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Conventional endodontic failure and retreatment

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Technologic advancements in dentistry have vastly improved the quality of care provided to the general population. These advancements, in conjunction with increased dental patient education and awareness, have helped to promote the view that the dentition should remain throughout people's lives. As the life span of the population increases, the need to maintain a patient's dentition for a longer period of time has led to a barrage of advanced procedures that were nonexistent years ago. As a result, the need for performing conventional root canal therapy also has increased dramatically. A survey performed by the American Dental Association stated that approximately 2.5 million endodontic cases were treated in 1960 [1]. Current studies estimate that the number of endodontic cases treated annually ranges from 24 to 50 million [1–4]. This is a dramatic increase. Ruddle [5] described this vast increase in endodontics as the ‘‘good news–bad news'' dilemma. The ‘‘good news'' is that hundreds of millions of teeth are salvaged through the combination of endodontics, periodontics, and restorative dentistry. The ‘‘bad news'' is that tens of millions of endodontically treated teeth are failing each year for a variety of reasons [5,6]. For example, the success rate for conventional-treated teeth is 85% to 90%; this still leaves a failure rate of 10% to 15%. In accordance with the studies mentioned above [1–6], a 10% failure rate would result in the failure of at least 2.4 million cases. Therefore, the future of endodontics will include dealing with the retreatment of its failures.

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Factors for failures

Not all conventional root canal treatments are successful. There have been many articles published [7–31] that provide a range of success anywhere from 53% to 95%. There are many reasons for the wide variety of outcomes. Several aspects can be attributed to the way in which endodontic successes and failures are reported. Some important factors are the frequency of recall evaluations, operator's ability, tooth selection, number of cases evaluated, patient's subjective response to and compliance with treatment, method of determining failures, and subjective interpretation of the results. There are approximately 25 potential factors reported in the literature that influence the outcome of conventional endodontic therapy (Table 1) [27]. Throughout the literature, these factors have been evaluated and reviewed with both agreement and disagreement as to their influence on endodontic success rates. There are some factors, however, that consistently are reported to have an influence on success or failure. These factors are as follows: the extension of the filling material, quality of the obturation, case

Table 1
Potential factors influencing success of endodontic therapy

Factors	Effect or success	No effect on success
Presence of apical pathosis	Yes	No
Extension of filling material	Yes	No
Tooth type	Yes	No
Observation period	Yes	No
Maxilla versus mandible		No
Obturation quality	Yes	No
Coronal leakage	Yes	No
Missed canals	Yes	No
Adequate cleaning and shaping	Yes	No
Pulp vitality	Yes	No
Culture	Yes	No
Obturation technique		No
Type of filling used		No
Number of treatments		No
Postoperative restoration	Yes	No
Intracanal medicament	Yes	No
Preoperative pain		No
Postoperative pain		No
Apical resorption	Yes	No
Length of time for treatment		No
Procedural periapical inoculation	Yes	No
Patient's health		No
Age		No
Gender		No
Operator skill		No

These criteria are presented in order of decreasing frequency at which time they were investigated to correlate with endodontic failures.

Data from Refs. [7–31].

selection, root canal system anatomy, inadequacy of cleaning and shaping, presence of periapical pathosis, iatrogenic procedural errors, and length of the observation period [5,6,16,32]. Presently, the belief is that the most important cause of failure is recontamination of the entire root canal system resulting from coronal bacterial leakage [26,33–35]. No correlation of the maxilla versus the mandible exists, nor does age or gender appear to play a role in the pathogenesis of endodontic failures.

Conventional retreatment versus microsugery

Endodontic failures are associated most often with periapical pathosis and pain. The decision to perform nonsurgical conventional retreatment, microsurgical endodontics, or even extraction and placement of an implant must be assessed carefully. There have been considerable improvements in endodontic microsurgery techniques that allow for the once-hopeless tooth to be salvaged [5,6,8]. These techniques and procedures are still limited by the amount of pulp tissue, bacteria, and any other irritants that can be removed successfully [5]. Therefore, a diligent examination of the suspected tooth must be performed to gather information so that the proper treatment can be rendered. For example, restorability, coronal leakage, missed canals, fractures, iatrogenic procedural errors, ability of the operator, type of filling material, ability to gain access to the filling material and the terminus of the root canal system, quality and extent of the obturation, patients' desires, and cost effectiveness must be considered before treatment planning. Consultation with the appropriate specialist, or team of specialists, to determine feasibility of treatment, prognosis, and cost effectiveness is of utmost importance for the clinician. Fig. 1 depicts a brief rationale strategy for deciding whether conventional nonsurgical retreatment or endodontic microsurgery is the best option.

Endodontic retreatment: case selection

Conventional endodontic retreatments are different from routine endodontic therapy in that the tooth already has been treated without success, a permanent restoration usually has been placed, and iatrogenic procedural errors must be dealt with. Furthermore, the prognosis for retreatment is much poorer than that for routine conventional endodontics. Conversely, through technologic advancements, improved training, and exceptional restorative techniques, clinicians can obtain successful superior results. Moreover, conventional retreatment can have a positive effect on the prognosis, even if surgery ultimately becomes necessary.

