

Current Practice in Endodontics: 2. Diagnosis and Treatment Planning

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Abstract: The aim of this series of six articles is to improve the quality of endodontic treatment in general dental practice by considering what is currently being taught in dental schools. This second article considers the accurate diagnosis of endodontic lesions, which frequently present as emergencies requiring prompt, rapid and efficient attention. The paper then presents the treatment normally indicated once a correct and accurate diagnosis has been made.

Dent Update 2000; 27: 388-391

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

It has been suggested that almost 90% of patients seeking emergency dental treatment have pulpal or periapical disease.¹ It is not intended in this paper to review comprehensively the differential diagnosis of dental pain, but rather to concentrate on those lesions diagnosed as being of endodontic or pulpal origin. It is assumed that a careful history has been taken, that the periodontal status has been considered, and that non-odontogenic pain eliminated – for example, organic diseases such as maxillary sinusitis, tumours, etc., functional disorders such as TMJ dysfunction, myofascial pain, vascular or neurological conditions, and psychological problems.

Of course, a definite diagnosis must be made before any irreversible treatment is carried out, and detailed and contemporaneous records should be

made of the findings leading up to that diagnosis. Although many endodontic emergencies present outwith a routine course of treatment, patients may also present during and after treatment. Endodontic problems during treatment will be considered in part four of this series, and post-treatment emergencies in part six.

CLASSIFICATION OF PAIN OF ENDODONTIC ORIGIN

When diagnosing dental pain, many practitioners refer mistakenly to 'acute' and 'chronic' pulpitis. These are histological terms, and such a diagnosis can be made only if the pulpal tissue is removed for histological examination. Irritation of the pulp, by whatever stimulus, causes inflammation. The more severe the inflammation the more serious will be the permanent damage to the pulpal tissue. One of four clinical diagnoses may be made:

- reversible pulpitis;
- irreversible pulpitis;

- periapical periodontitis;
- acute apical abscess.

The diagnosis can be arrived at by asking the following questions and with careful clinical examination.

- Where does the pain seem to be coming from?
- How long has the pain been present?
- How would you describe the pain?
- Does anything make it better?
- Does anything make it worse?
- Is there any relevant history, such as recent treatment or trauma?

Once the correct diagnosis has been made, the relevant and appropriate treatment follows automatically.

REVERSIBLE PULPITIS

This diagnosis indicates that, although the pulp is inflamed, once the stimulus or cause of the pain is removed the pulp will make a full recovery to normal health. This pain will arise only on stimulus, will be of relatively short duration, will last only a few moments and will quickly recede once the stimulus is withdrawn. It may be difficult for the patient to locate the offending tooth exactly. The tooth will not usually be tender to percussion, although an exaggerated response to pulp testing may occur. The radiographic appearance will be normal, with no widening of the periodontal ligament, although caries may be seen. Mild irritation may result in the formation of reparative dentine, but if the stimulus persists untreated further inflammatory changes may occur –

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turning the situation into an irreversible pulpitis and eventually pulpal necrosis. The border line between reversible and irreversible pulpitis may very occasionally be blurred, but usually the diagnosis is easy.

Reversible pulpitis is treated simply by the removal of the stimulus.

- Sensitivity from exposed dentine may be treated with fluoride varnish or a dentine bonding agent with the aim of occluding the exposed dentinal tubules, and the prescription of a desensitizing toothpaste.
- Occasionally the cause may be a high restoration, and occlusal adjustment will suffice.
- A cracked restoration, allowing thermal stimulation of dentine, simply requires replacement.
- When caries is found to be the cause of the pain a new restoration will usually suffice, although sometimes a sedative dressing may be advisable if the caries is close to the pulp.
- If a small pulpal exposure is discovered during the final stages of caries removal, and a diagnosis of reversible pulpitis has been made, the tooth should be carefully isolated to prevent ingress of saliva and bacterial contamination. The cavity should be irrigated with sterile saline, and carefully dried with sterile cotton wool pledgets.

