

Current Practice in Endodontics: 6. Retreatments and Periradicular Surgery

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Abstract: The prime aim of this series of six articles has been to improve the quality of endodontic treatment in general dental practice by considering what is currently being taught in dental schools. This final article considers what may go wrong following completion of root canal treatment, whether orthograde retreatment is possible and how it may be achieved, and if or when periradicular surgery may be indicated.

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Clinical Relevance: The demand for endodontic treatment increases every year, particularly as an ageing population retains more and more teeth. Through these articles general practitioners may better assess the quality of treatment, and improve their technique where necessary.

Sadly, however hard one tries, however many postgraduate courses one attends, however much one spends on the latest equipment, endodontic treatment is not always successful. In the final article in this series we will consider the factors that may have led to failure, and how such problems may be diagnosed and rectified.

When failure does occur orthograde re-treatment will almost always be the first approach, although the indications for periradicular surgery will be considered, together with details of what is currently considered good clinical practice.

WHAT IS SUCCESS?

Before proceeding, it may be prudent to consider what is meant by 'success' and 'failure'. Seltzer¹ suggested the term 'adequate clinical function',

indicating the satisfactory retention of the tooth without clinical signs or symptoms, even though the root filling may not appear technically perfect. Failure of endodontic treatment may become apparent shortly after treatment is completed, when the patient returns with a painful or mobile tooth, swelling or a discharging sinus. Alternatively, failure may not be diagnosed until a recall appointment, when a routine radiograph reveals a persistent or recurrent apical radiolucency. It is occasionally suggested during discussions at postgraduate courses that an absence of pain is the only required criterion for success, and that an apical radiolucency which does not heal is not an indication of failure. There may be serious problems in the near future for anyone holding this view.

Few dentists will have missed the reports in the dental literature over the last few years regarding the link between periodontal disease and systemic diseases, in particular pulmonary and cardiac disease,

although many other conditions are being investigated. Scannapieco and Genco recently published a comprehensive review, with excellent references.² Martin Trope told members of the British Endodontic Society at their Spring Scientific Meeting (London, 9 March 2000) that funding for this research in America is almost unlimited, and the results are about to cause serious concerns. Why does this concern endodontists? Periradicular periodontitis is virtually the same disease process as marginal periodontitis: the same micro-organisms are involved, the same bony destruction ensues, and the systemic effects may be identical. In other words, it may soon be reported that failed endodontic treatment, as seen in Figure 1, may be associated with systemic disease. The conclusions of this paper² suggested:

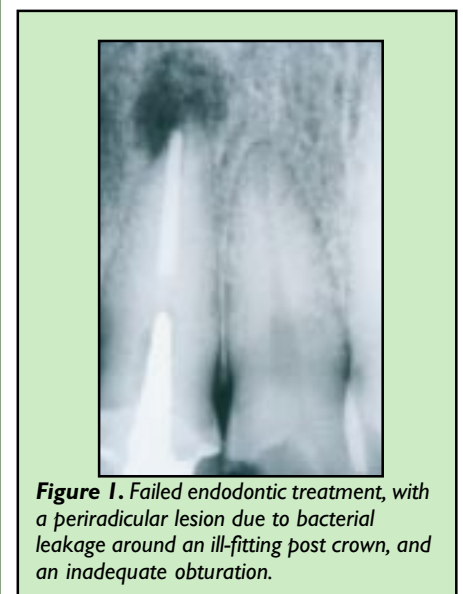


Figure 1. Failed endodontic treatment, with a periradicular lesion due to bacterial leakage around an ill-fitting post crown, and an inadequate obturation.

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Factors that may influence success in root canal treatment:

- Anatomy of the root canal system
- Aseptic technique
- Operator efficiency

Factors that may compromise success:

- Procedural errors:
 - Ledging
 - Perforation
 - Broken instruments
 - Missed canals
 - Root fractures
- Inadequate cleaning of root canal system by irrigation
- Level of canal obturation

Table 1. Factors influencing success or failure in root canal treatment.

Further research must be conducted to definitively establish the role of oral disease in the initiation and progression of pathological processes like atherosclerosis and respiratory infection. The implications of such research may have broad impact on the prevention of the major chronic diseases of man.

I would suggest that it may also have a broad impact on the definitions of success and failure in endodontic treatment.

FACTORS INFLUENCING SUCCESS OR FAILURE

Success will result if the root canal system has been cleansed of most of the microbial contamination, and if any remaining micro-organisms have been incarcerated by an effective obturation. The factors that may influence or compromise this success are listed in Table 1. Obviously the reason for failure must be diagnosed if at all possible before retreatment is carried out. For example, if the cause of failure is a vertical root fracture, extraction is almost inevitable.³

IS RETREATMENT APPROPRIATE?

