

The root to endodontic happiness

For many dental nurses in general practice, root canal treatment can seem dull and unrewarding. However, painless, efficient endodontics is a huge practice builder and a team approach is essential to achieve quality results

It is no secret that many dentists dislike root canal treatment and when it appears on their daylist the stress levels are rising before the patient even arrives! This in turn makes the dental nurses job harder, more stressful and the experience for everyone unfulfilling.

The technical achievement of high-quality root canal treatment may not be visible to the patient, fashionable like cosmetic procedures, or fill pages of glossy magazines, but it invariably provides the stable foundation on which the dentist and patient rely. Quality endodontics is a benchmark for good practice and providing efficient pain relief is most definitely a practice builder.

This article will discuss the cause of endodontic disease, the rationale for root canal treatment, endodontic equipment, the importance of isolation, efficient preparation techniques and the role of the dental nurse in ensuring that the whole procedure is comfortable and pleasant for the patient.

The cause of endodontic disease

The cause (aetiology) of endodontic disease is almost always the result of an immune reaction to bacteria (Kakehashi et al, 1965). Long before bacteria in caries,



Figure 1. Radiolucent areas around the roots of UR6

a crack or leaking filling have entered the pulp, an inflammatory response is seen. A pulpitic tooth could be hypersensitive to cold or sweet things. Initially, inflammation is reversible and removal of the irritant by placing a filling for example should allow the pulp to recover. Pulpas are extremely tough and have defence mechanisms to protect them from caries (and dentists with drills); they activate odontoblasts (dentine-producing cells) on the inside of the pulp chamber, which lay down irritation dentine to create a barrier.

If the pulp becomes irreversibly pulpitic, the unfortunate patient may report spontaneous pain or a lingering ache following hot or cold stimuli. They may not be able to distinguish which tooth is causing the pain. At this point, bacteria are only likely to be present in the superficial layer of the pulp, but already inflammatory chemicals released by the nerves in the pulp (neuropeptides) and bacterial toxins (lipopolysaccharide) can initiate an inflammatory response in the



Figure 2. Radiograph taken six months later. Good evidence of bony healing

periodontal ligament at the apex of the tooth. The dentist gently taps the teeth in these cases, as if there is inflammation present, the tooth is likely to be tender to percussion.

Only when the pulp is necrotic, no longer responds to vitality testing and a radiolucent area is visible on a periapical radiograph, can it be assumed that the entire pulp space is infected with bacteria. Scientific studies using culturing techniques have shown that the majority of infected root canals only harbour about eight to twelve different species. The root canal is a tough place to live and so the bacteria rely on each other for nutrients (synergy), lay dormant in times of stress waiting for suitable food sources and mutate to become resistant to challenges. They tend to be bacteria that like an environment with low or no oxygen (facultative or anaerobic bacteria). The bacteria exist in planktonic form, essentially floating in liquid in the canal and as biofilms on the canal walls; biofilms are very difficult to remove.

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Figure 3. Modern apex locators are very accurate. A diagnostic length radiograph may not be required thereby reducing the radiation dose to the patient

The periapical lesion represents a battle ground between the immune defence cells in the bone around the apex of the tooth and bacteria residing in the root canal. Chemical messengers (cytokines) produced by white blood cells (lymphocytes and neutrophils) activate osteoclasts in the bone. The result is removal of bone from around the apex and consequently the dark area seen on a radiograph.

Bacteria tend to stay confined in the root canal and are rarely found in the periapical lesion itself, unless there is an acute flare-up.

Figure 1 shows radiolucent areas around the roots of the UR6. The tooth is non-vital. Figure 2 is a radiograph taken six months later following root treatment and shows good evidence of bony healing.

Rationale for root canal treatment

Reversible pulpitis

There are no bacteria in the pulp and following restoration the inflamed pulp should return to health.

Irreversible pulpitis

The pulp will not survive, so either root canal treatment or extraction is required. The bacteria are likely to be in the



Figure 4. The view from the microscope is projected onto a monitor for the assistant

superficial pulp tissue, so for emergency treatment the dentist needs to remove the inflamed tissue from the pulp chamber only, irrigate with sodium hypochlorite and dress with a temporary restoration. The dentist should not enter the root canals unless they have time to prepare and disinfect them as bacteria could be inoculated into the pulp tissue and cause a flare-up. Antibiotics are not required, and a prescription without treatment will only prolong the patient's suffering. The misuse of antibiotics generally has undoubtedly resulted in resistant bacterial strains.