Certain teeth that have demonstrated clinical inadequacies in previous endodontic treatment, however, can be considered a success. A tooth that exhibits an incomplete obturation to the terminus of the root, yet is

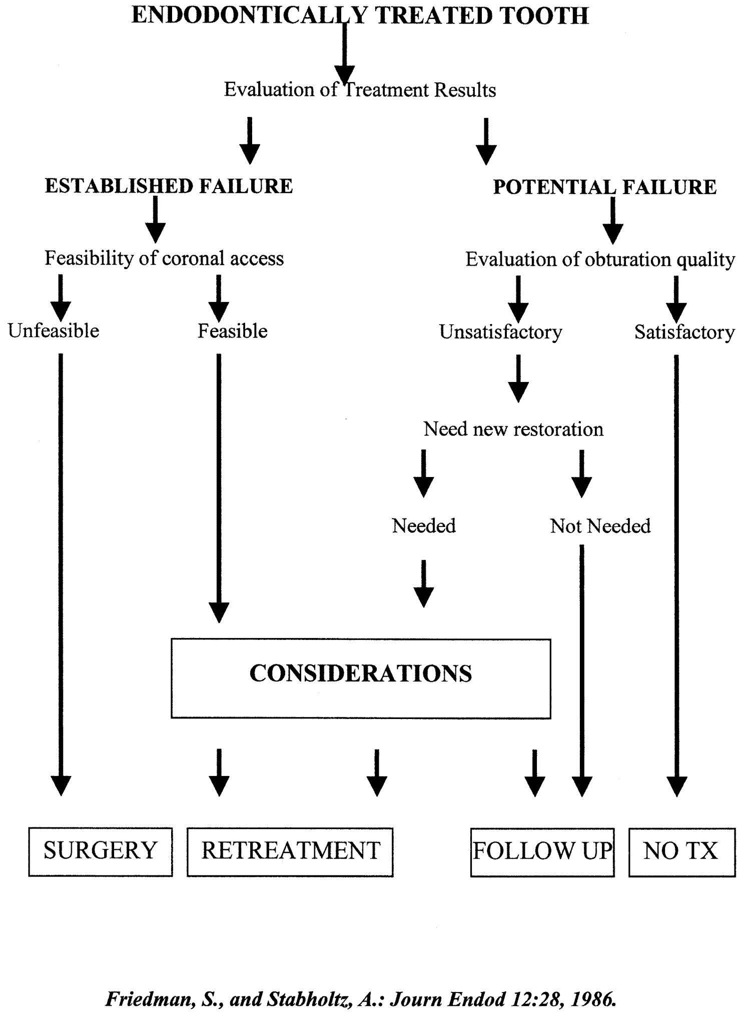


Fig. 1. Considerations for retreatment of an endodontically treated tooth. (*From* Friedman S, Stabholz A. Endodontic retreatment–case selection and technique. Part 1: criteria for case selection. J Endod 1986;12:28; with permission.)

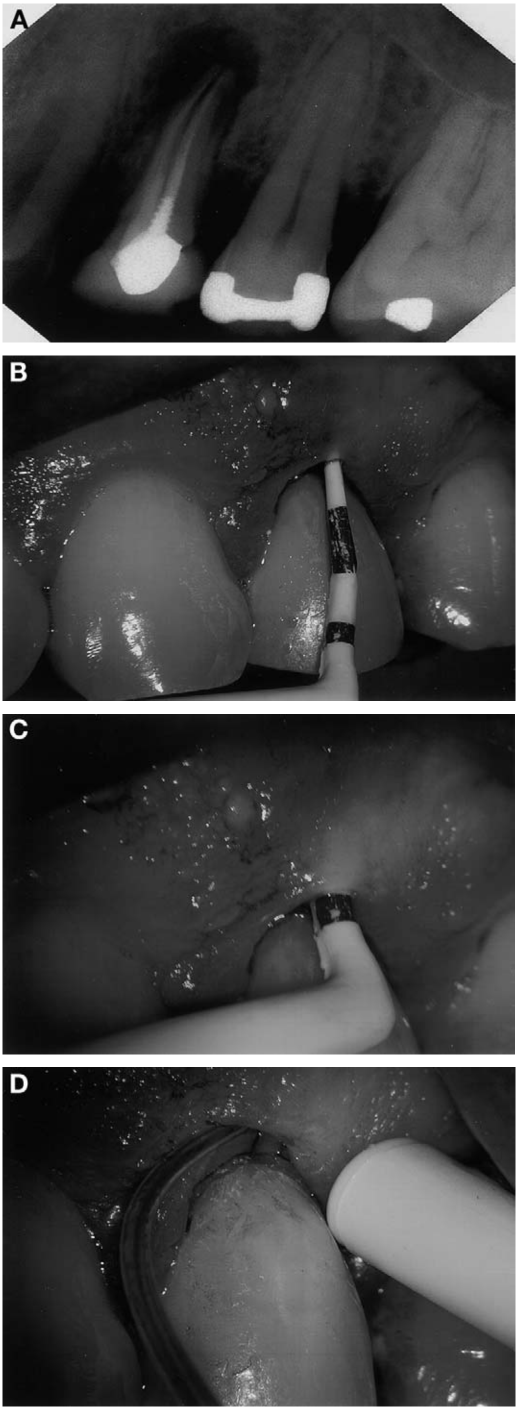
clinically sound, is a case in point. This type of tooth can be monitored rather than retreated unless the tooth in question is to receive a new definitive restoration or recurrent caries are present.

Factors that affect root canal failures can be attained from previous radiographs. Films that were taken preoperatively and postoperatively can demonstrate presence, absence, or healing of periapical pathosis. The history of the previous endodontic treatment can allow the clinician to discern what treatment was rendered and why. In addition, potential problems with further treatments can be anticipated if the endodontic treatment was performed on a tooth that presented with an abscess, or if a treatment was already performed and symptoms continue to arise. The time lapse between the previous treatment and the postoperative symptoms is of utmost importance to the diagnosis. The treatment itself also can be in question. The quality of cleaning, shaping, and obturation of the entire root canal system must be evaluated carefully depending on who the previous operator was. Nevertheless, there are always unforeseen circumstances that are out of any clinician's control that may account for the compromised treatment. Therefore, consultation and discussion with the previous operator will provide invaluable information about the prior treatment and proposed retreatment.

