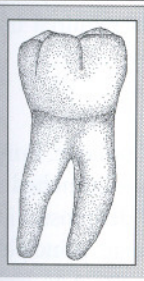
CHAPTER 1



BASIS FOR SUCCESSFUL ENDODONTICS

CHAPTER OUTLINE

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- Effect of Hunter's address
- Early use of x rays
- Reacceptance of endodontics

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- Importance of debridement
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Role of endodontics in reconstructive dentistry
- Preserving teeth after reshaping of crown contours
- Accommodating an attachment, or key and keyway
- Anticipating the possibility of future pulpal damage
- Utilizing bicuspidized and amputated teeth

Role of endodontics in prosthetic dentistry
- Limiting the number of teeth in the removable partial denture
- Allowing for retention of teeth with greater bulk as abutments
- Avoiding free-end saddles
- Providing for splinted multiple abutments
- Accommodating an attachment, or key and keyway
- Retaining alveolar bone
- Avoiding a full denture

As dentists became increasingly aware that natural teeth function more efficiently than any replacement, they found it worth additional effort to retain pulpally involved teeth. In the practice of dentistry the role of endodontics has greatly broadened in scope in the past 40 years. Although many factors are responsible, the most important reason behind this growth is the extremely high predictability of endodontic success.

Recent studies, compiling records of patients treated in dental schools and by general practitioners, indicate that 95% success is obtainable in endodontics. Increased experience, continued professional study, and training at the postgraduate level may further enhance this success ratio. Despite their recent popularity, implants do not approach this percentage.

Acceptance and the high predictability of endodontic therapy are often taken for granted by both practitioners and patients. To help one appreciate more fully the circumstances surrounding and the effort that has gone into the art and science of endodontics, a brief history will be presented.

HISTORY OF ENDODONTICS

Effect of Hunter's Address

After the turn of the twentieth century, the finger of scorn and ridicule was pointed at the treated tooth, and routine extraction of such teeth was advocated in both dental and medical journals. The lowest point in the history of endodontics occurred shortly after an address by William Hunter, an English physician, at McGill University in 1910 on "The Role of Sepsis and Antisepsis in Medicine." Much of his subject matter came from an earlier, relatively unnoticed paper by W.D. Miller, who in 1891 had expounded the intimate relationship between the dental and medical professions. Hunter vehemently criticized the prosthetic dentistry of the United States in particular, asserting that gold fillings, caps, bridges, and dentures were being built around and upon islets of frank infection and that, instead of eliminating sepsis, these restorations were responsible for its perpetuation.

Hunter was really speaking of periodontal rather than periapical disease and even suggested scaling and debridement procedures that would be readily accepted by the periodontists of today as potential solutions to the problem. Despite the many hazards restricting their efforts, a number of dentists of that time were able to perform a high caliber of endodontic therapy. Without radiographic and bacteriologic control, however, a considerable number of endodontic cases ended in failure. Dentists who disagreed with the philosophy of endodontics or were unwilling to spend the greater time required for therapy (as compared with extraction) eagerly publicized the failures. Billings and Rosenow applied Hunter's views to the pulpless tooth, and their animal experiments indicated a definite relationship between periapical and systemic disease.

Early Use of X Rays

Rhein soon adopted the roentgen ray for endodontic use to determine canal length and degree of filling. These initial radiographs were used by some as adjuncts to treatment, but they were used by others to evaluate previous therapy performed without such help. Even when x-ray guidance is coupled with present advanced knowledge, some cases are difficult to treat. Endodontic therapy performed in the nineteenth and early twentieth centuries without radiographs or the knowledge of bacteriology, and later evaluated by x-ray studies, was determined, in general, to be an abysmal failure. Rather than recognize the limitations that had forced earlier workers to have so many failures and attempt to organize a regimen that would increase chances for success, members of the health professions demanded extraction of pulpless teeth for their patients and, in fact, full-mouth extractions for patients with chronic diseases.

Not desiring criticism from physicians and happy to take the easier way out that tooth removal afforded, dentists subscribed to wanton extraction in preference to endodontic or periodontal therapy. The net result left many persons with impaired nutrition because they were unable to masticate properly certain foods required in a balanced diet.

Reacceptance of Endodontics

Fortunately some pioneer endodontists—Coolidge, Prinz, Sharp, Blayney, Appleton, and others—launched a counterattack against the extractionists. By demonstration of successful cases based on sound biologic principles, these men illustrated methods by which strategic teeth could be saved without any danger to the patient's health—in fact, with improvement in health.

By the late 1930s the corner had been turned in endodontics, and treatment of the pulpless tooth had become an integral part of dentistry. Continued research on a clinical and laboratory basis developed techniques, methods of evaluation, and selection of materials to further increase the success ratio. The American Association of Endodontists was formed to disseminate interest and develop increased skill in the area. Under the direction of Dr. Louis Grossman of Philadelphia, international conferences on endodontics were held where interested persons from all over the world met and discussed mutual problems.

PRINCIPLES OF ENDODONTIC THERAPY

The results of these organizations and efforts by the pioneers of the field led to the development of basic principles of endodontic practice. Because research and clinical analysis have caused elimination or alteration of some earlier guidelines, I want to enumerate the principles and philosophies that are the basis for this text.

Objective

The objective of endodontic therapy is restoration of the treated tooth to its proper form and function in the masticatory apparatus, in a healthy state.

Dentists must realize that initiation of endodontic therapy for a patient would not be a responsibility taken lightly. Although those who in the past decried endodontic treatment as a significant health hazard were surely incorrect in their basic premise, improper therapy may have a negative effect on a patient's systemic condition. By the same token, proper endodontic treatment may alleviate a systemic condition not thought to be related to a dental problem. Figure 1-1 illustrates such a situation.

Basic Phases of Therapy

There are three basic phases in endodontic treatment. First is the diagnostic phase, in which the disease to be treated is determined and the treatment plan developed. Second is the preparatory phase, when the contents of the

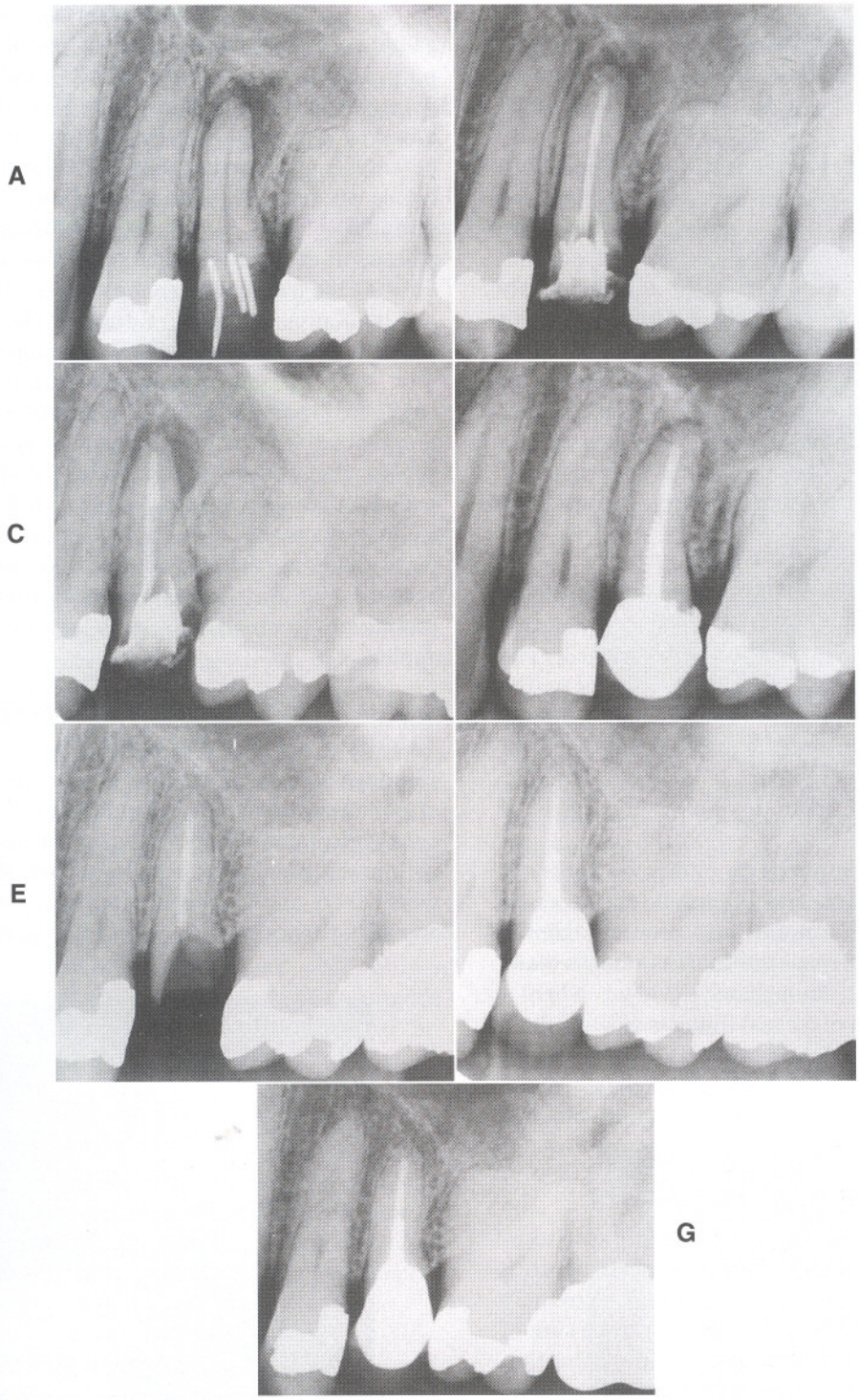


FIGURE 1-1 Patient who had been under treatment by otolaryngologist for recurrent maxillary left sinusitis for over 1 year. **A,** Preoperative film, straight view, indicating periapical lesion extending from second bicuspid and eroding the floor of the left maxillary sinus. **B,** Immediate postoperative film, straight view. C, Angled view from the distal. As soon as the canals were prepared (Type II canal system), the sinusitis stopped. Canals were filled with laterally condensed gutta-percha and Wach's paste sealer. **D,** One year later, lesion had decreased in size considerably. **E,** Three years after original treatment, the crown and post had been dislodged. The entire wall of the sinus adjacent to the treated tooth had been reconstituted, according to the radiograph. **F,** Five years after original treatment; compare to **A. G,** Twelve years after original treatment, still perfect healing. (Restoration by Dr. James Discipio, Berwyn, Ill.)

root canal are removed and the canal prepared for the filling material. The third phase involves the filling or obliteration of the canal to gain a hermetic seal with an inert material as close as possible to the cementodentinal junction.

Endodontic therapy may be thought of as a tripod, with the perfectly treated tooth on a pedestal and every leg representing a basic phase. If any leg is faulty, the entire system may fail. Although every leg is a separate portion, in the overall situation each phase must be meticulously carried out to obtain success. Every facet of treatment must be performed in a predetermined manner, with every step having its definite position in the series of procedures. Therefore much of this book, as well as other clinically oriented endodontic literature, is presented in a carefully outlined form to emphasize the importance of following the same step-by-step procedure for every case.

Importance of Debridement

Endodontic therapy is essentially a debridement procedure that requires the removal of the irritants of the canal and periapical tissue if success is to be gained. The debridement may be carried out in various ways as the case demands and may include instrumentation of the canal, placement of medicaments and irrigants, and, in some cases, surgery. No cases lend themselves to successful treatment without a significant degree of debridement.

From time to time emphasis in clinics or papers is given to various methods of canal filling, and the necessity for correct debridement is not always properly emphasized. Although preparation of the canal is often tedious and its results are not immediately evident when a postoperative radiograph of a canal filling is viewed, there is no doubt that canal debridement is of paramount importance. When a canal is properly prepared, any of the accepted methods of filling will almost certainly produce a successful result.

Use of the Rubber Dam Mandatory

As complex dentistry has developed, with restorative techniques utilizing telescopes, splints, superstructures, copings, etc., endodontic access is often extremely difficult. For this reason it is frequently best to be sure of proper access to the canal before rubber dam application so that the surrounding structures may be used as a guide. However, once access is obtained, the rubber dam should be placed immediately and under no circumstances should an enlarging instrument be used without its presence. Several excuses are given for avoiding the use of a rubber dam in endodontic therapy, but all are basically procrastinations and easily refutable. Some of the excuses offered are the additional time required for application (rarely more than a few seconds), plans for the tooth to be left open anyway, and lack of supragingival tooth structure (a crown-lengthening procedure may be performed).

The original use of the rubber dam was to aid in the gaining of an aseptic environment, and this is still a major purpose. Of equal importance is confinement of the irrigants, most of which are distasteful. The greatest need, however, is to prevent the aspiration of an instrument, a potentially grave matter. The mental anguish experienced by the dentist guilty of such an incident, plus the current attitudes of the courts in such matters, makes the placement of a rubber dam an extremely small premium for the excellent insurance it provides (Figure 1-2).