Assessment of a failed root canal filling cannot be carried out in isolation from assessment of the whole tooth, and its

relationship to the full mouth. Figure 2 shows a case referred for retreatment but, after considering all the options and the problems with restoration, the patient elected for extraction.

As well as ascertaining why the root filling failed, and how difficult retreatment might be (related to such factors as the position of any ledge or blockage, suspicion of a perforation) and its position, ease of dismantling a post, and the actual skill of the operator, other questions must be answered. It is vitally important that the patient is involved in this consideration, and that the prognosis is carefully explained.

The following questions should be addressed before a decision is made:

- Will the tooth be restorable once treatment is completed?
- Is it in function?
- How difficult is access?
- Does this particular patient find treatment difficult?
- What are the treatment alternatives?
- Are there financial issues involved?

If, after a full consideration, the patient gives informed consent to retreatment, then the following paragraphs may ease what must be considered a difficult procedure.

REMOVAL OF OLD ROOT FILLING

One advantage of using gutta-percha as a root filling material is that it is usually easy to remove, especially if failure has occurred because it was not well placed initially. The sealer used may cause greater problems if it was a resin-based material rather than one based on zinc oxide and eugenol. (Occasionally, paste fillings will be encountered, such as SPAD, which are usually impossible to penetrate.) Good access should be obtained, the floor of the pulp chamber carefully cleared of any restorative material, and Gates–Glidden drills used both to cut out the gutta-percha and to soften it by heat generation. Ultrasonic tips may also be used most effectively to break up the gutta-percha and to soften it by intrinsic heat generation.

It may be possible to insert a Hedström file into a poorly compacted filling and withdraw it virtually intact. Alternatively, fine files may be watch-wound into the filling, creating space for the action of solvents such as chloroform, oil of eucalyptus or oil of turpentine. Care should be taken on two counts:

1. These materials may also dissolve the rubber dam.
2. More importantly, they may be toxic to vital tissues, even possibly carcinogenic, and their use may lead to postoperative periapical inflammation and irritation.

Once the filling has been completely removed the canal should be thoroughly irrigated and dried to produce a clean operating field for re-preparation. There is evidence that chlorhexidine may be a better irrigant in retreatment cases,⁴ as certain micro-organisms (for example, *Candida*) may not have been killed by sodium hypochlorite and calcium hydroxide dressing of the initial treatment.⁵

There is also evidence that a long root filling has a poorer prognosis than one up to 2 mm short of the radiographic length of the tooth.⁶ This may be due to a foreign body reaction in the periradicular tissues rather than infection. However, it may prove impossible to remove gutta-percha that has extruded through the apex, as it may be trapped in the apical constriction. In this situation retreatment should involve the basic endodontic principles of



Figure 2. This patient presented with severe pain. The root canal treatment, only recently carried out, has failed due to the distal carious lesion.

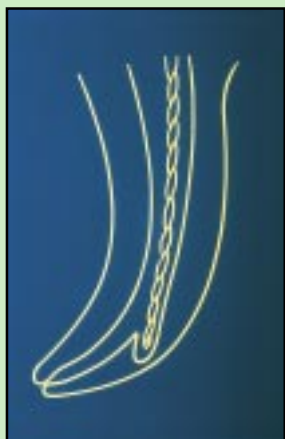


Figure 3. A diagram showing how a file will tend to follow straight line access into a ledge, and indicating where the true canal orifice should be explored.

cleaning, shaping and obturating the root canal to the correct apical position. If this is done adequately, the case should be reviewed regularly, and it may not be necessary to remove the excess filling by a surgical approach.

REMOVAL OF OR BYPASSING CANAL OBSTRUCTIONS

It may be obvious that the initial treatment failed because it was not possible to instrument and obturate to the full working length, either because a ledge had been created in the outside wall of a curved canal or because the canal had been obstructed by debris or a fractured instrument.

Figure 3 shows the problem that occurs when a ledge is created, as the file constantly straightens in the canal and engages the ledge. If this is not diagnosed, or is wrongly diagnosed as a blockage of compacted debris, further apical pressure will lead to a perforation. The apical 2 mm of the file should be curved (the notch in the rubber stop should be aligned with this curve for correct angulation when working blind in the canal), and the tip used to explore the inside curve of the canal until the original and correct path is re-entered. *Under no circumstances* should the file now be withdrawn: it should be worked until the orifice is enlarged sufficiently to permit

easy access to the apex again. A little EDTA gel on the tip of the file will assist elimination of the ledge, although care should be taken as, if the canal is not identified, EDTA may further compromise the ledge.