Periapical periodontitis

The pulp is necrotic and a radiolucent area could be visible on radiograph. The tooth should be root filled or extracted.

The fundamental aim is to remove pulp tissue and bacteria from the root canal system of the tooth and then seal the space that has been created so that bacteria cannot leak back into the canals and infect them.

After disinfection, a good seal needs to be provided by the root filling and coronal restoration. Coronal microleakage is a significant factor in the failure of root-filled teeth.

Root canal treatment

Root canal treatment can therefore be divided into three stages:

- Preparation and shaping of the root canals
- Disinfection
- Obturation.

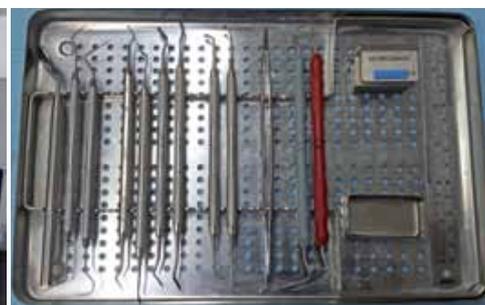


Figure 5. A tray system containing endodontic instruments. Far left is a front surface mirror and DG16 probe. Gutta percha pluggers are to the right (red and grey)

Preparation

Preparation is carried out to enlarge and taper the main root canals so that an irrigant, such as sodium hypochlorite, can be delivered throughout the entire root canal system and kill bacteria.

The taper of prepared canals needs to be sufficient to allow adequate interchange of the irrigant, especially at the root apex. Historically, the process of preparation was very time-consuming; using stainless steel files with a laborious filing action. Modern nickel-titanium (NiTi) mechanised techniques have greatly speeded up the process.

The dentist will first cut an access hole in the tooth to open the pulp chamber, the canal orifices can be located by careful examination with magnification and good illumination. The pulp floor tends to be darker and the walls light; this is known as the 'pulp floor map' and enables the dentist to locate the orifices, even when there has been significant irritation dentine deposited.

Once the canals have been located, the coronal aspect of the root canal is flared. The working length can then be estimated. Modern apex locators (Figure 3) are extremely reliable and the preferred means of calculating the length of the root canal. Usually a flexible stainless steel file size 10 (purple) or 15 (white) is used with a small amount of ethylenediaminetetraacetic acid (EDTA) lubricant.

Once the working length is confirmed the canal can be tapered rapidly using a



Figure 6. Essential set up for rubber dam

NiTi instrument. These are either rotary e.g. Protaper Next or reciprocating (jiggling) e.g. Wave.One (Dentsply Maillefer)

Disinfection

The work of two Scandinavian researchers (Byström and Sundqvist, 1981) showed that mechanical preparation alone was not enough to remove all the bacteria in infected canals; an antibacterial irrigant, such as sodium hypochlorite, is not only the most effective way of killing bacteria, but also dissolves organic material that could provide bacterial nutrients. The solution needs to be at a concentration of at least 1%, the strength of neat Milton's Sterilising Fluid and many other commercial products (Byström and Sundqvist, 1983).

Sodium hypochlorite is therefore used throughout the preparation and irrigation phase of root treatment. A 17% EDTA solution is also used to remove smear, mainly in retreatment. Irrigating with saline or local anaesthetic will be ineffective and chlorhexidine has been shown to have no benefit on outcome (Ng et al, 2011).

Obturation

Dressing the canals (after preparation and disinfection) with calcium hydroxide for seven days was shown to be effective at reducing the number of bacteria (Sjögren et al, 1991) and so evolved the concept of a two-visit strategy using a chemo-mechanical approach.

More recently, the universal use of a two-visit approach has been questioned



Figure 7. Rubber dam clamps

(Hargreaves, 2006). Advances in NiTi instrumentation have significantly speeded up preparation time, allowing more time for the delivery of irrigants. Many endodontists now use a single-visit approach for most cases, and research has shown no significant repercussions for the patient or reduced prognosis (Ng et al, 2011).