The Kansas Supreme Court ruled that the general dentist performing endodontic treatment on a patient must apply the same precautions during therapy as those employed by an endodontic specialist. There is no question that whereas many general dentists do not utilize the rubber dam during endodontic therapy, virtually all endodontists keep the dam in place. If a patient aspirates an instrument because of the failure of the dentist to place the dam, the practitioner is considered negligent, according to the Kansas Supreme Court, because the precautions normally taken by the specialist were not applied.

Great Respect Due the Periapical Tissue During Treatment

Although some techniques advocate intentional irritation of periapical tissue, many studies have indicated that all enlargement and filling procedures should be carried out within the canal. These studies have shown that even where there are large radiolucencies, when debridement and filling are carried out within the confines of the canal,

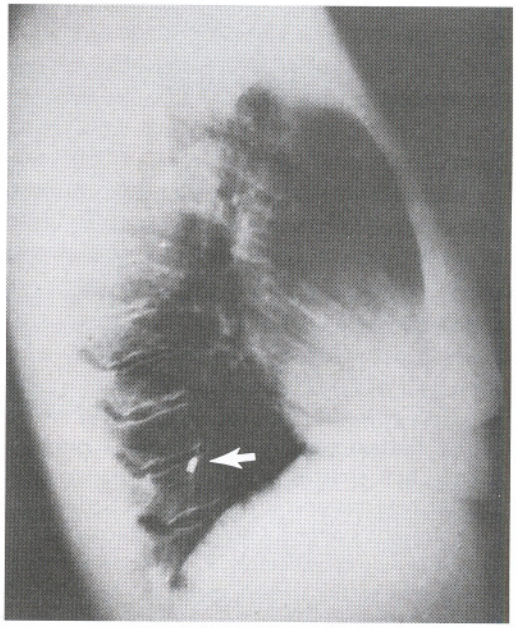


FIGURE 1-2 Chest x-ray film showing aspirated file *(arrow)* in bronchial tree. Rubber dam was not used because dentist intended to leave the tooth open. (Courtesy Dr. Paul Hoffer, University of Chicago Hospitals.)

healing will take place in most cases without surgery. Overinstrumentation is the most frequent cause of postoperative pain. Because the dentist should always be concerned with the elimination or reduction of pain, an accurate determination of canal length must be made and strictly adhered to during the enlargement and filling procedures. Proper treatment of periapical tissues also means that caustic drugs should not be used as medicaments.

Even though endodontic therapy involves working within the tooth, it is the surrounding structures and their response that determine success or failure.

Proper Restoration the Culmination of Success

Sufficient confidence is warranted in the endodontic result to insist that a proper restoration be placed on the treated tooth as soon as possible. Nothing is more disheartening than to see a well-treated tooth require extraction because of fracture following the placement of a restoration that does not afford cuspal coverage. Equally discouraging is a fracture or secondary caries that develop when the posttreatment temporary filling is retained for an extended period to see if success has been gained (Figure 1-3). A greater number of endodontically treated teeth are lost because of fracture due to improper restorations than because of poor endodontic result. Proper restoration of the treated tooth is an integral part of therapy and must be explained to the patient as a part of the treatment plan.

Other discouraging situations transpire when the restorative dentist places an inadequate or improper crown, onlay, or amalgam restoration; fails to provide cuspal protection when needed; or fabricates an inadequate or damaging post/core system.

Postoperative Observation Necessary

Despite the high degree of success, some failures will occur. Some of these may be successfully re-treated, and many will heal after surgery. Unless the patient is impressed with the necessity for recall, some of the initial failures that can be reversed will not be intercepted in time.

Case Presentation to Set the Stage

A case presentation should be given to each patient for any phase of dental treatment, whether the treatment needed is only an oral prophylaxis or encompasses a full-mouth reconstruction. If endodontic procedures are required in an overall treatment plan, the reasons for such therapy should be explained. At the time that the endodontic portion is to be commenced, a further examination should be given. Case presentation for endodontics should briefly explain the responsibilities of the patient and the dentist, the time involved, the prognosis, and the fee (including restoration). Most patients prefer a brief

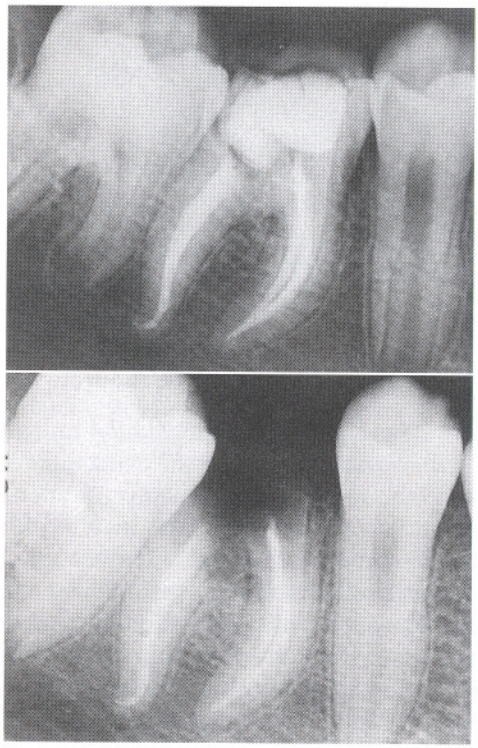


FIGURE 1-3 **A,** Immediate postoperative film of mandibular first molar, slight angle from the mesial, in 14-year-old patient. The case was quite difficult due to the extreme curvature of the distal root, but the result was excellent. Canals were filled with laterally condensed gutta-percha and Wach's paste sealer. **B,** Eighteen months later, no permanent restoration had been placed, and decay had passed through the furcation. Despite the excellent treatment, the tooth was lost. Note the mesial tipping of the second molar is already present.

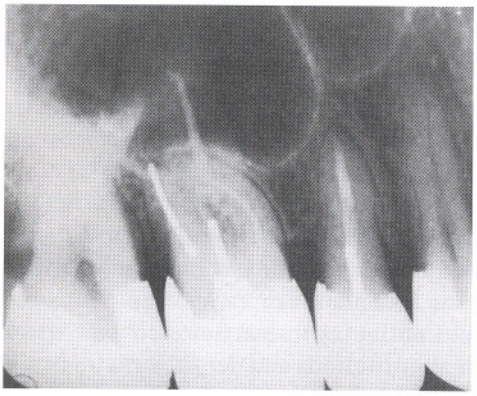


FIGURE 1-4 Four-year postoperative radiograph shows maxillary first molar with normal radiographic appearance. File was broken in mesiobuccal canal; however, because the tooth was asymptomatic with normal periapical tissue before treatment, the case was completed. Canal had been enlarged to size 25 before accident, and file is very close to apical foramen. (Restorations by Dr. Rod Nystul, formerly of Park Ridge, Ill.)

description of the phases of therapy, and a suggested method of presentation will be found in Chapter 2.

At times a patient will be seen for the first appointment on an emergency basis when endodontics is required, and a proper case presentation is difficult to perform. Correct procedure then is to make a brief explanation of the need to retain the involved tooth and utilize the available time to ensure the patient has relief from pain. Time should be allowed at the next appointment for the presentation.

INDICATIONS AND CONTRAINDICATIONS

There are few true contraindications to endodontic therapy. Two frequent causes for the extraction of pulpally involved teeth are a patient's inability to afford the fee for endodontic work and a dentist's inability to perform the necessary service adequately. The few true contraindications include insufficient periodontal support, a canal unsuitable for instrumentation or for surgery, a tooth that is not restorable after therapy, the presence of massive resorption, a nonstrategic tooth, or a vertical fracture.

Contraindications

Patient Unable to Afford Fee. The significance of this category is diminishing for two reasons, one economic and one educational. As society increases in affluence and as many employee fringe benefits are extended to include dental treatment, the fee for endodontic care is brought within the reach of a greater portion of the population than ever before. Also, with the dental IQ of the public increasing as a result of hygiene programs in schools, magazine articles, television programs and commercials, and other publicity, more patients are understanding the true value of each tooth as an integral part of the chewing mechanism and are able to realize that retention of the tooth in question is well worth the fee involved. On a purely economic basis, the fee for endodontic therapy plus restoration is usually less than the fee for a replacement by a fixed partial denture, making the retention of the tooth a more reasonable undertaking than its loss and replacement.

Inability of the Dentist. With improved instruments and filling materials, the performance of endodontic therapy has become much easier than it was only a few years ago. Continuing instructional courses are offered by most dental institutions and dental societies in an effort to increase the knowledge and skill of those interested. Many states are now making continuing education courses mandatory for license renewal. The use of extracted teeth for practice in the procedures of endodontic treatment gives excellent exercise in improving technique. For these reasons, the ability of the average dentist to perform routine treatment is enhanced. In addition, there is an excellent geographic distribution of enough specialists and general practitioners with skill in endodontics who are able to retain all but the most complicated cases on a referral basis.

Insufficient Periodontal Support. In evaluating periapical and/or pulpal disease, the practitioner must make a complete periodontal evaluation. Unless sufficient support is present to ensure retention of the tooth, endodontic treatment is contraindicated. Occasionally endodontic treatment is required to retain periodontally questionable teeth, as when an apparent periodontal lesion is caused by pulpal involvement. Further guidance in making this periodontal evaluation will appear in Chapter 2.

Canal Instrumentation Not Practical. This problem may be satisfactorily solved with surgical treatment. Three types of canal conditions are encountered that may contraindicate endodontic therapy.

Instruments broken within the canal can rarely be recovered or bypassed. In a study by Crump and Natkin, there was a relatively good prognosis if the broken instruments were within the apical third of vital teeth with normal periapical tissue (see Figure 1-4).

A second type of inoperable canal occurs when irregular dentinal sclerosis closes portions of the canal so as to make the passage of the smallest enlarging instrument impossible. Because this dystrophic calcification rarely completely obliterates the canal, careful exploring procedures often enable the apex to be reached. If the apex is not attainable, particularly when a periapical radiolucency is present, treatment is contraindicated.

The third type of inoperable canal occurs when the canal anatomy is such that a sharp dilaceration or a series of dilacerations makes enlargement impossible. Recent advances in specialized canal preparation procedures (Chapter 5) have enabled many such teeth that were formerly extracted to be saved.

Interestingly, two of the endodontic contraindications—sharp dilaceration and a calcified canal—frequently lead to the other contraindication mentioned, a broken instrument. In some of these cases the tooth may heal anyway, or it may be saved by surgical intervention; however, when that is impossible or impractical, extraction becomes inevitable.

Nonrestorable Tooth. Because the objective of endodontics is to return the treated tooth to good form and function, it is necessary to place a proper restoration after completion of the root canal filling. The best canal filling is useless if it is impossible to place a restoration. With alveoloplasty, gingivoplasty, improved dowel procedures, and other techniques, many more teeth are now restorable than with the limited techniques that were formerly available; however, some teeth still remain for

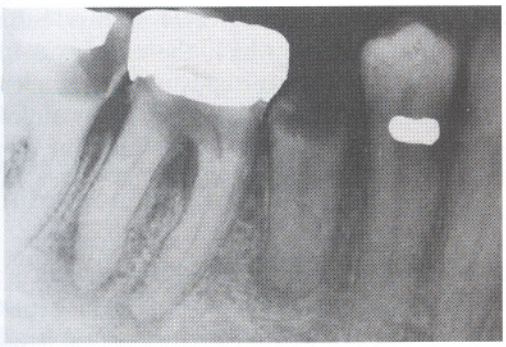


FIGURE 1-5 Severe furcation caries in mandibular first molar and root caries in second bicuspid necessitated extractions.

which proper restoration is not possible. Among these are teeth with severe root caries, furcation caries, poor crown-root ratio, and internally weakened root (Figure 1-5).

Massive Resorption. Resorption may be of either internal or external variety; if the resorption is of extremely large dimension, with perforations, therapy for the tooth is contraindicated. The resorptive process occurs because of phagocytic cells that destroy dentin. Unless all these cells are removed, either by surgery or by intracanal instrumentation, the process will continue. A large resorptive defect that is found on only one portion of the tooth may be surgically (Chapter 9) or nonsurgically (Chapter 14) correctable. Defects that have not perforated may respond to nonsurgical treatment. It is the severe defect involving large portions of the tooth structure that makes successful treatment impractical.

Nonstrategic Tooth. At the time that treatment is considered, a tooth may not appear to have great strategic value. However, before condemnation to extraction, thought should be given to possible future needs for the tooth. A good example for consideration would be an involved third molar in a patient with multiple missing teeth and a high caries incidence. Although the patient still retains other posterior abutments, the tooth probably should be retained if treatable because of possible further tooth loss. On the other hand, a pulpally involved third molar in a patient with full dental complement in a well-cared-for mouth is obviously better extracted than retained.