A clinical examination of subjective and objective signs will allow the clinician to determine the nature of the problem, as well as the growing restorative needs for the patient. The presence of acute intense symptoms, such as pain and swelling, is the driving force for most patients seeking to be evaluated and treated. Prescribing antibiotics and performing an incision and drainage can provide useful relief before committing to a treatment plan. Subsequently, a good periodontal assessment will help the clinician to determine the restorability and type of restoration for each tooth, as well as the strategic positioning of the tooth. Restorations of poor quality, lacking marginal integrity, or with recurrent caries must be replaced. Often, broken-down teeth must be evaluated for restorative needs and crown-lengthening procedures to allow for a ferrule effect and a healthy biologic width [5]. If the tooth in question is needed to support a fixed prosthesis that was newly fabricated, then retreatment or microsurgery must be considered high on the list of treatment alternatives. When the presence of severe periodontal disease or recurrent caries creates an unfavorable crown-to-root ratio, then extraction is the only option. When there are severe periodontal pockets with noted presence of radiographic endodontic pathosis, the need for extraction or retreatment must be investigated for the correlation for the endodontic–periodontic lesions or a vertical fracture (Fig. 2) [36].

The state of the previous treatment must be scrutinized. Anatomic and morphologic differences, as well as the quality of the endodontic treatment, must be evaluated to meet the present-day criterion. The anatomy and morphology of the root canal system significantly affects the outcome of routine conventional endodontic therapy. The root canal system creates an intricate array of anastamosis and bi- and trifurcations, which communicate with the surrounding periodontal apparatus, resulting in several portals of exit [37,38]. Thus, untreated root canal systems can harbor necrotic debris and bacteria that permeates through to adjacent periradicular tissues and ultimately promotes pathosis [6]. Untreated canals, however, are more amenable to conventional retreatment [32,39].

The prior endodontic treatment also must be evaluated for adequate cleaning, shaping, and three-dimensional obturation of the root canal system. Adequate cleaning and shaping procedures differ based on the


A
B
C
D

training and experience of the clinician. The apical extent of the obturation is always well defined. Overextension of gutta-percha occurs when there is no apical seal of the root canal system [16]. When this occurs, the obturated gutta-percha sometimes can be retrieved through the root canal system and removed from the periapical tissues. Occasionally, however, removal of the extended gutta-percha results in the disarticulation of the extruded gutta-percha mass and may require surgical intervention. Iatrogenic procedural errors such as transportations, ledges, separated instruments, and perforations contribute to the inability to retreat the system successfully. Therefore, canals with severe curvatures, dilacerations, calcifications, ledges, and iatrogenic procedural errors may result in endodontic microsurgery.

Finally, when making the decision to retreat or perform microsurgery, the cooperativeness of the patient must be considered. The clinician also must be aware of the patient's desires, expectations, influences of time, and financial obligations. Furthermore, all alternative treatment plans and the overall prognosis must be discussed before treatment. After all the data has been considered and discussed, the patient then can make an informed decision about retreatment, microsurgery, or possible extraction. The ability of the operator also must be evaluated. This is extremely important because several retreatment techniques require training and experience and should not be attempted otherwise. Therefore, the clinician—whether general practitioner or specialist—must evaluate each case and assess the operator's capability for treatment or referral accordingly.

Gaining access to the root canal system

Establishing access to the treated root canal usually is difficult. Many retreatment cases are restored with a post, core, and crown. The removal of coronal restorations sometimes is unnecessary and contraindicated. Satisfactory and esthetic restorations are expensive and should be considered as a service to the patient. As a result of trying to keep costs to the patient at a minimum, clinicians typically access through the restoration if it is intact and deemed to be functional. Retained coronal restorations also facilitate rubber dam placement, prevent leakage, and allow for easier temporization. However, all restorations of poor quality, poor marginal adaptation, and those that present with recurrent caries should be removed completely to facilitate the retreatment process [29]. Endodontically, the decision to remove the coronal restoration is due primarily to the requirement of additional access to facilitate the retreatment process. Removal of the coronal restoration in conjunction with the surgical operation microscope allows for enhanced

Fig. 2. (*A*) Preoperative radiograph of abscess in tooth before treatment. (*B,C*) Initial examination with probing depths. (*D*) Examination with microscope and capillary tip to locate vertical fracture.

assessment of tooth morphology. Furthermore, radiographic information such as the identification of perforations, untreated root canal systems, and the coronal extent of silver cones can be detected. Vertical fractures also may be identified easier once the restoration is removed, and enhanced access for the clinician also can be obtained.

Facilitated post removal

Access for endodontic retreatment cases usually includes removal of a post and core. The literature provides evidence that a post space can cause a vertical root fracture, due to weakening of the integrity of the canal wall [40–42]. Therefore, removal of a prefabricated or cast post can cause root fractures. The risk increases with long, well-fitted, larger-diameter posts [29]. Therefore, before retrieval of the post, all core materials that are in contact with the post and with the pulp chamber must be removed. Cast post and cores should be reduced to a single post preparation before removal. Once straight-line access to the pulp chamber is created, the remaining core material is removed from the post. Thin diamond burs and piezoelectric ultrasonics can assist with the final removal of the core around the post. Special instruments have been designed to facilitate the removal of posts [5,16,20,43,44]. However, studies agree that the retention of the post should be reduced first with the use of piezoelectric ultrasonics before its removal [5,41,43–48]. Ultrasonic vibrations can be used to disintegrate the cement and trough around the post to help with the loosening and removal. The use of ultrasonics alone can be sufficient to remove several posts.

Another instrument that allows for increased vibrations is the rotosonic, Roto-Pro bur (Ellman International, Hewlett, New York) The Roto-Pro bur is a six-sided, noncutting instrument that comes in two shapes: the regular straight tip bur and the football-rounded bur. The bur is placed in a high-speed handpiece and rotates along the side of the post. It is kept in intimate contact in a counterclockwise fashion to facilitate loosening and

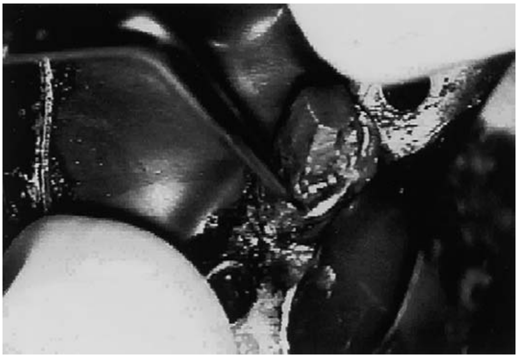


Fig. 3. Use of ultrasonic device to reduce cement and retention of cast post.

