modality	Patient's group				Total n=21	
	Dental n=14		Skeletal n=7			
	No.	%	No.	%	No.	%
Habit correction with tongue crib	9	64.3	3	42.9	12	57.1
Non extraction	8	57.1	0	.0	8	38.1
Extraction 4 1st premolar	3	21.4	5	71.4	8	38.1
Extraction 4 2nd premolar	0	.0	1	14.3	1	4.8
Extraction 2 upper 1st premolar	1	7.1	0	.0	1	4.8
Extraction 2 lower 1st premolar	2	14.3	1	14.3	3	14.3
Romovable appliance	6	42.9	0	.0	6	28.6
Fixed appliance	8	57.1	7	100.0	15	71.4

*Multiple responses

It was revealed that highest percentage of the patients received fixed appliance 71.4% followed by habit correction with tongue crib 57.1%. However, 38.1% of the patients were treated without extraction. Data revealed that the proportion of habit correction with tongue crib and removable appliance were required in dental group of patients whereas fixed appliance and extraction were needed more in skeletal group of patients.

Table 7. Pre and post treatment study model analysis of both group

Study model analysis	Dental n=14			Skeletal n=7		
	Pre treatment	Post treatment	p value	Pre treatment	Post treatment	p value
Over jet	-.07 0.3	2.4 0.4	0.001*	-0.9 0.5	2.8 0.6	0.001*
Over bite	-1.6 0.9	2.3 0.5	0.001*	-2.6 1.0	2.4 0.4	0.006*

p value reached from paired t test

Data analysis revealed significant changes in overjet and over bite in both groups of patients p<0.05 .

Table 8. Pre and post treatment cephalometric analysis of the skeletal and dental groups

Cephalometric analysis	Dental n=14			Skeletal n=7		
	Pre treatment	Post treatment	p value	Pre treatment	Post treatment	p value
Mandibular plane angle	36.4+3.9	35.7+3.8	0.055*	42.0 +5.7	40.4+5.3	0.025*
Gonial angle	127.6 +4.1	127.3 +4.0	0.292	132.9 +6.4	132.9+6.4	-
Palatal plane angle	28.6 +4.6	28.1 +4.2	0.111	33.4 +6.5	32.1+6.4	0.022*
Palatal plane	7.9 +2.4	7.6 +1.9	0.513	8.6 +3.8	8.3+3.3	0.356
Angle between SGn & SN	69.2 +5.9	68.8+ 5.1	0.306	72.9 +5.4	71.7+5.1	0.015*
Angle between SN plane to A point	85.0 +2.6	81.4 +1.4	0.001*	82.1 +2.3	80.6+1.1	0.052
Angle between SN plane to B point	81.0 +4.0	78.8 +1.5	0.013*	77.0 +3.6	78.1+1.1	0.339
Difference between SNA & SNB	4.0 +3.8	2.6 +0.9	0.119	4.9 +3.7	2.4+0.8	0.096

p value reached from paired t test

Cephalometric analysis of the patients indicated that among the dental group mandibular plane angle, angle between SN plane to A point and angle between SN plane to B point significantly decreased from pretreatment p<0.05 . In the skeletal group mandibular plane angle, palatal plane angle, angle between SGn & SN, between SN plane to A point significantly decreased from pre-treatment status p<0.05 . However, no statistically significant difference was seen in cephalometric parameters of gonial angle and difference between SNA & SNB p>0.05 .

Table 9. Pre and post treatment dental measurement of the skeletal and dental groups

Cephalometric analysis	Dental n=14			Skeletal n=7		
	Pre treatment	Post treatment	p value	Pre treatment	Post treatment	p value
Upper incisor angulation	115.3±5.0	111.8±3.4	0.036	115.1±9.9	113.1±5.9	0.472
Upper incisor protrusion	8.1±1.8	3.9±0.8	0.001	9.0±3.5	4.0±1.2	0.003
Lower incisor angulation	101.9±9.2	93.6±3.7	0.001	97.3±7.3	94.0±1.2	0.257
Lower incisor protrusion	10.5±3.5	4.6±1.3	0.001	9.1±4.3	4.4±1.4	0.013
Inter-incisal angle	108.5±11.9	124.6±4.2	0.001	113.0±10.3	122.4±4.8	0.024
Upper face height	53.1±6.1	54.1±5.5	0.002	53.9±5.7	54.9±5.5	0.038
Lower face height	71.9±7.9	72.1±8.9	0.739	73.9±5.5	73.9±4.9	1.00
Anterior face height	125.1±12.0	125.5±12.3	0.416	127.4±9.8	128.3±9.3	0.017
Posterior face height	78.7±11.1	80.4±10.5	0.001	77.3±7.5	78.4±7.3	0.047

p value reached from paired t test

Data analysis revealed that in the dental group of patients upper incisor angulation, upper incisor protrusion, lower incisor angulation, lower incisor protrusion, and upper facial height decreased from pre-treatment status, whereas inter-incisal angle, upper facial height and posterior facial height increased from pre-treatment status $p<0.05$. But no statistically significant mean difference was found in other variables $p>0.05$. On the contrary, upper incisor protrusion and lower incisor protrusion was decreased from pre-treatment status $p<0.05$ among the dental group of patients. It was also noted that inter-incisal angle, upper facial height, anterior facial height and posterior facial height increased from pre-treatment status $p<0.05$.

