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The ultimate goal of endodontic treatment is the long-term retention in function of teeth with pulpal or periapical disease. Depending on the diagnosis, this therapy typically involves the preparation and obturation of all root canals.

Both steps are critical to an optimal long-term outcome. This article is intended to update clinicians on the current understanding of best practices in the two pillars of nonsurgical endodontics, canal preparation and obturation, and to highlight strategies for decision making during both uncomplicated and more difficult endodontic cases.

Prior to initiating therapy, a clinician must establish a diagnosis, take a thorough patient history and conduct clinical tests. Recently, judicious use of cone-beam computed tomography (CBCT) has augmented the clinically available imaging modalities. Verifying the mental image of canal anatomy goes a long way to promote success in canal preparation. For example, a raised canal frequency is associated with endodontic failures. As most maxillary molars have two canals, in the mesiobuccal root, case referral to an endodontist for treatment is the long-term retention in function of teeth with pulpal or periapical disease. Depending on the diagnosis, this therapy typically involves the preparation and obturation of all root canals.
more coronal is more vulnerable to failure. Infringement of the root surface has been shown to be associated with failure. For example, a lower rotational speed of 350 rpm results in delayed buildup of fatigue and reduced incidence of taper lock. Material imperfections such as micro-cracks and milling marks are clear that with additional support of the sites. Such surface imperfections after manufacturing can be removed by electrochemical polishing but it is unclear if this process extends fatigue life. Manufacturers’ recommendations differ with regard to the way the instruments are moved. A typical recommendation in using a rotary instrument into the canal gently in an in-and-out motion for three to four cycles after lubrication is recommended, followed by irrigation to clean the file. It is difficult to determine exactly the apically exerted force in the clinical situation. Several studies have suggested that forces start at about 1 Newton and range up to 5 N. Precise torque limits during instrumentation are used as a means to reduce failure. Most clinicians use torque-controlled motors, where the force is transmitted to the file by a linear movement. To reduce friction, manufacturers often recommend use of gel-based lubrication. However, even such lubricants have not been shown to be beneficial and actually damage the instrument surface. ProFile® instruments Therefore, it is recommended to flood the canal system with water immediately after using the ProTaper rotary in order to reduce friction and avoid overheating. The best way to do this is to create an access opening that can act as a resorb (Fig. 3).

There are several concerns about using NiTi instruments. The effects of procedures on periapical tissues is not clear. It has been shown that protein particles cannot completely be removed from machined nickel-titanium surfaces. More importantly, it is understood that the apical limit of Ca(OH)2 as a disinfectant is not well-defined in the cases of periapical tissues. The use of NiTi instruments has been associated with periapical lesions. The severity of these lesions varies by instrument, but long-term follow-up studies have demonstrated a decrease in the size of lesions. The current clinical evidence suggests the role of accessory instruments such as the furcation. It has been shown that NiTi files can be used to achieve an adequate coronal seal. The coronal seal is important in preventing the entry of bacteria from the oral cavity into the apical periodontium. In order to achieve an optimal seal, the clinician must take special care to ensure that the access opening is free of debris. The access opening must be wide enough to allow the placement of a suitable seal. The seal must be placed in the canal and inspected for a complete coating of gutta-percha. After the introduction of MTA (mineral trioxide aggregate) as a mate- rial for apical seal, it has become the most used material for apical seal. MTA is biocompatible and has a high degree of bioactivity. Current recommendations advise that clinicians are judicious when reusing rotary instruments as they are not flexible and can over- come apical constriction. Glide path files, for example, PatiFiles® and ProGlider® (Dentsply Maillefer) are designed specifically for rotary instrumentation and may be used to create a delicate touch.

Clinical results

While results from in vitro studies on rotaries are often abundant, clinical studies on these instruments are sparse. Comparing NiTi and stainless steel files, there are fewer canal transportation and fewer instruments required to achieve perforations. Subsequently, using radiographic evaluation of the same patient 30 days after instrumentation did not show any difference between the three systems with an overall favorable outcome rate of about 85 percent. A more consistent clinical result is seen when the manufacturer’s directions are followed. While there is no consensus among manufacturers, a set of common rules applies to root canal preparation. Root canal systems appear to expand in the following sequence:

- Analysis of the specific anatomy of the case.
- Canal scouting.
- Canal enlargement.
- Preparation of working length.
- Root canal shaping to desired size.
- Gauging the formation, apical adju- dication.

Obturation of the root canal system

A well-shaped and cleaned canal sys- tem should create the conditions for a successful root canal obturation. On the other hand, this root canal system is in- capable of the body’s immu- nological and biochemical responses to coronal leakage. Accordingly, best practices dictate that root canals should not be shaped to a complete canal; only to prevent ingress of nutrients or oral microorganisms.

None of the established techniques for root canal filling provides a definitive coronal, lateral and apical seal.

Basic strategies in root canal obturation

In a well-prepared root canal fillings should seal all foramina leading to the peri- odontium, be without voids, adapt to the curved canal walls and end at the apical constriction. Working length must be accurate as well as the possibility of overfills, particularly in infected canals. The root filling procedure is the last step of root canal treatment and is considered as the most important factor in the overall success of root canal treat- ment. This is why special sealing tech- niques can claim superior healing success.

Current developments in root canal obturation materials

Root canal obturation is a critical step in the root canal treatment. The materials used for obturation can be classified into three main groups, based on their composition:

- Non-cemented gutta-percha (so-called monocore systems).
- Cements with gutta-percha or sealer (so-called dual core systems).
- Cements without gutta-percha or sealer (so-called triple core systems).

In general, these three groups can be further divided into three subgroups based on the type of cement used. The choice of obturation material depends on the clinician’s preference and the patient’s factors. Some clinicians prefer a more rigid obturation material, while others prefer a more flexible material. In general, cemented systems are preferred over non-cemented systems due to their superior sealing ability. However, cemented systems are more expensive and require additional time and effort. In conclusion, the choice of obturation material depends on the individual patient’s factors and the clinician’s preference.

Summary and conclusions

Root canal treatment is a complex procedure that requires the use of various instruments and materials. The success of root canal treatment depends on several factors, including the type of instrument used, the operator’s skill level, and the patient’s compliance. In order to achieve the best results, it is important to follow established guidelines. Cases with a high risk of failure should be referred to an endodontist. While many cases can be treated successfully in routine practice, the ad- ditional care is necessary for difficult cases such as those involving extensive previous restorations. The specific obturation material used appears to have a minor role on overall outcome, such as the extent of the apical periodontitis. The use of a specific obturation material should be based on the clinician’s preference and the patient’s factors. In conclusion, the choice of obturation material depends on the individual patient’s factors and the clinician’s preference.