

VITAL GUIDE SERIES

1 Endodontics: The difference between Endodontics & Root Canal treatment

- What is root canal treatment and what is the difference between root canal treatment and endodontic treatment?
- Why would a patient need endodontic treatment? What are the symptoms?
- What are the success rates of endodontic treatment?

1

VITAL GUIDE TO

Endodontics

Welcome to the first in the Vital Guide Series. At the end of this article are some CPD questions which are designed to get you thinking about the article, to help you remember some of the key points and you may even win yourself a book. Here **Peter Carrotte**¹ takes us through the basic principles of endodontics and explains the difference between this and root canal treatment.

Introduction

For many patients the thought of having to have a 'root canal' causes fear and dread. All members of the dental team need to be fully informed of exactly what this involves in order to put their minds at ease. Obviously the dentist will already be quite familiar with these procedures, and the dental nurse will have a fairly good understanding. However, other members of the dental team may not be quite so sure.

Here is an explanation of the processes involved so that all members of the team can familiarise themselves with the procedures and the terminology associated with them.

What is root canal treatment?

Root canal treatment is carried out when the tooth's pulp, the soft tissue core of the tooth containing the blood supply, nerves and connective tissue necessary for the tooth's growth and health, becomes damaged in some way. This is usually caused by bacteria

entering the pulp through a deep cavity or failed filling. Root canal treatment involves removing the damaged and infected pulp, shaping the root canal spaces so that the entire root canal system can be cleaned and disinfected, and then filling the space so that no more infection can enter. Figure 1 shows a diagram of the clinical situation, Figure 2 shows a radiograph of a tooth that needs root canal treatment, and Figure 3 shows a successfully root-treated tooth.

What is the difference between root canal treatment and endodontic treatment?

Although the two terms are often used as if they mean the same, root canal treatment is in fact just one part of endodontic treatment. Whenever any restorative dental treatment is carried out the dentist has to protect the pulp from damage. The total care of the pulp is called endodontics. For example, if decay has spread very deeply into the tooth but the infection has not yet entered the pulp, the dentist will seal the dentine tubules and may place a small amount of calcium hydroxide on an exposed part of the pulp to promote normal healing and keep the pulp alive. This would be endodontic treatment, but not root canal treatment.

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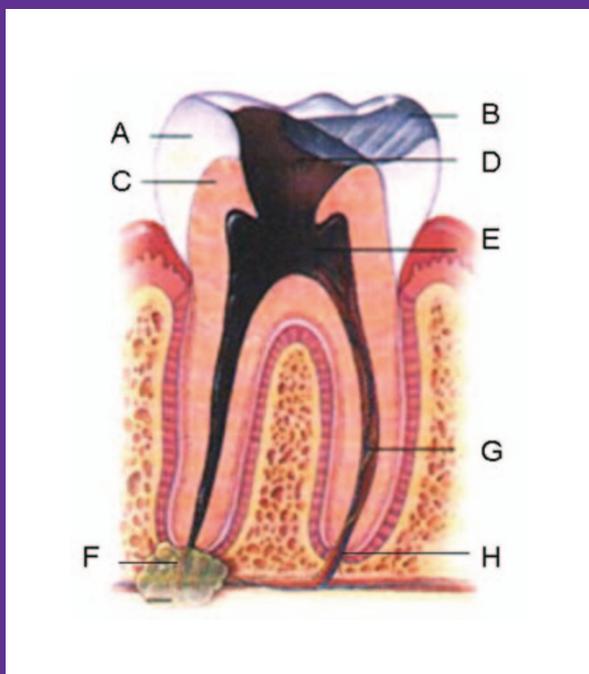


Fig 1 A diagram of the some of the terms used in this paper, and problems that may lead to a tooth requiring root canal treatment. A – Enamel; B – Old filling; C – Dentine; D – Decay; E – Dental pulp space; F – Apical abscess; G – Vital pulp tissue; H – Apical foramen.



