

Comparative Evaluation of External Apical Root Resorption Postretraction and Space Closure with 022 & 018 Self-Ligating Brackets

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ABSTRACT

Comparison of external apical root resorption (EARR) from pretraction to postretraction and space closure with sliding mechanics, a retrospective clinical study comparing 0.022 and 0.018 self ligating MBT bracket systems .28 patients separated in 2 groups of 14 patients. Group I: Self ligating (0.022" slot), Group II : Self ligating (0.018"slot). Computed tomographic records were collected at two intervals of time.T1: Preretraction & T2 : Postretraction and space closure. The preretraction and post space closure computed tomography scans were evaluated for the assessment of external apical root resorption. For the intergroup mean of sample values among 2 distinct groups, independent t test was used to analyse the data using Statistical software software 19.0 Version.

There's no statistical substantial variation among 2 groups over T1 - T2 in terms of EARR in either of arches. Maxillary lateral incisors revealed greatest level of root resorption in both groups, with maxillary teeth showing greater apical root resorption than mandibular teeth.

No statistical substantial variance into EARR among 022 & 018 self ligating MBT bracket systems was found from preretraction to postretraction and space closure.

Keywords : Apical root resorption, Self ligating brackets, Maxilla, Mandible

I. INTRODUCTION

Root resorption that occurs as result of orthodontic treatment is irreversible. Orthodontic root resorption has been recognised as clinical issue since 1920s¹. To understand this phenomena, we need to know as much as we can about its sources, impacts, and preventative measures. Because of external apical root resorption (EARR), orthodontic treatment might produce in less than ideal outcomes in certain circumstances². There are two ways to describe this phenomenon: surface resorption and transitory inflammatory resorption. One of the most often impacted teeth are maxillary lateral incisors, which are more vulnerable to EARR than the mandibular ones.³

Multifactorial EARR aetiology may be separated into biological (genetic predisposition, systemic variables like hormonal changes, teeth agenesis, as well as medication consumption), mechanical (excessive tooth moving, root torque (movement type), orthodontic force size, intensity as well as type of force, as well as bracket elements.⁴

Brackets that self-ligate eliminate need for an elasticated or wire ligature, their advantages include decreased treatment time; improved oral hygiene, less friction, and superior treatment results⁵⁻⁷. The self ligating Smart Clip bracket (3M Unitek MBT), 2 C-shaped spring clip upon each sides of bracket slot are utilised in this research to hold wire. By applying instrumental or finger pressure to archwire, the clips are opened up for insertion or removal of archwire.⁸

Most studies now use IOPA or orthopantomogram to assess EARR in maxillary as well as mandibular incisors^{9,10}, while just few use CT scans to do so in molars¹¹. In addition, usage of various self-ligating bracket slots as well as sizes hasn't even been compared with EARR's performance. Purpose of this retrospective controlled clinical study is evaluating EARR on CT scans from pretraction to postretraction and space closure with sliding mechanics comparing 0.022 & 0.018 Smart Clip self ligating MBT bracket systems.

II. MATERIALS & METHODS

This study has been carried out upon 28 patients, having age 12-25 years undergoing orthodontic treatment. Treatment planned was fixed appliance therapy with all four extraction. The inclusion criteria were good general health, no systemic disease, permanent & periodontally sound dentition- probing depth less than 3mm with no radiographic or computed tomographic evidence of bone loss. The exclusion criteria were root resorption, endodontic treatment, dilacerated incisor roots, anodontia, impacted canines, incomplete root formation and decayed or carious teeth.

The patients having earlier Class I, i.e., a low level of danger The Little's irregularity index ranges from 6-15 mm in Class II dental/skeletal interactions, after leveling and alignment have been casually assigned to 2 groups of 14 patients.

1. Group I: 14 patients of self ligating (0.022" slot) in which space closure was carried out with 0.019x0.025 inch stainless steel archwire with sliding mechanics (Fig 2 and 4).
2. Group II : 14 patients of self ligating (0.018"slot) in which space closure was carried out with 0.017x0.025 inch stainless steel archwire with sliding mechanics (Fig 3 and 5).