It has long been recognized that there is a significant difference in outcome between capping an inflamed and a non-inflamed pulp.² If bleeding cannot be arrested then it may be assumed that there is irreversible inflammation; the pulp should be extirpated and root canal treatment commenced. Calcium hydroxide placed on a bleeding exposure will not seal the cavity, and the pulp capping will fail. Pulp capping is a difficult procedure and, unless this protocol is followed carefully, bacterial contamination of the exposure will occur and the pulp will die. If bleeding stops quickly, then a small dressing of calcium hydroxide should be placed,

and the cavity lined with a glass ionomer material to seal the dentine tubules – again to prevent bacterial contamination. Finally, a sound restoration should be placed.

There is no indication for the use of steroid-containing materials to reduce the inflammation, which will subside once the stimulus is removed. If it is considered that steroids are indicated to reduce pain and inflammation, then the original diagnosis must be questioned.

During treatment of reversal pulpitis, bacterial contamination of pulp tissues should not be allowed to occur, and antibiotics are *never* indicated for reversible pulpitis. Should the symptoms persist or worsen, the original diagnosis may have been incorrect.

IRREVERSIBLE PULPITIS

In cases of irreversible pulpitis the pain may arise spontaneously, and not just as a response to stimulus. It will last for longer and longer periods, and frequently awakes the patient at night. Hot and cold stimuli will cause prolonged pain, although in the later stages of inflammation cold may relieve the pain. However, once the chemical mediators of the inflammation pass through the apical delta into the periradicular tissues, the offending tooth will become tender to percussion and be easily located by the patient. A widened periodontal ligament may be seen on a radiograph, even though the tooth may still contain vital tissue.

If extraction of the affected tooth is not indicated, treatment of irreversible pulpitis is simple – extirpation of the pulp and root canal therapy. If the diagnosis is correct the pulp is dying. No amount of steroid or sedative dressing will prevent this, although the painful irreversible pulpitis may be changed into an asymptomatic irreversible pulpitis. A dentist on a postgraduate course in Hull once replied to this statement, ‘That’s all very well for you – you are good at endodontics. I’m not, and I won’t start root canal treatment until it’s really necessary!’ The answer to this, of course, is that a tooth with an

irreversible pulpitis is easier to treat than a long-standing necrotic tooth with deep-seated infection and possibly sclerosis, which will certainly develop if treatment is delayed! There will also be a higher success rate than if a periradicular pathology is present. When the fee under the general dental services is the same, no matter how difficult the treatment, the case for early intervention is even greater.

If the busy practitioner does not have time to extirpate an exposed or irreversibly inflamed pulp and complete the root canal preparation immediately then a steroid dressing may be applied to a large exposure, but always bear in mind that when the tooth is re-opened the pulpal tissue may be more sensitive due to changes in the unmyelinated c-fibres (anaesthesia in endodontic treatment will be dealt with in the next article in this series). As in reversible pulpitis, the pain will subside once the appropriate treatment is given, and the prescription of antibiotics is not indicated.

APICAL PERIODONTITIS

Apical periodontitis is the body’s defence against inflammation and infection of the pulpal tissue. Apical periodontitis is not always painful, and many such lesions remain undetected until found incidentally on routine radiographic examination. Pain may arise either from a new lesion or as a result of an acute exacerbation of a chronic lesion. Here the pain is usually severe, and the tooth will be tender to percussion and often also to palpation. With a new lesion there may be no change visible on a radiograph, or only slight widening of the periodontal ligament.

It should be remembered, however, that a tooth does not have to be non-vital to suffer apical periodontitis, which may occasionally arise from occlusal trauma or bruxism. Vitality testing may help with this diagnosis, although with multi-rooted teeth it is possible to have both vital and non-vital tissue at the same time.