Fig 2 A radiograph showing the clinical picture of the diagram in Figure 1.

Why would a patient need root canal treatment?

Root canal treatment is usually prescribed to relieve pain and there are three classic painful conditions that may be diagnosed.

- A toothache that lasts briefly and is only brought on by a stimulus such as hot or sweet shows that the pulp is slightly inflamed. This would be diagnosed as *reversible pulpitis*. *Pulpitis* means that the nerve is inflamed, but *reversible* means that if the cause is found and treated (an early cavity or exposed dentine for example) the damage will fully recover. However, if the pain lasts a long time and occurs some times without any stimulus (for example waking the patient up at night) the pulpitis is diagnosed as irreversible. The pulp has been so badly affected that it is dying. Root canal treatment will remove the pulp and the pain.
- If the *irreversible pulpitis* is severe the pulp may die and become infected. The infection (or products of the inflammation) leaks out of the root canal through the apical foramen (where the nerves and blood vessels entered the tooth) and causes inflammation of the surrounding bone. This is diagnosed as *periapical periodontitis* (inflammation around the apex of the tooth) and results in loss of bone. The classical sign on a radiograph can be seen in Figure 2.
- If the inflammation in the bone becomes so severe that pus is formed the diagnosis is *periapical abscess*. Patients call all of these lesions abscesses, but it is only really an abscess when pus is present as seen in Figure 4. The pus will sometimes drain through the bone by making a narrow tube called a sinus, as seen at Figure 5. Once this happens the pain often disappears, but the patient may notice a bad taste.
- Root canal treatment is sometimes prescribed when there is

no pain. This might be if the root canal is needed for a post to support a crown if the tooth is very broken down, or if the tooth is to be cut down to support an overdenture.

What are the alternative treatments?

If the pain is severe the only real alternative may be extraction. However, the patient will then have a gap that they may wish to be filled. If they don't want to wear a denture this might involve a bridge requiring extensive preparation of the adjacent teeth. Alternatively, and becoming increasingly prescribed, would be an implant. The patient should be advised that the long-term prognosis of an implant might be better than that for a difficult molar root treatment.

The dental team should also be aware that the pain might be stopped by applying a steroid/antibiotic paste to the pulp. It must be understood that this only stops the pain and the tooth will die painlessly. Root canal treatment will still be required at some time in the future. Of course, a patient who did not want to have root canal treatment may ask to have such a dressing to preserve the tooth as long as possible before extraction becomes inevitable.

What does root canal treatment involve?

There are three classic stages to root canal treatment; isolation and access; shaping and cleaning; filling (usually called *obturation*).

A. Isolation and access

It is essential that a rubber dam be applied to the tooth being treated, as shown in Figure 6, for two reasons; firstly to prevent entry of non-dental bacteria to the root canal. The bacteria normally found in an infected root canal are quite specific and



Fig 3 A radiograph showing a completed root canal treatment.



Fig 4 Pus draining from a heavily infected tooth.



Fig 5 A chronic sinus draining infection from around the apex of an infected tooth. A gutta percha point has been placed in the sinus prior to taking a radiograph.

easily removed. Once other more toxic bacteria are introduced, treatment becomes more difficult and less successful. An American endodontist once said that if you have a patient you don't like, and you want the root treatment to fail, all you have to do is spit in the root canal! Of course, the effect will be the same whether you spit in it or the patient does!

Rubber dam prevents saliva entering the tooth during treatment. It also protects the airway from the fine files and strong chemicals used. Figure 7 shows a file that was dropped and had to be removed from the patient's intestines. Needless to say, an expensive legal claim resulted which should easily have been avoided. Once the tooth has been isolated an access cavity is cut into the pulp chamber to allow the fine instruments to enter the nerve canals. This involves just the same drilling as for a routine filling. Figure 8 shows an access cavity for a lower molar.

