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PREVALENCE OF EXTERNAL APICAL ROOT RESORPTION AMONG SAMPLE OF SUDANESE ORTHODONTIC PATIENTS TREATED WITH FIXED APPLIANCES

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ABSTRACT

Root shortening as a result of apical root resorption is an undesirable consequence of orthodontic treatment. The objective was to determine the prevalence of external apical root resorption in a sample of Sudanese orthodontic patients treated with fixed appliances and to evaluate the association of treatment duration, age, gender and the type of malocclusion on the degree of external apical root resorption. The study sample consisted of 29 patients (8 males, 21 females) after completion of orthodontic treatment with fixed appliances. External root resorption in all teeth groups (except third molars) was evaluated from pre- and post-treatment panoramic radiographs. The association of root resorption with treatment duration, age, gender and the type of malocclusion was tested by independent t- test with level of significance set at $p \le 0.05$. Maxillary incisors were the most commonly affected teeth with resorption 16 (55.2%) while the mandibular premolars 2(6.9%) and molars 1(3.4%) were the least affected teeth on both maxillary and mandibular arches. Root resorption was significantly associated with age group (p < 0.05), no associations were found between the degrees of root resorption treatment duration, gender, and the type of malocclusion (p > 0.05). The number of subjects enrolled in this study was so limited, yet the facts assembled are quite informative and rather beneficial. It shed some light on the prevalence of external apical root resorption after orthodontic treatment among a group of Sudanese patients

Keywords: Fixed Appliance, Root Resorption, Malocclusion, Panoramic X-Rays

INTRODUCTION

Nowadays the demand for orthodontic treatment has been increasing rapidly due to the motivation and dental awareness particularly among the adult population. With increasing the number of patients treated orthodontically with fixed appliances; it is documented that orthodontic treatment has potential risks such as caries, periodontal problems and root resorption. External apical root resorption (EARR) is a complex problem with multifactorial etiology and its extent varies between patients and in different teeth within the same patient (Armstrong, 2007). When the external apical root resorption occurred in patients with fixed appliance is considered to be an iatrogenic consequence. Patient's characteristics such as type of malocclusion, age, root morphology, dental anomalies, and previous trauma were suggested as possible risk factors (Beck and Harris, 1994). Whereas there is some controversy as to whether the age of the patient is related to orthodontically induced resorption (Maria et al., 2012; Glenn et al., 2001). A significant correlation between the duration of treatment with fixed appliance and the degree of apical root was found (Satu et al., 2007). A vast amount of information concerning the incidence, etiology and management of external apical root resorption (EARR) had been published to assess the association between the orthodontic treatment and the external apical root resorption (EARR) among different population and countries. Yet no study concerning this problem was published among orthodontic Sudanese patients and the information regarding orthodontic practice and its consequences is needed.

The main objective of this study was to determine the prevalence of external apical root resorption among a sample of Sudanese patients treated with fixed appliances. While the specifics objectives were to assess the degree of external apical root resorption according to tooth region. Also to determine the relationship between external apical root resorption and the duration of treatment, the type of malocclusion, the age of the patients and gender.

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MATERIAL AND METHODS

An observational case finding hospital based retrospective study during period from November 2012 to February 2013, among sample patients treated in orthodontic clinics (Faculty of Dentistry, University of Khartoum). Twenty nine patients were selected from a pool of patients satisfying the following inclusion criteria: Sudanese nationality; a clear pretreatment and post-treatment Orthopantomograms [OPGs]; no root resorption in the pretreatment radiographs; no endodontic treatment; age of the patient should be not less than 15 years. The post-treatment root length was compared with the root length on the pretreatment radiographs and the degree of external apical root resorption was evaluated using the Satu and Jaakko index (2007). for root resorption Grade 0 (no radiographically visible external apical root resorption); grade 1(mild resorption with rounding of root apex to about one-quarter of the root length) and grade 2, moderate to severe resorption with loss of one-quarter or more of the root length. Association of external apical root resorption with age, gender, duration of treatment and type of malocclusion was tested by independent T. test with level of significance set at $P \le 0.05$, using SPSS program version 21.

