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Comparison of posterior tooth angulation in patients with normal bite and deep bite malocclusion

Syed Riaz Shah Gilani[a], Shahab Adil[b], Kawish Syed[c]

Abstract

Introduction: Malocclusions should not be always considered as disease entities but, they should be observed as expression of an underlying inconsistencies. The aim of the study was to compare the angulations of posterior teeth in patients with normal bite and deep bite malocclusion.

Material and methods: Lateral Cephalometric analysis of 194 deep bite (38 male,59 female) and normal bite (39 male,58 female) with 97 untreated subjects in each group were compared having permanent dentition. statistical analysis was performed using descriptive analysis and intergroup comparison. Were performed through ***t*** tests. The results were considered significant at, *p*.value ≤*0.05*

Results: There was significantly greater distal angulation of mandibular first premolar and mandibular second molar in relation to mandibular plane in deep bite malocclusion group than those with normal occlusion.

Conclusions: There was a significant difference between posterior tooth angulation in normal occlusion and deep bite malocclusion, the mandibular first premolar and second molar had greater distal angulation in relation to mandibular plane.

Keywords: Angulation; cephalogram; occlusion; overbite

Introduction

Deep bite is characterized by the excessive vertical overlap of mandibular incisors with neuromuscular dental and skeletal relations when teeth are occluded in maximum intercuspation.[1] Normally, during occlusion the incisal edges of the lower teeth should overlap the upper teeth palataly, (i.e. 1-3 mm overbite).[2] Deep bite can be commonly associated with Class II div 2 malocclusions as compared to Class I and Class II malocclusions.3

Various orthodontists[4-5] have found that the mesiodistal angulation of dentition may vary substantially conferring to certain aspects and can show constancies.[6]During the development of teeth and the final tooth position there are compensatory changes, influenced by the rotation of apical bases which were studied by Bjork and Skieller.[7]Literature in the past showed that dental components were less effective than skeletal components on overbite variation and compensatory changes in the molar is not well recognized in the studies.[8-9]

It is quite challenging to attain normal occlusion with acceptable and stable results for orthodontic cases with severe vertical problems either deep bite or open bite. However, unsurprisingly there are cases which present with normal bite having good natural compensation in individuals with extreme vertical skeletal problems. Angulations of Pre molars and molars in

[a] BDS, Resident, Department of orthodontics, Peshawar Dental Hospital, Peshawar, Pakistan.
[b] Corresponding Author. BDS, FCPS; Professor, Head Department of Orthodontics, Peshawar Dental Hospital, Peshawar Pakistan.
Email:shahabadil@hotmail.com
[c] BDS, MCPS; Assistant Prof, Department of periodontics, Sardar Begum Dental Hospital, Peshawar Pakistan.

patients with deep-bite malocclusion and normal bite malocclusion were selected because it can be one of the factors which either produces deep bite malocclusion or acting as a compensatory pattern for normal bite malocclusion. In this way, we hope to give a reference for clinicians to understand the potential of posterior anchorage, the effects of orthodontic appliances on anchorage and encourage new revolutions in the field of orthodontics. This will ultimately help the orthodontist in terms of achieving good post treatment results in overbite problems. The aim of this research was to find out any variation in angulations of posterior teeth in subjects with normal and deep-bite malocclusion.

Material and methods

A retrospective cross sectional study was conducted for a total study duration of 4 months from date of ethical approval from institutional review board on 30th Sep 2020. A sample size is

Table I: Gender wise distribution among the groups

		normal bite and deep bite		Total
		normal bite	deep bite	
Gender of the patient	Male	39	38	77
	Female	58	59	117
Total		97	97	194

Calculated[10] considering a test power of 80 % with a 5 % significance level concluded that in each of the two groups a minimum of 97 subjects were required for providing reliable outcomes.[11]

The research was conducted at Peshawar Dental college and Hospital and Sardar Begum Dental College and Hospital Peshawar after the approval from institutional ethical review board committee (Ref No: Prime/IRB/2020-58). Pretreatment lateral cephalograms of 194 subjects (78 males and 116 females) from both the hospitals record files of Orthodontics department, meeting the inclusion criteria were selected. The inclusion criteria were 1/3rd incisal coverage of lower incisors by the upper incisors for normal bite group and greater than 1/3rd coverage for deep bite group irrespective of vertical profile, no history of previous orthodontic treatment, posterior crowding, craniofacial abnormalities, missing teeth and complete eruption of the premolars and molars in both the groups. The subjects with missing teeth, previously treated orthodontically, significant restorations on any posterior tooth and presence of any remaining primary dentition were excluded.

The subjects were distributed into two groups (Table I), established on volume of deep bite, irrespective of cephalometric features. All of them were having permanent teeth up to the second molars. The cephalometric analyses were executed on matt paper. In total 19 measurement were made (Table II). Angulations of posterior teeth were analyzed in both the arches between the premolars (from apex to tip of cusp) and the molar long axis (from furcation to the center of the crown) to the mandibular plane, interdentally and maxillary plane Figure1(a), Figure1(b) and Figure1(c).