En masse retraction of SS wire was performed upon wire by steel hooks mesial through canine utilising NiTi closed coil springs which delivered force of 100 g on either side of wire. CT scans are performed on all of individuals who have been preselected (Single Slice Spiral CT, GE Medical Systems, USA) were taken during the following stages:

T1: Preretraction in Group I - after levelling and alignment upto 0.019x0.025 inch SS wire in 0.022" slot and in Group II – after leveling and alignment upto 0.017x0.025 SS wire in 0.018" slot (Fig 2 and 3).

T2: Post retraction in Group I & II - after retraction and space closure completion (Fig 4 and 5).

Single experienced radiologist carried out all the scans CT images were taken with same orthodontist to examine root resorption. The intraexaminer errors were eliminated by randomly selecting 50 percent of CT images 30 days after initial recording and repeating their measurements. The left as well as right sides data of both arches and both groups were pooled with their average being taken.

The undermentioned teeth were evaluated for EARR :

- i. Maxillary central and lateral incisors: Incisal edge till root tip
- ii. Mandibular central and lateral incisors: Incisal edge till root tip
- iii. Maxillary first molar: a) Mesio Buccal cusp tip till mesio Buccal root tip, b) Distobuccal cusp tip till distobuccal root tip
- iv. Mandibular first molar: a) Mesio Buccal cusp tip to mesial root tip, b) Distobuccal cusp tip to distal root tip.

CT scan linear measurement were done upon Linux operating system using Voxtool 3.0.64q by reassembling 5 mm pieces taken during patient's exposure upon sagittal sections of 1 mm each. An option for 2D measurement appeared by clicking on display icon with which by dragging linear measurements were made, in the centre of long axis a sectional cut was made and Figure 1 shows position of each individual tooth's cusp and root apex relative to each other, following which comparisons were made before and after space closure. For inter-group comparisons, root resorption was reported as percentage of tooth shortening.¹²

Percentage resorption per tooth is deliberated by:

Percentage resorption (%) = $(T_1 - T_2) \times 100 / T_1$, Where: T_1 = preretraction tooth length, T_2 = post retraction tooth length.

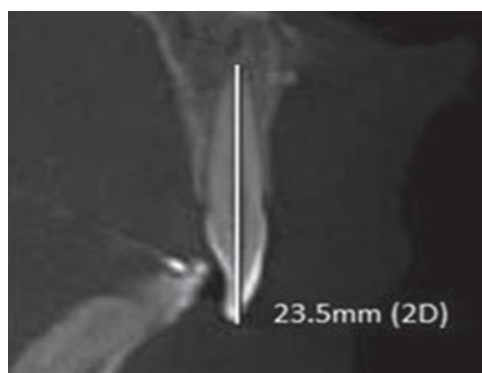


Fig1: Linear measuring tooth length assessment of maxillary right central incisor upon computed tomography scan (sagittal section)

III. RESULTS

The preretraction and post retraction and space closure CT scans were evaluated for the assessment of EARR. The records were analyzed and data was transferred to excel sheets.

Statistical Analysis : For this research, 2 steps of statistical analysis were carried out:

T₁- Preretraction; T₂- Post retraction and space closure

Using Microsoft Excel 2007 and SPSS (analytical package for social sciences) statistical software 19.0 Version, data for this research was input. Descriptive statistics included mean, standard deviation. unpaired/independent t test was used to compare the difference in average score among 2 separate groups. Threshold of significance in this investigation was set at $p \leq 0.05$, which is considered significant.

Independent t-test : Use the Independent t Test whenever test statistic would be expected to emulate normal distribution to assess whether 2 sets of data are statistically different. Independent samples t-test is employed when two sets of independent identically distributed sample were collected, one for every population studied, and results are compared.

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\left(\frac{(N_1 - 1)s_1^2 + (N_2 - 1)s_2^2}{N_1 + N_2 - 2}\right)\left(\frac{1}{N_1} + \frac{1}{N_2}\right)}}$$

Where X₁= first Group Mean , X₂ = Second Group Mean

SD = standard deviation

Σ = sum of

X = scores obtained

\bar{X} = mean score of data

N = number of scores

The mean of the data of root resorption percentage from T₁ to T₂ for every tooth of every patient is presented into the following Table.