RESULTS

The maxillary incisors were the most commonly affected teeth with resorption; 16 (55.2%) of cases were found to have moderate to severe resorption with loss of one- quarter or more of the root length (Grade 2); while the mandibular premolars and molars were the least affected teeth on both maxillary and mandibular arches. In the mandibular premolars 22 (75.9%) of the cases were found to have no radio-graphically visible root resorption (Grade 0) whereas 5 (17.2%) were found to have mild resorption with rounding of root apex to about one- quarter of the root length (Grade 1). In the mandibular molars 28 (96.6%) of the cases were found to have no radio-graphically visible root resorption (Grade 1) whereas only one case exhibited mild resorption with rounding of root apex to about one – quarter of the root length (Grade 1) Table (1) .

Affected teeth	Age Group	Mean	Std. Deviation	P - Value
Axillary	10 - 20 years	2.1875	.75000	
	20 - 30 years	3.7500	1.42223	.001
	> 30 years	5.0000	0.0000	
	Total	2.9310	1.36096	
Mandibular	10 - 20 years	1.3750	1.36015	
	20 - 30 years	2.0833	1.08362	.338
	> 30 years	2.0000	0.0000	
	Total	1.6897	1.25651	
Overall	10 - 20 years	3.5625	1.50416	.003
	20 - 30 years	5.8333	1.85047	
	> 30 years	7.0000	0.0000	
	Total	4.6207	2.00738	

Table1: The association between external root resorption and different age groups.

No association was found between the degrees of root resorption and treatment duration but it was observed that Grade 1 and Grade 2 root resorption increased with increasing the duration of treatment among all types of the teeth in the maxillary and mandibular arches (Table 2&3).

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Treatment duration	One year					2 Years a	2 Years and more	
Index of Resorption	GO	G1	G2	G0	G1	G2	P-value	
Maxilla	3	1	3	2	7	13		
Incisors	(42.9%)	(14.3%)	(42.9%)	(9.1%)	(31.8%)	(59.1%)	0.113	
	1	4	2	7	12	3		
Canine	(14.3%)	(57.1%)	(28.6%)	(31.8%)	(54.5%)	(13.6%)	0.526	
	4	2	1	11	8	3		
Premolars	(57.1%)	(28.6%)	(14.3%)	(50%)	(36.4%)	(13.6%)	0.929	
	6	1	0	22	0	0		
Molars	(85.7%)	(14.3%)	(0. %)	(100%)	(0. %)	(0. %)	0.071	

Table 2: The relationship between Index of root resorption in different maxillary teeth and the treatment duration

Table 3: The relationship between Index of root resorption in different mandibular teeth and the treatment duration.

Treatment duration			Year 1				Year 2
Index of resorption	G0	G1	G2	G0	G1	G2	P-value
Mandible	4	2	1	7	11	4	0.475
Incisors	(57.1%)	(28.6%)	(14.3%)	(31.8%)	(50%)	(18.2%)	
	4	3	0	9	13	0	0.452
Canine	(57.1%)	(42.9%)	(0. %)	(40.9%)	(59.1%)	(0. %)	
	6	1	0	16	4	2	0.670
Premolar	(86.7%)	(14.3%)	(0. %)	(72.7%)	(18.2%)	(9.1%)	
	7	0	0	21	1	0	0.566
Molars	(100%)	(0. %)	(0. %)	(95.5%)	(4.5%)	(0. %)	

The results showed that root resorption was significantly associated with age group P-value (0.003). Although there was no significant association between the index of root resorption in different tooth groups and Angle's classification of malocclusion; but it was clear that cases with CIII malocclusion showed more Grade 1 &2 root resorption in the different type of teeth in both maxillary and mandibular than cases with class I and C II malocclusion. There was no association between the index of root resorption and gender table (4&5).