Once disinfected, the root canal system has to be sealed. Use of lateral condensation of gutta percha points and sealer is well documented and works well, but in order to fill the irregular internal anatomy, thermal techniques may be more advantageous.

Endodontic equipment

As a dental nurse, you will be responsible for the care, maintenance and delivery of sterilised kit for the root canal treatment.

Magnification

Because root canals are minute, magnification and illumination is essential. Your dentist may use loupes and a headlamp so that they can see into the access cavity.

Endodontic specialists use operating microscopes with greater magnification and cameras to allow the assistant to see the operative field on a screen (Figure 4).

Hand instruments

Apart from the usual dental instruments used in conservative dentistry, there are a few specific ones for endodontics (Figure 5):

- A front surface mirror is essential when using a microscope to prevent a fuzzy image



Figure 8. A rubber dam with clamp in place ready to hand to the dentist

- A DG16, which is a double-ended long probe for exploring the pulp floor
- Gutta percha pluggers—these are used to compact gutta percha during obturation but are also useful when placing restorative material in the access cavity.

Isolation

Rubber dam is cheap, quick to place (a few seconds) and has many benefits, but sadly many dentists never use it (Marshall, 1998). This may be because the dentist is not confident or it is not readily available in the surgery.

Why use rubber dam?

There are several reasons why a rubber dam should be used:

- To protect the patient from ingestion or inhalation of an endodontic instrument. Failure to use a rubber dam in this instance could prove difficult to defend in court. As a dental nurse, you could be held partly responsible if an instrument is lost and you are left holding the suction. Removal of an object from the lung requires specialist medical intervention, significant inconvenience for the patient and potentially high litigation costs
- To prevent the 'choking' feeling of waterspray, liquids and particulate matter in the back of the patients mouth during treatment, and to keep the soft tissues safe from irrigants and instruments. Even the most experienced dental nurses can find it difficult fighting a lively tongue while retracting the cheeks and keeping



Figure 9. A typical assortment of burs for endodontic treatment



Figure 10. Pre-bending the irrigating needle will help prevent extrusion of sodium hypochlorite



Figure 11. Four-handed transfer of sterile paper points may take some practice

an eye on what instrument may be required next

- To allow the operator to control the surgical site and prevent bacterial contamination of the root canal system by saliva during endodontic treatment, which could result in failure
- Improved visibility, for you as the dental nurse and the dentist who should be working with magnification
- Would you want a patient to spit in your face? Just have a look at your personal protective equipment after a big crown preparation! Rubber dam prevents the bacterial-laden aerosol—created when using a high-speed handpiece or ultrasonic instrument—from potentially infecting the dental nurse or dentist
- Improved patient comfort. To the non-believers: patients regularly comment on how much better treatment is with ‘that plastic sheet—is that a new thing?’.

The rubber dam kit

As a dental nurse, you can have a really big impact in speeding up the placement of rubber dam as much of the kit can be set up in advance (Figure 6):

- Plastic rubber dam frame: a rubber dam sheet can be pre-fitted to the plastic frame to speed up placement. The dam does not need to be dismantled if a radiograph is required
- Rubber dam punch: a single hole punch is all that is required
- Rubber dam forceps
- Rubber dam: medium grade latex and a non-latex option for allergic patients

■ Clamps: three clamps will cover most eventualities (Figure 7):

- Number 14: a winged molar-style clamp
- Number 1: a winged clamp for premolars or maxillary anterior teeth
- EW: a wingless clamp for anterior teeth

■ Floss

■ Scissors

■ Caulking: silicone to seal any leaks

■ Wedget: rubber string for retaining a dam without a clamp.

Efficient preparation techniques

If the endodontic kit in your practice consists of a few well-used files stuffed into a sponge then it is definitely time for a rethink.

Modern preparation techniques use NiTi instruments that either rotate continuously or reciprocate. The metal is highly flexible and fracture resistant. If used properly, then instrument fracture is very unlikely and the preparation time will be quick. Your dentist may need to undertake additional training to become confident with new preparation systems, but it should make endodontic treatment simpler, less tedious and tiring.