Right and left-side data was gathered, as well as average was calculated from this pooled information. Changes in external apical root resorption were noticed in both the groups. maxillary teeth showed higher apical root resorption than mandibular teeth. In both groups, maxillary lateral incisors had highest EARR, whereas mandibular first molars had lowest EARR. More external apical root resorption was observed in retraction by sliding mechanics in self ligation group II with 0.018” slot while less was observed in self ligation group I with 0.022” slot, which can be attributed to less clearance angle (4.1 degree) after insertion of 0.017”x0.025” stainless steel wire in 0.018” slot.¹³

Finally when comparing between the two groups using independent t test, no significantly substantial variance ($p = 0.325$) was observed.

IV. DISCUSSION

In orthodontic therapy, resorption of the apical root is common and unwelcome side effect. In spite of this, advancements in orthodontic procedures as well as materials have been made to alleviate this issue.¹⁴ EARR has been connected to variety of parameters, including age, gender, systemic diseases, malocclusion type, tooth structure, treatment duration, tooth movement type, and quantity of orthodontic force., hereditary disposition, as well as the kind of orthodontic appliance.¹⁵⁻¹⁷ According to Becks H.¹⁸ endocrine problems such as hypothyroidism, hyperthyroidism, and hyperpituitarism are related to root resorption. Other systemic factors and pathologies have been suggested but have yet to be confirmed. Root resorption may be exacerbated by hormonal abnormalities also. No significant differences between the two sexes have been noted in literature.¹⁹ Research has shown that certain shapes are more prone to post orthodontic root resorption. Teeth with pipette-shaped roots experience the most resorption out of all the root types.²⁰ Dilacerated roots also are also more susceptible to resorption. Therefore, patients having severely dilacerated incisor roots were excluded from the study.

This study was carefully planned with strict inclusion and exclusion criteria configured to exclude all potential sources of incorrect data. Selected patients had good oral and general health without any systemic diseases and had been advised for following good oral hygiene practices throughout the study period.

Using computed tomography scan, we looked at external apical root resorption. There's been increasing use of computed tomography (CT) to better see root resorption and to provide more precise diagnoses of its extent and location. Furthermore, since spiral CT has higher resolution than CBCT, it was employed in place of latter. It's also crucial to realise that CT scans outperform model-based methods in terms of determining root's geographical location.²¹.

In the present study on CT scan linear measurements external apical root resorption was observed in T1 - T2 into both group more in group II with 0.018" slot and less in group I with 0.022" slot but in statistical analysis and intergroup comparison using Independent t test it was non-significant. Also more external apical root resorption was seen in maxillary teeth as equated with mandibular teeth. Other studies have shown that root resorption is more common in maxillary teeth compared to mandibular teeth. Our findings are consistent with these findings²².

Many researchers - Segal GR et al²³ and Jolien T and Zachrisson BU²⁴ believe that the farther a tooth is moved, the greater root resorption. Maxillary incisors are moved often than other teeth and it is not surprising that they experience highest degree of root resorption. In the present study also maxillary incisors showed more apical root resorption than other teeth. Lateral incisors has most root resorption of all of maxillary teeth.^{3,22}. Maxillary lateral incisors showed most root resorption into current investigation. This might be due to variety of factors. Dentists typically have to relocate teeth to right position because roots of maxillary left lateral incidents are commonly shifted mesially. As result of their narrower or curvier roots, lateral incisors are at increased risk of resorption.

Letie EF et al (2012)²⁵ Using conebeam CT (CBCT), the researchers determined EARR occur throughout every teeth; yet, bracket design made no difference in quantity of EARR. Our findings are corroborated by this research. There was no significant link between orthodontically stimulated inflammatory root resorption (OIIRR), as revealed by retrospective research by Sameshima and Sinclair²⁶, which looked at several treatment parameters for prediction and prevention of OIIRR. Our investigation found that there was no statistical substantial variation into EARR among 0.022" as well as 0.018" self-ligating bracket systems.

It's also necessary to do further research in this area since there has been lack of comparisons between self-ligating MBT bracket systems with 0.022" as well as 0.018" EARR.

V. CONCLUSIONS

More external apical root resorption was observed in maxilla and less in mandible, highest being in maxillary lateral incisors in both the groups. More EARR was observed in 0.018" slot and less in 0.022" slot but it wasn't statistically substantial.

There had been statistically no substantial variance in external apical root resorption with sliding mechanics when comparing 0.022" and 0.018" self ligating MBT bracket systems from pretraction to postretraction and space closure.

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