

Clinical Outcome of Teeth Treated Endodontically with a Nonstandardized Protocol and Root Filled with Resilon

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Abstract

The purpose of this study was to evaluate the clinical outcomes of root canal treatment in private practice and filled with Resilon. Immediate postoperative radiographs were compared to follow-up radiographs of at least 1 year in 82 randomly selected primary endodontic cases treated according to a nonstandardized protocol but root-filled with Resilon. The Periapical Index (PAI) and the Clinical Impression of Healing (CIH) quantification procedures were used to determine the status and change in the condition of the teeth. The PAI evaluation revealed that 90% of the teeth that were healthy at the initial reading (PAI, 1 or 2) maintained the condition at follow-up evaluation. Of those teeth that were unhealthy (PAI, 3–5) at the initial reading, 73.3% were judged healthy (50%) or improved (23.3) at the last evaluation. In contrast, the proportion of healthy or healing with the CIH evaluation was 89.4%. The findings of this study support the contention that regardless of treatment protocol, healing rates for Resilon-filled teeth in private practice were within the range of success rates for studies with uniform treatment techniques mostly in university settings with gutta-percha root filling. (*J Endod* 2007;33:1290–1292)

Key Words

Endodontic infections, outcomes analysis, periradicular lesions, Resilon

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The field of endodontics focuses on the prevention and/or elimination of apical periodontitis, and treatment consists of 2 phases, microbial control and root filling. Success in preventing or eliminating apical periodontitis is dependent on many factors. These include (1) preoperative factors (eg, primary endodontics or retreatment, presence of apical periodontitis, patient systemic health) (1); (2) intraoperative factors (eg, size of instrumentation, positive or negative culture at filling, length or density of fill, presence of procedural errors) (2, 3); and (3) postoperative factors (eg, presence or quality of coronal restoration) (4).

Many studies have been performed over the years evaluating the relative importance of preoperative, intraoperative, or postoperative factors in the outcome of endodontically treated teeth. In most of these studies gutta-percha and some type of sealer have been used to fill the root canal. However, when the ability of gutta-percha to seal the canal is evaluated, it is quite apparent that it fails in this primary function (5–7). However, as evidenced by the outcome studies, root canal treatment can be highly successful even if a gutta-percha technique has been used (8, 9). This fact might lead one to believe that although in vitro and in vivo studies show gutta-percha does not predictably seal the root canal, it does work in vivo, and therefore its inability to seal the canal is not important. However, studies by Ray and Trope (4) and others have demonstrated that it is the coronal seal above the gutta-percha filling that is critical for the prevention of coronal leakage and reinfection of the root canal. Thus, if the coronal seal is inadequate or breaks down over time, the canal filled with gutta-percha is susceptible to reinfection. Therefore, the endodontist is dependent on the quality of the coronal restoration for long-term success. Because most endodontists do not place the coronal restoration after root canal treatment, the long-term success of the specialty is not in its hands. Clearly it would be advantageous to create a coronal barrier from the root orifice to the apex.

A new, bonded endodontic root filling material, Resilon (Pentron Clinical Technologies, Wallingford, CT) has been developed as an alternative to conventional gutta-percha (10). Gutta-percha contains 35% gutta-percha rubber and 65% filler material. With Resilon the 35% gutta-percha rubber material has been replaced by 35% synthetic polyester with 65% fillers. Because of the resin-based core material, Resilon is able to bond to the adhesive sealer, which in turn will bond to cleaned dentinal surfaces, thus forming a “monoblock.” Results from research on the Resilon system thus far have been published in vitro and in dogs, indicating a superior (11–17) or equal (18–21) seal to coronal leakage when compared with gutta-percha techniques. To date only one study with an untested variation of the fluid filtration technique has shown an inferior seal for Resilon compared with gutta-percha (22). The purpose of this study was to determine the healing rates of teeth treated endodontically with Resilon root filling observed radiographically over time. This study compared immediate postoperative (IPO) radiographs with short-term (1 year) post-treatment, follow-up (F) radiographs from private practice endodontic cases treated with the Resilon system root filling. These findings were then compared with gutta-percha-treated teeth reported in the literature.