Treatment involves removal of the



Figure 1. A radiograph showing a large apical radiolucency, which the patient elected to leave untreated.

causative agent, and, except for the rare occlusal problem, root canal treatment should be commenced at once.

Following preparation and copious irrigation with sodium hypochlorite, the canal should be dried and dressed with a mixture of calcium hydroxide and a steroid paste, to reduce the inflammation and complete the disinfection. Antibiotics are not indicated as the immune system is quite able to resolve any infection in the periradicular tissues once the source of the infection has been removed.

Although this article is about endodontic pain, asymptomatic periapical periodontitis may be found associated with any tooth on a routine radiographic examination. Once such a periapical radiolucency is detected, the practitioner must advise the patient of the finding, present the treatment options and prognoses, and arrive at a mutually agreed treatment plan. Figure 1 shows a large lesion on a lower molar of which the patient was quite unaware. After considering the options, he elected to leave the tooth alone and seek treatment only if he began to experience symptoms. Of course, this discussion was carefully recorded in the patient's dental notes.

ACUTE APICAL ABSCESS

In the early stages the acute apical abscess may be difficult to distinguish from an apical periodontitis. However, the usual symptoms are exquisite pain and swelling, associated with a necrotic pulp. Due to extrusion caused by the apical inflammation, the tooth in

question will usually be mobile, and even the suggestion of palpation or percussion will invoke a painful response from the patient!

If the pulp is found to be vital then a periodontal lesion may be suspected. Much has been written regarding endo-perio lesions,^{3,4} but in the case of a non-vital pulp endodontic treatment must always be carried out successfully before the periodontal lesion will regress. Again, in the case of a true periodontal abscess, pain is not so severe and will not usually cause loss of sleep.

Many cases that present as acute apical abscess are in fact acute exacerbations of chronic apical periodontitis. In the case of a true acute abscess there will probably only be evidence on a radiograph of a widening of the periodontal membrane space.

With an exacerbation of a chronic lesion, examination may reveal a sinus through which pus is draining into the

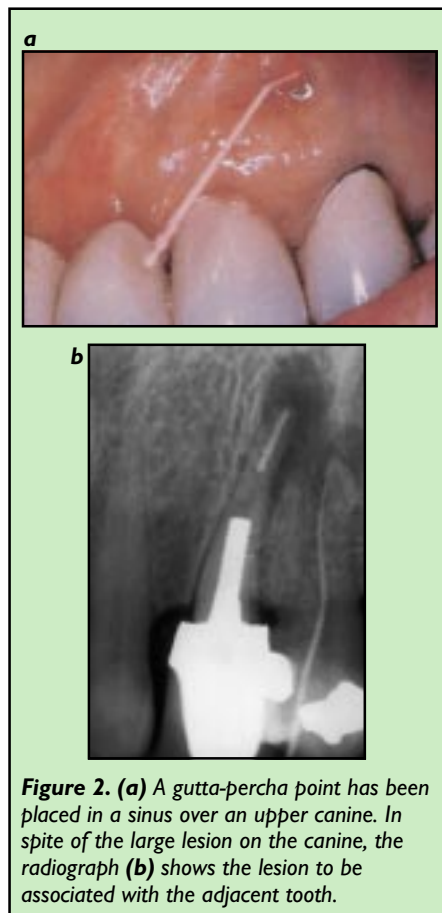


Figure 2. (a) A gutta-percha point has been placed in a sinus over an upper canine. In spite of the large lesion on the canine, the radiograph (b) shows the lesion to be associated with the adjacent tooth.



Figure 3. Drainage of pus through an access cavity, not prescription of antibiotics, is the appropriate treatment for an acute apical abscess.

oral cavity. While such lesions usually drain into the buccal sulcus, always remember that a swelling in the palate over the palatal roots of the upper first molar may be draining from an upper lateral incisor, as this tooth has a palatal inclination and pus will follow the path of least resistance. If a sinus is present and a radiograph is to be taken, it is important for diagnosis to thread a gutta-percha point into the sinus tract, as shown in Figure 2. Here a sinus is draining over an upper canine, but the lesion was actually associated with the adjacent premolar, despite the obvious pathology associated with the inadequately root-filled, post-crowned canine.