Fig. 4. (*A*) Preoperative radiograph with clinical crown and post broken at the gingival margin. (*B*) Placement of tubular taps. (*C*) Placement of extraction pliers. (*D*) Postoperative radiograph. (Courtesy of Dr. William Goon.)

removal of any post (Fig. 3) [5]. However, caution must be observed when using either of these instruments. In a preliminary study at the University of the Pacific School of Dentistry [49], the use of piezoelectric ultrasonics without the use of a coolant such as water resulted in a bony dehiscence. Therefore, it is recommended that the use of ultrasonics or rotosonics be used in conjunction with a constant, irrigating, and coolant such as water.

Occasionally the post can break and cause obstructions in the canal, which results in unforeseen complications [20,44]. Also, sonic vibration may not be enough to retrieve posts from the root canal system. Therefore, devices have been made to add forces along the long axis of the tooth to enhance post removal [5,20,43,44]. These devices are the Gonon Post Puller, the Ruddle Post Removal System, and the Masserann Kit. The Gonon Post Puller and Ruddle Post Removal System (SybronEndo, Orange, California) are equipped with trephine burs that allow for the milling of the coronal 1 mm to 3 mm of the post itself, and have corresponding-sized tubular taps. Rubber cushions are placed on the taps before mechanical threading of the

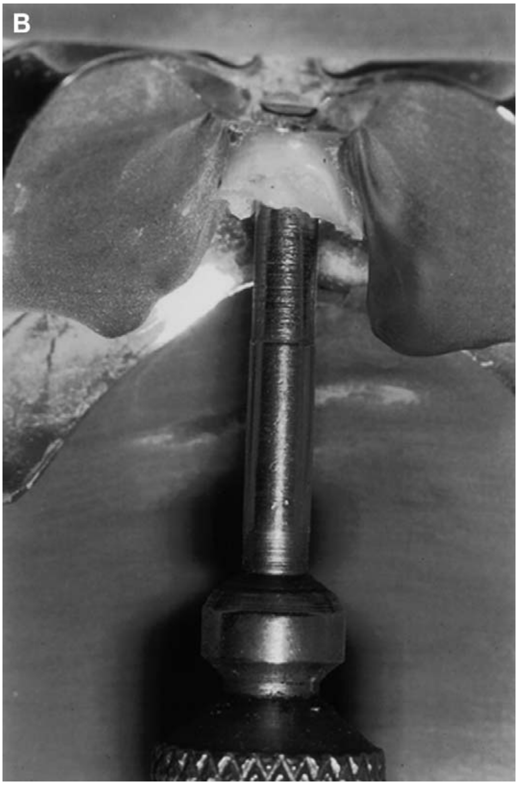


Fig. 4 (*continued*)

post. The taps are screwed with a counterclockwise motion onto the post until a snug fit is obtained. The rubber cushions then are pushed down onto the functional biting surface of the tooth. The post removal pliers are placed with the extracting jaws engaged into the tap and on top of the rubber cushion for support. The instrument is held firmly, while the screw is turned to open the jaws of the pliers, causing a build-up of pressure. As a result, the screw is difficult to turn. The clinician should monitor the cushion on the tooth and either pause a few seconds or place an ultrasonic on the tap, use the vibrations, and loosen the cement. The combination will allow for future turning of the screw and eventual removal of the post coaxial to the root (Fig. 4). The Masserann Kit also uses a trephine bur; however, one size larger than the post should be selected. The bur should be placed around the post instead of on the post [20,44]. This larger trephine bur removes excess dentin supporting the post for approximately 3 mm into the orifice of the canal wall. Afterward, a trephine bur one size smaller than the post is selected. It is used with a slow-speech latch attachment to screw into the post. The post then can be removed with a counterclockwise motion (Fig. 5). In addition, the Masserann Kit also has an extractor that makes use of

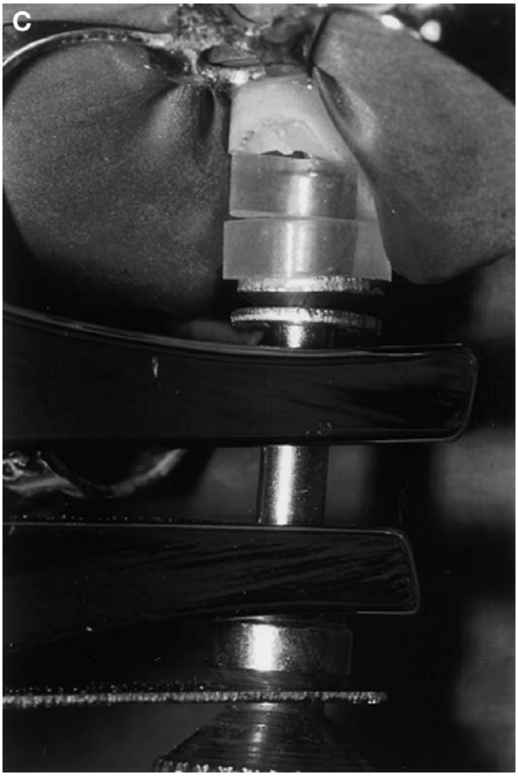


Fig. 4 (*continued*)

a mechanical device to grasp the post. Ultrasonic vibration also can aid in the retrieval of the post, as mentioned above [5,6]. The disadvantage of the Masserann Kit is the initial unwarranted removal of excess dentin from around the post.

Gaining access to the apical terminus

The aspect of gaining patency to the apical foramen is arduous. The canals must be negotiated through removal or bypassing obstructions and filling materials in the canals. Obturated canals are filled mostly with either semisolid materials such as gutta-percha, pastes, and cements or with solid materials such as silver points and Thermafil obturators. Sometimes a clinician can encounter disarticulated instruments as well.

