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Original Article

Assessment of effect of vertical malocclusion on root crown ratio of maxillary anterior teeth

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ABSTRACT:
Aim: To assess the effect of vertical malocclusion on root crown ratio of maxillary anterior teeth.
Materials & Methods: Eighty four subjects with vertical malocclusion and equal number of controls in age ranged 12- 30 years were exposed to maxillary anterior intra- oral radiographs, lateral cephalographs and panoramic radiographs. Root crown ratio of maxillary anterior was recorded in open bite, deep bite and control group. ***Results:*** A significant difference ($p< 0.05$) was found in SNA^o in all groups (group A- 81.4, group B- 83.6, group C- 81.4), SNB^o (group A- 80.2, group B- 78.2, group C- 78.5), ANB^o (group A- 2.6, group B- 2.8, group C- 2.2) and overbite (group A- -3.4, group B- 5.3, group C- 2.6). On comparison of root-crown ratios in vertical malocclusions, a statistically significant ($P < 0.001$) difference in open bite group for all maxillary incisors was noted in periapical radiographs and panoramic radiographs while deep bite group showed non- significant difference ($P> 0.05$). **Conclusion:** Open bite group subjects had maximum root resorption as compared to deep bite group and healthy controls.
Key words: Open bite, Deep bite, malocclusion, Healthy subjects

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INTRODUCTION:

Physiologic or pathologic process can lead to root resorption. The origin of root resorption remains unclear.[1] Numerous factors have be implicated in root resorption such as inflammatory processes, physiologic tooth movement, tooth pressure exerted from impacted adjacent tooth, tumors, cysts, and idiopathic factors.[2] It is further found that missing occlusal contact may lead to root shortening. Patients possessing open bite malocclusion are more susceptible to root resorption and orthodontic treatment may be the other cause.[3]

Factors such as root form and size, traumatic occlusion due to premature contacts, heavy masticatory forces, and gender have been reported to affect the root resorption.[4] The management of vertical malocclusions is one of the most challenging tasks. Recent studies demonstrated that degree of force application, type of tooth movement, duration of force and type of appliance alters the amount of root resorption.[5] Arntsen et al[6] found that root lengths of maxillary incisors were affected in different malocclusions even without orthodontic treatment. Among various teeth, maxillary anteriors tend to maximum root resorption as compare to other teeth. Parafunctional habits also influence root resorption. Root resorption is directly proportional to the root crown ratio, which implicates that a decrease in root crown ratio represents the presence of root resorption. Short roots affect crown root ratio which has great impact on tooth prognosis.[7] Hence, the present study aimed at assessing effect of vertical malocclusion on root crown ratio of maxillary anterior teeth.

METHODOLOGY

Eighty four subjects of either gender were enrolled in present study. The study was commenced after Ethical

review board granted permission. Consent from all subjects was well obtained in written. Sample size was selected based on previous studies. Inclusion criteria such as subjects' age ranged 12- 30 years, subjects with open bite, deep bite and presence of all teeth was adopted. Exclusion criteria was subjects with previous history of trauma, orthodontic treatment, developmental tooth anomalies and systemic disorders was used. Equal number of age and gender matched were selected as control.

Subjects were thoroughly examined followed by maxillary anterior radiographs taken with paralleling technique, lateral cephalographs and panoramic radiographs. Skeletal morphology was determined with tracing of lateral cephalographs. All the panoramic and periapical radiographs were traced to assess the root-crown ratio by 'Method of Lind'. All teeth were traced and the distance from root tip to cervical line was root length and from cervical line to incisal edge was crown length. Root crown ratio of tooth was computed by dividing the root length by the crown height (RL/C). Mean values were noted and statistically determined using unpaired T test. Significant p value less than 0.05 was recorded.

RESULTS

Table 1 Cephalometric measurements

Measurements	Group A (Open bite)	Group B (Deep bite)	Group C (Control)	P value
SNA^o	81.4	83.6	81.4	Significant
SNB^o	80.2	78.2	78.5	Significant
ANB^o	2.6	2.8	2.2	Significant
Overbite	-3.4	5.3	2.6	Significant

A significant difference ($p< 0.05$) was found in SNA^o in all groups (group A- 81.4, group B- 83.6, group C- 81.4), SNB^o (group A- 80.2, group B- 78.2, group C- 78.5), ANB^o (group A- 2.6, group B- 2.8, group C- 2.2) and overbite (group A- -3.4, group B- 5.3, group C- 2.6) (Table 1).

