

ORIGINAL ARTICLE

Root Resorption and Orthodontics: A Panoramic Study

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ABSTRACT

Introduction: Root resorption is often encountered in orthodontics. Knowledge of risk factors and its prevention is important for an orthodontist. Hence this study is aimed at identifying factors like age, gender, type of treatment in assessment of root resorption. **Materials and methods:** 90 patients were selected and panoramic films at T1, T2, T3 intervals were available and studied using modified root resorption score. The entire sample was divided into different tooth groups with respect to age, gender and type of treatment. Data was analysed comparing root resorption in males and females, extraction and non-extraction, age below 20 years and above 20 years at T1, T2 and T3 intervals. A P-value of < 0.5 was considered statistically significant. **Results:** The difference in root resorption with respect to age, gender and type of treatment was found to be statistically non-significant at T1 and T2 intervals. The difference in root resorption with respect to type of treatment and age in anterior teeth at T3 was found to be more with more resorption in extraction and higher age groups but this difference was also statistically non-significant. **Conclusion:** Age and type of treatment may be important in assessment of root resorption. Gender does not play any role in determination of root resorption.

Key words: Root resorption, panoramic films, age, gender.

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INTRODUCTION

Orthodontics as an art and science evolved due to the dynamic nature of supporting structures of teeth¹. The supporting structures of teeth include the bone and the periodontal ligament. The basis of orthodontic tooth movement is the application of controlled forces well within the physiologic limits of the supporting structures. Root resorption is a clinical condition characterized by loss of cementum, dentine with or without the surrounding bony structure². Root resorption can be both physiological and pathological. Physiological root resorption plays an important role in eruption of permanent teeth. Roots of deciduous teeth get selectively resorbed to pave the way for eruption of permanent teeth. Pathological root resorption occurs in roots of permanent teeth compromising their longevity. The relationship between root resorption and orthodontic treatment has been a subject of wide interest due to its effect on patient as well as due to the legal implications for the orthodontist. Albert Ketcham was the first person who suggested that apical root resorption is a consequence of orthodontic treatment and later confirmed it on the basis of radiologic evaluation of treated cases^{3,4}.

It has been observed in the literature that however controlled the orthodontic force may be some areas of resorption always appear. But these areas are microscopic and do not appear on a radiograph with a capacity of self repair⁵. This phenomenon is neither physiologic nor pathologic but a therapeutic orthodontic one. But once this process continues beyond self repair, which means that repair of cementum is disturbed and dentine is exposed, it

is now classified as a pathologic process. With the increase in number of persons taking up orthodontic treatment as well as patient expectations it becomes imperative on part of the orthodontist to be well aware about this issue. In most patients root resorption does not compromise the longevity of teeth but it has been observed that in about 5-14.5% of the cases where it is severe enough the integrity of tooth is compromised⁶⁻¹¹. The association between orthodontic treatment and pathologic root resorption is not clear even if it has been studied extensively. The etiology is complex and multifactorial and it may be related to biologic variability of an individual and the effect of mechanical stimulus. Therefore this study is aimed at finding factors which may be related to root resorption and orthodontic treatment.

MATERIALS AND METHODS

A total of 90 patients who had undergone fixed orthodontic treatment for at least one year in the department of Orthodontics and Dentofacial Orthopaedics, Government Dental College and Hospital, Srinagar, J&K, India were randomly selected. Patients with clefts or those requiring orthognathic surgery were excluded. Panoramic radiographs before treatment (T1), at six months interval (T2) and at one year interval (T3) were available. Among the subjects, 56 were females and 34 were males and 59 patients had undergone extraction of all four premolars (first or second premolars). 40 patients were above the age of twenty and rest were below twenty years of age. The roots of incisors, canines and premolars were examined according to modified root resorption score¹².

Table 1: Modified root resorption score

Degree of root resorption	Features
0 degree	No visible root resorption
1 st degree	Mild resorption, the root apex is blunted and diffuse.
2 nd degree	Moderate resorption, the root apex disappears, the root apex looks more like a half circle not a taper. The contour is sometimes discontinuous or not smooth; the amount of root resorption is about approximately one-quarter of the root.
3 rd degree	Severe resorption, the end of the root shows excessive blunting; the contour of the root apex is more likely to be discontinuous; root resorption is more than one-quarter of the root.

Mean root resorption score of every patient was calculated in following groups:

1. Upper incisors and canines
2. Upper premolars
3. Lower incisors and canines
4. Lower premolars

These scores were carried out at T1, T2, T3 panoramic radiographs for every patient.

The sample was divided and compared with mean resorption score of each group of teeth as follows :

1. Male to female comparison
2. Extraction to non-extraction comparison
3. Below 20 years age group to above 20 years age group

Statistical analysis:

The mean root resorption score was calculated for each tooth group with respect to each comparison group was calculated as follows:

Mean root resorption score (MRRS) = $\frac{\text{Sum of score}}{\text{Number of teeth}}$
 (separately for males and females, for extraction and non- extraction and for age below and above 20 at T1, T2, T3 respectively)

The mean root resorption score of each tooth group was compared and p- value calculated for each category for T1, T2 and T3 respectively. A P - value of < 0.05 was considered significant.

