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Dentistry

A RETROSPECTIVE STUDY ON POSTERIOR TOOTH ANGULATIONS IN PATIENTS WITH DEEP BITE VERSUS NORMAL BITE VISITING GOVERNMENT DENTAL COLLEGE AND HOSPITAL, KOLKATA

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ABSTRACT **Introduction:** Posterior teeth alignment play a vital role in the treatment of vertical occlusal discrepancy particularly that of deep bite. **Aim and Objective:** The aim of this study was to compare the posterior tooth angulations in patients with deep bite versus normal bite. The objective of this study was to compare the co-relation between the change in posterior teeth angulations with increase in bite depth (i.e from normal bite to deep bite). **Material And Methods:** Lateral cephalometric radiographs and study models of 50 normal bite(6 male , 44 female) and 50 deep bite(18 male , 32 female)patients having permanent dentition, were used for measuring dental and skeletal parameters. Statistical analysis was done for intergroup comparison which was performed through t tests and co-relation was done through Pearson's correlation calculator. The results were considered significant at ,p value <0.05. **Results:** The maxillary molar teeth were more mesially angulated in normal bite than deep bite with respect to palatal and occlusal plane .All Mandibular posterior teeth were significantly more distally angulated in normal bite than deep bite in relation to mandibular plane . A weak negative correlation was found between maxillary posterior teeth and bite depth. A weak positive correlation was found between mandibular posterior teeth and bite depth. **Conclusion:** The maxillary and mandibular posterior teeth showed different angulations in deep bite and normal bite patients.

KEYWORDS : Angulation, deep bite, normal bite, lateral cephalometry

INTRODUCTION:

When excessive overlap of the anterior teeth occurs, it results in development of anterior deep bite .[1] During occlusion, the incisal edges of the upper (maxillary) teeth should overlap the lower (mandibular) teeth palatally resulting in 1-3 mm overbite which is considered normal.[2]Reported unfavourable consequences of an untreated deepbite include increased anterior crowding ,maxillary dental flaring and associated periodontal sequelae.[3-6] The curve of Spee is considered to be the result of forward tipping of premolars and molars . A deep curve of Spee results in a more confined area for the upper teeth whereas a reverse curve of spee results in excessive room for the upper teeth. So nearly a flat plane of occlusion is most commonly desired to normal occlusion[7].The anterior component of force is produced by axial inclination of permanent teeth in such a way that some of the forces of chewing produce a mesial resultant through the contact points of teeth. Its pattern is such that both the upper and lower teeth are angulated slightly mesially producing a gentle curve of spee in the lower arch.[8]

The aim of this study is to compare pre-molar and molar teeth angulations in adolescents and young adult patients with normal bite and deep bite on lateral cephalometric radiographs. The objective of this study is to compare the co-relation between the change in posterior teeth angulations with increase in bite depth (i.e from normal bite to deep bite). Thus it is an attempt in predicting anchorage need of individual patients for orthodontic treatment as more forwardly angulated posterior teeth need greater anchorage preparation and vice versa.

MATERIALS AND METHODS

For this retrospective cross sectional study , lateral cephalometric radiographs and study models along with history sheets of one hundred adolescence and young adult patients (15-25 yrs)were selected. Among them ,fifty normal bite(six male , fourty four female) and fifty deep bite(eighteen male ,thirty two female) patients were selected from the archive of department of Orthodontics and Dentofacial Orthopedics of Dr. R. Ahmed Dental College And Hospital , Kolkata after ethical clearance from the institutional ethics committee on28.03.2024(Memo no:RADCH/EC/14/2024). The sample size was calculated according to sample size calculator .The sample size was taken according to sample size calculator as provided by statistician:

Sample size $N=4Z\alpha^2S^2/W^2 =39$

W/S=0.63

Standard normal deviate For $\alpha=Z\alpha=1.96$

CL=confidence level(95%)

W=desired total width of confidence interval (5)

S=standard deviation of the variable

Reference: Hullly SB, Cummings SR, Browner WS , Grady D, Newman TB. Designing clinical research: an epidemiologic approach. 4th edition. Philadelphia ,PA: Lippincott Williams and Wilkins ;2013.Appendix 6D, page 80

The mean age (mean±s.d)of males was 16.16±1.64 years(range 15-20 years) and that of females was 17.97±3.11years(range 15-25 years) respectively. The duration of the study was 3 months from the date of ethical committee clearance .A written informed consent form was taken from parents or individuals whose radiographs , study models and case history sheets were used in this study.

