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Factors Influencing the Removal of Posts

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SUMMARY

Root canal retreatment in teeth restored with intraradicular posts has attracted interest due to the difficulties of their removal without weaking, perforating or fracturing the remaining root structure. The use of ultrasonic devices has been suggested by some authors to facilitate post removal, reducing the possibility of fractures or root perforations. **The purpose** of this study was to determine the efficacy of cast posts removal by ultrasonic device regarding post length, adaptation of post to root canal walls and cement type. **Material and methods:** Seventy-seven single rooted endodontically treated teeth restored with cast posts were included to this study. Post removal was processed with ultrasonic and time for this was recorded. The length and width of the post, quality of post adaptation, type of cement were evaluated according to radiographic findings and clinical records. **Results:** Mean value of time needed for post removal was 14.15 (SD ± 8.57) minutes. A strong correlation was observed between the time of post removal and post length (r=0.620, p=0.000).The mean time required for the removal of posts cemented with zinc phosphate was 11.36 min (SD ± 5.84) and for the posts cemented with resin modified glass-ionomer was 15.37 min (SD ± 3.83). Statistically significant difference in the time needed for the posts cemented with different cements was observed (p = 0.002). The mean time needed for the post removal with the inappropriate adaptation was 10.1 min (SD ± 6.0) and the time for the post with appropriate adaptation was 15.7 min (SD ± 8.9). Statistically significant difference between these two groups was observed for the time of posts removal (p = 0.003).

According to the results of linear regression model test, 50% of variation in time needed to remove posts was explained by following variables: post length, post adaptation and the cement type. The total regression model was highly significant (p = 0.000).

Conclusions: The time taken for post removal depended on post length, its adaptation in the root canal and on the type of luting cement. Root fractures are unlikely to occur with good case selection.

Keywords: root canal retreatment, post, ultrasonic device, cement type

INTRODUCTION

The most common reason for failure of root canal treatment is the presence of microorganisms within the root canal system (1,2). When endodontic failure occurs, conservative retreatment is the preferred treatment of choice rather more than periapical surgery, since such type of retreatment is generally more successful and more predictable (3).

Coronal microleakage has received considerable attention as a factor related to failure of endodontic treatment and much emphasis is placed on the proper quality and timing of the final coronal restoration.

Orthograde root canal retreatment requires removal of the existing coronal restoration in order to obtain access to the root canal system. In some cases this may include removal of a post. There is little information in the dental literature to indicate how often the rationale need is for post removal. Abbott analysed the treatment performed on 2000 patients referred to a specialist endodontist and reported that post removal was required for 210 teeth (4). This represented 9.4% of all teeth treated.

Root canal retreatment in teeth restored with intraradicular posts has attracted interest due to the difficulties of their removal without weaking, perforating or fracturing the remaining root structure. Removal of posts from root canals is often a tedious and difficult procedure. A wide variety of factors can influence the success of such procedure. In all cases it is necessary for the clinician to evaluate his or her ability to remove posts.

The removal of posts can be accomplished by simple means, special removal devices or a combination of these. The methods used and the success rates achieved with various post removal devices and techniques varied. Ultrasonic instruments are a valuable asset for removing intraradicular posts from root canals before nonsurgical endodontic therapy. The use of ultrasonic devices has been suggested by some authors to facilitate post removal, reducing the possibility of fractures or root perforations (5).

The cementing agents have to promote post retention and provide marginal sealing, as bacterial coronal leakage is now recognized as a major cause of endodontic failure (2). Currently four main groups of commercial cementing agents are used for cast posts: zinc phosphate, glass-ionomer, resin and polycarboxylate cements. Zinc phosphate and glass-ionomer cements were found to be more retentive than polycarboxylate and resin cements.

The purpose of this study was to determine the efficacy of cast posts removal by ultrasonic device regarding post length, adaptation of post to root canal walls and cement type.