B. Shaping and cleaning

Shaping and cleaning involves opening the root canals with fine files to allow strong disinfectant solutions to flush through the entire root canal system to remove all infection. The root canal system is far more than just the main canals as seen on a radiograph. There are many little fins and canals that exist inside the tooth and they must all be disinfected. If bacteria remain inside the tooth (for example if the canals are not widened enough to allow lots of irrigation), the treatment will probably fail.

Ordinary K-type hand files might be used, although more and more dentists are using greater taper nickel titanium files driven by a special motor, which give improved shaping. The use of an EDTA lubricant, such as Glyde or FleEze, makes filing easier and permits more efficient dentine removal.

Well shaped canals allow good access for the irrigant, ideally sodium hypochlorite. This is usually just called bleach, and may be bought from any supermarket. This will be a five per cent solution, which may be diluted before use. All members of the team must know that this solution is being used, to protect their own and the patient's clothes from damage. Needless to say, the patient should always wear protective glasses. If the irrigation regime includes the use of an EDTA solution, the smear layer will be removed from the walls of the root canals and cleaning will be much better.

Cleaning, or disinfection, may require an intervisit dressing of calcium hydroxide in the root canals. A temporary filling will be used to protect the root canal system between visits. Glass ionomer cement is preferred as there is less chance of this being lost and the canals becoming more infected. A patient under treatment should be told to return immediately if the temporary filling is lost.

C. Obturation

Obturation involves filling the root canal system with a sealer cement and gutta percha (rubber) points. These should fill all parts of the canal so that the final radiograph shows no spaces in which bacterial infection may recur. A coronal seal of resin modified glass ionomer is placed over the gutta percha to seal the entrances to the root canals. Research has shown that this is the most important part of the obturation.





Fig 6 A patient undergoing root canal treatment, fully protected with a rubber dam, goggles and a plastic bib.



Fig 7 This file was dropped down a patient's throat because the airway was not protected. It has lodged in the intestine.



Fig 8 A good access cavity permits easy, straight-line access to all the root canals. Access cavities that are too small make treatment more difficult and possibly less successful.

Is root canal treatment painful, and might patients experience any problems during treatment?

It should really be possible to ensure that all dental treatment is painless. A local anaesthetic should remove all discomfort. Even though the nerves of teeth being root treated are often dead, a local anaesthetic should still be used to avoid pain from the rubber dam clamp, from instruments measuring the length of the root, and other possible stimuli.

Very occasionally a nerve that is dying may be extra-sensitive. The dentist may be able to apply anaesthetic directly to the nerve tissue, or may have to use a steroid dressing to relieve the pain and continue treatment at another visit. It has been suggested that the patient in this situation should be advised to take a large dose (up to 800 mg) of ibuprofen an hour before the next appointment. There may be some discomfort around the tooth following treatment, indeed it is sensible to warn the patient of this and advise the use of anti-inflammatory painkillers for a few days following treatment. Patients are usually very happy to do this if they have been warned in advance, rather than being told when they telephone with discomfort on the day after the appointment!

Very, very occasionally a tooth that has had a long-standing chronic periapical infection may flare up seriously following treatment. This is called a 'phoenix abscess'. Again, the patient should have been warned that this might happen as part of obtaining informed or valid consent, and antibiotics may be required.

Is root canal treatment expensive?

To be carried out properly, root canal treatment can be very time consuming and difficult. Just finding the root canals can take a long time. Magnification with loupes or a microscope will help enormously, but these cost between £1,000 and £20,000. Modern rotary files are up to five times more expensive than the old type, and modern clinical guidelines suggest that these should be disposed of after each patient or they may pose a serious cross-infection risk. The files alone can cost up to £30 per treatment. Like most things in life, cheap is often not appropriate in root canal treatment. If it is done quickly and poorly the infection may not be fully removed and the tooth will have to be extracted. Spending more to have the treatment done adequately may be a sensible long-term investment. Of course, the cost of replacing a tooth that has been extracted may be hundreds of pounds for a bridge, or thousands for an implant, which makes the modest cost of a good root canal treatment far more attractive!