Vertical Fractures. Vertical fractures through root structure have an almost hopeless prognosis (Figure 1-6). Many exotic treatments have been suggested, including circumferential root wiring, "zipper" amalgam implants, and removal of the smaller fragment. Experience shows, however, that in only the rarest instance does any measure of success result. A related condition that often has symptomatology similar to that of teeth requiring endodontic treatment, but may have a hopeless prognosis, is the cracked-tooth syndrome (Chapter 2).

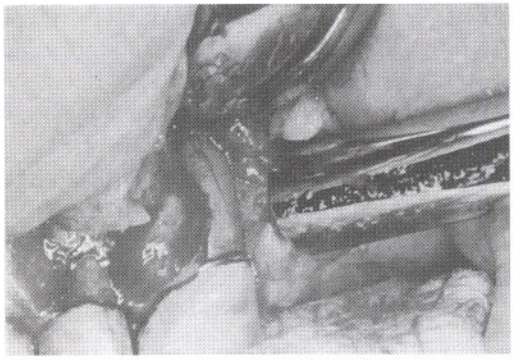


FIGURE 1-6 Vertical fracture of maxillary cuspid. Area did not heal after routine endodontic therapy, and periapical surgery was suggested. When flap was raised, a defect to the apex was seen.

Indications

Any teeth not contraindicated are excellent candidates for successful endodontic therapy. Many of the supposed contraindications of the past have been proved false. These include the presence of severe disease, the number of previously treated teeth, advanced age of the patient, or large size of the radiolucency. A brief discussion of a few of these false contraindications follows. In the presence of serious illnesses (e.g., rheumatic fever, malignancies, coronary artery disease), endodontic treatment is definitely preferable to extraction. Bender and Seltzer have demonstrated that there is a lower incidence of bacteremia after endodontic treatment than after extraction. For patients with heart problems, endodontics requires no alteration of existing anticoagulant administration. Patients with malignancies may be undergoing radiation therapy that makes extraction sites conducive to osteoradionecrosis.

Some time ago it was contended that no patient should have more than five treated teeth and that extraction was indicated for any beyond that number having pulpal involvement. Of all the supposed contraindications to endodontic therapy, this is probably the most ridiculous. Many patients have two or three times that many successfully treated teeth; some reports show patients with all their teeth treated. In fact, if any patient has multiple successful cases, the prognosis for additional teeth is excellent. On the other hand, a patient with a history of endodontic failures should be evaluated cautiously if another tooth requires treatment because this patient may have poor recuperative ability, unusual canal anatomy, or some rarely found condition that militates against successful treatment.

PROGNOSIS FOR ENDODONTIC THERAPY

One of the first questions asked by patients concerning treatment deals with the anticipated degree of success. Endodontics is extremely fortunate in that the degree of

success enjoyed is probably the best found in any phase of dentistry, much higher than that in periodontics and other phases of reconstructive dentistry. This degree of predictability has been the factor most responsible for the acceptance of endodontics by the general practitioner, who is acutely aware that a treated tooth may be counted on to perform any function in the oral cavity that an untreated tooth performs in a tremendous preponderance of cases. Some of the factors that affect prognosis in endodontics will now be discussed.

Studies Dealing with Success Ratios

Many studies have investigated the degree of success in endodontics, using certain variables for comparison. One of the most interesting was reported by Ingle and Beveridge, indicating that undergraduate students at the University of Washington were capable of obtaining 95% success. The significance of this study points out that when a carefully followed course of therapy is instituted, results are strongly in favor of success. Undergraduate students treating their initial cases have close supervision and little opportunity to deviate from predetermined patterns of therapy. The advisability of remaining within a regimen of this type is affirmed by the results.

Strindberg reported on degree of success, basing his criteria on the point to which the canal was filled—whether past the radiographic apex, exactly to it, or short of it. All types, even those teeth grossly overfilled, responded with success more than 90% of the time, although teeth that were filled slightly short of the apex had the highest ratio of success.

Prognosis for Older Patients

The prognosis for older patients is actually better than that for the younger age group on a statistical basis. This is probably because of the tighter apical foramina, lack of completely patent auxiliary canals, dense periapical bone, and because the teeth of patients who have reached advanced age usually are healthier specimens than those of patients whose teeth succumb at earlier ages.

Elderly patients rarely have painful exacerbations during treatment, with a tendency toward a chronic type of problem rather than acute fulmination. This means that intratreatment visits to relieve pain, which disturb the normal day's scheduling of patients, are infrequent. Although healing for older patients might be somewhat retarded, particularly if certain systemic problems are present, in general they heal satisfactorily (Figure 1-7). In

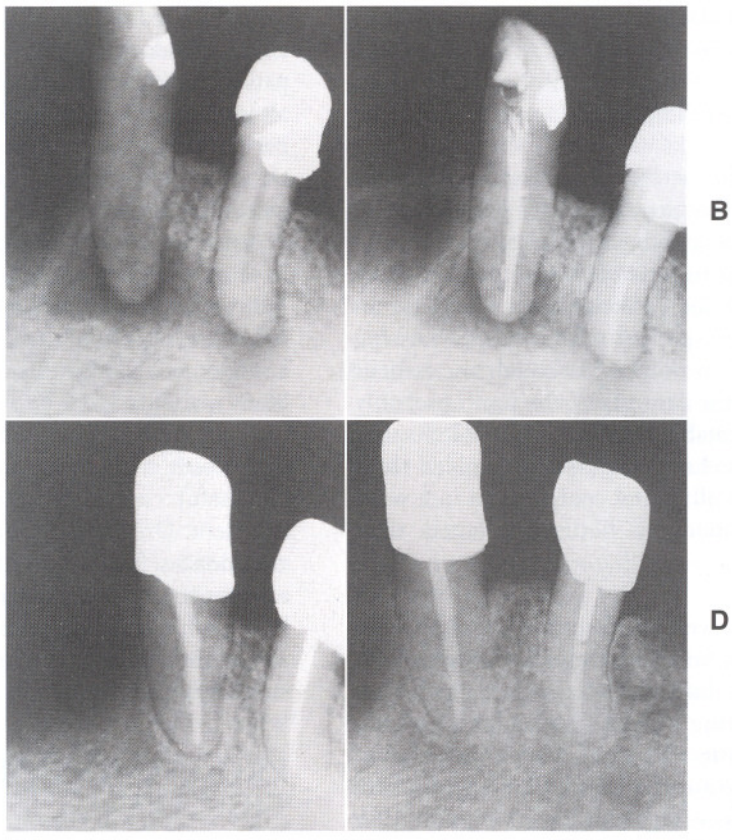


FIGURE 1-7 Healing ability of elderly patients. A, Large periapical lesions around mandibular cuspid and bicuspid of a 73-year-old patient. **B,** Canal fillings with laterally condensed gutta-percha. **C,** Perfect healing 18 months later; teeth are serving as partial denture abutments. **D,** Perfect healing still demonstrated 18 years after original treatment. (Restoration by Dr. Robert Wheeler, Chicago.)

fact, reports of healing in many septuagenarians and octogenarians are included in this text without specific comments because of their good healing potential (see Figs. 11-1 and 11-2, A and B, in particular).

Significance of Large or Long-standing Radiolucencies

Large radiolucencies will usually heal extremely well, often without surgery (Figure 1-8). Studies have been published to indicate that the success ratio for teeth with radiolucencies is lower than that for teeth with normal periapical bone. This is contrary to my clinical observation and certain unpublished findings of groups at Loyola University and Indiana University. Pulpless teeth are usually easier to treat than those that have vital tissue because no anesthetic is required, and the solvents used as intracanal irrigants are not resisted by vital tissue; the necrotic material that remains is highly susceptible to the solvent action.

The longer a periapical lesion is present, the better the chance that it will undergo cystic degeneration and convert from a granuloma, with excellent healing potential, to an apical periodontal cyst. There is considerable evidence that this type of cyst will heal after nonsurgical endodontic treatment, although in some cases surgery does become necessary. Even when a periapical lesion is known to have been present for a long time and there are the classic cystic appearances for a very radiolucent lesion with a sclerotic border, routine treatment should be undertaken with equanimity. An observation period should follow, during which radiographs are taken at 6-month intervals. Generally, healing will occur (Figure 1-9). If the lesion persists or becomes larger, surgery may be performed (see Figure 9-3).

Although the percentage is quite low, in some cases surgery must be utilized in order to achieve a successful result. Many such examples are presented in Chapter 9. Generally, a suitable observation period has indicated lack of healing before any attempt at surgical intervention.

In some instances, however, surgery must be instituted early in the treatment plan. Some radiolucent lesions may exhibit an aggressive or suspicious appearance. In these cases, the canal preparation and filling are performed in a minimal number of appointments. Periapical surgery follows at the same appointment, or at a subsequent sitting soon thereafter, to gain information from the biopsy. Depending upon the histologic diagnosis, the treatment is continued accordingly (Figure 1-10).

The quality of healing of some radiolucencies might surprise even the operator on occasion. Figure 1-11 illustrates a case in which it was not certain if the lesion was of endodontic origin. However, because any subsequent surgery probably would jeopardize the vitality of the involved tooth, the canal was prepared and filled. The result was quite gratifying, but not entirely expected.

Significance of Large, Rapidly Growing Radiolucencies

If large radiolucencies of a long-standing nature have healing ability, what is the reaction to treatment of large, rapidly growing lesions? Rapidly growing lesions that are not of endodontic origin may be very serious, and concern about a malignancy in such instances is justifiable. If, however, the lesion is definitely of endodontic origin, the prognosis is quite good for nonsurgical treatment.

Generally, if a lesion of endodontic origin grows very rapidly, it will heal very rapidly with proper treatment. Figure 1-12 demonstrates such a case, in which a large, diffuse lesion was known to be less than 6 months in development. After correct therapy, it healed perfectly in that amount of time.

Significance of Periodontal Disease

The periodontal condition of the involved tooth has an important bearing on the prognosis. As will be discussed in Chapter 11, necrotic teeth that simulate periodontal disease, but are not in fact periodontally involved, respond well to endodontic therapy. On the other hand, if a periodontal condition is present but untreated on an endodontically involved tooth, the prognosis is poor. Because the periapical area remains within the confines of the periodontal ligament space, the disease process from the periodontal condition will retard or prevent proper healing if endodontic treatment alone is performed.

Reaching the Apex

Ability to reach the apical foramen has definite implications. Because the objective of filling is to seal this foramen, inability to debride and fill this area may alter the prognosis. There are various reasons why an apical foramen may not be reachable, even by the most expert operator. Severe curvatures, broken instruments, miscalculation of canal length, development of ledges, and inadequate instrumentation are among the most common reasons. A preoperative radiograph can often indicate if the apex will be difficult to reach. If so, the patient should be informed about the chance of failure. When the pulp is vital and the periapical tissue normal before treatment, a good prognosis persists even if the root canal filling must be terminated a few millimeters short of the apex.

However, when a preoperative radiolucency is present, unless the apical portion of the canal is reachable with the cleansing instruments and the irritants responsible for apical inflammation can be removed, the prognosis is poor. In these cases, apical surgery should be instituted when possible; otherwise, extraction is necessary.

