Tooth Survival after Surgical or Nonsurgical Endodontic Retreatment: Long-term Follow-up of a Randomized Clinical Trial

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Abstract

Introduction: The aim of the study was to determine long-term tooth survival after endodontic retreatment and whether the presence of intraradicular posts influences the outcome. **Methods:** Ninety-five teeth were randomly assigned to surgical or nonsurgical endodontic retreatment. Forty-seven teeth in 45 patients were treated by conventional endodontic surgery and 48 teeth (47 patients) by nonsurgical retreatment, including the removal of intraradicular posts in 37 (77%). The outcome was tooth survival; follow-up continued until the tooth had been extracted, at least 10 years had elapsed since retreatment, the patient declined further follow-up, or the patient died. The Fisher exact test was used to analyze differences between the groups. **Results:** The median follow-up time was 10.1 years (range, 0.0–15.6 years). The overall survival rate was 76%, with no significant differences in long-term tooth survival between retreatment methods or the presence of an intraradicular post. The reasons for tooth extraction were related to the retreatment method. Vertical root fractures were significantly more frequent in the nonsurgical group when retreatment included post removal ($P = .036$). **Conclusions:** There was no significant difference in long-term tooth survival after surgical or nonsurgical retreatment. The presence of intraradicular posts did not affect long-term tooth survival, but for teeth with posts, those retreated nonsurgically were more frequently extracted because of vertical root fractures than those retreated surgically ($P = .036$). The major limitations of the study were a smaller sample size and the use of outmoded retreatment techniques. *(J Endod 2018;■:1–7)*

Key Words

Endodontic retreatment, long-term tooth survival, posts

Significance

Longevity is a key consideration in endodontic retreatment. This clinical study examined long-term tooth survival in a randomized setup (surgical vs. nonsurgical) and revealed valuable information on 10-year survival rates and on why retreated teeth may be extracted.

The aim of root canal treatment is to cure or prevent periapical disease in order to promote long-term tooth survival. Cohort studies, conducted mainly in specialist and university settings, have reported high efficacy (1, 2). However, cross-sectional studies of endodontic outcomes in general practice continue to show a high prevalence of root-filled teeth with posttreatment disease (3).

In cases of posttreatment disease, tooth-preserving treatment options include surgical and nonsurgical endodontic retreatment. Favorable treatment outcomes, at least in the short-term, have been reported for both methods (4, 5). However, the method of choice for comparing 2 or more treatment methods is the randomized controlled trial (RCT). A recent Cochrane review of endodontic retreatment (6) identified only 2 RCTs comparing surgical and nonsurgical retreatment (7, 8).

In a study by Kvist and Reit (8), 95 root-filled incisors and canines with posttreatment disease were randomly assigned to surgical or nonsurgical intervention with follow-up at 6, 12, 24, and 48 months. At the final follow-up assessment, attrition was low (4.2%), and the survival rates were comparable (89% and 93% in the surgical and nonsurgical groups, respectively). There was no statistically significant difference in periapical healing between surgical and nonsurgical retreatment.

Both available RCTs were undertaken before the introduction of modern technological advances in clinical endodontic practice. The treatment methods were mainly traditional without the use of operating microscopes, ultrasonics, nickel-titanium endodontic instruments, and bioceramic filling materials. However, the long-term outcomes are still of interest, partially because of the shortage of RCTs with long-term observation periods. Considering the extensive effort and cost involved in endodontic retreatment, longevity is a key consideration.

As a possible consequence of the outdated methods, Kvist and Reit (8) found that in the surgical group 4 cases, which had been classified as healed after 12 months, subsequently exhibited recurrence of the apical radiolucency or presented with clinical symptoms. Hypothetically, this sequence of events may jeopardize long-term tooth survival because root-filled teeth with posttreatment disease are at higher risk of extraction (9).

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Intraradicular posts may also negatively affect long-term tooth survival (10). The presence of posts in teeth with root fillings of poor quality has been found to increase the risk of posttreatment disease (11). Moreover, post removal before retreatment in order to allow access to the root canal system is considered a risk factor for inducing vertical root fractures (12–15). In the study by Kvist and Reit (8), 80% of the included teeth had been restored with an intraradicular post. In the long-term, this could lead to a systematic difference in tooth survival between the 2 retreatment methods because of a higher incidence of vertical root fractures in the nonsurgical retreatment group. The aim of the present study was to compare long-term tooth survival after surgical or nonsurgical endodontic retreatment and to investigate whether the presence of intraradicular posts influenced the outcome.

Materials and Methods

The methodology of the study design was presented in detail in the original study (8). A brief summary is provided here.

