External Apical Root Resorption after Orthodontic Treatment in Ramadi City

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Abstract

Background:- External Apical Root resorption is one of the most common and undesirable sequel of orthodontic treatment .
Objective:-The purpose of the present study was to research and identify factors related to root resorption during orthodontic treatment in Ramadi city.
Patients and Methods: This study consisted of 172 patients who had completed orthodontic treatments and taken the pre- and post-treatment panoramic radiographs. The length of tooth was measured. A NOVA and *t* test was performed to compare the mean amount of root resorption between right and left side, male and female, between extraction and non-extraction cases, open bite ,deep bite and normal bite and class I ,class II &class III. The correlation coefficients were measured between the amount of root resorption and the beginning age of the orthodontic treatment, and the duration of treatment.
Results: In this study the maxillary central incisors were the most resorbed teeth, there is no significant different between male and female, left and right side. There was a significant different between extraction and non-extraction therapy, open bite, normal bite and deep bite and class I,II and III treatment. this study showed that treatment duration and the age of the patient was not related to the degree of resorption .
Conclusion :-The radiographic follow up for the assessment of root resorption of all patients undergoing orthodontic therapy .These findings show that orthodontic treatment should be carefully performed to the tooth, moved a greater distances during treatment.
Keywords: Root Resorption, Orthodontics, Panoramic Radiography, Ramadi city

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Introduction

External Apical Root resorption (EARR) is one of the most common and undesirable sequel of orthodontic treatment.[1, 2] It is an inflammatory process that leads to an ischemic necrosis localized in the periodontal ligament after the application of Orthodontic force.[3,4] Because cementum is normally more resistant than bone, orthodontic forces to a tooth usually cause bone resorption rather than the loss of cementum.

Root resorption occurs when the pressure on the cementum exceeds its reparative capacity and dentin is exposed, allowing the multinucleated odontoclasts to degrade the root substance.[5]

It has received considerable attention but the causes remain essentially unknown[1]. Apical root resorption observed mid- or post treatment is occasionally of passing interest to the clinicians. Fortunately, truly severe resorption that threatens the longevity of

the tooth or forces a halt to treatment is rare.

The fact is, however, that orthodontic tooth movement does directly cause irreversible resorption of the root. As the movers of the teeth, it is incumbent for us to know as much as possible about the causes, effects, and prevention of this phenomenon[6]. most studies [7, 8] on root resorption and its relationship with orthodontic treatment have found that there are multiple factors associated with root resorption. Age, gender, nutrition, genetics, the type of appliance, the amount of force used during treatment, extraction or non-extraction, duration of treatment, and the distance the teeth are moved all have some influence on root resorption. Generally, the causes and mechanism of resorption are still unclear.

The purpose of the present study was to research and identify factors related to root resorption during orthodontic treatment in Ramadi city.

Subjects and Methods

Subjects

One hundred seventy two patients(76 males and 96 females) aged from 12 to 36 years with the mean of 23.23 ±6.1 who had fixed orthodontic appliance therapy (straight wire, Roth value) were randomly selected from subjects treated at the Orthodontic Department, the mean of duration of treatment is15.9 months . Panoramic radiographs before and after orthodontic treatment is available. Patients who required orthogenetic surgery or had a cleft lip and/or palate were excluded from the study. So table1 shows the distributions of the samples.

(Table1) shows the distributions of the samples. The final study group included 172 patients

Variable		NO
Gender	Male	76
	Female	96
Extraction	Extraction	91
	Non extraction	81
Molar classification	Class I	85
	Class II	58
	Class III	29
Over bite	0-4	88
	Open bite	47
	Deep bite	37

Methodology

The tooth length from the tooth apex to incisal edge or cusp tip was measured on the panoramic radiograph using a digital caliper (accurate to 0.01 mm).

These measurements were performed on both pre- and post-treatment panoramic images. Root resorption was calculated by the difference of the tooth length between the images. The tooth length was measured for the left and right permanent second premolars, canines, lateral incisors, and central incisors on both jaws the first permanent premolar excluded from this study because this tooth may be extracted.

Only teeth which had completed the root formation were measured. The measurement error of the tooth length was analyzed using the intra-observer reproducibility of 40 randomly selected panoramic radiographs; 20 radiographs taken before orthodontic treatment and the corresponding 20 ones at the end of active treatment. The tooth length was re-measured one month after the original measurements.

Data analysis

The root resorption was calculated by subtracting the post-treatment values from pre-treatment values. The root resorption of the tooth and the factors of malocclusion were analyzed with a one-way ANOVA. An independent *t* test was performed to compare the mean amount of resorption between right and left, male and female, between extraction and non-extraction cases, open bite, deep bite &normal bit and class I, class II &class III The correlation coefficients were measured between the amount of root resorption at the beginning age of the orthodontic treatment, and the duration of treatment. The statistical analyses were carried out using SPSS.

Result

The maxillary central incisor was the most resorbed, followed by the maxillary lateral incisor, the mandibular central incisor, and the mandibular lateral incisor. . According to the tooth types the mean of root resorption show in (table 2).