Many teeth have apical foramina located some distance short of the radiographic apex (Figure 1-13; see also many cases in Chapter 6). Often this is revealed by the preoperative radiograph or by subsequent instrumentation and measurement radiographs. In these cases a favorable

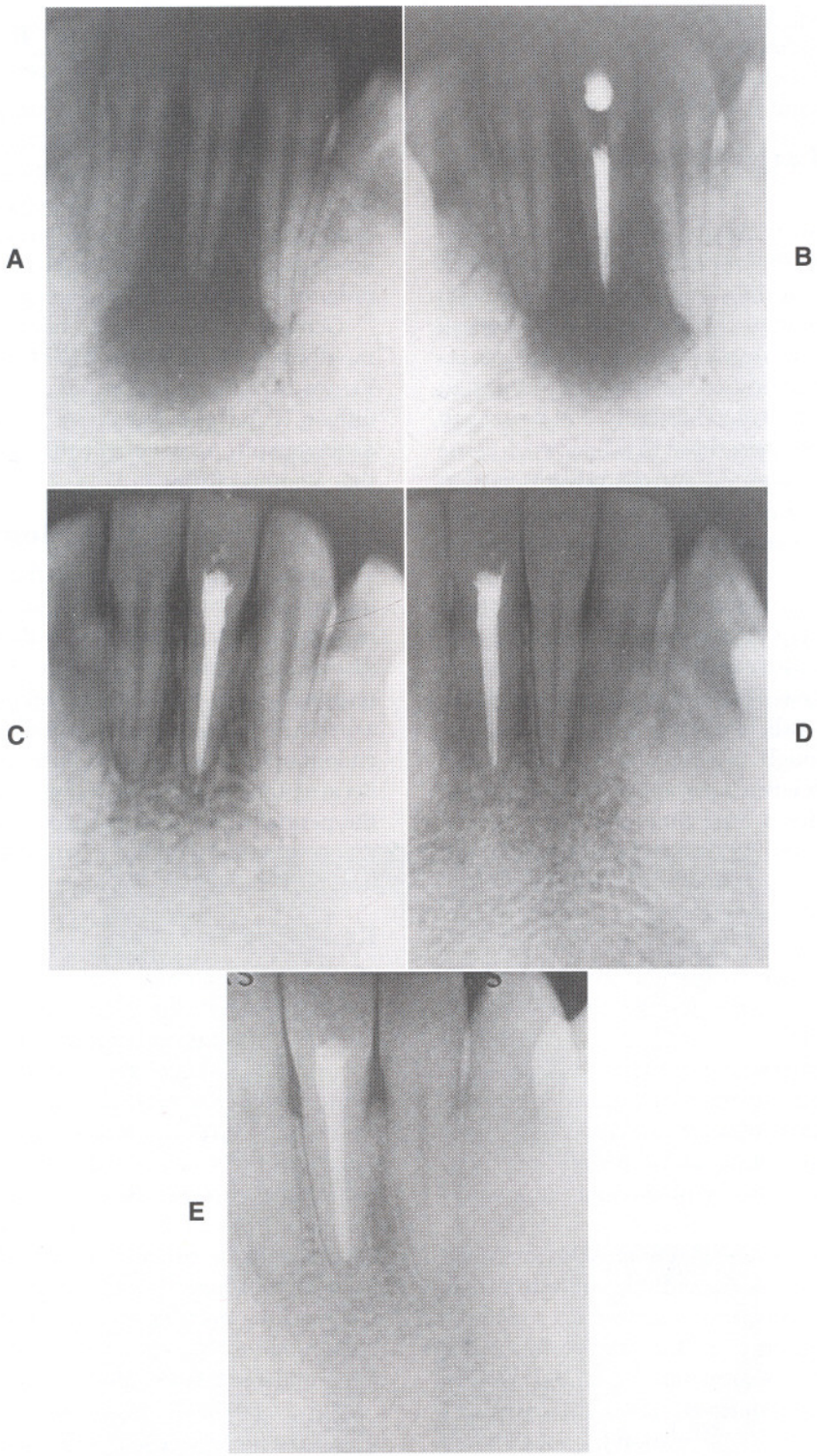


FIGURE 1-8 **A,** Large periapical radiolucency associated with mandibular incisor. **B,** Canal filling with gutta-percha and lateral condensation. No surgery was performed. **C,** Excellent healing after 12 months. **D,** Complete healing at 30 months. Note that canal filling was just short of radiographic apex in **C,** but it now is several millimeters short of radiographic apex, indicating apposition of apical cementum. **E,** View 17 years after original treatment, still perfect healing. (Restoration by Dr. Morton Schreiber, Highland Park, Ill.)

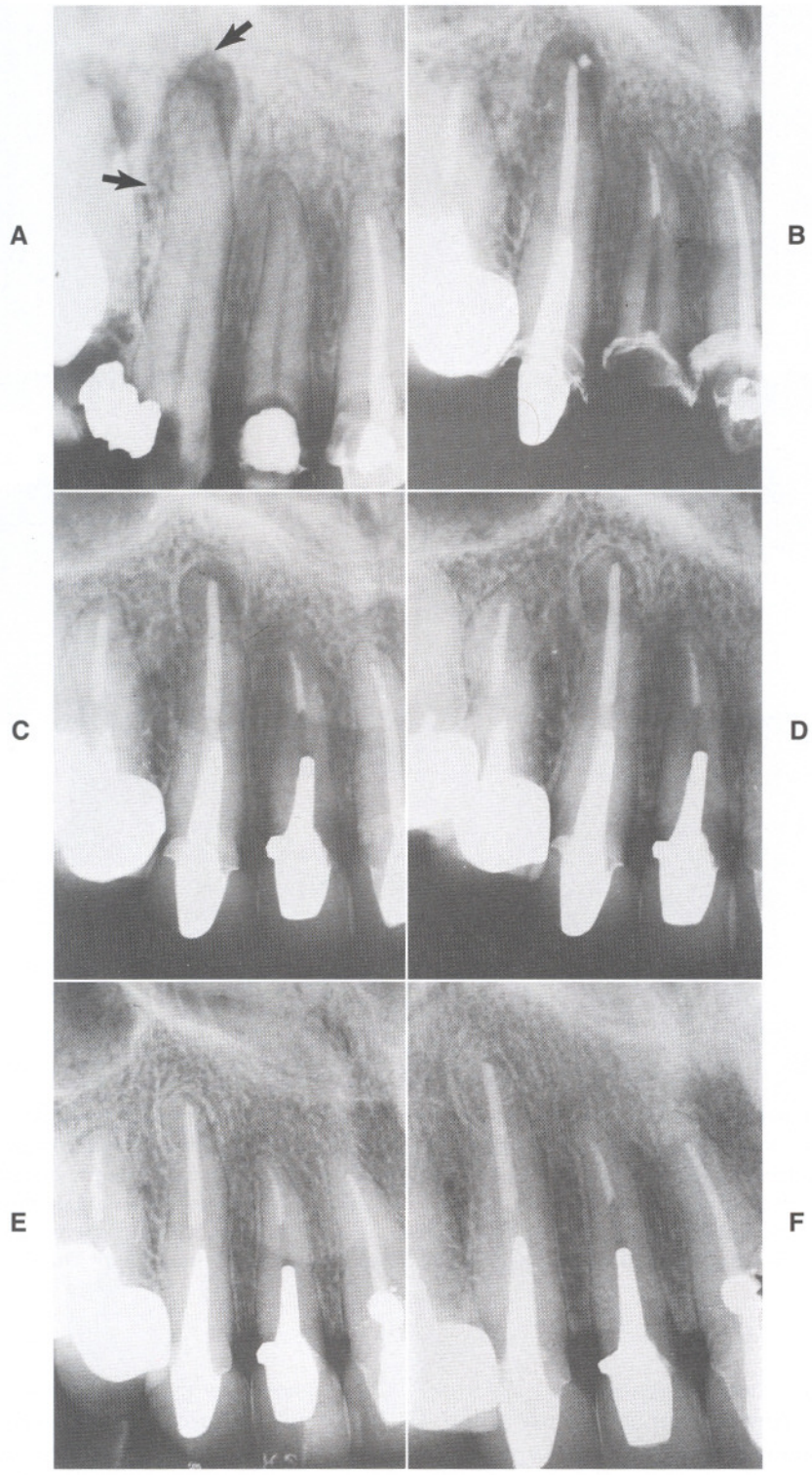


FIGURE 1-9 **A,** Large periapical radiolucency associated with maxillary cuspid. Patient had been aware that the problem was present for several years before treatment. Lesion extended down the labial surface of the root for a considerable distance. Arrows indicate apical and cervical extents of the radiolucency. **B,** Three months after canal filling with gutta-percha and lateral condensation. No surgery was performed. **C,** One year after treatment, area is much smaller. **D,** Excellent healing 2 years after treatment. **E,** Area 14 years after treatment continues to look excellent. **F,** Twenty-three years after original treatment. Periapical lesion completely healed. Also, note canal filling is now several millimeters from the radiographic apex. Compare to **B** and **C,** in which it was flush to the radiographic apex. (Restorations by Dr. Sherwin Laff, Chicago.)

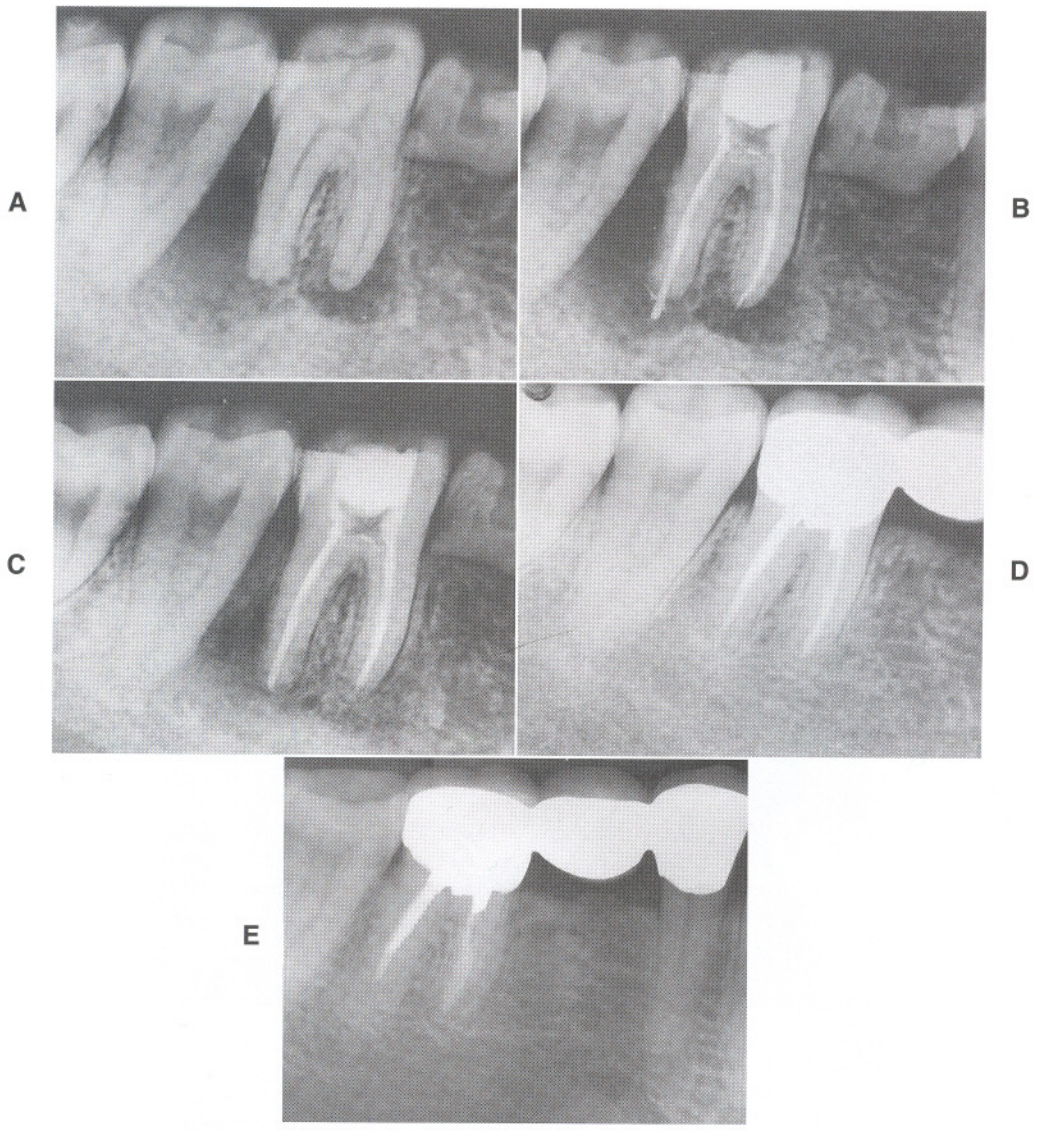


FIGURE 1-10 **A,** Preoperative film of mandibular first molar. The periapical lesion did not appear typical to me, and I was afraid that it was other than purely endodontic in origin, although electric pulp testing gave no response. **B,** Accordingly, the canals were prepared and filled with laterally condensed gutta-percha and Tubliseal, followed by periapical curettage. Biopsy indicated periapical granuloma. **C,** Nine months later, advanced healing is noted. With favorable biopsy report, restoration was undertaken. **D,** Twelve years after original treatment, healing is perfect. The primary molar had loosened and was extracted, with the first molar serving as posterior bridge abutment. **E,** Twenty-eight years after original treatment, entire area looks excellent. (Restoration by Dr. Sherwin Strauss, Chicago.)

prognosis results when the canal is enlarged and filled to the true apical foramen. Any attempt at overinstrumentation to reach the radiographic apex will result in intratreatment pain and a diminished success ratio.

Re-treatment of Failures

Analysis of failures will be discussed further in subsequent chapters, and suggestions will be made concerning re-treating these cases. When a failure by another practitioner makes re-treatment necessary, a careful diagnosis must be performed to ascertain the prognosis. The most common cause of failure is lack of apical seal, which may be diagnosed by radiograph in some instances. Typical of this kind of failure is the extremely short canal filling, the single cone "swimming" in the much larger canal, and the failure to follow root curvature. Another type of failure is seen when a canal has been left unfilled in a multicanaled tooth because it went unnoticed by the previous operator (Chapter 4). When these obvious causes are determined to be present, the prognosis for re-treatment is good.