MATERIAL AND METHODS

Sixty-three patients with a need of endodontic treatment were referred to a specialist endodontist for the root canal retreatment procedure. Seventy-seven single rooted

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endodontically treated teeth restored with cast posts (further in the document – cases), with poor quality of primary endodontic treatment with diagnosis of apical periodontitis and need of new prosthetic treatment were included to this study (6). All these teeth required post removal prior endodontic retreatment. The previous endodontic therapy in these teeth had been completed by a variety of dentists more than 5 years ago.

In order to evaluate the status, periapical radiographs were taken with *Eggens* holder and right-angle technique from each clinical case. The film was placed parallel to the long axis of the tooth and the central beam was directed at right angles to the film aligned through the root apex. The radiographic features of 77 cases were evaluated. The length and width of the post, quality of post adaptation were recorded according to radiographic findings. Posts adaptation was evaluated by interradicular relation of post to root canal walls seen in the radiograms. No visible gap between root wall and post was marked as appropriate post adaptation and visible gap respectively – inappropriate. Type of cement used for the post cementation of these posts was identified from clinical records.

Prior to endodontic retreatment it was obligatory to conclude in each case that there is no clinical or radiographic signs to suggest the presence of vertical root fracture.

Length and width of posts in the cervical region were measured twice by two persons with standardized electric ruller. The mean values of respective results obtained from two examiners were statistically analyzed.

For removal of posts Ultrasonic device MasterPiezon 400 (EMS) with a D4 (EMS) ultrasonic tip was used during this survey. All posts were subjected to ultrasonic vibration of 30 kHz for the different time period until posts were felt to be loosened and easily removed with haemostats. Time needed to loosen the posts was measured by timer and recorded. After removal of post from its bed the root canal system was evaluated with endodontic microscope (*Carl Zeiss*) at the magnification of x10 for presence of dentinal cracks.

Statistical analysis

The data were analyzed by descriptive and multivariate methods. The statistical significance of differences in time used to remove posts cemented with two different cements was tested by independent – samples T test. The correlation between time needed for the post removal and post length and width was evaluated by Pearson's correlation test. The linear regression model was calculated to estimate the impact of factors for the time of the post removal. The tests were performed using SPSS computer software. The statistical significance level was set at $p<0.05$.

RESULTS

All of the 77 post were succesfully removed using the ultrasonic device. No fractures of roots after posts removal were observed. Mean value of time needed for post removal was 14.15 (SD ± 8.57) minutes. The minimum time required was 3.06 minutes and maximum time was 31.46 minutes.

Posts included in the study varied in length and width. The mean length of the post was 6.81 mm (SD ± 1.65). The mean width of the post in the cervical region of the tooth was 2.49 mm (SD ± 0.35). A strong correlation was observed between the time of post removal and post length (Table 1) and there was no statistically significant correlation between width of the post and time ($r = 0.18$, $p = 0.12$).

Information regarding type of cement used for the post cementation from clinical records was available in 68 from all 77 cases. Two types of cement, e.g. zinc phosphate and resin modified glass-ionomer cement, were used. These cements were used accordingly in 63.6% and 24.7% of all cases. The mean time required for the removal of posts cemented with zinc phosphate was 11.36 min (SD ± 5.84) and for the posts cemented with resin modified glass-ionomer was 15.37 min (SD ± 3.83). Statistically significant difference in the time needed for the posts cemented with different cements was observed ($p = 0.002$).

Table 1. Correlation of the measurements of the post with the time needed for the post removal.

Measurements of the post	Standardized correlation coefficient	P value
Length	0.620	0.000
Width	0.163	0.156

Pearson correlation

Table 2. Linear regression model test of the impact factors for the time needed for the post removal.

Independent variable	Standardized coefficient beta	P value
Length of the post	0.614	0.000
Type of the cement	0.291	0.002
Adaptation of the post	-0.214	0.018

Dependent variable: the time needed for the post removal
$p = 0.000$

Inappropriate adaptation of the post in the root canal was observed in 72.3% of cases and appropriate adaptation in 27.7% of all cases. The mean time needed for the post removal with the inappropriate adaptation was 10.1 min (SD ± 6.0) and the time for the post with appropriate adaptation was 15.7 min (SD ± 8.9). Statistically significant difference between these two groups was observed for the time of posts removal ($p = 0.003$).