RESULTS

Table 2: Comparison of root resorption with respect to gender

Region (MRRS)	T1			T2			T3		
	M	F	P- value	M	F	P- value	M	F	P- value
U I & C	0.11	0.30	0.383	0.31	0.40	0.457	1.21	1.19	0.494
U PM	0.10	0.09	0.509	0.12	0.21	0.437	0.44	0.34	0.545
L I & C	0.10	0.20	0.427	0.21	0.24	0.482	0.63	0.52	0.540
L PM	0.21	0.12	0.562	0.32	0.33	0.495	0.43	0.45	0.491

*M: Male, F: Female, MRRS: Mean root resorption score

Table 3: Comparison of root resorption with respect to type of treatment

Region (MRRS)	T1			T2			T3		
	NON-XTN	XTN	P- value	NON-XTN	XTN	P- value	NON-XTN	XTN	P- value
U I & C	0.23	0.19	0.524	0.11	0.86	0.223	0.55	1.86	0.199
U PM	0.12	0.16	0.469	0.21	0.22	0.493	0.46	0.98	0.332
L I & C	0.13	0.14	0.492	0.21	0.92	0.252	0.21	1.99	0.115
L PM	0.20	0.21	0.493	0.16	0.33	0.404	0.53	1.01	0.349

*NON-XTN: Non- extraction, XTN: Extraction, MRRS: Mean root resorption score

Table 4: Comparison of root resorption with respect to age

Region (MRRS)	T1			T2			T3		
	< 20 Y	> 20 Y	P- value	< 20 Y	> 20 Y	P- value	< 20 Y	> 20 Y	P- value
U I & C	0.07	0.10	0.471	0.49	0.67	0.433	0.55	1.99	0.183
U PM	0.14	0.11	0.523	0.31	0.53	0.405	0.46	0.53	0.471
L I & C	0.09	0.12	0.473	0.33	1.01	0.278	0.29	1.98	0.131
L PM	0.22	0.20	0.512	0.54	0.89	0.384	0.42	0.51	0.462

*<20Y: Less than 20 years of age, > 20 Y: More than 20 years of age, MRRS: Mean root resorption rate

As evident from table 2 there is no significant association between root resorption and gender of an individual at T1, T2 and T3 and in all the groups of teeth.

It can be observed from table 3 that there is more root resorption in extraction group than non-extraction group with respect to upper and lower anterior teeth at T3, but this difference is not statistically significant. Similarly it can be seen from table 4 that there is a comparatively greater difference in root resorption between two age groups with respect to upper and lower anterior teeth at T3. This difference also is not statistically significant.

DISCUSSION

In order to study root resorption associated with orthodontic treatment, panoramic, periapical or cephalometric films can be used. Cephalometric films can be used to find incisor lengths before and after orthodontic treatment but in cases of overlapping of roots as in cases of anterior crowding, it is difficult to localize root apices. Periapical radiograph can also be used for this study due to its higher accuracy as compared to panoramic radiographs and lower cost – benefit ratio as compared to computed tomography¹³. But in order to study resorption in anterior as well as posterior teeth multiple radiographic exposures are required making it less suitable. The advantage of panoramic film is that it gives information about all the teeth in a single film making it convenient to use especially when radiographs are required at multiple intervals. Hence in this study panoramic films were used.

Also in this study modified root resorption score was used, which is based on change in shape of root apex and not on change in root length. The change in root length is more suitable with periapical radiographs due to its higher accuracy as compared to panoramic films. It has been observed in a study¹⁴ that this method is comparable with the other studies^{8,15} using periapical radiograph.

This study shows no significant difference in root resorption between males and females. This finding is in agreement with various studies^{16,17}. But studies conducted by various authors^{18,19} have found that root resorption is more in females.

It is evident that difference in root resorption is more for two age groups with more resorption for older individuals but the difference is not statistically significant. Others^{8,15} have also found similar findings with no significant

difference in root resorption with age. But some authors²⁰ have found less root resorption in younger individuals. This can be explained by a protective mechanism against root resorption and increased ability of cementum repair in younger individuals. This protective mechanism constitutes cementoid on root as well as thick layer of predentin²¹. Regarding the relationship between extraction and root resorption, it was observed in this study that more resorption was present in extraction cases compared to non-extraction ones especially in the lower anterior region but this relationship was not statistically significant. Some authors^{22,23} have found resorption significantly greater in extraction group as compared to non-extraction group.

Clinical implications:

This study is relevant in day to day orthodontic practice. This study helps us identify factors associated with root resorption thereby aiding in prevention and control of root resorption thereby preventing psychological trauma to patient and clinician as well as legal implications for the orthodontist.

Study limitations and future directions:

This study is based on two dimensional study of a three dimensional structure. Also panoramic films have some inherent inaccuracies, hence this study might have some errors incorporated. Further studies involving computed tomography with larger sample sizes may be conducted.

CONCLUSIONS

1. The type of treatment, whether extraction or non-extraction may be a factor in assessment of root resorption with more resorption in extraction cases.
2. Age of an individual may also be an important factor with chances of resorption increasing with increasing age.
3. Gender is not a factor in determination of root resorption in this sample.

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