(Table 2)The mean of root resorption according to the tooth types.

Variable	Mean	S. D
Maxillary Central Incisor	1.09	± 0.96
Maxillary Lateral Incisor	0.77	± 0.30
Maxillary Canine	0.46	± 0.06
Maxillary Second Premolar	0.23	± 0.17
Mandibular Central Incisor	0.63	± 0.19
Mandibular Lateral Incisor	0.55	± 0.15
Mandibular Canine	0.28	± 0.11
Mandibular Second Premolar	0.23	± 0.16

In this study there were no significant differences ($p>0.05$) between right and left sides, this show in (Table3)

(Table3) comparison of the mean value of EARR between left and right side

Variable	Left side	Right side	P. Value
Maxillary Central Incisor	1.09 ± 0.9	1.0.8 ± 0.11	0.91
Maxillary Lateral Incisor	0.78 ± 0.32	0.72 ± 0.16	0.07
Maxillary Canine	0.45 ± 0.08	0.46 ± .06	0.2
Maxillary Second Premolar	0.23 ± 0.18	0.22 ± 0.26	0.47
Mandibular Central Incisor	0.63 ± 0.19	0.62 ± 0.18	0.93
Mandibular Lateral Incisor	0.55 ± 0.07	0.54 ± 0.15	0.57
Mandibular Canine	0.28 ± 0.12	0.26 ± 0.2	0.12
Mandibular Second Premolar	0.23 ± 0.27	0.24 ± 0.30	0.25

no significant differences (p>0.05)

No significant difference of root resorption (p>0.05) between the male and female is shown in (table 4).

(Table4) comparison of the mean value of EARR between males and females.

Variable	Male	Female	P. Value
Maxillary Central Incisor	1.02 ± 0.12	1.06 ± 0.16	0.06
Maxillary Lateral Incisor	0.74 ± 0.13	0.75 ± 0.11	0.86
Maxillary Canine	0.47 ± 0.07	0.45 ± 0.06	0.15
Maxillary Second Premolar	0.15 ± 0.07	0.14 ± 0.03	0.22
Mandibular Central Incisor	0.56 ± 0.11	0.60 ± 0.10	0.053
Mandibular Lateral Incisor	0.50 ± 0.13	0.52 ± 0.08	0.11
Mandibular Canine	0.38 ± 0.05	0.17 ± 0.03	0.65
Mandibular Second Premolar	0.50 ± 0.18	0.51 ±0 .92	0.09

no significant differences (p>0.05)

In (table 5) Patient with extracted teeth is highly significant difference (p<0.001) than non-extracted cases .

(Table5) comparison of the mean value of EARR between extraction &non extraction cases.

Variable	Extraction	No. Extraction	P. Value
Maxillary Central Incisor	1.29 ± 1.2	0.87 ± 0.11	0.004 <0.05
Maxillary Lateral Incisor	1.03 ± 0.12	0.48 ± 0.11	0.000*
Maxillary Canine	0.50 ± 0.08	0.41 ± .08	0.000*
Maxillary Second Premolar	0.38 ± 0.07	0.06 ± 0.030	0.001
Mandibular Central Incisor	0.80 ± 0.10	0.44 ± 0.04	0.000*
Mandibular Lateral Incisor	0.68 ± 0.05	0.41 ± 0.10	0.000*
Mandibular Canine	0.38 ± 0.058	0.17 ± 0.03	0.003
Mandibular Second Premolar	0.38 ± 0.04	0.06 ± .02	0.001

*Highly significance p<0.001

Open bite cases show a highly significant difference (p<0.001) than normal and deep bite this show in(table 6) the open bite is the most one having EARR followed by deep bite then (0-4).

(Table6) comparisons of the mean value of EARR between0-4, deep bite &open bite

Variable	0-4	Open bite	Deep bite	P. Value
Maxillary Central Incisor	0.18 ± 0.11	1.0 ± 0.17	0.74 ± 0.12	0.000*
Maxillary Lateral Incisor	0.69 ± .16	0.78 ± 0.14	0.79 ± 0.09	0.000*
Maxillary Canine	0.52 ± .15	0.57 ± 0.14	0.35 ± 0.16	0.001
Maxillary Second Premolar	0.32 ± 0.08	0.48 ± 0.09	0.28 ± 0.09	0.004
Mandibular Central Incisor	0.58 ± 0.17	0.75 ± 0.14	0.74 ± 0.09	0.000*
Mandibular Lateral Incisor	0.67 ± 0.05	0.71 ± 0.10	0.71 ± 0.06	0.003 <0.05
Mandibular Canine	0.21 ± 0.07	0.36 ± 0.14	0.33 ± 0.13	0.000*
Mandibular Second Premolar	0.17 ± 0.03	0.17 ± 0.03	0.20 ± 0.11	0.039 <0.05

*Highly significance p<0.001

In this study there is highly significant difference between class I,II and III patients(p<0.001) except the maxillary canine show no significant difference p>0.05 as shown in the(table 7) the central and lateral incisor had more resorption in class II patient while mandibular canine is more in class III patients.