Semisolid material removal

Removal of gutta-percha can be obtained with several techniques. Considerations for the removal of gutta percha depend on the initial

Fig. 4 (*continued*)

examination and the quality and extent of the filling material. Table 2 summarizes considerations with regard to the elimination of gutta-percha in the canal. The quality of the obturation must be identified. The fastest way to retreat a canal is to pull out the gutta-percha [29]. This is especially true when the canal is not condensed well [16]. Using any type of forceps or a Hedstrom file can remove the filling material immediately. However, when the canal is well condensed, it may necessitate the use of other instruments and techniques to facilitate removal. Before the use of these techniques, the extent of the filling material and the canal curvatures must be noted. Removal of the coronal portion of the gutta-percha can be achieved with heat caries such as the Touch-N-Heat (Kerr Corp., Glendora, California) or System B (Analytic Endodontics, Orange, California). Gates Glidden burs (Dentsply Maillefer, Ballaigues, Switzerland) also are quite effective in the removal of the coronal portion of the filling material. Recent studies [50–54] have demonstrated the successful use of nickel-titanium rotary files as well. Once the coronal portion of the filling material has been removed, other techniques and devices then can be employed readily.

Fig. 5. (*A*) Preoperative radiograph of separated post in lower incisor. (*B*) Depth of trephination and use of Masserann Kit. (*C*) Postoperative radiograph of post removed. (Courtesy of Dr. William Goon.)

Solvents have been used in the past to soften and dissolve gutta-percha [16,55–58]. However, all solvents are somewhat toxic to patients and should be used with caution [55,57]. Solvents available for dissolution of gutta-percha filling material are as follows: (1) chloroform, (2) eucalyptol, (3) xylene, (4) methylechloroform, (5) halothane, (6) turpentine oil, (7) pine needle oil, and (8) white pine oil. Chloroform is the most commonly used solvent, due its effectiveness of dissolution [55,57,58]. It also is relatively inexpensive and easy to use. When small, underprepared and curved canals need negotiation, chloroform and small K-type files are best suited. The sequential technique involves refilling of the created reservoir in the canal orifice with drops of chloroform and picking into the dissolving gutta-percha while filing with a size 10, 15, and 20 stainless steel file. This is continued until the terminus is negotiated, after which all solvents should be discontinued. Sequentially larger K-type files then are inserted into the canal until all the gutta-percha mass is removed.

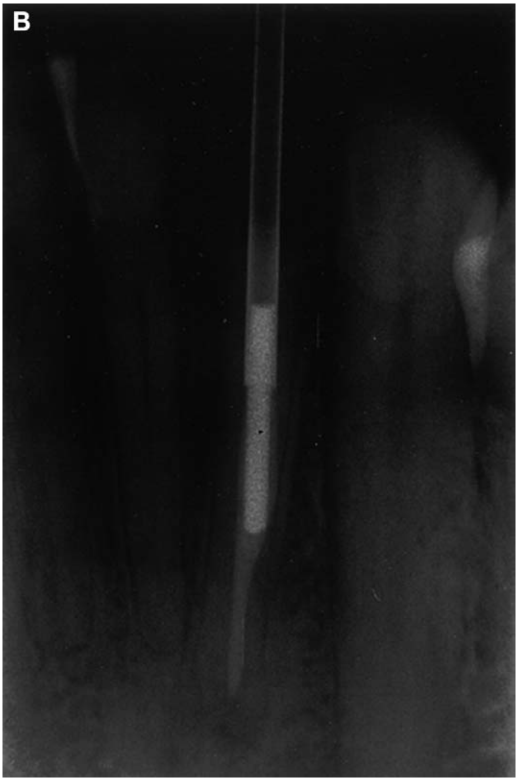


Fig. 5 (*continued*)

Researchers have reported that the newer nickel-titanium rotary instruments can facilitate the removal of gutta-percha in the canal [50–54]. Caution should be taken when using rotary files around curvatures and underprepared canals, however, because disarticulation can occur, resulting in complications of the retreatment. Nevertheless, the use of stainless steel hand files, with and without the use of solvents, has proved to be more effective in complete removal of the filling material from the canal wall [50,52–54,59]. Moreover, the use of the surgical operation microscope has been documented to improve the entire removal of gutta-percha from the canal walls (Fig. 6) [59]. Chloroform unfortunately is classified as a beta-2 carcinogen [55,57]. Eucalyptol, an alternative, is less irritating than is

Table 2
Considerations for gutta-percha removal

	Pull out	Dissolve
Condensation	Poor	Well
Shape of canal	Straight	Curved
Length	Overextended	Incomplete

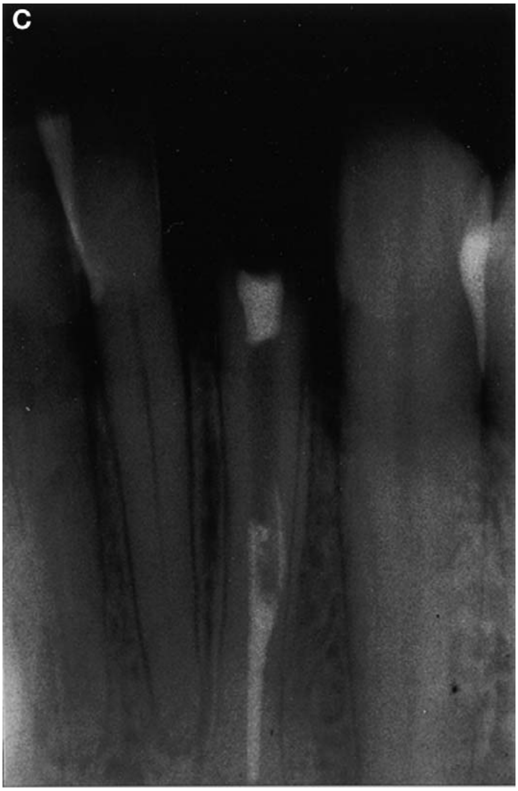


Fig. 5 (*continued*)

chloroform and has an antibacterial effect [55,57]. It is, however, a less-effective gutta-percha solvent and must be heated to improve the solubility of the gutta-percha mass.