Treatment in the first instance is relief of symptoms by drainage of the pus. The normal route for this would be via the root canal (Figure 3). Supporting the tooth with a finger whilst gently opening the pulp chamber is usually accepted by most patients, and once the pressure is relieved pain relief is instantaneous. It will, however, be unlikely that rubber dam can be placed, and great care should be taken to avoid contamination with saliva. It is similarly unlikely that much canal instrumentation can be performed, but the tooth should be irrigated with copious amounts of sodium hypochlorite and sealed with a temporary dressing for 24–36 hours. This will disinfect the canal and remove much of the source of the infection responsible for the acute apical inflammation.

When the patient is reviewed, canal preparation can be carried out and a



Figure 4. (a) A radiograph of an upper molar taken with a bisecting angle technique. (b) The same tooth exposed using a long cone paralleling technique. (Films courtesy of Dr Stephen Godfrey.)

calcium hydroxide dressing placed. It has been recognized that leaving teeth on open drainage significantly reduces the long-term prognosis,⁵ and is rarely indicated. Indeed, the logic behind open drainage has always been dubious. The canal will become contaminated with food debris, and the microbial population becomes much more intractable.

Of course, if the patient is not willing to allow an access cavity to be cut due to the local tenderness, a fluctuant swelling should be incised under topical anaesthesia: the expression 'Never let the sun go down on undrained pus' holds as true today as when it was first used! Antibiotics are indicated *only* if there has been systemic spread of the infection, the patient is unwell and has a raised temperature. A patient who has been awake all night with toothache may not be febrile, simply suffering from lack of sleep and an excess of analgesics. Antibiotics do not work in the presence of pus, and once the source of the



Figure 5. A very difficult endodontic case. Early identification of the difficulty and referral for specialist treatment would seem appropriate.

infection has been removed the immune system should be able to control the periapical lesion.

Where antibiotics are indicated, penicillin remains the agent of choice, unless the patient has an allergy to this, in which case clindamycin is usually indicated. Most of the micro-organisms present in the root canal are sensitive to penicillin.⁶ Metronidazole should be used only in conjunction with another antibiotic as, although it is very effective against anaerobic Gram-negative bacilli, it has limited action against many of the other organisms found in the root canal. It is rarely, if ever, the first antibiotic agent indicated.⁷

RADIOGRAPHY

If a radiograph is indicated whilst examining the patient, the film may become the basis for commencing endodontic treatment. It is important therefore that a long-cone parallel technique is used routinely. Numerous film-holding and beam angulation systems are available to assist the operator in this. A film taken by this method, as opposed to the bisecting angle technique, will give a clearer view of the shape of the pulp chamber and pulp horns, assisting access, and will be more accurate for subsequent estimation of the canal length, as shown in Figure 4.

TREATMENT PLANNING

A frequent complaint regarding

endodontics is that the fees payable by the NHS do not reflect the difficulty in treatment, and such political discussions often form part of postgraduate courses. Whilst every effort is being made by representatives of the British Endodontic Society to remedy this situation, at present these fees have to be accepted. The prudent practitioner will therefore assess cases carefully, and may not attempt difficult cases such as that shown in Figure 5. As part of obtaining informed consent the prognosis must be given for each tooth, and the patient must accept that a significant percentage of difficult molar treatments will not be successful.

Telling a patient that a tooth has a poor prognosis before treatment commences is seen as a wise explanation – telling them exactly the same after the treatment has failed is seen as a lame excuse!

CONCLUSION

Accurate diagnosis of an endodontic emergency is essential if the correct treatment is to be given. Frequently this will be root canal treatment, and in the next article in this series we will be considering current thinking with regard to the positioning, techniques and instruments used in cutting access cavities.

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