Will any further treatment be required?

Teeth that have to be root treated are usually heavily filled and broken down. Once the root treatment has been completed it is usually sensible to place a crown or cuspal onlay to support the remaining tooth structure and avoid the risk of fracture. Some dentists even protect the tooth with a band to avoid the risk of fracture during treatment. Research has shown that a large proportion of teeth that are not protected after root canal treatment subsequently suffer cusp fracture, which may lead to their loss.

The dentist may take a radiograph after one year to ensure that the treatment has been successful. This is a good part of audit and clinical practice and a modest cost worth the peace of mind.

The only other treatment that might be required relates to the



Fig 9 This tooth was root treated over 10 years ago and has been functional and symptomless ever since. The periapical lesion was discovered incidentally when the adjacent tooth required treatment. Whether this root canal treatment can really be classed as unsuccessful may be a good subject for debate at a practice staff meeting.

discolouration that often follows a root treatment. The tooth becomes darker, sometimes quite grey. Internal bleaching can be performed to lighten the colour, but a crown or porcelain veneer may eventually be required.

How long will the tooth last?

Success in root canal treatment is complicated. First we must understand the criteria for success, which are;

- adequate isolation from salivary bacteria;
- good access so that all the canals can be identified;
- thorough shaping to permit irrigation of the entire canal system;
- removal of all bacteria with an appropriate disinfection regime;
- three dimensional obturation of the entire root canal system;
- a sound coronal seal at the base of the pulp chamber with an effective final restoration.

The criteria of success are then;

- resolution of symptoms;
- resolution of any signs (such as a sinus tract);
- healing or reduction in size of any radiographic lesion;
- and the tooth must, of course, still be in function.

The dental literature is full of research reports into the success of root canal treatment. A brief summary suggests that for a new case when there is little infection (such as an irreversible pulpitis) success over five years should be above 90%. When a radiographic lesion is present (periapical periodontitis) this falls to about 80%. If this treatment fails and the tooth is re-treated the five-year prognosis would be around 70%. However, this is related to the satisfaction of all four of the criteria of success. If not all are satisfied, but the tooth is symptomless, as seen in Figure 9, we may consider the concept of functionality. If the tooth is functional, with no symptoms, has the root treatment really been a failure? From this perspective, and accepting that in reality all dental treatment will eventually fail, patients can be reassured that root canal treatment is normally successful. It is certainly better than extraction!

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CPD Questions

In future, *Vital* will be offering verifiable CPD when it becomes mandatory for DCPs in 2008. In the meantime we have provided some CPD style questions for our new 'Vital Guide to...' series to encourage you to anticipate future CPD requirements. We are pleased to offer a copy of the book *Communication and the dental team* kindly provided by Stephen Hancocks Limited (www.shancocksLtd.com) to the senders of first 5 correct entries to be drawn on 1 May 2006. The answers to the questions will be published in the next issue of *Vital*.



In the context of this article, only one of the answers to each of the following questions is correct.

- Which of the following would not be a reason for carrying out a root filling?
 - Reversible pulpitis
 - Irreversible pulpitis
 - Periapical periodontitis
 - Periapical abscess
- Although all the following are important reasons for using rubber dam, which is the most important?
 - To stop the patient swallowing instruments
 - To make treatment easier and more comfortable
 - To stop saliva and other infections entering the root canal
 - To stop the patient talking and having to rinse out
- What prognosis for successful treatment after 5 years would you give to a patient having a root treatment for a case of irreversible pulpitis?
 - Over 90%
 - Between 80% and 90%
 - Between 70% and 80%
 - Less than 70%
- Although all the following are important in the obturation phase of the root treatment, which has been shown to be the most important?
 - A good apical seal
 - Three dimensional filling of the root canal system
 - A filling that is within 1mm of the radiographic apex of the tooth
 - A good coronal seal.