The geographic location at which the endodontic therapy was performed can aid in the decision of the retreatment. Pastes and cements can be grouped into categories of soft and hard setting as well as impenetrable and irremovable [5]. Pastes that often are found in root canals performed in Russia, Eastern Europe, and the Pacific Rim pose complications due to the hardness of the material [5], whereas pastes and cements that are used in the United States are usually soft and can be removed readily [5]. The extent of the filling material is again of the utmost importance. Usually the coronal portion of the canal is obturated with the paste or cement, leaving the middle and apical portion of the canal free of obstruction. However, one must commonly deal with ledges, transportations, and calcifications. Disintegration of the coronal portion of the paste or cement can be enhanced with piezoelectric ultrasonic vibrations [5,6,60,61]. Use of a microscope also will facilitate removal of the filling material in the straight portion of the canal. The use of ultrasonic vibrations will allow for

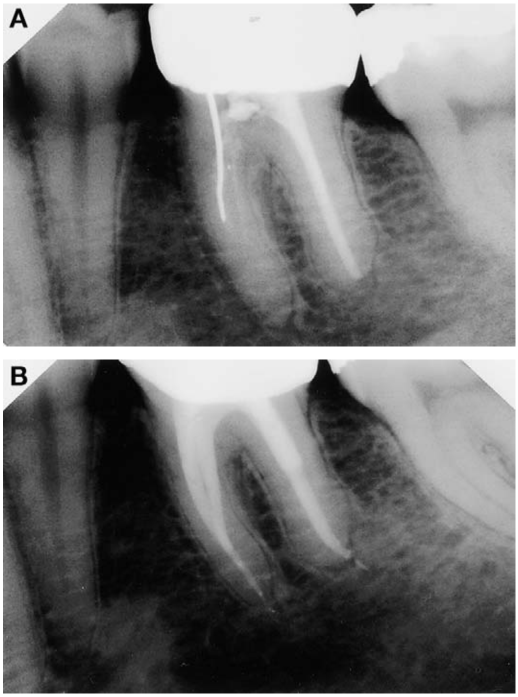


Fig. 6. (*A*) Preoperative radiograph of incomplete failing root canal. (*B*) Postoperative radiograph of root canal fully treated after removal of the silver point gutta-percha, and localization of the second mesial canal with the aid of the microscope.

the hardest of materials to be removed [5,6,61]. Caution must be exercised with the amount of heat generated from the sonics, and irrigating coolant must be engaged. Heat has some effect on soft porous materials, but is limited in its usefulness. Gates Glidden burs also are useful with soft material, but do not afford great credibility with hard pastes and cements. The use of end-cutting nickel-titanium rotary instruments such as the Quantec file (SybronEndo, Orange, California) can be advantageous (Fig. 7). The end-cutting files, although dangerous, can be helpful in penetrating the filling material and facilitate its removal. Solvents such as Endosolv "R" and "E" (Endoco, Memphis, Tennessee) also can be helpful to soften the formidable material [5]. The "R" is used for resin-based materials, whereas the "E" is used for eugenol-based materials.

Solid materials removal

The treatment plan for the removal of solid objects that obstruct the root canal system depends on the feasibility of removing or bypassing the impediment. Silver points can be removed with relative ease due to the chronic leakage that occurs and the loss of an apical seal with the cement

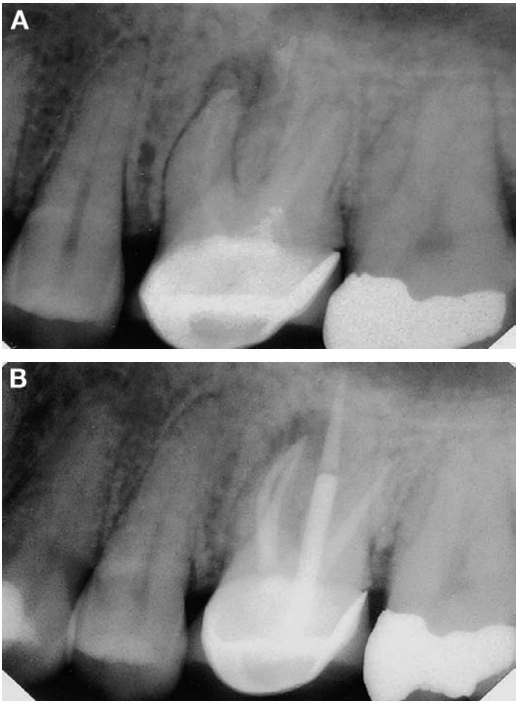


Fig. 7. (*A*) Preoperative radiograph of an abscessed molar with a paste fill. (*B*) Postoperative radiograph revealing second mesial buccal canal. The Quantec file and ultrasonics were used to remove the paste fill.

over time. The extent of the obturation is significant. Overextended points have a higher affinity for disarticulation into the periapical tissues and may require surgery. The quality and the diameter of the silver point must be considered when retrieval techniques are employed. Thin points have a tendency to dislodge with ease and can break more easily, whereas larger diameter silver points have an affinity for the canal wall and can be more difficult to bypass and remove. Luckily, most canal preparations have a coronal portion of the canal that is flared whereas the silver cone is parallel in shape. The area of the flared preparation is advantageous for the removal of the silver point by the clinician [5]. However, the operator also must note that silver points are brittle and can fracture easily.