A blockage caused by incorrect filing, especially if a 'push-pull' technique is used, may be broken up with small (No. 06 or 08) files, watch-winding into the blockage, accompanied by copious irrigation. Large files should not be used as these will merely compact the debris.

Fractured instruments are far more difficult to deal with, and probably the highest chance of success involves referral to an endodontic specialist! A microscope and adequate illumination are almost essential, especially if the instrument lies deep within the canal. An excellent technique using cyanoacrylate glue has been described by Gary Carr.⁷ If the fractured piece is visible it may be possible to grip it with Stieglitz forceps, which have long fine beaks, and a pair of which should be in every practice. Alternatively, it may be possible to pass a Hedström file down the side of the instrument, and withdraw the two together. The application of ultrasonic energy with a CT4 tip may help to loosen the fragment, and will enhance the flushing action of the irrigant.

REMOVAL OF POST CROWNS

Cases are frequently seen where the failure occurs after a post-retained crown has been fitted. Faced with this situation many dentists may adopt a surgical approach. However, the basic endodontic principles referred to so frequently in these articles must be borne in mind: failure has occurred almost certainly because the root canal system is still infected. Periradicular surgery carried out on an infected canal is highly likely to fail. Wherever possible the crown should be dismantled and orthograde retreatment carried out, although it may be useful to ascertain what the post was cemented with, as dentine-bonded resins may prove particularly difficult. The advantages and disadvantages of dismantling or surgery, and the prognosis

for each, should be discussed with the patient so that their informed consent is obtained to the agreed procedure.

If dismantling is to be attempted, first the crown should be removed to expose the post and core. Ultrasonic energy should be applied to the post with a suitable instrument tip for several minutes to start to break down the luting cement (an ultrasonic CT4 tip may be used to create a small trough around the core to expose the cement surface). Then a post removing system may be employed, as illustrated in Figure 4. Either is fairly straightforward to use. If this is not successful, however, the ultrasonic tip may be troughed deeper around the post, gradually removing cement and exposing more metal whilst avoiding contact with the actual post. This technique is preferable to the older Masseran kit, which usually removes more tooth substance than is necessary. Some form of magnification is a valuable aid to these procedures.

Once the crown has been dismantled, retreatment may be carried out, although long-term temporary post crowns should be avoided: Fox and Gutteridge⁸ showed that these tend to leak very quickly, and compromise success. Of course, if the patient elects not to have the crown removed, or if dismantling is not successful, periradicular surgery may be considered.

INDICATIONS FOR PERIRADICULAR SURGERY

Periradicular surgery must always be the final choice in retreatment, and should be reserved for those cases where it has proved impossible to completely clean,



Figure 4. Two systems for removing post crowns: Egglar and Ruddle.



Figure 5. A failed root canal treatment, further compromised by inappropriate periradicular surgery.

shape and fill the root canals. Surgery is not a method of overcoming inadequate orthograde treatment. Indeed, if the reason for failure has not been correctly diagnosed, surgery may actually compromise long-term success. Figure 5 shows a case in which surgery has been carried out inappropriately:⁹ re-treatment, following removal of the inadequate obturation with silver points, should have been carried out. Not surprisingly, the surgery shown here failed as the infected canal contents, and the corrosion products from the silver points, continued to leak around the amalgam retrograde filling.

Surgery may be indicated in the following situations:

- where retreatment has been carried out to the best of the operator's ability without success;
- where it has been decided not to remove a post retained crown;
- where the root canal is obstructed; or
- where failure is due to a perforation that is not amenable to internal repair.

Periradicular surgical techniques and instrumentation have changed radically in the last few years, and are outwith the scope of this article. It would be wise for any general dental practitioners who wish to undertake such surgery to update and familiarize themselves with current thinking and techniques by attending appropriate postgraduate courses.

CONCLUSION

When a root canal treatment fails, every effort must be made to ascertain the

reason for failure before further treatment is prescribed, and to ensure that retention of the tooth is in the patient's best interests. In the majority of cases, orthograde retreatment will be the first option. Periradicular surgery should be contemplated only in strictly defined cases, and clinicians undertaking such surgery should ensure that they are fully conversant with the relevant up-to-date literature.

By way of an exercise, readers may wish to consider the teeth shown in Figure 6, and suggest a treatment plan. There are many alternatives, including the one put forward by a colleague in periodontology of extraction and implants!