The radiographs and dental casts along with written informed consent were taken from the archive of department of orthodontics . So the authors did not need a written informed consent as it was already taken.

The inclusion criteria were: adolescent and young adult male and female patients aged between 15 to 25 years of age, presence of full complement of fully erupted permanent teeth with or without third molars, class I malocclusion ,class II malocclusion, teeth with anterior deep bite more than 3mm,teeth with normal over bite not more than 3 mm, minimal crowding in upper or lower arch(not more than 2 mm).The exclusion criteria were: teeth with caries , periodontal diseases, large restorations or crown, no previous history of orthodontic treatment, subjects with debilitating systemic diseases , gross facial deformity, subjects with missing teeth and mixed dentition.

The subjects were distributed into two groups – **Normal Bite** and

Deep Bite depending on amount of overbite . Normal bite and Deep bite measurements were done on study models according to conventional method using scale (mm).The cephalometric analysis were carried out on led acetate paper by only one orthodontist to avoid inter-examiner error. In total 28 parameters were measured. (Table 1) .

Table 1: Cephalometric Variables

Growth pattern(˚)	
SN-PP	SN to palatal plane angle
SN -GoGn	SN to Go-Gn angle
FMA	Frankfort horizontal to mandibular plane angle
PP-MP	Angle between the palatal plane (ANS to PNS)and the mandibular plane(Go-Gn)
Dental relationship(mm)	
Overbite	Distance between the upper(maxillary) and lower(mandibular) incisor borders perpendicular to the functional occlusal plane
Maxillary mesiodistal angulation (˚)	
Mx4OP	Angle between Long axis of upper first premolar to functional occlusal plane
Mx5OP	Angle between Long axis of upper second premolar to functional occlusal plane
Mx6OP	Angle between Long axis of upper first molar to functional occlusal plane
Mx7 OP	Angle between Long axis of upper second molar to functional occlusal plane
Mx4PP	Angle between Long axis of upper first premolar to palatal plane
Mx5PP	Angle between Long axis of upper second premolar to palatal plane
Mx6PP	Angle between Long axis of upper first molar to palatal plane
Mx7PP	Angle between Long axis of upper second molar to palatal plane
Mandibular mesiodistal angulation (˚)	
Md4OP	Angle between Long axis of lower first premolar to functional occlusal plane
Md5OP	Angle between Long axis of lower second premolar to functional occlusal plane
Md6OP	Angle between Long axis of lower first molar to functional occlusal plane
Md7OP	Angle between Long axis of lower second molar to functional occlusal plane
Md4 MP	Angle between Long axis of lower first premolar to mandibular plane(Go-Gn)
Md5 MP	Angle between Long axis of lower second premolar to mandibular plane(Go-Gn)
Md6 MP	Angle between Long axis of lower first molar to mandibular plane(Go-Gn)
Md7 MP	Angle between Long axis of lower second molar to mandibular plane(Go-Gn)
Interdental angulation(˚)	
Mx4.Md4	Angle between Long axis of the maxillary and mandibular first premolars
Mx5.Md5	Angle between Long axis of the maxillary and mandibular second premolars
Mx6.Md6	Angle between Long axis of the maxillary and mandibular first molars
Mx7.Md7	Angle between Long axis of the maxillary and mandibular second molars

In upper arch, angulations of posterior teeth were analyzed and consisted of measuring the angles between the premolars '(root apex to highest point of buccal cusp) and molars' long axes(root furcation to centre of crown) to the functional occlusal plane and palatal plane. Similarly in lower arch it was done between the pre-molars' and molars' long axes to the functional occlusal plane and mandibular plane .The functional occlusal plane was drawn through the overlapping cusps of pre-molars and molars. The inter pre-molar and inter-molar angulations were measured as well (figure :1&2).

For statistical analysis IBM SPSS stasistics (version 20 new York , united states) software were used. Descriptive statistics for comparison of gender distribution amongst the groups and independent t-test to relate the variables in normal and deep bite group was used. Pearson's co-relation calculation was used to co-relate posterior tooth angulations with change in bite depth. Results were considered significant at P value of <0.05.