Table II: Cephalometric Variables

Maxillomandibular relationship	
SNA	SN to NA angle
SNB	SN to NB angle
ANB	NA to NB angle
Growth pattern	
SN. PP	SN to palatal plane angle
PP.MP	Angle between the palatal plane (ANS/PNS) and mandibular plane (Go/Gn)
Gonial Angle	Ar-Go to Go-Gn Angle
Dental relationship	
Overbite	Distance between the maxillary and mandibular incisor boarders, perpendicular to the functional occlusal plane
Maxillary mesiodistal angulation	
Mx4.pp	Long axis of maxillary first premolar to ANS-PNS, angle
Mx5.PP	Long axis of maxillary second premolar to ANS-PNS, angle
Mx6.pp	Long axis of maxillary first molar to ANS-PNS, angle

Mx7.pp	Long axis of maxillary second molar to ANS-PNS, angle
Mandibular mesiodistal angulation	
Md4.MP	Long axis of mandibular first premolar to the mandibular plane (Go-Gn)
Md5.MP	Long axis of mandibular second premolar to the mandibular plane (Go-Gn)
Md6.MP	Long axis of mandibular first molar to the mandibular plane (Go-Gn)
Md7.MP	Long axis of mandibular second molar to the mandibular plane (Go-Gn)
Interdental Angulation	
Mx4.Md4	Long axis of the mandibular and maxillary first premolar
Mx5.Md5	Long axis of the mandibular and maxillary second premolar
Mx6.Md6	Long axis of the mandibular and maxillary first molar
Mx7.Md7	Long axis of the mandibular and maxillary second molar

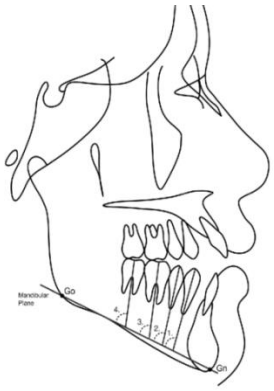

Figure 1(a): Posterior tooth angulations in Mandible

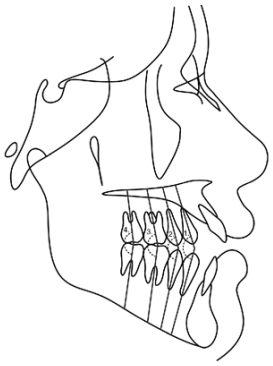

Figure 1(b): Posterior tooth angulations Interdentally

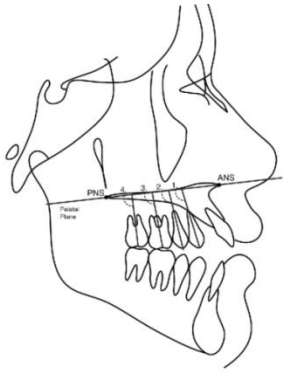

Figure 1(c): Posterior tooth angulations in maxilla

Table III: Intergroup comparison of all Variables

Variables	Normal bite (N=97), Deep bite(N=97)	Mean	S. D	*P*.value
SNA	normal bite	81.53	4.138	.058*
	deep bite	82.60	3.670	
SNB	normal bite	77.55	4.113	.909
	deep bite	77.65	3.396	
ANB	normal bite	4.18	2.700	.033*
	deep bite	4.94	2.221	
SN-PP	normal bite	9.0825	2.756	.058*
	deep bite	8.3608	2.504	
PP-MP	normal bite	25.04	6.213	.149
	deep bite	23.81	5.553	
Gonial Angle	normal bite	122.96	5.526	.649
	deep bite	122.61	5.189	
overbite	normal bite	2.32	.490	.000*
	deep bite	4.93	1.111	
Mx4-PP	normal bite	92.12	6.300	.894
	deep bite	91.98	8.535	
Mx5-PP	normal bite	90.45	7.510	.730
	deep bite	90.92	10.880	
Mx6-PP	normal bite	89.75	8.13	.262
	deep bite	91.51	12.977	
Mx7-PP	normal bite	88.40	11.876	.295
	deep bite	90.47	15.384	
Md4-Mp	normal bite	89.71	13.578	.015*
	deep bite	93.92	10.139	
Md5-MP	normal bite	89.53	10.781	.137
	deep bite	91.84	10.739	

Md6-MP	normal bite	90.89	8.540	.133
	deep bite	92.77	8.865	
Md7-MP	normal bite	90.90	7.848	.003*
	deep bite	94.64	9.367	
Mx4-Md4	normal bite	164.59	8.270	.894
	deep bite	164.78	11.783	
Mx5-Md5	normal bite	167.08	6.916	.178
	deep bite	168.80	10.449	
Mx6-Md6	normal bite	154.68	7.421	.506
	deep bite	165.64	12.065	
Mx7-Md7	normal bite	164.29	7.612	.521
	deep bite	165.22	11.994	