Table 2 Root crown ratio (R/C ratio) with & without open bite groups

Open bite	Tooth	Group A	Group C	T value	P value
IOPA	11	1.02	1.34	2.7	Significant
	12	1.07	1.51	3.10	Significant
	21	1.01	1.31	1.44	Significant
	22	1.13	1.40	2.82	Significant
OPG	11	1.01	1.51	7.50	Significant
	12	1.12	1.52	10.2	Significant
	21	0.98	1.48	4.12	Significant
	22	1.12	1.53	11.5	Significant

On comparison of root-crown ratios in vertical malocclusions, a statistically significant ($P < 0.001$) difference in open bite group for all maxillary incisors was noted in periapical radiographs and panoramic radiographs (Table 2).

Table 3 Root crown ratio (R/C ratio) with & without open bite groups

Open bite	Tooth	Group B	Group C	T value	P value
IOPA	11	1.31	1.34	0.7	Non- Significant
	12	1.47	1.52	0.32	Non- Significant
	21	1.33	1.31	0.01	Non- Significant
	22	1.42	1.42	0.65	Non- Significant
OPG	11	1.45	1.50	9.74	Non- Significant
	12	1.55	1.54	1.72	Non- Significant
	21	1.46	1.49	5.40	Non- Significant
	22	1.52	1.52	1.41	Non- Significant

On comparison of root-crown ratios in vertical malocclusions, a statistically non- significant (P >0.001) difference in deep bite group for all maxillary incisors was noted in periapical radiographs and panoramic radiographs (Table 3).

DISCUSSION

Short roots may obscure treatment planning in orthodontics and prosthodontics when considering anchorage or estimating the ability of a tooth to carry masticatory forces.[8] Disturbances during root development or resorption of the originally well-developed roots are main reasons for short dental roots. Root resorption is usually seen in patients undergoing orthodontic treatment or dental trauma.[9] Numerous research studies have evaluated the amount of root resorption after orthodontic treatment using intra-oral or panoramic radiographs. Various conditions such hypoparathyroidism, Down's syndrome and Turner syndromes have short rooted teeth. In some cases a etiology remains idiopathic.[10,11] Root resorption after orthodontic treatment is mainly classified as minor or moderate, when grading scales have been used. Accentuated or severe resorption, >4 mm or reaching one-third of the original root length, is seen in 1.0–2.6 per cent of teeth.[12]

We included eighty four subjects in age range 12-30 years for the assessment of effect of vertical malocclusion on root crown ratio of maxillary anterior teeth. In a study by Holtta et al[13] 2779 teeth were measured on 108 panoramic radiographs. The intra- and inter-examiner reproducibility of the assessment method was good (Pearson correlation coefficients 0.87 and 0.83, respectively; P < 0.001) and the mean R/C ratios did not differ between the repeated measurements (P > 0.05). These findings suggest that this method can be used in the assessment of the relative root length of 'normal' teeth and its alterations in teeth with developmental or acquired aberrations of dental roots. Males had higher R/C ratios than females. The ratios of the antagonist teeth were significantly greater in the mandible than in the maxilla except permanent lateral incisors in males and the permanent second molars in both genders.

It was found that SNA^{o} in group A was 81.4, in group B was 83.6 and in group C was 81.4. SNB^{o} in group A was 80.2, in group B was 78.2 and in group C was 78.5, ANB^{o} in group A was 2.6, in group B was 2.8 and in group C was 2.2 and overbite in group A was -3.4, in group B was 5.3 and in group C was 2.6.

It was observed that on comparison of root-crown ratios in vertical malocclusions, a statistically significant (P < 0.001) difference in open bite group for all maxillary incisors was noted in periapical radiographs and panoramic radiographs whereas in case of deep bite group, a statistically non- significant (P >0.001) difference found for all maxillary incisors was noted in periapical radiographs and panoramic radiographs. Massler et al[14] reported that root resorption is directly correlated to the age of the individual and progresses with age. Uehara et al[15] determine the root-crown (R/C) ratio and dental root length of teeth in patients with open bite and seek any relationships with occlusal contact (OC) and the mandibular plane (Mp) angle. 31 with open bite with negative overbite of at least four anterior teeth and 31 control patients with clinically normal overjet and overbite were enrolled. Results showed that R/C and OC ratios from the incisors to premolars were significantly lower for patients with open bite than for controls, and some teeth had short dental roots. Relationships between low R/C ratio or root length and high Mp angle were significant in patients with open bite.

CONCLUSION

Authors found that open bite group subjects had maximum root resorption as compared to deep bite group and healthy controls.

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