All NiTi endodontic files are sterile and designed for single use. Some have design features to prevent reuse. Although there is no significant published evidence of cross contamination of Creutzfeldt-Jakob disease and prions when reusing endodontic files, there is plenty of

evidence to show that these instruments are placed under considerable stress when machining around curved canals and therefore single use is advisable to reduce the risk of fracture (another common reason for litigation). Single-use also reduces the risk of needle-stick injuries during decontamination, which is good practice.

With reciprocating techniques, a single instrument can often be used to complete shaping of the root canal. Combined with a couple of hand files per treatment, this significantly reduces the amount of kit and cost.

The role of the dental nurse

Patients are often very anxious and apprehensive about the prospect of having root canal treatment. Unfortunately, there is plenty of poor but readily accessible information available on the internet, and you will frequently find patients with numerous friends or work colleagues happy to share bad anecdotes. The words ‘root canal’ have unfortunately become synonymous with pain and are often portrayed in a negative light in comedy.

The dentist may also be anxious and, if newly qualified, not particularly experienced at root canal treatment. Working together as a team will give the patient confidence and help put them at ease.

Your support providing empathy for the patient is particularly important, giving reassurance that the procedure does not need to be painful. Reinforce

the signals the patient can use to indicate to you that they may wish to stop for any reason. You are in a much better position to see a hand raise than the dentist, who will be concentrating on the inside of an access cavity. Sometimes the patient may require additional suction under the rubber dam sheet. My assistants are all able to adjust the dam so that any saliva can be evacuated without me having to stop what I am doing.

You will have pre-fitted the rubber dam to a frame and selected the appropriate clamp for the tooth that is being treated, making rubber dam application much quicker (Figure 8). Have a small length of floss and caulking to hand for final adjustment. Rubber dam application should only take a few seconds. Dental nurses can also place a rubber dam in the patient's mouth, if they are trained to do so (General Dental Council, 2013).

Access cavity preparation can be difficult through metal restorations and a tungsten carbide fissure bur such as a Jet Beaver bur is useful. Make sure damaged or worn burs are replaced during decontamination as this will make cutting the access cavity much easier, quicker and less likely to result in mishaps, such as perforation (Figure 9).

While the dentist is hunting for the canal orifices, the apex locator can be set up. The lip hook is placed gently under the dam, and this is a good opportunity to check that saliva is not building up behind it.

Note the length and reference points for each canal as they are established. These will also be important for the patient records. The rotary or reciprocating instruments can now be measured to the correct length and handed to the dentist in sequence. Some modern preparation techniques will only require one file. The dentist will check the instrument during use to make sure it has not distorted or become fatigued.

During preparation, the dentist will need plenty of syringes of sodium hypochlorite to flush the canals of debris.

KEY POINTS

- Endodontic disease is fundamentally an immune response to bacterial infection of the root canal.
- Rubber dam is essential for many reasons in endodontics and there is no justification for not using it.
- Modern preparation techniques with single use instruments make tapering the root canals faster, safer and cheaper. They allow increased time for disinfection with sodium hypochlorite.
- A team approach will greatly enhance the patient experience and make root treatment more efficient.

Use a safe-ended needle and make sure that the irrigant does not drip on clothes as it will stain. It is also a good idea to pre-bend the needle to prevent extrusion (Figure 10).

The irrigant is agitated in the canals to break up biofilm, and the canals are dried with sterile paper points. You may need to practice passing the points clipped in tweezers, so that the tip of the point is the right way round for the tooth that is being treated (Figure 11).

At this point, the tooth will either be dressed with a medicament such as calcium hydroxide or obturated with gutta percha and sealer. The dentist should give you some indication of their intention before starting treatment so that you can have the relevant equipment ready.

To avoid potential contamination, it is a good idea to sterilise gutta percha points in sodium hypochlorite before use and use a sterile ruler—not one used with dirty files at the beginning of treatment.

Finally, a sealing filling is placed in the access cavity, which could be IRM (Dentsply), a compomer or a dual-cure composite.

Conclusion

In most cases, endodontic treatment involves managing a bacterial infection in the root canal. Being meticulous at each stage and following good cross-infection measures will improve the likelihood of success.

There are many ways the dental nurse can make the team more efficient and root canal treatment more rewarding. **DN**

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