Significance (*P< 0.05

Results

Group I (normal bite) comprised of lateral cephalograms acquired from 97 (39 male,58 female) subjects, with mean age of 18.66 (13-31 years range). Their overbite ranged from 1-3 millimeter (mean 2.32 mm). Fifty-one with class I(ANB:0-4) while 43 were with class II (ANB >4) skeletal relationship

Group 2 (deep bite) comprised of lateral cephalograms acquired from 97 (38 male,59 female) subjects having mean age of 18.04 (12-29 years range). The deep overbite ranged from 4-7mm with mean of 4.93 mm. Forty-one with class I(ANB:0-4) and 56 were with class II (ANB > 4) skeletal relationship. For statistical analysis IBM SPSS statistics (version 20 New York, United States) software was used. Descriptive statistics for comparison of gender distribution amongst the groups (Table III) and independent *t*-test to relate the variables in normal and deep bite group was used. Results were considered significant at P value of < 0.05(*)

The deep bite group showed an increased tendency towards class II skeletal relationship, downward inclination of palatal plane and distal angulation of mandibular first premolar and mandibular second molar (Table III).

Discussion

In literature much importance was given to skeletal and dento alveolar components in open bite patients.[12-13] In a study conducted by Guilherme et al[14] in which a comparison of mesiodistal angulation between normal occlusion and open bite malocclusion was performed which concluded that both first and second mandibular premolar has similar mesiodistal angulation in relation to mandibular plane, our results showed distal angulation of mandibular first premolar and second molar in deep bite malocclusion in relation to the mandibular plane.

Björk et al[15] studied the compensation of teeth throughout development and it was concluded that there is a predisposition of distal inclination of posterior teeth in clockwise-rotated mandibles but our results were in contrary to these finding as the mandibular first premolar and second molar in relation to mandibular plane showed distal angulation which may have compensated for deep bite malocclusion. It has been suggested that a discrepancy between the occlusal force may effect mandibular molars to be mesially inclined[16-17] but our study was not in agreement in this regard because mandibular premolar and molar in relation to mandibular plane showed distal angulation. It has been demonstrated that in patients having malocclusion (Angle's class II) the premolars and molars were distally angulated than those with normal occlusion,[18] which is in covenant to our study as 57% of the patients in deep bite group had distal angulation of lower first premolar and second molar in relation to mandibular plane. In deep bite patients the orthodontic treatment is greatly influenced by smile arc. In order to avoid unesthetic effects on facial profile it is contraindicated to intrude maxillary incisors in patients whose smile arc is flat, while vice versa for excessive incisor display.[19-20] Regarding the skeletal components, the mandible was revealed to be responsible in the etiology of the vertical malocclusions.[21] El-Dawlatly et al[22] concluded that skeletal components were mostly involved in the etiology of open bite especially the gonial angle while in deep bite ,the dental

discrepancies were mainly responsible. In our study both skeletal and dental components had significant differences in deep bite group with smaller gonial angle and anti-clockwise mandibular inclination in deep bite group. The angulation of mandibular premolars and molars could be because of the divergent maxillary plane when related to the cranial base and posterior teeth must be distally angulated to occlude as this is known to be a dento-alveolar compensatory mechanism.[23] For a more stable treatment the clinician must have a thorough knowledge of skeletal and dental features because it is challenging to treat deep bite effectively.[24] Our decision-making process in planning the treatments for deep malocclusions should be focused to address the fundamental cause; as every distinct case should receive customized mechanics to resolve the offending factor rather than restricting our treatments to limited predetermined techniques. Our study had certain limitation as we endeavored to explore the comparison between posterior tooth angulation in normal bite and deep bite in relation to mandibular plane, palatal plane and interdentally, a relatively large study sample can be used to better evaluate the angulation of posterior teeth. Moreover, for data collection conventional lateral cephalograms were used which was time consuming and also chances of image distortion and errors are always there, therefore the mesiodistal angulation of each tooth with new imaging technology like 3-D images generated from CBCT can be helpful to better evaluate both the intergroup comparison of tooth angulations. The study aimed to compare posterior tooth angulations in normal occlusion and deep bite malocclusion based on the amount of overbite irrespective of the skeletal vertical profile. There can be a difference in angulation between a skeletal normal angle compared to low angle. Therefore, another study can be conducted for comparison in future.

Conclusions

It is concluded that the mandibular first premolar was distally angulated in deep bite group as compared to the group with normal bite occlusion in relation to mandibular plane. The mandibular second molar was also more distally angulated in deep bite group as compared to normal bite occlusion group in relation to mandibular plane

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