Table 4: The relationshi	p between the index	s of root resorption and	l gender in the maxillar	v arch.
			B 	,

			Males				Females
Index of resorption	G0	G1	G2	GO	G1	G2	P-value
Maxilla	4	5	12	1	3	4	0.744
Incisors	(19%)	(25.8%)	(57.1%)	(12.5%)	(37.5%)	(50%)	
	6	10	5	2	6	0	0.257
Canine	(28.6%)	(47.6%)	(23.8%)	(25%)	(75%)	(0. %)	
	8	9	4	7	1	0	0.065
Premolars	(38.1%)	(42.9%)	(19%)	(87.5%)	(12.5%)	(0. %)	
	20	1	0	8	0	0	0.530
Molars	(95.2%)	(4.8%)	(0. %)	(100%)	(0. %)	(0. %)	

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Gender Males **Females Index of resorption** GO **G2** G0 **G2 P-value G1 G1** 8 9 4 3 0.900 Incisors 4 1 (19%) (38.1%) (42.9%) (37.5%) (50%) (12.5%)9 12 0 4 4 0 (42.9%) (50%)Canine (57.1%)(0.%)(50%)(0.%)0.73014 5 8 0 2 0 **Premolars** (66.7%) (23.8%)(9.5%) (100%)0.730 (0.%)(0.%)0 20 1 0 8 0 (4.8%) (0. %) Molars (95.2%) (0.%)(100%)(0.%)0.530

Table 5: The relationship between the index of root resorption and gender in the mandibular arch.

DISCUSSION

The occurrence of root resorption in the maxillary and mandibular arches was found to be almost the same among males and females with no significant difference which is in consistence with the result of the study by (Pandis & Nasika, 2008), whereas Leopoldo *et al.*, (2011) reported that root resorption was greater among males when compared to females. This difference in results could be due to the small sample size of the present study as well as the number of females was more than males. The index of apical root resorption was found to be associated with the age increasing age increasing the possibility of resorption, a similar finding had been reported by Glenn., (2001), in contrast with Leopoldo's *et al.*, (2011) study results; whereas Maria *et al.*, (2012) concluded that no difference in external apical root resorption according to age. This variation in the results in the age group and root resorption can be attributed to the small number of the study sample, which was mainly targeting young age groups. Furthermore the teenage groups are more concerned about esthetic and therefore seek orthodontic treatment more than adult's population.

The present study showed no significant association between the root resorption and the treatment duration in contrast with Satu's & Jaakko's, (2007) and Segal's *et al.*, (2004) studies. This difference in the results could be due to the effect of other factors such as age of the patient, trauma and the amount of force of tooth movement in the different studies. The maxillary incisors exhibited moderate to severe resorption with loss of one-quarter or more of the root length (Grade 2) followed by maxillary canine and mandibular incisors in the present study. However, Yun *et al.*, (2011) reported that the maxillary central incisor are the most resorped tooth, followed by the maxillary lateral incisor, the mandibular central incisor, and the surrounding structures in the anterior segment which may be the factor of increasing root resorption and the type of malocclusion, but almost 59% of the patients who exhibited root resorption were found to have class III malocclusion, a similar result had been observed by Kaley, (1991). In contrast Brezniak, (2002) had stated that dental and skeletal malocclusion induce occurrence of root resorption. This result is mostly due to the very small sample in the present study as well as the majority available full records were belonged to patients with class III malocclusion.

Conclusion

The number of subjects enrolled in this study was small, yet the facts assembled are quite informative and rather beneficial. No association between root resorption, gender; treatment duration and the type of malocclusion was found, whereas as an association between root resorption an age of the patient was found (P- value 0.003). Almost 59% of the patients were found to have class III malocclusion. The prevalence rate of external apical root resorption was found to be 22.8% and the maxillary incisors were the mostly affected teeth.

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ACKNOWLEDGMENT

We would like to thanks the University Medical Science and technology for supporting the study and the participants without whom this work could never be accomplished.

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