However, when treatment appears to have been adequate yet unsuccessful, the patient should be warned of the possible need for surgery (if practical) or continued failure (if re-treatment is undertaken).

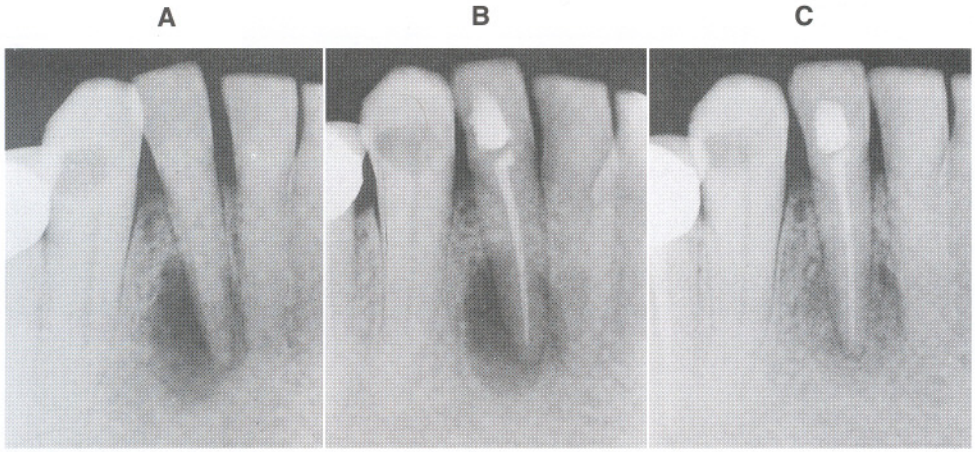


FIGURE 1-11 Unusual healing of periapical lesion and realignment of affected tooth. A, Preoperative film of mandibular lateral incisor area. A large periapical lesion is present that seems to involve the lateral incisor, but no etiology was apparent. The alignment of the tooth was poor, with a large space between it and the adjacent central incisor and overlapping of the cuspid. The patient stated that the tooth had gradually taken this position over the previous several years after being straight originally. Electric pulp testing gave some, but not normal, response. However, it was decided that if surgery were employed to curette the lesion, the vitality of the pulp probably would be compromised, so endodontic therapy was instituted. **B,** After canal preparation and filling with laterally condensed gutta-percha and Wach's paste sealer in two appointments. The tooth was entered originally without anesthetic, but the patient could not tolerate the pain. A local anesthetic was administered, but it was impossible to tell the condition of the pulp upon extirpation. **C,** Eighteen months later, with excellent periapical healing. Even more surprising, the alignment of the tooth is greatly improved.

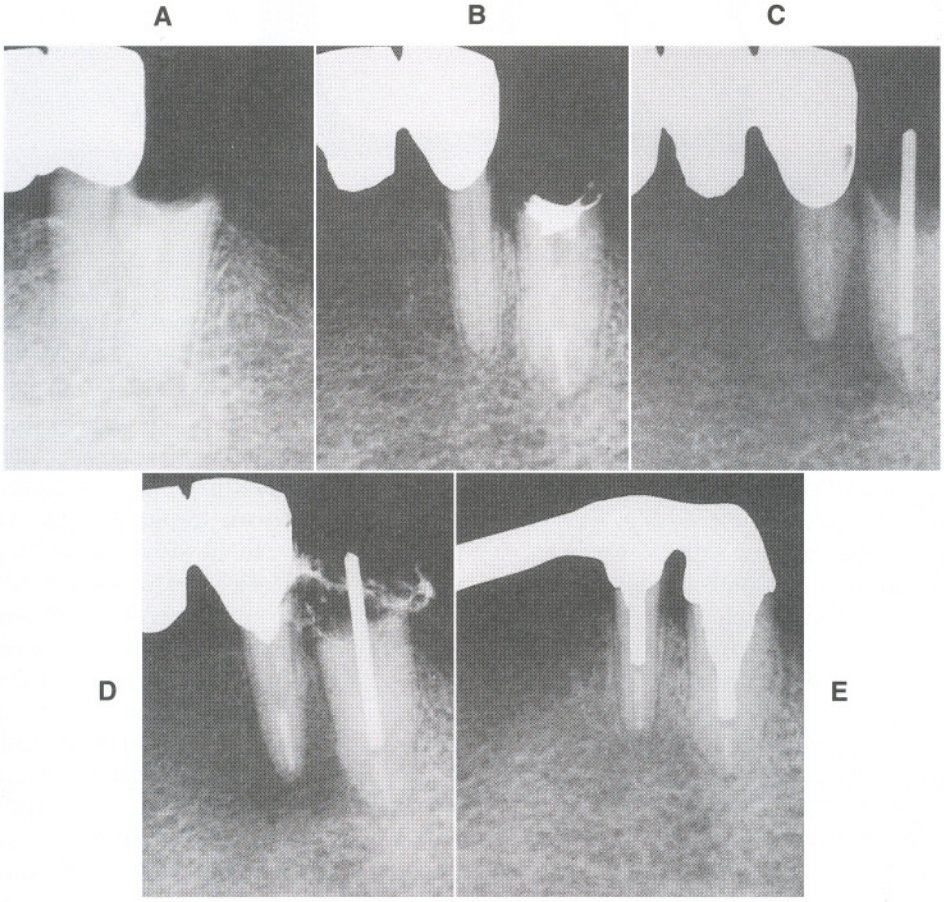


FIGURE 1-12 Healing of a rapidly growing lesion of endodontic origin. A, Preoperative radiograph of mandibular cuspid, obviously requiring endodontic treatment because of massive caries. Deep decay under the adjacent lateral incisor is seen, as well as a failing bridge abutment. **B,** Treatment is completed easily on the cuspid; canal filled with laterally condensed gutta-percha and Wach's paste, with post room prepared. The patient was returned to the restorative dentist to remove the defective bridge and fabricate a temporary bridge. For several reasons, this took almost 6 months to accomplish. **C,** Patient developed a swelling and rushed to the endodontist to treat the lateral incisor. The preoperative film indicated a very large, diffuse radiolucency extending almost to the treated cuspid. **D,** After emergency treatment (Chapter 3), the patient did well and the tooth was completed similarly to the cuspid. **E,** Six months later, a splint has been fashioned over the two treated teeth together with the opposite cuspid to anchor an overdenture. The radiolucency is completely gone; compare to **D.** (Restoration by Dr. Edward LeMire, Chicago.)

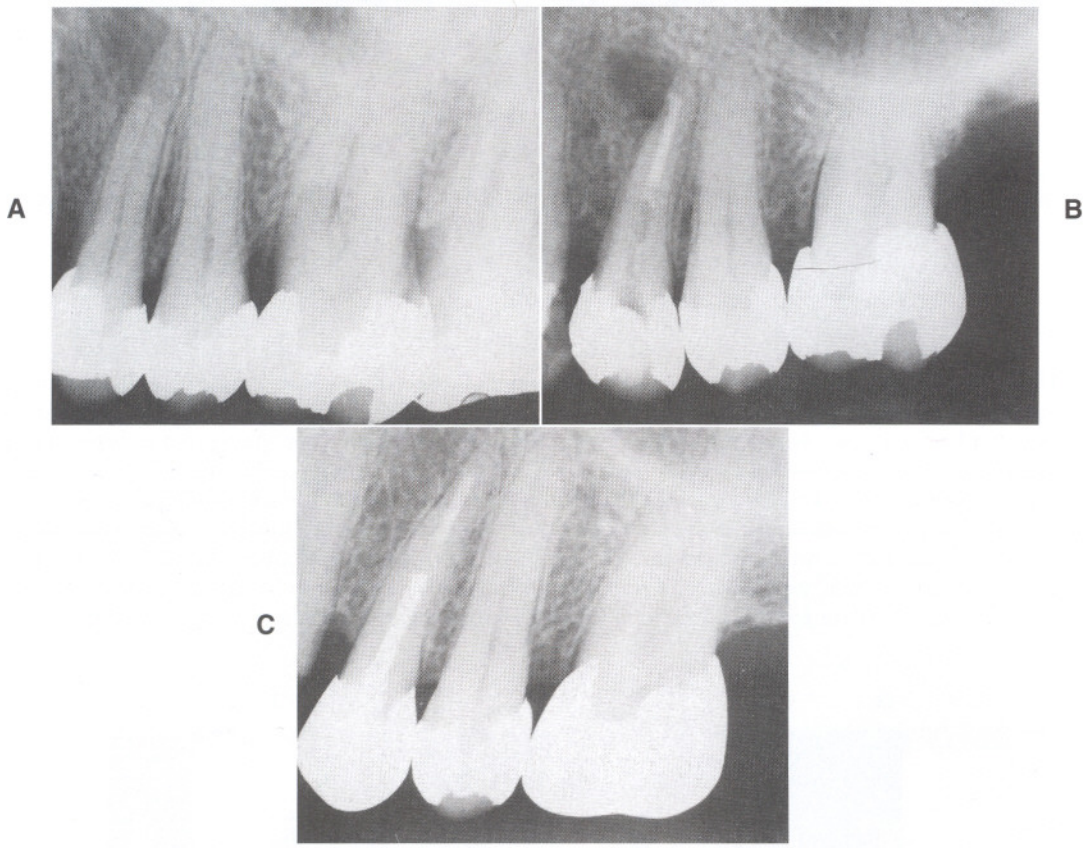


FIGURE 1-13 **A,** Radiolucency on mesial surface of root of maxillary first bicuspid. **B,** Canal filling stops short of radiographic apex, but sealer extrusion seems to indicate exit site of apical foramen. **C,** Radiograph a year later shows complete resolution, indicating that canal was well filled. (Restoration by Dr. Jacob Lippert, formerly of Chicago.)

ROLE OF ENDODONTICS IN RESTORATIVE DENTISTRY

The next segments of this chapter will discuss the role of endodontics in the three major areas of general practice: restorative, reconstructive, and prosthetic dentistry. Many dental practices include all three of these areas as well as other important phases of dentistry, whereas some practices are principally involved in only one of these fields.

The importance of endodontics in any general practice is to be emphasized.

The restorative dentist is principally concerned with the placement of restorations in teeth with carious lesions and the replacement of restorations that show faults due to improper margins, contour, or function. This dentist is additionally interested in replacing missing teeth with bridges of short or medium span and avoiding the use of removable partial dentures.

Sturdevant et al state that the goal of modern operative dentistry is the restoration of proper tooth form, function, and esthetics while maintaining the physiological integrity of the teeth. Without endodontics, this goal becomes extremely difficult to attain in a significant number of patients. Some of the situations in which the use of endodontics is necessary will now be discussed.

Saving the Irreplaceable Tooth

The most posterior tooth in any dental arch cannot be easily replaced with a fixed prosthesis. Cantilever bridges, full-arch splints, and similar prostheses fall into the category of reconstructive rather than restorative dentistry. The most typical case to illustrate the importance of the posterior tooth can be demonstrated by the pulpal or periapical involvement of a mandibular second molar. Unless this tooth is retained by endodontic intervention (Figure 1-14), supereruption of the maxillary second molar may occur and cause the extraction of that tooth as well.

In some patients a second molar already may be missing and the first molar involved. Unless this tooth is retained, fixed replacement becomes extremely difficult, and a removable partial denture is usually indicated.