(Table7) comparison of the mean value of EARR between class I, II &III

Variable	Cl I	Cl II	Cl III	P. Value
Maxillary Central Incisor	0.94 ± 0.93	1.16 ± 0.21	1.09 ± 0.22	0.000*
Maxillary Lateral Incisor	0.57 ± 0.14	0.78 ± 0.14	0.65 ± 0.13	0.000*
Maxillary Canine	0.52 ± 0.15	0.58 ± 0.14	0.55 ± 0.14	0.067 >0.05
Maxillary Second Premolar	0.31 ± 0.08	0.46 ± 0.10	0.35 ± 0.05	0.000*
Mandibular Central Incisor	0.58 ± 0.16	0.76 ± 0.14	0.76 ± 0.10	0.000*
Mandibular Lateral Incisor	0.67 ± 0.05	0.72 ± 0.12	0.68 ± 0.06	0.004 <0.05
Mandibular Canine	0.21 ± 0.07	0.51 ± 0.19	0.56 ± 0.11	0.001
Mandibular Second Premolar	0.63 ± 0.03	0.47 ± 0.28	0.17 ± 0.11	0.000

There is no Significant correlations ($p>0.05$) between the age of beginning orthodontic treatment , duration of orthodontic treatment and the amount of root resorption this is shown in(table 8).

(Table8) correlation between the age and treatment duration and EARR.

Variable	N	Minimum	Maximum	Mean	Std. Deviation	Correlation
Age	172	12 Years	36.2	23.9	6.18	0.17
tr. duration	172	7 Months	25	15.9	3.70	0.86

Discussion

EARR is commonly caused by orthodontic treatment. The description and analysis of EARR extends throughout this century, however few variables are clinically valuable as predictors of EARR because of the large inter-individual variations in response to treatment[9].

In general, the types of tooth which are moved the farthest tend to show the most frequent and severe EARR [10, 11] the maxillary incisors are generally, on average, moved a greater distances during treatment than other teeth. It was reported that the incisors were most likely to show EARR and the severest resorption[12,13]regardless of the genetic or treatment-related factors, the maxillary incisors consistently showed more apical root resorption than any other teeth[11,14,15]In this study, the maxillary central incisors were the most resorbed

.follow by maxillary lateral incisors as show in (table 2).

There were no significant differences found between right and left sides this agree with [6, 15] as show in (table 3).

In our study there is no significant different between male and female, as show in (table 4). most studies indicate the lack of gender dimorphism in this aspect[10,15,16,17,18].While other studies still report a greater tendency to apical root resorption after orthodontic treatment among the females[19,20,21]

But Baumrind et al& Geraldo et al [7&22] show male more EARR than female this statement should be revised based on the current knowledge.

Despite the controversial reports Sharpe et al [9] showed that the incisors experienced more EARR in extraction cases on was greater than in non-extraction cases. The incidence of EARR was 3.72 times higher in patients for whom extractions were performed than those without extraction.[23] in this study, the extraction cases demonstrated relatively more EARR compared with the non-extraction cases as show in (table 5).

It could be supposed that the extraction of teeth could increase the amount of movement.

Harris and Butler [24] documented that in the sample of cases with anterior open bites, the greater risk and degree of root resorption during the treatment. More incisor resorption was observed in the cases with larger overbite[25] ,in our study, although open bite cases showed more root resorption, than other cases (table 6) that may be due to the jiggling of anterior teeth in open bite during elastic wear [15]. In contrast to other studies, [15, 25] .

In this study the upper incisor is more resorption in class II patient (table 7) this due to greater torque and longer root displacement is required to correct excess over jet.

While mandibular canine is more in class III patient this may be due to the tooth, moved a greater distances during treatment ,it was reported show EARR and the severest resorption this agree with [15,16] and disagree with [13,17,19].

Harris reported that the risk of EARR also seemed to be independent of the age once the root formation had completed.[9] the traditional concept that the orthodontic root resorption increased with age [15,6,26] was recently disproved.[14, 23] In agreement with these recent reports, our study also showed no relationship between the patient's age and the amount of resorption. The possible correlation between the duration of active treatment and the incidence and severity of EARR was controversial.[7,11,,15,26] Some studies concluded that the duration of treatment might be correlated to the extent of EARR,[6,9,13,27-29]-while others found no significant association between EARR and treatment duration[25,30-32] Our study (table 8)revealed that the duration of treatment was no significantly correlated with the root resorption.

In conclusion, the patient- and treatment-related variables and their relationship to the apical root resorption were as follows in this study. The maxillary central incisors were the most resorbed teeth, there is no significant difference between male and female, left and right side. There was a significant difference between extraction and non-extraction therapy, open bite, normal and deep bite and class I,II and III treatment.

This study shows the treatment duration and the age of the patient was not related to the degree of resorption.

On the basis of results, a radiographic follow up for the assessment of root resorption of all patients undergoing orthodontic therapy. These findings show that orthodontic treatment should be carefully performed to the tooth, moved a greater distances during treatment which is reported more EARR and the severest.

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