RESULTS

Group 1(Normal bite) comprised of lateral cephalograms of 50 (six male , fourty four female) subjects with mean age of 18.2 yrs(15 to 25 yrs). Their overbite ranged from 1 to 3 mm(mean 2.3 mm). Fourty subjects were found with class I(ANB: 0-6) while ten were with class II(ANB:5-9) skeletal relationship.(table 2)

Group 2 (Deep bite) comprised of lateral cephalograms of 50 (eighteen male ,thirty two female) subjects with mean age of 16.88 yrs)(15 to 23 yrs). Their overbite ranged from 4 to 12 mm(mean 5.46 mm). Ten subjects were found with class I(ANB:2-6) while fourty were with class II(ANB:0-9) skeletal relationship.(table 2)

Table 2: Gender Wise Distribution Among The Groups

Gender of the patient	Normal bite	Deep bite	total
Male	6	18	24
Female	44	32	76
Total	50	50	100

The group 2(deep bite) showed significantly less vertical growth pattern (with respect to FMA and SN-GoGn) than group 1(normal bite) although more upward inclination of palatal plane (with respect to SN plane)was found in group 1 .The bite depth was significantly greater in group 2 than group 1(table 3).

The upper first molar and second molars in group 1 were more mesially inclined than group 2 when measured in relation to functional occlusal plane. The upper first premolar and both the first and second molars in group 1 were significantly more mesially inclined than group 2 with respect to the palatal plane (table 3).

In group 1 , lower first and second premolars along with lower first and second molars showed significantly more distal angulations than group 2 in relation to mandibular plane (table 3).

Table 3: Intergroup Comparison Of All Variables

Variables	Normal bite Deep bite	Mean	S.D	P value
SNA	Normal bite	82.28	3.58	0.382
	Deep bite	81.36	3.80	
SNB	Normal bite	78.32	3.85	0.065
	Deep bite	76.32	3.64	
ANB	Normal bite	3.96	2.24	0.089
	Deep bite	5.04	2.17	
SN-PP	Normal bite	8.42	4.79	0.848
	Deep bite	8.64	3.15	
SN-GoGn	Normal bite	31.08	6.06	0.064
	Deep bite	27.92	5.71	
FMA	Normal bite	27.84	5.63	0.016
	Deep bite	23.64	6.25	
PP-MP	Normal bite	23.68	4.27	0.016
	Deep bite	20.16	5.62	
Overbite	Normal bite	2.33	0.61	0.0001
	Deep bite	5.46	1.72	
Mx4OP	Normal bite	76.64	4.92	0.059
	Deep bite	79.32	5.06	
Mx5OP	Normal bite	82.48	4.51	0.093
	Deep bite	84.76	4.88	
Mx6OP	Normal bite	86.24	4.68	0.006
	Deep bite	89.64	3.63	
Mx7OP	Normal bite	92.92	7.53	0.018
	Deep bite	97.52	5.57	
Mx4PP	Normal bite	93.52	5.02	0.021
	Deep bite	90.24	4.70	
Mx5PP	Normal bite	87.56	5.11	0.079
	Deep bite	85.24	3.97	
Mx6PP	Normal bite	83.72	4.60	0.011
	Deep bite	80.24	4.66	
Mx7PP	Normal bite	77.16	7.32	0.008
	Deep bite	72.36	4.69	
Md4OP	Normal bite	83.48	4.68	0.744
	Deep bite	83.92	4.79	
Md5OP	Normal bite	84.36	4.40	0.749

	Deep bite	84.76	4.39	
Md6OP	Normal bite	81.84	3.66	0.436
	Deep bite	80.96	4.25	
Md7OP	Normal bite	78.48	4.39	0.389
	Deep bite	77.08	6.74	
Md4MP	Normal bite	82.32	4.67	0.005
	Deep bite	86.28	4.83	
Md5MP	Normal bite	81.4	4.39	0.006
	Deep bite	85.2	5.03	
Md6MP	Normal bite	83.96	4.85	0.002
	Deep bite	89.16	6.38	
Md7MP	Normal bite	87.68	3.93	0.011
	Deep bite	92.68	8.57	

In group 2, interdental angulations between the upper and lower first and second premolars along with first and second molars were greater than group 1 (table 4).

Table 4: Intergroup Comparison Of Inter-dental Variables

Variables	Normal bite Deep bite	mean	S.D	P value
Mx4Md4	Normal bite	160.48	6.55	0.148
	Deep bite	163.04	5.74	
Mx5Md5	Normal bite	167.12	5.84	0.094
	Deep bite	169.8	5.23	
Mx6Md6	Normal bite	168.24	4.89	0.095
	Deep bite	170.52	4.56	
Mx7Md7	Normal bite	170.24	5.8	0.184
	Deep bite	172.4	5.54	

In the correlation between posterior teeth angulations and bite depth, it was seen that that there were weak negative correlations between upper posterior teeth angulations (with respect to palatal plane) with increase in bite depth.