Before beginning any removal technique, a microscope should be used to ensure that all core build-up material and excess cements around the silver point are removed. After exposing the silver point, a microneedled forceps, Steiglitz forceps (Chige, Long Island, New York), or a hemostat can be used to grasp the object. The operator should test the resistance of the silver point in the canal with a controlled tug on the forceps. Rather then pull along the long axis of the canal, the clinician should manipulate the forceps with

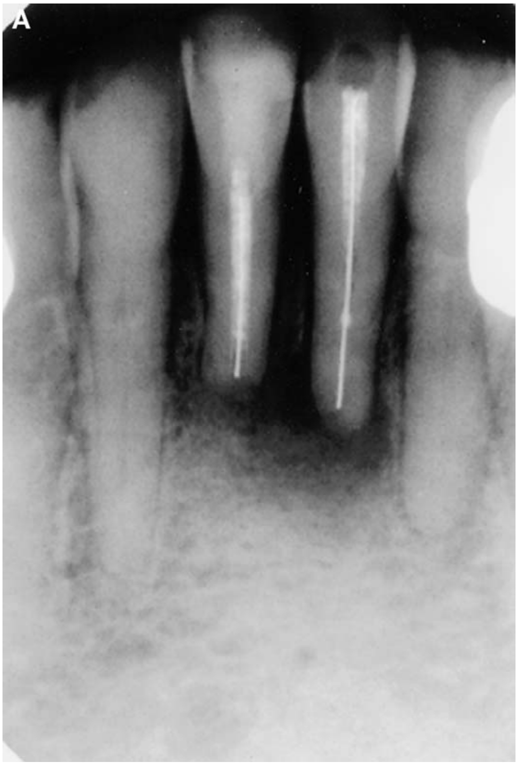


Fig. 8. (*A*) Preoperative radiograph of a root canal failure with silver points. (*B*) Radiograph of one silver point separated in the apical third. (*C*) Use of the twisted Hedstrom technique. (*D*) Radiograph of silver point retrieval. (*E*) Postoperative radiograph.

a fulcrum to elevate the silver point out of the canal. Too often, the operator will pull straight upward to mimic a post removal and the silver cone disarticulates into the canal, resulting in unforeseen complications [5,16,27]. If the silver point has tension and resistance, then the use of ultrasonics on the forceps for an indirect vibration can help to loosen the point and remove the obstruction. Placement of ultrasonics directly on a silver cone will disintegrate the material, and should be avoided [5,16,27,45].

When the obstructed silver point fractures, the object must be located with an exposed radiograph and bypassed with K-type files. Use of small-diameter 08 and 10 files along with a chelating agent will assist in the task. A radiograph should be exposed once the terminus has been negotiated. Upon negotiation of the apical foramen, sequential enlargement of the canal wall is obtained. The operator must increase the size of the canal until it is possible to bypass the impediment with Hedstrom files on two to three sides. Twisting the handles, as well as the positive rake angles of the instrument, will make it easier to grasp the obstruction from the canal [5]. A hemostat can be used to grasp the file handle. A cotton roll is then positioned for

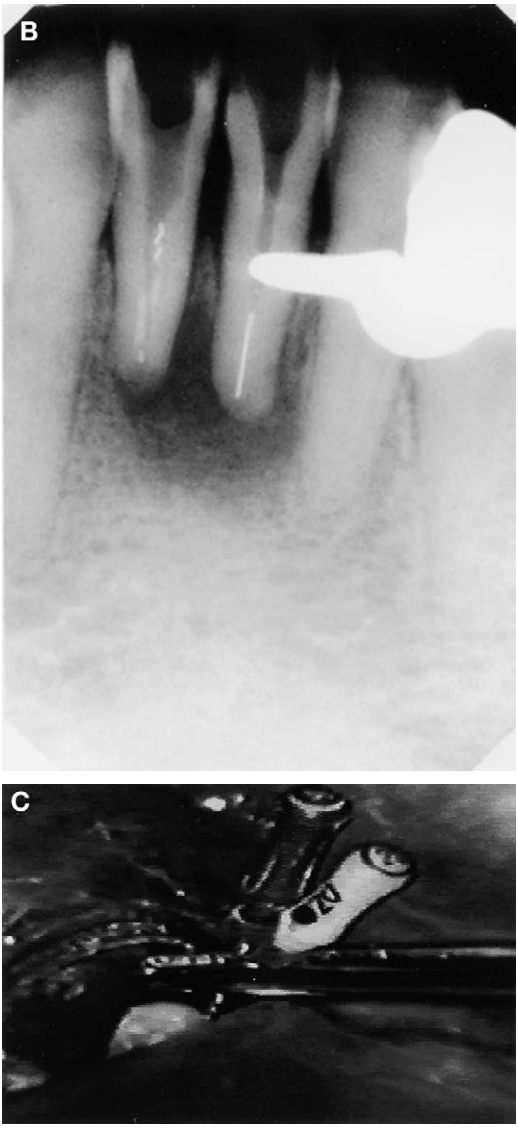


Fig. 8 (*continued*)

leverage and the hemostat is rotated over it to remove the silver point. Another radiograph is exposed to ensure that the obstructed filling material was removed (Fig. 8).

When an object cannot be bypassed or the silver point demonstrates a larger diameter, then extracting devices such as the post removal systems or the Endo Extractor Kit (Kerr Corp., Glendale, California) can be used