I have enjoyed writing this series of articles, and I hope readers have not only refreshed their knowledge and understanding of basic endodontic treatment principles but have also acquired a few useful tips to improve the quality of their treatments. Reports published recently into the quality of root canal treatments have made depressing reading,^{10,11} and anything aimed at improving this situation must be valuable.

However, I have also found writing this series frustrating in that there was so much more that could have been written, if only my time and journal space were unlimited. I do hope that interested dentists will take their endodontic studies further, by attending postgraduate courses, using the excellent CAL

programmes now available, buying a good endodontic text, and joining the British Endodontic Society.

REFERENCES

1. Seltzer S. Root canal failure. In: *Endodontology: Biologic Considerations in Endodontic Procedures*, 2nd edition. Philadelphia: Lea and Feibiger, 1988; p.439.
2. Scannapieco FA, Genco RJ. Association of periodontal infections with atherosclerotic and pulmonary diseases. *J Periodont Res* 1999; **34**: 340–345.
3. Moule AJ, Kahler B. Diagnosis and management of teeth with vertical root fractures. *Aust Dent J* 1999; **44**: 75–87.
4. Jeansonne MJ, White RR. A comparison of 2.0% chlorhexidine gluconate and 5.25% sodium hypochlorite as antibacterial endodontic irrigants. *J Endodont* 1994; **20**: 276–278.
5. Waltimo TMT, Siren EK, Orstavik D, Haapasalo MPP. Susceptibility of oral *Candida* species to calcium hydroxide *in vitro*. *Int Endodont J* 1999; **32**: 94–98.
6. Vesselink PR, Walton RE. Apical treatment location of root canal treatment procedures. *Oral Surg Oral Med Oral Pathol Oral Radiol Endodont* 2000; **89**: 99–103.
7. Carr GB. Retreatment. In: Cohen S, Burns RC, eds. *Pathways of the Pulp*, 7th edition. St Louis: Mosby, 1998; pp.824–827.
8. Fox K, Gutteridge DL. An *in-vitro* study of coronal microleakage in root-canal-treated teeth restored by the post and core technique. *Int Endodont J* 1997; **30**: 361–368.
9. Danin J, Linder LE, Lundqvist G, Ohlsson L, Ramskold LO, Stromberg T. Outcomes of periradicular surgery in cases with apical pathosis and untreated canals. *Oral Surg Oral Med Oral Pathol Oral Radiol Endodont* 1999; **87**: 227–232.
10. McColl E, Smith M, Whitworth J, Seccombe G, Steele J. Barriers to improving endodontic care: the views of NHS practitioners. *Br Dent J* 1999; **186**: 564–568.
11. Saunders WVP, Saunders EM, Sadiq J, Cruickshank E. Technical standard of root canal treatment in an adult Scottish sub-population. *Br Dent J* 1997; **182**: 382–386.

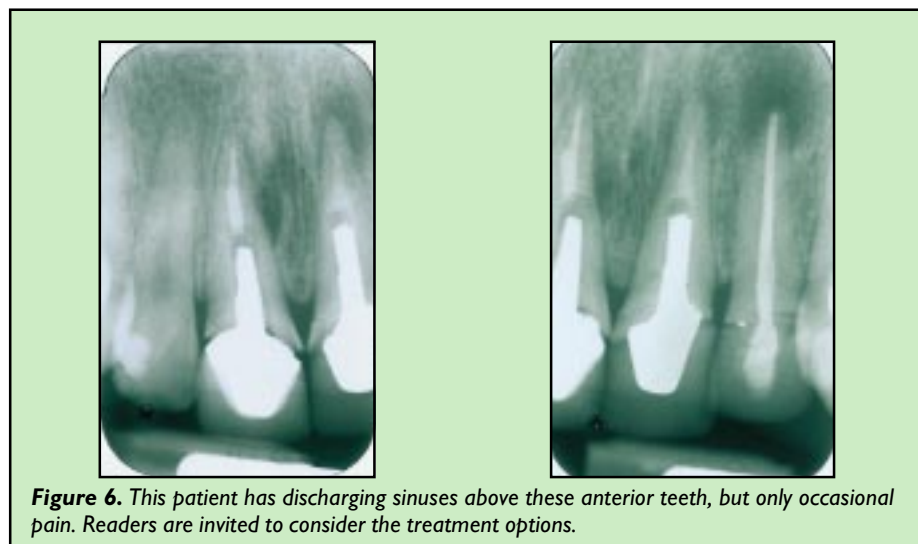


Figure 6. This patient has discharging sinuses above these anterior teeth, but only occasional pain. Readers are invited to consider the treatment options.