Table 10. Pre and post treatment soft tissue analysis of the skeletal and dental groups

Soft tissue analysis	Dental n=14			Skeletal n=7		
	Pre treatment	Post treatment	p value	Pre treatment	Post treatment	p value
Inter-labial gap	1.5 3.9	0.0 0.0	0.178	7.4 6.2	1.4 2.5	0.027
Esthetic plane	4.6 3.7	1.6 2.6	0.001	4.6 4.9	2.6 2.4	0.111

p value reached from paired t test

Data analysis shows that inter-labial gap significantly decreased in skeletal group of patients $p<0.05$, but not in dental group $p>0.05$. It was also found that the esthetic plane also significantly decreased after treatment in dental group of patients $p<0.05$, but no statistically significant changes was observed in skeletal patients ($p>0.05$).

Table 11. Distribution of the patients by duration of treatment

Duration of treatment (months)	Patient's group				Total n=21		p value
	Dental n=14		Skeletal n=7				
	No.	%	No.	%	No.	%	
<20	8	57.1	1	14.3	9	42.9	
≥20	6	42.9	6	85.7	12	57.1	
Mean ± SD	18.2±3.1		24.0±4.1		20.1±4.4		0.004*
Range	12-24		16-30		12-30		

*value reached from Mann-Whitney U test

The mean duration of treatment was 24.0±4.1 months among the skeletal group and the mean duration was 18.2±3.1 months among the dental group, but the mean difference was statistically significant $p<0.05$. This indicated that skeletal group of patients needed more time than the dental group.

Table 12. Distribution of the patients by prognosis of treatment

Prognosis of treatment	Patient's group				Total n=21		p value
	Dental n=14		Skeletal n=7				
	No.	%	No.	%	No.	%	
Corrected	12	85.7	5	71.4	17	81.0	0.574
Partially corrected	2	14.3	2	28.6	4	19.0	

§p value reached from Fisher's exact test

Data analysis revealed the overall prognosis was favourable 81.0%. Prognosis was found to be high among the dental group of patients (85.7%) compared to skeletal group (71.4%), which was not statistically significant (p>0.05).

DISCUSSION

The present study was carried out to evaluate the pattern of malocclusion among the armed forces family members seeking orthodontic treatment. The incidence of open bite malocclusion was 2.3% in the study. The study commensurate with the study of other communities like Caucasians (2.9%),[15] The present study also varies with other studies like 8% in Kenya,[16] 6.6% in Saudi Arabia,[17] 4% in Pakistan, 19 8.7% in Colombia.[18] This might be due to different nature and number of samples. The present study shows females had higher preponderance (76.2%) over the male subjects (23.8%). It might be due to more consciousness of the females towards aesthesis (Table 1,2,3) The present study was undertaken to determine the incidence in Angle's malocclusion criteria also, the majority (47.6%) of open bite cases had Class I malocclusion. The finding are in close agreement with Hossain et al.[20] (Table 4) While differentiating the etiology in this study, tongue thrust found to be the main cause (71.4%), followed by heredity, nasal obstruction and short upper lip. Several studies are in favour of our study stating the compex etiology of open bite malocclusion.[1-14] (Table 5)

In this study, the treatment modalities of open bite were habit correction with tongue crib (57.1%), Extraction (61.9%), Removable appliance therapy (28.6%), Fixed appliance therapy (71.4%) and no surgery was undertaken. The study coincides with Kim Y,[35] Lopez Gavito et al,[33] Schudy.[39] The treatment of open bite with removable appliances are advocated by many authors and treatment result is nearer to this study.[30,31,37] However, some study advocates different concepts like functional appliances,[42,44,45] molar intrusion,[36] segmental distraction and surgery.[12] The difference in treatment modalities are due to variations in age of individuals and a wider community scope for treatment (Table 6). In the study pre and post treatment model analysis showed significant changes in overbite and overjet in both group of patients. This is a positive prognostic indicator of successful treatment (Table 7). Cephalometric analysis of the patients in vertical measurements indicated that mandibular plane angle, palatal plane angle and SNA angle significantly decreased in post treatment p<0.05 (Table 9). It is interesting to note that the values are nearer to Cangialossi, and Gershater values,[9,24] that the post treatment reduction in these angles results in greater lower anterior face height caused by a downward tipping of the mandibular plane. These parameters were insignificant between the two groups-dental open bite and skele-

tal open bite subjects (Table 8). Cephalometric datas on dental and linear measurements revealed that upper incisor protrusion, lower incisor angulation and lower incisor protrusion significantly decreased after treatment. At the same time Inter incisal angle, upper face height and posterior facial height significantly increased after treatment. These changes are indicators of success of treatment. In open bite subjects the upper facial height and the posterior facial height is less causing a long facial with greater lower facial height. Reduction in the posterior facial height and an steep mandibular plane angle rather worsen the condition since it brings rotational changes in mandible (Table 9). These are consistent with studies carried out by Remmers et al,.[41] Sassouni and Chang.[25,26]

Soft tissue analysis showed significant decrease in interlabial gap and esthetic plane in both groups (Table 10). Generally the skeletal open bite cases had large interlabial gap. A reduction in it has a positive influence on patients esthetic plane and facial profile. Data analysis regarding the duration of treatment, the skeletal group required more treatment time (24.0.± 4.1 months) than the dental group (18.2± 3.1 months). The mean duration was significant (Table 11). Statistically significant results were found regarding the prognosis and patient satisfaction of treatment (Table 12). Favorable prognostic outcome was found among the dental group (85.7%) compared to skeletal group (71.4%) (Table 12).

CONCLUSION

From the result of the present investigation and its conclusion, it may be suggested that incidence of open bite was 2.3%. The treatment period and wear time of appliance in dental type of open bite was shorter than those of skeletal type of open bite. All subjects showed significant improvement - both skeletal and dental group, though prognosis was better in dental type of open bite cases.

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