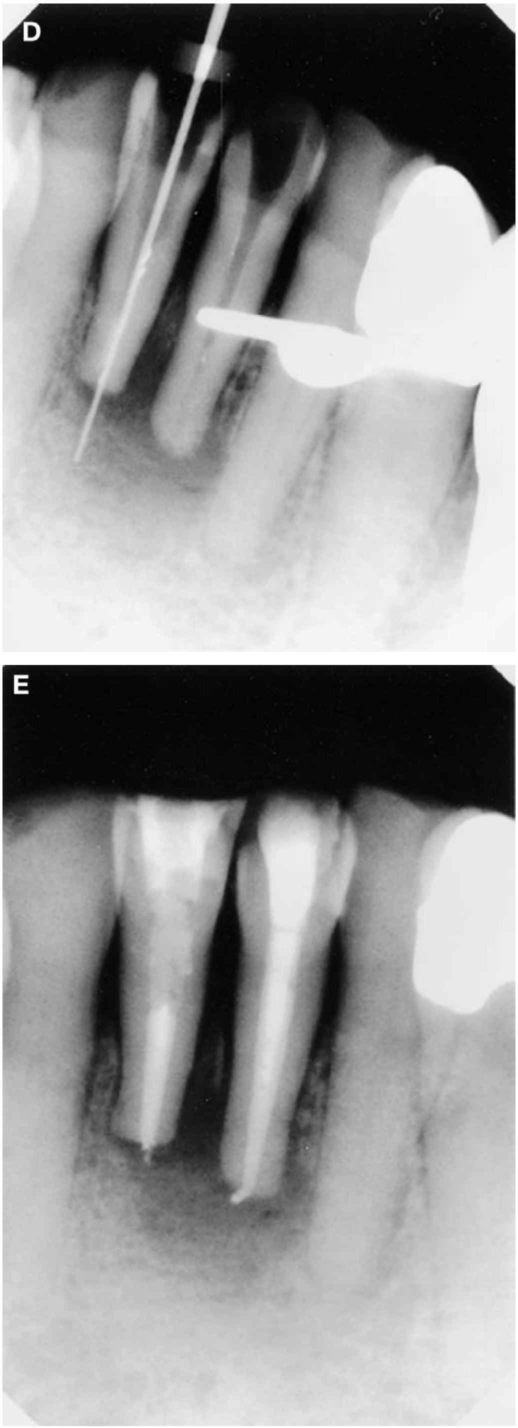


Fig. 8 (*continued*)

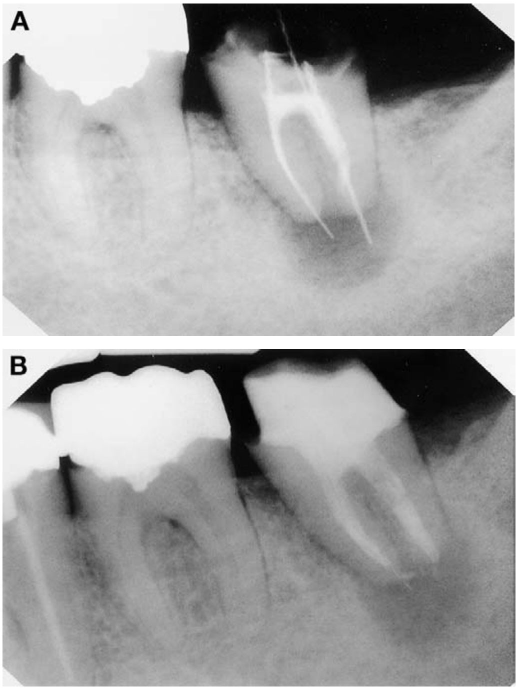


Fig. 9. (*A*) Preoperative radiograph of failing endodontic treatment with Thermafil. (*B*) Successful retreatment of the case using indirect ultrasonic vibration to remove the metal cores.

[43]. The Endo Extractor Kit has four trephine burs that correlate to files with different diameter sizes. The use of cyanoacrylate adhesives aids in the adhesion of the silver point to the extractor. Silver points are soft and can erode with mechanical manipulation from trephine burs. Therefore, choosing the exact trephine is extremely important. The trephine bur removes approximately 3 mm of surrounding dentin. An extractor with adhesive in the cannula is selected and placed over the object. After the adhesives are set, the extractor is checked for resistance; ultrasonic vibration can ensure the removal of the obstruction, as discussed earlier.

Thermafil obturators (Dentsply, Tulsa Dental, Tulsa, Oklahoma) are either metal or plastic carriers of gutta-percha. Carrier-based obturators originally were designed with metal carriers [62]. The manufacturer has since changed the carrier to plastic, which, unfortunately, is more difficult to remove. Occasionally, in a few number of cases, a metal obturator will present itself as the original obturation material. The metal obturator has cutting flutes that entangle the surrounding gutta-percha and make it more difficult to retrieve and remove the obstacle [62]. The rake angles also will present a problem with retrieval as they can engage the dentinal wall [5]. The coronal portion of the canal and obturator should be accessed using the post-removal techniques described above. The metal obturator can be grasped with a forceps similar to the silver cone removal technique mentioned above. By emplying the fulcrum and leverage technique, the file can be removed readily [63]. Direct or indirect use of ultrasonics can loosen the metal carrier from the canal wall and gutta-percha, to facilitate removal as well (Fig. 9). In addition, applying heat to the metal framework can dissolve the gutta-percha. The plastic obturator can be removed forcefully without removal of the gutta-percha mass surrounding it. Plastic obturators, like silver points, will erode with the use of ultrasonic vibration. Furthermore, the use of heat will melt the plastic, creating further difficulties in retrieval of the obstacle. Solvents can be used to remove coronal gutta-percha and bypassing with hand files can loosen the obstruction for both the metal and plastic carriers [5,64]. Once the carrier is loosened, removal with twisted Hedstrom files can be accomplished. Another technique uses heated Hedstrom files and insertion directly into the plastic carrier. The clinician places two to three Hedstrom files into the core of the carrier and waits for them to cool. The heated files penetrate the plastic and, after they cool, the plastic—which becomes welded to the files—can be removed with ease using the fulcrum technique and forceps. Nickel-titanium rotary instruments can also be used in the removal of plastic carrier-based systems. Upon removal of the carrier and gutta-percha, routine conventional retreatment can ensue.

Summary

Technologic advancements in dentistry and specifically endodontics have vastly improved the quality of care rendered to patients. These advancements allow clinicians to gain insight into the retreatment of failing root canals. Due to training, practice, and patience, clinicians can expand their capabilities alongside of these technologic advancements to perform endodontic retreatments with increased success.

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