In contrast , there were weak positive correlations between lower posterior teeth angulations (with respect to mandibular plane) with increase in bite depth except lower first molar tooth which shows moderate positive correlation.

The inter pre-molar and inter molar angulations also showed weak positive correlations with increase in bite depth.

DISCUSSION

In literature, open bite patients' skeletal and dental features have been discussed in large numbers than deep bite patients[8,9] . It has been reported that patients with long face has wider palato mandibular angle and open bite is more common in them whereas the reverse is true in patients with deep bite[10]. Angulations of premolars and molars play an important role in producing deep bite or may act as a compensatory factor in normal bite subjects.[11] .Our results showed significantly more distal angulation of mandibular first and second pre-molars along with mandibular first and second molar in normal bite cases than deep bite group with respect to mandibular plane. Badiee M et al[12] showed in their study that open bite patients had greater the mean angulations of all the maxillary teeth relative to the palatal plane than normal bite and deep bite. Similarly those values were more in normal bite patients than in patients with deep bite. Our study also showed that maxillary first and second molars were more mesially inclined in normal bite patients than deep bite when measured in relation to both the functional occlusal plane and palatal plane. Bjork et al[13], after studying the compensation of teeth throughout development found that clockwise rotated mandibles had a tendency to have a predisposition of distal inclination of posterior teeth. In contrast our study showed that in case of normal bite groups the mandibular first and second pre-molars along with mandibular first and second molars were more distally angulated than deep bite . This may probably be due to compensatory effect of deep bite malocclusion.

The interdental angulations between first and second premolars and between first and second molars show the compensatory effect of posterior teeth to open the bite more in deep bite groups than the normal bite groups. It is known that distal tipping of posterior teeth helps in bite opening . From that we can say that more forward tipping of posterior teeth may result in deep bite which is not desireable for good esthetics.

Regarding the skeletal components ,the mandible plays a crucial role in the etiology of the vertical malocclusions.[14] El Dawlatly et al[15] concluded that open bite is caused mainly by skeletal components especially the gonial angle while in deep bite the dental discrepancies were mainly responsible. Our study shows both skeletal and dental components had significant differences between normal bite and deep bite groups with significantly smaller mandibular plane angle and intermaxillary angle along with anticlockwise mandibular rotation (table 3)in deep bite than normal bite. The same holds true for bite depth also as deep bite group shows significantly more bite depth than normal bite group. The greater value of SN-PP angle(table 3) in deep bite case corroborates well in establishing deep bite as palatal plane shows downward rotation and mandibular plane shows anticlockwise rotation.

The negative correlation between upper posterior teeth angulations and bite depth shows that the upper posterior teeth may have compensated by being uprighted with respect to palatal plane. Again the weak positive correlation between lower posterior teeth angulations and bite depth could be due to the attempt of the posterior teeth by being angulated more forwardly(with respect to mandibular plane) to open the bite as increase in bite depth normally is associated with anticlockwise rotation of the mandible. Finally , the weak positive correlations between inter pre-molar and intermolar angulations with increase in bite depth also might be compensatory effect of the posterior teeth by being uprighted more to open the bite. The clinician must have a thorough knowledge of both skeletal and dental features for a better treatment planning as every individual case need customized mechanics to get relief of the problems rather than resorting to predetermined techniques. As the duration of the study was short and sample size was small , so definitive conclusions regarding posterior tooth angulations in normal bite and deep bite in relation to palatal plane, occlusal plane , mandibular plane and interdentally can not be drawn properly. A relatively large study sample can be used for better evaluation of the posterior teeth angulation. Moreover this study used lateral cephalograms for data collection, which have chance of image distortion resulting in some errors. To avoid this , new and better imaging techniques like 3-D images generated from CBCT can be very useful in evaluating comparison of posterior tooth angulations . In future long duration study with more sample size can be undertaken to bring about more definitive results.

CONCLUSIONS

The current study concluded that maxillary first molar and second molar were more mesially inclined in normal bite group than deep bite when measured with respect to both palatal plane and occlusal plane .The mandibular first and second pre-molars as well as mandibular first and second molars were more distally inclined in normal bite group than deep bite when compared with respect to mandibular plane.

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