According to the results of linear regression model test, 50% of variation in time needed to remove posts was explained by following variables: post length, post adaptation and the cement type (Table 2). The total regression model was highly significant ($p = 0.000$).

DISCUSSION

Posts are frequently used for the retention of coronal restorations in endodontically treated teeth with severe coronal destruction. Removal of posts from root canals is often a tedious and difficult procedure. The present study shows that the post removal success is influenced by the length of the post, quality of post adaptation and type of luting cement.

When a post is present in a tooth that requires root canal retreatment there is often a dilemma what kind of treatment procedure is indicated. In one survey 66% of the endodontists in such cases preferred to remove the post, whilst 27% considered either post removal or periapical surgery, 45% reported that a root fracture had occurred during post removal, but this represented less than 0.002% of the estimated number of posts removed by all respondents (4).

Several techniques can be used to remove posts. In a survey of American endodontists regarding the methods used to remove posts, Stamos & Gutmann reported that the majority of respondents used haemostats (67%) or they drilled out the posts (62%) (5). These figures are surprising and alarming, particularly regarding the use of a bur to drill out a post. This procedure can lead to loss of a considerable amount of the root dentine, which may result in root perforation or may weaken the tooth and predispose it to a vertical fracture. During the last decade ultrasonic vibration (7,8) started to be the most common method used to remove posts. During the post removal the ultrasonic oscillation is generated in the device and transferred to the cast post as a mechanical energy. The most frequent combinations were the

initial use of ultrasonic vibration in association with subsequent use of post removal devices. The initial use of ultrasonic vibration on a post for 2 min has been shown to reduce the amount of force required to remove the post by 30% (9). The results of this study influenced some respondents to use ultrasonics as a method of choice. Mechanical energy disrupts the cement bond between the post and the walls of the root canal. Once the cement bond is broken removal of the post is facilitated.

Unfortunately, amongst the cementing agents no one possesses all the ideal properties. Currently four main groups of commercial cementing agents are used for cast posts: zinc phosphate cement, glass-ionomer cement, resin cement and polycarboxylate cement. The cementing agents have to promote post retention and provide marginal sealing to impede microleakage, as bacterial coronal leakage is now recognized as a major cause of endodontic failure. During endodontic retreatment with no clinical records it is not always feasible to determine what type of luting agent was used for post cementation. The time used for the removal of posts is influenced by cement type (9). Within the limitation of this study it was found that zinc phosphate and resin modified glass-ionomer cements were used. As shown in present study the posts cemented with zinc phosphate were loosened more quickly than posts cemented with resin modified glass-ionomer cements. This finding coincides with data from other studies.

Multiple studies have shown retention is considerably influenced by fit of the post. A larger diameter, and therefore better adapted, post consistently requires a greater tensile force to break the cement seal and free the post (10, 11, 12). Additionally a well adapted post inherently minimizes the film thickness of cement. In fact the literature suggests that the ideal cement film thickness should be between 25 to 35 mm. A thicker layer is inconsistent with optimum cement tensile strength, causing reduced post retention (10,12). According to the results of present study it was shown that posts with an inappropriate adaptation needed less time to be removed.

Johnson et al. demonstrated that as much as a 30% increase in post retention with as little as a 2 mm increase in post length (11). Higher post retention increases post resistance to removal procedures as it was shown in present study.

Despite the proved safety of the procedure where the ultrasonic device is used, dentinal cracks were reported on the root surface of some teeth in association with the use of ultrasonic vibration, although it is possible that these cracks were also present prior to post removal (7).

Use of ultrasonics ensures minimum loss of dental tissue, reduces working time and risk of fractures or root perforations (8). This study has demonstrated that posts can be safely, predictably and quickly removed from teeth in order to allow root canal re-treatment and/or new restorations to be provided. As a result of this, the presence of a post in a tooth root should not be considered as an indication in itself for periapical surgery.

CONCLUSIONS

1. The time taken for post removal depended on post length, its adaptation in the root canal and on the type of luting cement.
2. Root fractures are unlikely to occur with good case selection.

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