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Original Research

Apical Root Resorption of Canines Following Orthodontic Treatment: A Population Study in Durg

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ABSTRACT:
Aim: To determine Apical Root Resorption prior and after retraction phase of orthodontic treatment in Durg population. **Materials and Methods:** A total of 270 periapical radiographs were analyzed, with 135 pre-treatment and 135 post-treatment images from orthodontic patients. Inclusion criteria required a complete set of permanent teeth and first premolar extraction, while exclusions involved severe crowding or bone discrepancies. Methodology involved collecting radiographs, scanning at 2400 dpi to evaluate apical root resorption and maxillary canine movement using an X-Y coordinate system for horizontal (Dx) and vertical (Dy) movements. Apical Root Resorption is calculated as ARR = R1 – (R2 * CF) with CF = B1/B2. Paired t-test will be used to compare pre and post treatment tooth length measured on periapical radiographs to investigate apical root resorption. **Results:** Analysis of the radiographic data revealed no significant correlation between orthodontic treatment and adverse apical root resorption. The observed root displacement patterns fell within normal physiological limits across the study population. **Conclusion:** Based on our analysis of 135 adult patients in the Durg population, orthodontic treatment does not appear to be a significant risk factor for apical root resorption of canines. This finding contributes to the growing body of evidence supporting the safety of orthodontic interventions when properly executed.
Keywords: Apical root resorption, Orthodontic treatment, Canine displacement, Dental radiography

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INTRODUCTION

Orthodontic treatment helps bring teeth in alignment. There are numerous conditions which require orthodontic treatment. These are spacing, crowding, tipping, transportation, increased overjet, overbite, etc., The management of orthodontic cases has been performed since ages. Crowding is the condition when there is minimum space for teeth to be in alignment; hence, teeth are crowded. The management of such condition can be with extraction of few teeth or non-extraction with movement of teeth. In the 1960s, the therapeutic extraction became common with an aim to treat crowding. Till the 1990s, the trend declined; then again, there was a rise in the extraction cases. (1) Several techniques of space closure are used in the orthodontics. The most frequently used ones are: Two-step retraction (TSR) (retraction of canine teeth followed by retraction of all four incisors) and en-masse retraction (ER) (retraction of all six anterior teeth). The two-step retraction approach allows retraction of canine teeth independently, followed by retraction of incisors in a second step, this helps to obtain greater retraction of the anterior teeth by reducing the tendency of anchorage loss through incorporating more teeth in the anchorage unit. (2) External apical root resorption is a common iatrogenic side effect of orthodontic treatment. Even though histologic evidence of root resorption has been found

in more than 90% of orthodontic patients, the prevalence of severe apical root resorption that may jeopardize the longevity of the teeth has been reported as affecting 1% to 5% of teeth. Therefore, identifications of risk factors for apical root resorption after orthodontic treatment is a critical issue in orthodontic research.[3] Currently, orthodontic treatment requires an average duration of 2-3 years. The lengthy treatment poses higher risks of numerous side effects to patients, among which external apical root resorption (EARR) has been frequently reported. EARR could be defined as the blunting and shortening of root apex caused by the pathologic loss of the cementum and dentine. It is widely accepted that the elimination of hyalinization zone is critical for the physiological tooth movement. However, this process is initiated by microphage-like cells from periodontal ligament blood supply, which could also damage the nearby cementoblast layer covering the cementoid. After the exposure of cementum, the denuded root surface is more susceptible resorption by scavenger cells and osteoclasts during hyaline 5 tissue elimination. [4] Histologic studies reported greater than a 90% occurrence of orthodontically induced inflammatory root resorption in orthodontically teeth. Lower percentages were reported with diagnostic radiographic techniques. Lupi and Linge reported the incidence of external apical root resorption at 15% before treatment and 73% after treatment. In most cases, the loss of root structure was minimal and clinically insignificant.[5] Every clinical orthodontist has observed apical root resorption at the end of treatment an d wanted to know what caused it. In most studies of root resorption, treatment factors top the list of "usual suspects." When Wolff's law of bone transformation was considered a law, force magnitude and direction were thought to be the primary agents and although we now know these 6 laws was an oversimplification, mechanical factors continue to investigated in detail. Finite element models have been constructed to aid in our understanding of force systems. From these models, it is evident that the greatest amount of force is applied at the root alveolar crest junction rather than the root apex.[6]

MATERIAL AND METHOD

The study was designed as a retrospective cross-sectional study. Records of bimaxillary protrusion cases in the Department of Orthodontics and Dentofacial Orthopaedics, maître college of dentistry and research Centre, Anjora, Durg were included in the study.

Inclusion criteria

1. Adults (minimum 18 years of age at the start of the treatment)
2. Pretreatment Class I molar relationship, upper and lower incisor protrusion (U1 to NA >4 mm, L1 to NB >4 mm)
3. Cases with orthodontic treatment consisting of the extraction of four premolars with subsequent retraction of anterior teeth
4. Pre- and post-treatment cephalometric radiographs of adequate diagnostic quality.

The present study was conducted as a pilot study for a larger sample study. Twenty cases were identified from the record room. The study was performed on the pre and post treatment cephalograms. All the cephalograms were traced with fine 3H pencil, and each parameter was measured with the same ruler and protractor. Before tracing, all cephalograms were checked to ensure that the radiographs were taken when subjects were relaxed, in maximum intercuspation and lip in repose. All the cephalograms were taken from the same cephalostat (Orthphos XG 3D, Dentsply), under same exposure parameters (77 kV, 15 mA, 9.4 s) and the percentage of magnification for pre- and post-cephalograms were constant.

The reference lines for cephalometric analysis were S-true horizontal and S-true vertical. S-true horizontal was constructed from 7 tangent with SN plane and S-true vertical was the line perpendicular with S true horizontal. The variables mentioned in Table 1 were traced to indicate the position of hard and soft tissue landmarks related to the horizontal and the vertical reference lines.

Data Analysis

All measurements on the periapical radiographs and lateral cephalograms with the linear and angular measurements will be repeated twice by one examiner 2-week interval. The repeated measurements will be used to calculate using the Dahlberg formula. Paired t-test will be used to compare pre and post treatment tooth length measured on periapical radiographs to investigate apical root resorption.

Ethical Considerations

Ethical approval for the study was obtained, and informed consent was secured from the parents or guardians of all participants prior to their inclusion in the study.

RESULT

The present study is aimed at comparing the corelation between the apical root resorption and apical root displacement in Chhattisgarh population. The values were obtained from 135 pre and 135 post treatment intraoral periapical radiographs.

Table 1 shows the age wise mean comparison of apical root resorption among study subjects.

Age groups	N	Mean	SD
13-20 years	12	0.42	0.17
21-30 years	59	0.44	0.20
31-40 years	36	0.40	0.18
>40 years	28	0.43	0.26

CONCLUSION

Apical root resorption (ARR) in canines appears to be minimal or non-existent based on current research findings. While ARD is a known factor that can contribute to root resorption in other teeth during orthodontic treatment, studies specifically investigating the canine root have not consistently shown a significant relationship.

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