Materials and Methods

Approval for the project was obtained from the UNC School of Dentistry Committee on Investigation Involving Human Subjects.

A total of 16 dentists provided the investigators in this study with IPO and F radiographs of 82 teeth that had been root-filled with Resilon. Participating private

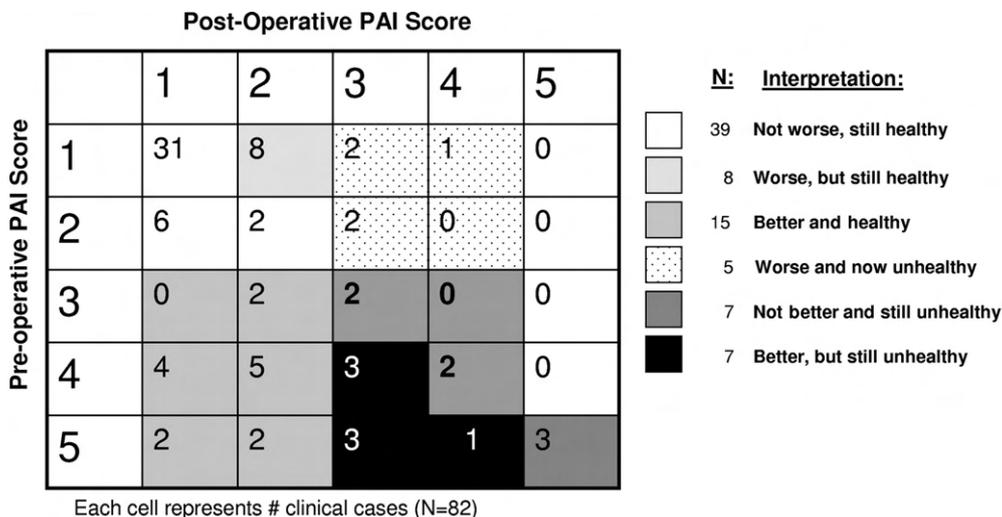


Figure 1. Comparison of preoperative with postoperative PAI scores.

practitioners were from the continental U.S. and Western Europe. Teeth were randomly selected by the doctors' office managers without input from the practitioners, with the agreement that patients and doctors would remain confidential. The study accepted radiographs of teeth with and without apical periodontitis but did not collect diagnostic information or patient-related variables. The patient was required to be asymptomatic when the postoperative radiograph was taken. Beyond the use of Resilon root filling, there was no standardization regarding endodontic treatment protocol or technique used by practitioners. Although no bite registration was required to reproduce angulation at follow-up examination, radiographic guidelines were required to have similar projection angles between IPO and F films, demonstrate the entire apex and lesion, and have at least 1-year follow-up.

Two evaluation approaches were used to determine the short-term healing rate of 82 teeth. The first method used the Periapical Index (PAI) (23), a scoring index based on histologic analysis by Brynoff (23). For this part of the study one examiner was used. This approach required evaluation of reliability through a calibration process before rating radiographs, the blinding of the observer relative to the endodontic treatment phase and restoration status, the random ordering of individual radiographs to be scored, and the assignment of ratings on a 5-point scale in which 1 represented teeth with normal apical periodontium, and 5 denoted the presence of radiolucency and radiating expansion of bony structural change.

The second evaluation method used in this study was the Clinical Impression of Healing (CIH). Three examiners were used for this evaluation. In this approach, there was no evaluation reliability requirement; clinical observers viewed the IPO-F pairs with a known restoration status, and observed teeth received 1 of 3 ratings: healed, healing, or not healed/not healing.

Healing rates were expressed in percents and proportions. For the PAI, the following calculations were made: (1) the proportion of teeth that started healthy (PAI 1, 2) and stayed healthy (PAI 1, 2); (2) the proportion of teeth that started unhealthy (PAI 3–5) and finished healthy (PAI 1, 2); (3) the proportion of teeth started unhealthy (PAI 3–5) and finished improved but still unhealthy, ie, healing (PAI 3–5); (4) the proportion of teeth that started healthy (PAI 1, 2) and ended unhealthy (PAI 3–5); and (5) the proportion of teeth that started unhealthy (PAI 3–5) and ended the same or worse.