If a single irreplaceable tooth is important to save, two irreplaceable teeth are twice as important to save, as demonstrated in Figure 1-15, involving two maxillary molars. When two teeth are involved, treatment of both should be attempted rather than deciding which tooth would be better, then treating that one and extracting the other. If, from a financial standpoint or for another acceptable reason, only one may be saved, it is best to initiate treatment for both, ensure that at least one is salvageable,

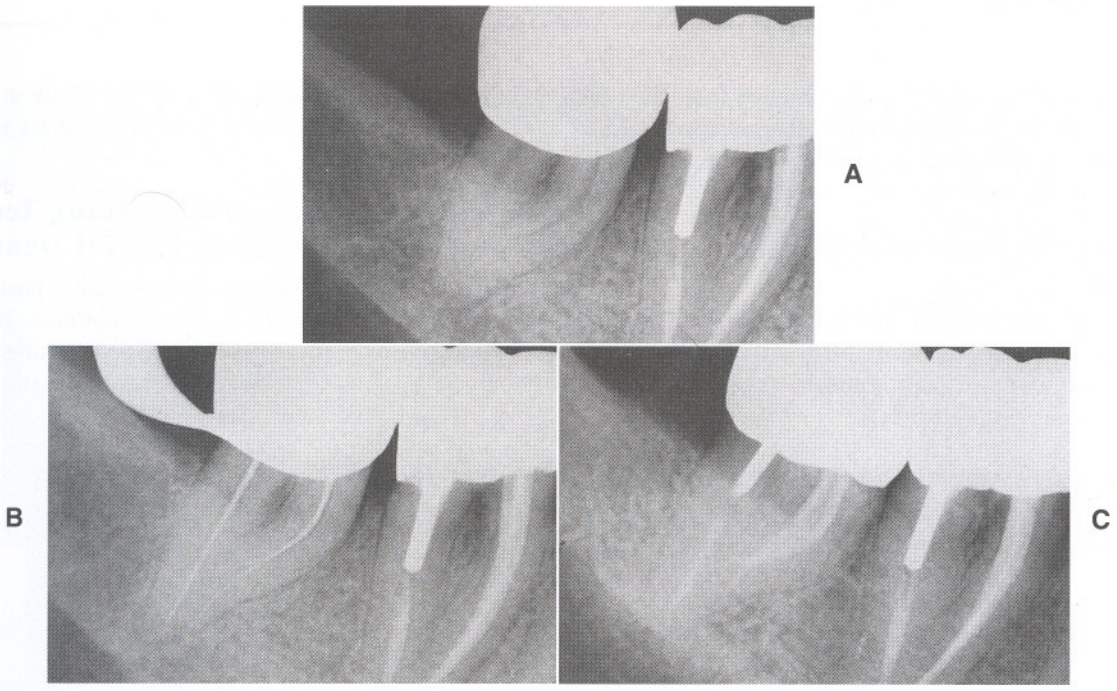


FIGURE 1-14 Endodontic treatment to retain the irreplaceable tooth. A, Mandibular second molar, tender to percussion and temperature changes, requiring endodontic therapy. **B,** Case is quite difficult due to curvature of the mesial canals; however, because the tooth is irreplaceable, therapy is continued. **C,** Three years later, tooth is symptom free and a desirable result is assured. (Restoration by Dr. Steve Labkon, Kenilworth, Ill.)

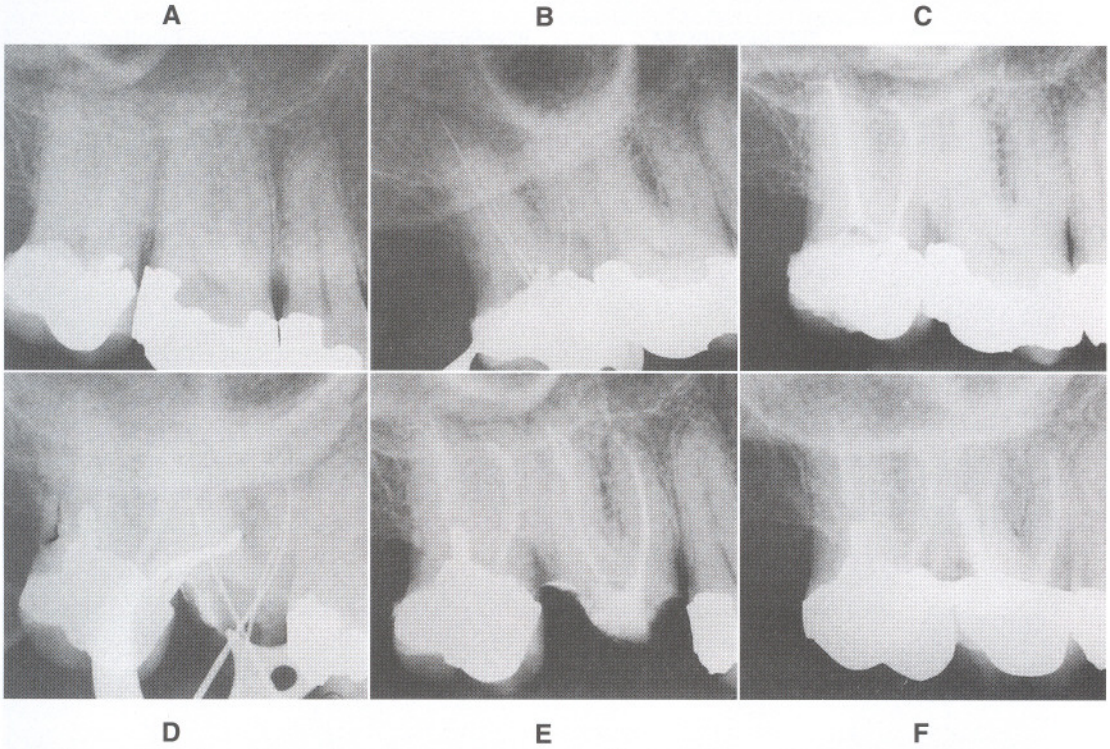


FIGURE 1-15 Saving two irreplaceable teeth. A, Preoperative radiograph of maxillary molar area. A porcelain fused to metal crown is present, but the patient reported that the dentist had placed a pulp capping over the exposed pulp (note area distal to the pulp horns). Pain became severe after the crown was seated. **B,** Initial files in place. **C,** Completion of treatment with filling of laterally condensed gutta-percha and Wach's paste. **D,** Several years later at a checkup appointment for the second molar, the patient complained of tenderness to percussion in the area, thinking that it was the treated tooth. A periapical radiolucency was noted on the mesiobuccal root of the first molar, and that tooth, not the second molar, responded to percussion. Accordingly, the first molar was treated. Files in place indicated two canals in a Type II configuration (Chapter 4) in the mesiobuccal root. **E,** The tooth was completed with laterally condensed gutta-percha and Wach's paste, with post room prepared. **F,** Twelve years after treatment of the first molar, 14 years after completion of the second molar. The filling of the mesiobuccal root of the first molar now appears to be 2 mm short of the radiographic apex, although it was flush in **E.** Nineteen years later radiolucency has healed, and both teeth look excellent. (Restoration by Dr. Peter Feimer, Chicago.)

and then make a choice. If one is extracted first, the one retained may prove to be untreatable or unrestorable, and the other, already extracted tooth has been wasted. In this scenario, nothing is left.

Retaining the Posterior Bridge Abutment

One of the most important indications for endodontic treatment is a pulpally involved molar with an edentulous space anterior to it. If such a tooth is lost, the entire segment becomes edentulous, with no posterior abutment for a fixed partial denture available. Only a removable partial prosthesis can then be used to replace the missing teeth (Figure 1-16).

Preserving Enough Remaining Teeth for Use with a Fixed Partial Denture

In addition to the absence of an abutment posterior to an edentulous area, removable partial dentures are indicated when the ratio between the number of missing teeth in an arch and the number of retained teeth in the same arch approaches one to one (Figure 1-17).

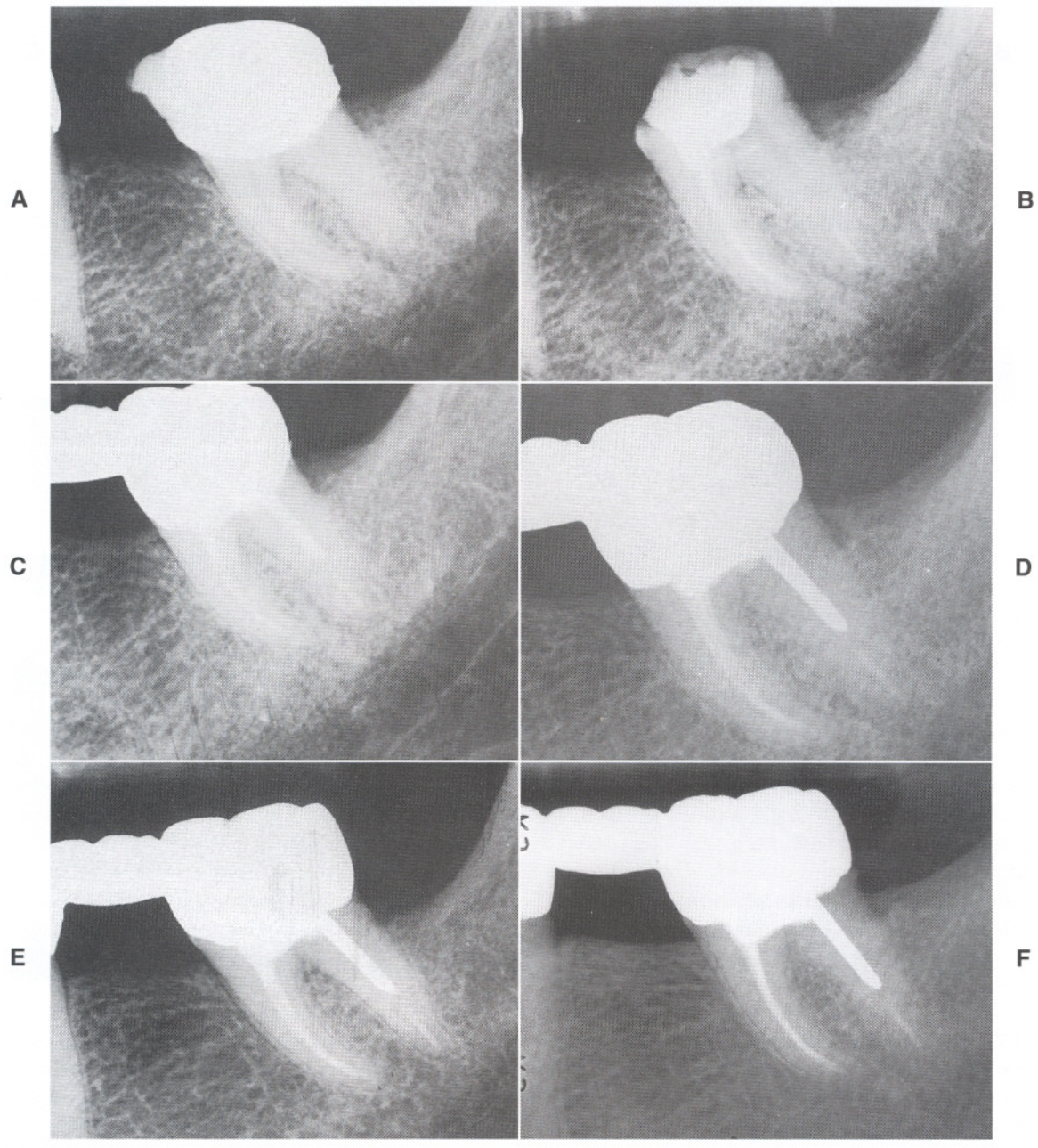


FIGURE 1-16 Endodontic treatment to retain a posterior bridge abutment and avoid a removable partial denture. A, Pulpally involved mandibular second molar. **B,** Canals filled with gutta-percha, with post room provided. **C,** Four years after treatment, treated tooth continues to serve as an excellent posterior abutment. **D,** Nine years after original treatment. **E,** Fifteen years after original treatment. **F,** Thirty years after original treatment, area remains normal and functional. (Restorations by Dr. Arnold Wax, Chicago.)