Ethical Approval

The study was approved by the Committee for Research on Human Subjects at the University of Gothenburg, Gothenburg, Sweden (Dnr: 234-89).

Patients and Teeth

The subjects included 92 patients referred to the University of Gothenburg for endodontic retreatment because of posttreatment disease. Patients fulfilling the following inclusion criteria were consecutively enrolled:

1. Single-rooted maxillary and mandibular incisors and canines in which apical radiolucency was clearly visible on x-rays
2. Root canal treatment performed more than 4 years earlier or the presence of clinical signs and symptoms
3. No apical-marginal communication was observed
4. Randomization of retreatment options was considered to be medically as well as economically feasible
5. Patient consent was obtained

In all, 95 teeth were randomized (16) according to 3 factors (ie, the size of the periapical lesion, the apical position of the root filling, and the technical quality of the root filling) for either surgical or nonsurgical retreatment. The characteristics of the 2 treatment groups after the randomization process are presented in Table 1. Figure 1 shows a flow diagram of the study based on the Consolidated Standards Of Reporting Trials. Intraradicular posts were present in 39 teeth (83%) in the surgical group and 37 (77%) in the nonsurgical group.

Treatment Procedures

All treatments were performed through the years 1989 to 1992 by a single operator at the Department of Endodontology, Institute of Odontology, University of Gothenburg.

Surgical Retreatment. The root apex was exposed by the conventional surgical technique. After removal of the periapical granuloma, the root apex was resected approximately 2 mm. When possible, the root canal was instrumented using Hedstrom files (up to ISO 40) and filled with gutta-percha as described by Reit and Hirsh (17). In the remaining cases, a small round bur was used to prepare a retrograde cavity of 2–3 mm that was subsequently filled with gutta-percha, softened either in chloroform or by heating over an open flame.

Nonsurgical Retreatment. Thirty-seven (77%) of the 48 teeth in this group had been restored with a crown and an intraradicular post, which had to be removed to access the root canal. A systematic approach was used for the post removal procedure, initially using a post extractor (Sjödings, Kista, Sweden) supplemented if necessary by the use of ultrasonics, burs, or a combination of these. In a clinical protocol, the type of post, the methods used for each post removal, and the time required for post removal were documented.

The tooth was isolated by a rubber dam, and the operation field was disinfected by consecutive application of 30% hydrogen peroxide and 10% iodine tincture. Existing root filling material was removed mechanically using Gates/Glidden drills and stainless steel hand files up to an apical size of at least ISO 50, if possible to within 0.5–1 mm of the radiographic apex. Chloroform was used as a supplement only when necessary. Buffered 0.5% sodium hypochlorite was used as an irrigant. An interappointment dressing of calcium hydroxide paste was placed with a Lentulo spiral. After 2 weeks, the root canals were reentered and filled with gutta-percha softened in 5% rosin chloroform using the cold lateral condensation technique. When indicated, space for a post was prepared directly after the root filling procedure. After retreatment procedures, all teeth were referred back to the general dentist for restoration of the tooth, including a new intraradicular post if indicated.

TABLE 1. Characteristics of Patients and Teeth in the Surgical (S) and Nonsurgical (NS) Retreatment Groups

Patients*	S *n* = 45	NS *n* = 47
Sex, *n* (%)		
Male	16 (36)	22 (47)
Female	29 (64)	25 (53)
Age (years)		
Mean	53	52
Range	28–75	17–74
Teeth, *n* (%)	*n* = 47	*n* = 48
11, 21	10 (21)	17 (35)
12, 22	26 (55)	24 (50)
13, 23	4 (9)	2 (4)
33, 43	7 (15)	5 (10)
Restoration, *n* (%)		
Crown with post	39 (83)	37 (77)
Crown without post	3 (6)	0 (0)
Age of root filling, *n* (%)		
≤4 years	5 (11)	4 (8)
>4 years	42 (89)	44 (92)

*Three teeth were eligible in 1 patient, and 2 teeth were eligible in 3 patients.

Follow-up

Clinical and radiographic follow-up examinations were scheduled after 6, 12, 24, and 48 months and annually thereafter until the tooth had been extracted, at least 10 years had elapsed since retreatment, the patient declined further follow-up, or the patient died. In case of extraction, the reason for extraction was retrieved from the patient's records.

Outcome

The outcome was tooth survival defined as the tooth being *in situ* at follow-up examinations.

Statistical Analysis

The Fisher exact test was used to analyze differences between groups. The tests were 2-tailed, and the level of significance was set at 5% ($P < .05$).

Kaplan-Meier curves were calculated for each time series (surgical and nonsurgical groups) using IBM SPSS 24.0 (IBM Corp, Armonk, NY)