For teeth that were evaluated with the CIH, the percent of healed or healing teeth and the percent not healed/not healing were obtained for

each of 3 evaluators. Also, average proportions were calculated for the healed/healing and not healed/not healing categories.

After these calculations for PAI and CIH, comparisons were made with gutta-percha–based results reported in the literature.

Results

The findings for the PAI analysis are seen in Fig. 1.

Fifty-two of 82 teeth started healthy (PAI 1, 2). Of these, 47 (90.38%) remained healthy. Thirty of the 80 teeth started unhealthy (PAI 3–5), and 15 (50%) finished healthy (PAI 1, 2). Of the 30 teeth that started unhealthy (PAI 3–5), seven (23.3%) were improved but not yet healthy. Thus the healed and healing rate for the unhealthy teeth was 73.3%.

Five of the 52 teeth (9.6%) started healthy (PAI 1, 2) and ended unhealthy. Four of 30 teeth (13.3%) that started unhealthy (PAI 3–5) remained unhealthy.

Table 1 presents the results of the CIH. Results from the CIH analysis were dichotomized into favorable (healed or healing teeth) and unfavorable healing (not healed/healing). There was an average of 90.9% favorable healing (range, 85.3%–92.6%). The CIH classification did not permit analysis of a starting condition of the teeth; teeth in the process of healing were subsumed under the category of favorable healing. Rater 1, who was also calibrated to evaluate according to the PAI protocol, gave the most favorable ratings for the 82 experimental teeth.

Discussion

The current study is a unique evaluation of randomly selected material from private practice endodontics. The study summarizes results of various endodontic treatment protocols and various general practitioner restorative treatments that share only one commonality,

TABLE 1. Postoperative Classification of CIH

	Healed or healing	Not healed or not healing
Reader 1	92.6%	7.3%
Reader 2	85.3%	14.6%
Reader 3	90.2%	9.7%
Mean	89.36%	10.5%

CIH is based on interpretation of changes in preoperative and postoperative radiographs.

Resilon root filling. The vast majority of the cases were performed by endodontists, with 2 general dentists included who have a special interest in endodontics. Because the cases were all performed in a private practice setting without the knowledge that in the future they would be used for a scientific analysis, we can assume that the results fairly represent the outcome expectations for private practice.

Two methods of analysis were used in this study: the PAI, a research tool that requires extensive calibration, and the CIH, reflective of how we evaluate our treatments in clinical practice. Following the example of several studies (24–26), only one PAI examiner (F.T.) read radiographs in the current study. One of the major concerns in conducting research that requires judgments on the part of an observer, even a calibrated observer, is the reliability of ratings assigned. This concern was offset by the rigorous standardization of PAI examiner (calibration kappa must be >0.61). In the current study the calibrating examiner (F.T.) scored a kappa of 0.82, 0.9, and 0.83 on sequential control readings before proceeding to experimental radiographs.

Whereas the PAI is a research tool correlated with histologic findings, the CIH method used direct visual comparison of IPO and F pairs to assess whether a tooth had healed, was healing, or was not healed or healing. As expected, outcomes from this method were higher (averaging 90.9%). One of the reasons we included a CIH analysis was to evaluate the differences in success rates compared with the PAI and thus emphasize that the lower PAI scores are not indicative of poorer results compared with previous studies in which the CIH was commonly used (1, 2, 8, 9).

This study showed again the importance of the preoperative status of the tooth as it relates to treatment outcome. As with most other studies, an unhealthy state at the time of treatment negatively impacted on the rates of healing at the follow-up examination.

Both the PAI results and the CIH results in this study are comparable to outcomes achieved in controlled clinical studies mostly performed in a university setting and definitely with the knowledge that the data would later be used for scientific analysis. These results show that endodontics performed by individuals with a high level of training and interest in endodontics can duplicate those outcomes achieved in more controlled settings.

The new resin-based filling material Resilon was the only common feature used in all the cases. The root filling is one part of the overall root canal procedure; therefore, it is difficult to evaluate its contribution to the success (or failure) of overall treatment. However, it can be said according to the results of this study that it was not in any way detrimental to the success rate achieved in these cases.

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