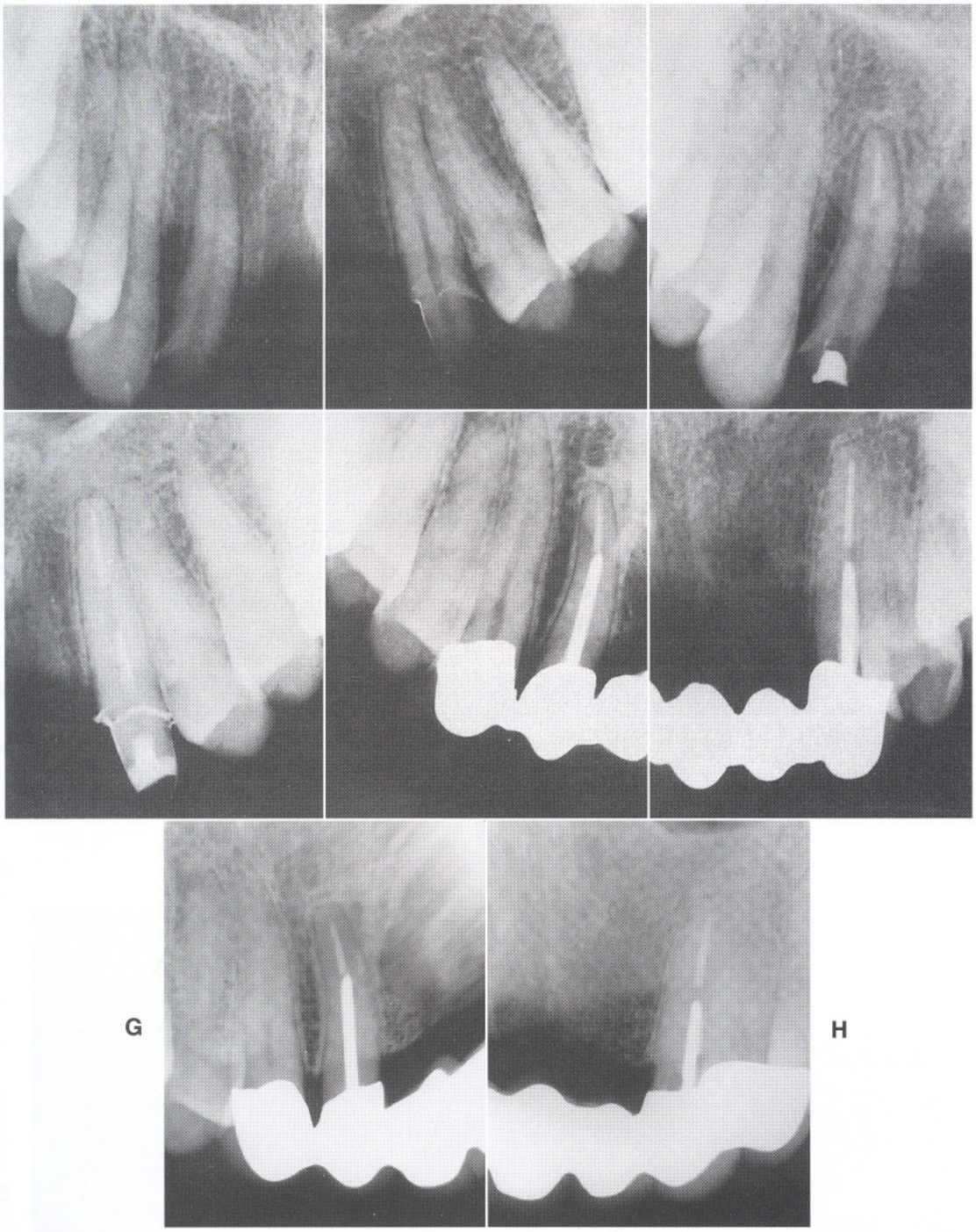


FIGURE 1-17 Patient was a 22-year-old female, badly injured in an automobile accident in a foreign country she visited as a present for graduating college. Two teeth had been avulsed but not replanted, and two teeth were fractured and extracted. The dentists in the foreign country also wanted to extract the maxillary lateral incisor (no. 7), but she was able to stop this despite severe pain in the area. **A,** Preoperative radiograph of no. 7 with obvious exposure, mobility, and tenderness to percussion. **B,** Preoperative film of opposite cuspid (no. 11) with temporary plastic crown and tenderness to percussion. **C** and **D,** Canal filling with laterally condensed gutta-percha and Wach's paste, with post room prepared. **E** and **F**, Areas 14 years after treatment, indicating excellently fabricated bridge, with normal bone associated with each treated tooth, avoiding the need for removable partial denture. **G** and **H,** Areas 22 years after original treatment, still functioning well. (Restorations by Dr. Kerry Voit, Chicago.)

The presence of multiple teeth requiring endodontic care in one arch should be no stumbling block. Many successful results are seen where quadrants are entirely composed of treated teeth (Figure 1-18). If endodontic treatment were not performed, the number of teeth requiring extraction would force replacement by a removable partial denture only.

Lessening the Length of Bridge Span

When pulpal involvement has occurred in teeth adjacent to an edentulous area, some practitioners have recommended extraction to use only uninvolved teeth as bridge abutments. Experience with treated teeth as abutments has now demonstrated their ability to serve as well as uninvolved teeth (see Figure 1-18). In fact, wherever it can be achieved, the reduction in length of bridge span made possible by using treated teeth as abutments reduces both periodontal strain and possible damage to the retainers.

Improving Esthetic Results in an Arch with Diastemas and Involved Anterior Teeth

The replacement of an anterior tooth with a fixed partial denture is usually a relatively simple procedure. However, when the involved arch has natural diastemas, the esthetic result is extremely poor because of the necessary overcontouring and excessive width of each tooth in the bridge. In such an arch, the anterior tooth with endodontic involvement may be restored with a post-and-core jacket crown and excellent esthetic results obtained (Figure 1-19).

Avoiding Use of Lower Anterior Teeth as Abutments

Because of their anatomy and/or arch position, lower anterior teeth are difficult to use as bridge abutments. When lower anterior teeth have pulpal or periapical involvement, endodontic therapy avoids the necessity for cutting down or pinledging narrow, frequently crowded adjacent teeth.

Limiting the Extent of the Problem

When a tooth in an intact quadrant requires endodontic treatment, adjacent teeth remain uninvolved in the subsequent restorative procedures. If the tooth is extracted, however, the adjacent teeth must be prepared as bridge abutments, with possible resultant problems or an implant placed. These adjacent teeth may be virgin but require considerable tooth reduction, or existing restorations in these teeth may be extensive and serviceable, yet have to be discarded and new retainers fabricated. Endodontic care limits the extent of the problem to only the involved tooth (Figure 1-20).

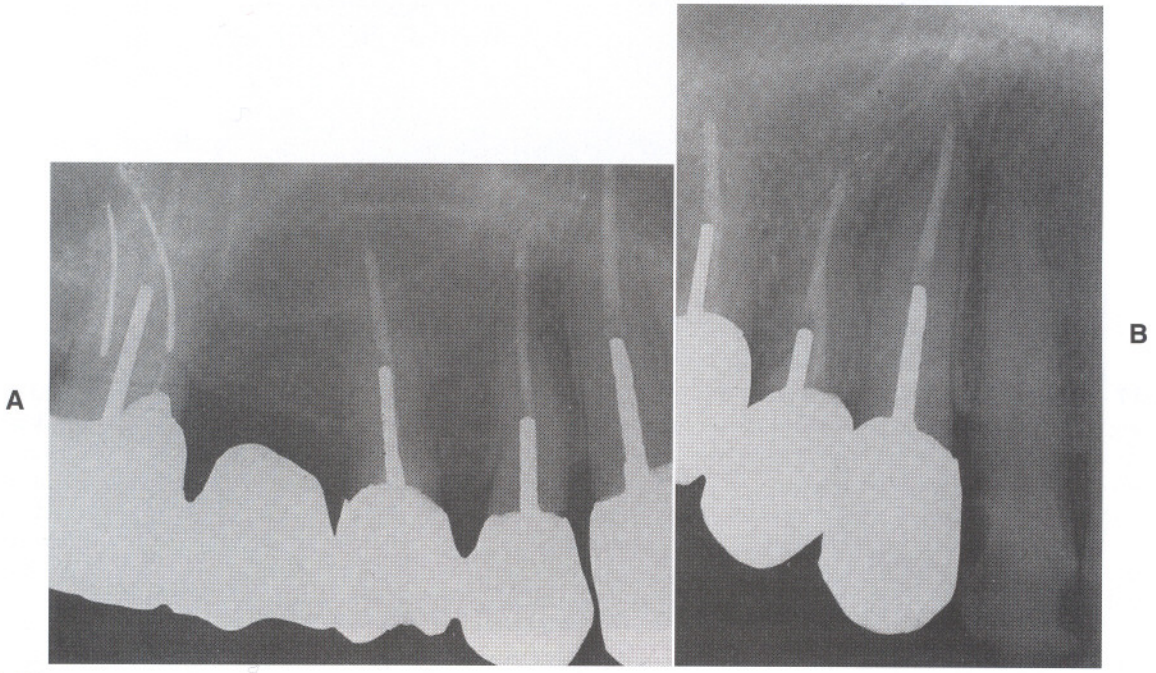


FIGURE 1-18 **A,** Case originally shown in the first edition with entire quadrant composed of endodontically treated teeth, avoiding the need for a complex maxillary partial denture. **B,** Fifteen years after therapy and restoration, area looks excellent. (Restorations by Dr. Arnold Wax, Chicago.)

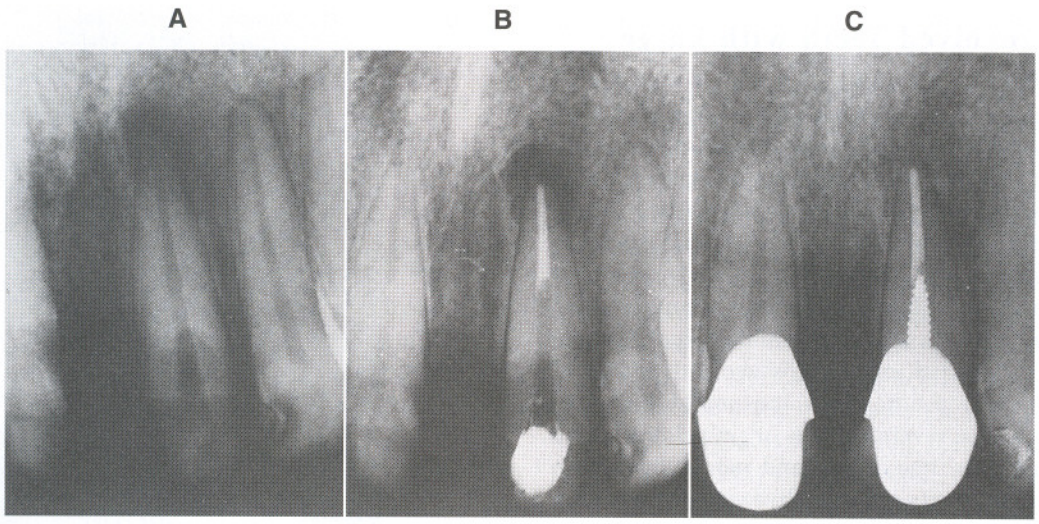


FIGURE 1-19 **A,** Maxillary anterior area. Note wide diastema and periapical involvement of a central incisor. **B,** Endodontic therapy completed and post space provided. **C,** Complete healing 1 year later, preventing the need for a fixed bridge that would have poor esthetic qualities. (Restorations by Dr. Sherwin Strauss, Chicago.)

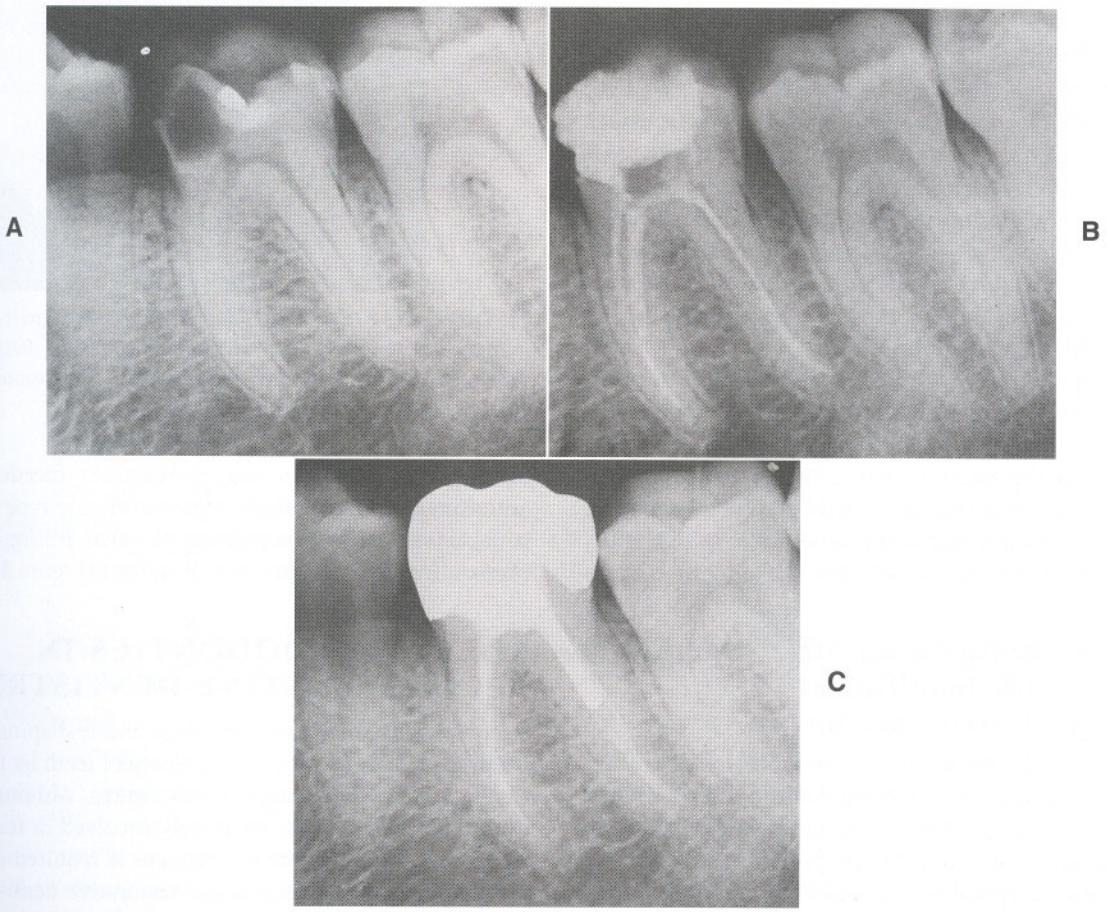


FIGURE 1-20 **Endodontic treatment to limit the extent of the problem. A,** Pulpally involved mandibular first molar. Extraction would necessitate replacement with a fixed bridge using adjacent caries-free nonrestored teeth as abutments. **B,** Therapy completed and post space provided. **C,** One year after treatment and restoration, limiting the problem to single tooth. (Restoration by Dr. M. Kolenskyj, formerly of Chicago.)

Retaining Involved Teeth with Large Restorations

Operative dentistry has provided many complex procedures for successfully restoring badly broken-down teeth. Pins, indirect casting with impression materials of extremely low-dimensional change, high-speed cavity preparation, and other procedures have enabled dentists to restore rather easily teeth that formerly provided tremendous problems. However, the use of any of these procedures may result in some irreversible pulpal damage; even when direct pulpal exposure is avoided, sufficient pulpal damage may accrue from the combinations of procedures to cause a severe pulpitis or pulpal death.

After considerable time, effort, and money have been expended in an effort to save a tooth, extraction is a step that is difficult for both the dentist and the patient. Endodontic treatment may be used to retain such a tooth. Usually, access may be prepared directly through the existing restoration. If cuspal coverage is already present, after completion of endodontic therapy a reinforcing post or pin may be employed to utilize the previously placed restoration and thus not completely waste the earlier restorative efforts.

Avoiding Loss of Bridge and Abutments

Two-appointment bridge construction is relatively routine at present. The first appointment consists of tooth preparation with high-speed instruments, making impressions, and bite registration and temporization; the second appointment involves try-in, adjustment, and cementation. All these procedures may cause pulpal damage and even without actual pulpal exposure may result in a pulpitis or pulpal degeneration.

Continued pain after cementation usually indicates the need for endodontic intervention. As in treatment of a tooth with an extensive restoration, access may be prepared directly through the casting and a reinforcing pin or post utilized to retain the previously placed crown after completion of endodontic therapy. Loss of the bridge with the involved abutment is thus averted.

Facilitating Restoration After Fracture of a Tooth with Insufficient Supragingival Structure for a Crown

Traumatic or accidental fracture of a tooth located near the gingival margin and having minimal remaining supragingival structure offers a considerable restorative problem. To limit the extent of the problem, the dentist should avoid extracting the injured member and constructing a bridge.

A temporary tissue-borne partial denture (flipper or spring-plate) is constructed to give satisfactory esthetics during the endodontic and restorative procedures if an anterior tooth is involved. A post-and-core type of crown is fabricated after completion of canal filling and post preparation, and the problem is solved (Figure 1-21).

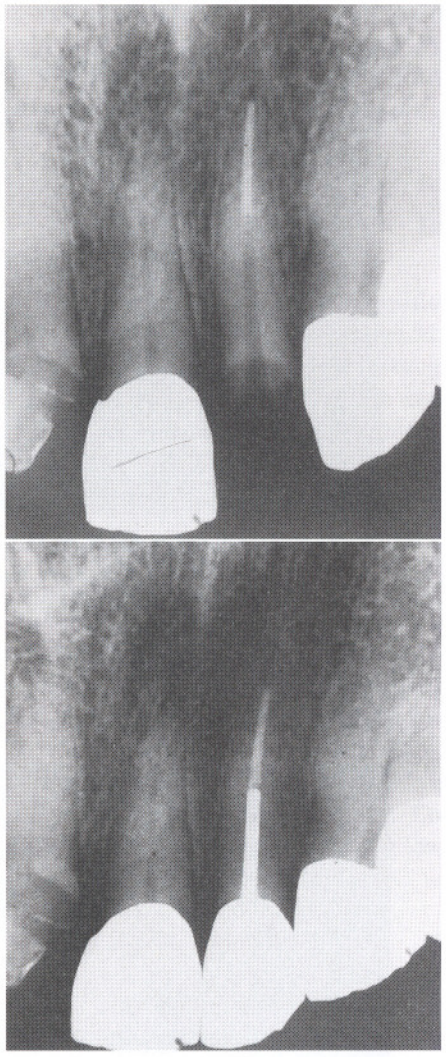


FIGURE 1-21 **A,** Maxillary lateral incisor fractured at gingival margin. Canal filled and post room prepared. **B,** Restored with veneer crown over cast core and dowel. (Restoration by Dr. Morton S. Rosen, Chicago.)

ROLE OF ENDODONTICS IN RECONSTRUCTIVE DENTISTRY

Reconstructive dentistry involves the reshaping, repositioning, and frequently the replacing of teeth by the use of castings and other complex procedures. Although periodontal therapy is most intimately involved in reconstructive dentistry, endodontic treatment is required in a great number of cases. Many of the restorative dentist's needs for endodontics are shared by the reconstructive dentist, particularly the need to avoid removable prostheses. Whenever possible, fixed replacements are utilized.

Endodontics is required by the reconstructive dentist in additional areas as well.

Preserving Teeth After Reshaping of Crown Contours

Although vertical and occlusal relationships may be altered by orthodontic treatment, these changes are most often obtained by reshaping the coronal contour of the tooth by using crowns or onlays. This may require considerable reduction of tooth structure to obtain sufficient thickness of material, and consequent pulpal exposure or irreversible damage may occur. Because reconstructive dentistry requires the most possible abutments with periodontal health, many reshaped teeth will require endodontic therapy if they are to be retained.

Problems are frequently seen in lower anterior teeth that were originally overcrowded and sustained periodontal damage. After necessary periodontal therapy, such teeth are splinted to gain a desired occlusal relationship and esthetic appearance. Preparation of the teeth requires considerable reduction of tooth structure in either the labial or the lingual direction, rarely both, to obtain the necessary parallelism for splint insertion and may cause considerable pulpal damage to these thin teeth. Through endodontic therapy and post-and-core types of crowns, retention of affected teeth is accomplished.

Accommodating an Attachment, or Key and Keyway

Key and keyway attachments—Chayes, Sterns, and other types—are frequently used to avoid the use of clasps for partial dentures or to distribute forces of stress in fixed replacements. To accommodate the male attachment, which is usually placed on the partial denture or posterior segment of a fixed prosthesis, considerable tooth reduction for the female attachment must be performed, which may result in pulpal damage. On occasion the pulp of the tooth that will house the female attachment is purposely sacrificed, and endodontic procedures are performed so an attachment can be placed directly over the center of the root.

Anticipating the Possibility of Future Pulpal Damage

In certain cases it becomes advisable to perform endodontic therapy on teeth that have exhibited no pulpal exposure when there is considerable indication that endodontics will be required in the future. This is frequently seen in a case involving the splinting of anterior teeth after extensive periodontal therapy. Necessary root planning and scaling, considerable tooth reduction during preparation to gain parallelism and adequate width of finishing line, and other restoration procedures may cause irreversible pulpal damage. It is easier to perform endodontic therapy before the castings are cemented, and a wise treatment plan will allow this to be done.

Cases in which only minimal tooth structure remains after abutment preparation are often best served by performing endodontic treatments and restoring with a post-and-core type crown even if the tooth is unexposed. When one member of a splint is placed over a tooth with little structure available for retention, that abutment may pull off, exposing the tooth to massive carious activity. Meanwhile, the splint is still held in place by the other abutments, and neither the patient nor the dentist is aware of the damage that is developing. If endodontic therapy is performed on these marginal teeth, post-and-core crowns will afford superior retention and greater protection to the remaining root face.

Utilizing Bicuspidized and Amputated Teeth

Any tooth or portion of a tooth with good periodontal health may be utilized by the reconstructive dentist as an abutment. Bicuspidized or hemisected mandibular molars, as well as maxillary molars with one or even two amputated roots, afford greater retentive qualities to the reconstruction than would the pontic needed if the entire tooth were extracted. These fractions of a tooth may be extremely valuable because their presence in the posterior segment of the arch allows for added retention in that area. Endodontics provides the necessary initial step in any of these procedures (see Chapter 10).

ROLE OF ENDODONTICS IN PROSTHETIC DENTISTRY

For many years a common philosophy in prosthetic dentistry was to extract any tooth with pulpal involvement in an arch in which a removable partial denture was to be used. The rationale was that a prosthesis was to be fabricated to replace missing teeth anyway, and treated teeth could not be relied on. Experiences with treated teeth have indicated the fallacy of such an argument, and the need for endodontics has been well recognized by the prosthetic dentist for a number of purposes.

Limiting the Number of Teeth in the Removable Partial Denture

Obviously, the greater the number of natural teeth in an arch, the fewer are the teeth required in the prosthesis. The higher the ratio of natural to replaced teeth in any involved arch, the better is the prognosis for the partial denture. Reasons include the following: (1) more abutments may be utilized, (2) less strain accrues to the

abutments, and (3) there is a greater choice of available abutments.

Allowing for Retention of Teeth with Greater Bulk as Abutments

As a general rule, the more posterior any abutment is, the better it serves. This is because of the greater bulk, both coronal and root, found in posterior teeth. Thus molars are better than bicuspids, which in turn are better than cuspids, as partial denture abutments (Figure 1-22).

If posterior teeth are pulpally or periapically involved, endodontic therapy must be utilized if the prosthetic dentist wishes to take advantage of the greater bulk available.

Avoiding Free-End Saddles

Any posterior abutment, even if only on one side in a bilateral case, is extremely valuable. A posterior tooth utilized as an abutment prevents the torquing or settling that bilateral free-end saddles frequently cause.

Providing for Splinted Multiple Abutments

Experience with partial denture clasps on nonsplinted singly abutting teeth, particularly mandibular premolars, has indicated that a considerable degree of periodontal breakdown occurs. Many articles have reported on the need for two or even three abutting teeth with conically shaped roots to be used as partial denture abutments. Endodontics is necessary in retaining teeth to provide multiple splinted abutments if pulpal involvement has affected potential candidates.

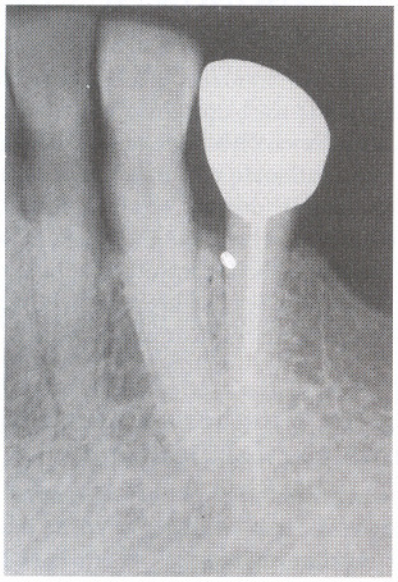


FIGURE 1-22 Endodontic treatment retains the mandibular first bicuspid, a better partial denture abutment than the adjacent cuspid. (Restoration by Dr. Jacob Lippert, formerly of Chicago.)

Accommodating an Attachment, or Key and Keyway

See p. 21.

Retaining Alveolar Bone

Shortly after an extraction, the alveolar bone in the vicinity begins a resorptive process. Only retention of the tooth can prevent this loss of bone. Therefore, when endodontic therapy is required, not only is the treated tooth retained, but the adjacent alveolar bone—important for retention of the tissue-borne portion of the partial denture—is also retained.

Avoiding a Full Denture

Even one or two periodontally healthy teeth are often sufficient to retain a partial denture. Although some controversies exist as to the advisability of preserving only a few maxillary teeth in preference to supplying a full denture, there is unanimity concerning the necessity for retaining mandibular teeth to hold a partial denture. Again, endodontics may be required if such teeth have pulpal or periapical involvement.

If a minimal number of abutments are available and they are judged to be rather weak for supporting a removable partial denture, the use of an overdenture may avoid the need for a full denture supported solely by tissue. The remaining teeth may be treated endodontically and restored with post, cores, and telescopes. A bar may be used between the abutments to provide further retention. The full denture fabricated to utilize such retained teeth has much greater retention than the routine denture (Figure 1-23).

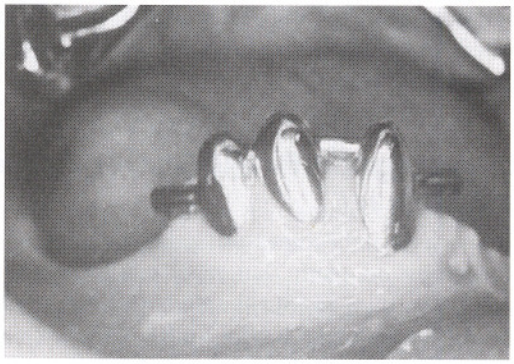


FIGURE 1-23 Minimal number of remaining teeth, treated endodontically and restored with telescopes and bars. Note poor bone level of mandibular edentulous areas. Overdentures had excellent stability. (Reconstruction by Dr. Donald Cunningham, formerly of Indianapolis.)

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