Clinical Update

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8955 Wood Road
Bethesda, Maryland 20889-5628

Vol. 38, No. 4 October 2016

Pulpectomy Therapy of Posterior Teeth

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Introduction

Pulpectomy is defined as the complete removal of the dental pulp to the level of the apical foramen.[1] Performing a thorough pulpectomy increases treatment success, patient satisfaction, minimizes unscheduled patient visits, and enhances predictable clinical outcomes. The purpose of this clinical update is to outline the procedure for performing a pulpectomy in posterior teeth (many of the listed specifics also relate to anterior teeth). The emphases on the pre-operative and intra-operative details are critical for clinicians to consider during this procedure.

Pre-operative Evaluation

A thorough pre-operative evaluation is as important as the actual pulpectomy. Knowledge of the patient's chief complaint, medical history, and past dental history, as well as a comprehensive clinical exam is crucial. Diagnostic radiographs are essential to accurately interpret pathosis, evaluate root/pulpal morphology, and for orientation to normal anatomic structures. Previous studies using extracted teeth provide key information regarding the relationship between external anatomical features and the pulp chamber floor.[2]

Radiographs: Diagnostic information is increased when two radiographs are exposed: straight and angled views.[3] Properly positioned images should encompass the entire tooth and extend at least 3 mm beyond the apex to include the entire radiographic lesion. The paralleling radiographic technique provides the most accurate image[4] and when combined with the buccal object rule yields additional valuable diagnostic information. Once all of the pre-operative evaluation information has been assessed, an accurate pulpal & apical diagnosis can be made.

Access

Morphological Measurements: Basic understanding of pulp morphology can enhance the access preparation. Deutsch and others measured anatomical landmarks of pulp morphology in maxillary and mandibular molars. The average distance from the buccal cusp tip to the floor of the chamber was reported to be approximately 8 mm for all molars.[5] Knowing the cutting flute length of the access burs can help prevent unexpected perforations. For example, the cutting flute length of an Endo-Z bur is 9 mm. The top of the flutes would not be carried past the MB cusp unless the chamber floor is reached. Complete caries excavation and restoration prior to entering the pulp is important in assessing restorability and ensuring proper coronal seal after treatment to minimize leakage. The use of a rubber dam during endodontic treatment is the standard of care and essential to maintaining an aseptic environment. Placing rubber dam caulking at the tooth/retainer junction minimizes saliva contamination significantly.[6] There is no published literature to determine the isolation efficacy during root canal treatment using Isolite®.

Visualize Access: The access preparation should reflect the underlying pulpal anatomy. For maxillary molars, a triangular outline form towards the mesial half of the tooth is most common (Fig. 1B). Weller and Hartwell proposed a modified rhomboidal access, as seen in Figure 1A, that improved their ability to locate MB2 canals.[7]

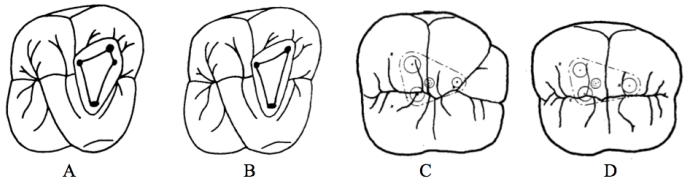

Fig 1: A. Modified access B. Classic access Fig 2: C. Mandibular first D. Mandibular second

In mandibular molars, the ideal outline form is a rectangular or trapezoidal shape and is centrally positioned, as depicted in Fig. 2C, D.[8] Several techniques can be used to identify canal orifice location. The most valuable tool is intimate knowledge of pulpal anatomy. Anticipating approximate locations and variations will greatly increase the success of locating canal orifices. Other common techniques include 1) using the subpulpal groove as a guide, 2) soaking the pulp chamber with sodium hypochlorite and looking for bubbling from vital tissue, and 3) pecking the pulpal floor with #10 K-file while applying reciprocating quarter turns.

Coronal/Straight-line Access: Canal orifices should be enlarged to obtain straight-line access into the canals while avoiding perforations. Orifice openers, such as Gates-Glidden (GG), or rotary file orifice openers are used with an outward brushing stroke away from the furcation. Rotary file orifice openers can enlarge the coronal aspect of the canal with more control due to non-cutting tips. Using Fig. 3 as a reference, the final orifice preparation (in red) is located away from the original orifice position (in green) and danger zone.[9] Preflaring the orifices will provide more accurate working length (WL) due to removal of the cervical bulge of dentin.[10] Recent studies utilizing micro-computed tomography of mandibular molars recommended orifice relocation by removing the dentinal shelf an average of 0.52 mm.[11]

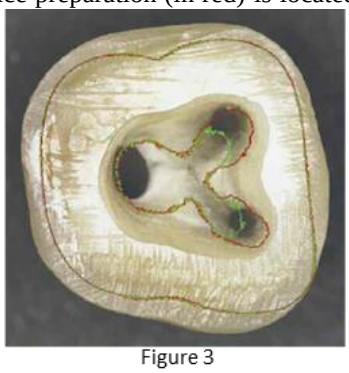

Figure 3
Courtesy of Dr. Clifford J. Ruddle

Working Length

It is crucial to obtain an accurate WL prior to instrumentation using an electronic apex locator (EAL). This is accomplished by placing a #10 file passively into the canal. Patency is obtained when the bar indicator reaches the first red line or audibly by a full tone on the Root ZX. This length should be easily reproducible. It is highly recommended to take a radiograph at this length with a minimum size #10 file in all canals. Subtract 1 mm from patency to obtain the most accurate WL. When an EAL is not available, take the radiographic estimated WL and subtract 2 mm. This will predictably ensure instrumentation is within the canal space.[12] For cases where apical resorption is evident, it is recommended to subtract 2.0 mm from the patency measurement.[13]

Cleaning and Shaping

Radicular Access: Shaping the coronal and middle thirds of the canal facilitates bacterial reduction by allowing irrigants to more easi-

ly gain access to these areas. If using GG, limit their use to the coronal 1/3, or to 3 to 4 mm from the orifice and away from the furcation area. The diameter of GG#2 is 0.7 mm (size of an ISO #70 file), GG#3 is 0.9 mm and GG#4 is 1.10 mm.

Apical Instrumentation: The goal is to maintain the original canal curvature and allow deeper canal penetration of intracanal medication and irrigants to better exert their effects. Filing to an apical size of a #25 file is recommended as it will generally maintain the canal's original curvature,[14] allowing irrigants to penetrate the apical part of the canal. Instrumenting 2 mm short of WL is acceptable because it ensures the medication is within the canal system.[15]

Irrigation: One of the most important facets of performing a thorough pulpectomy is the use of appropriate irrigants. While instrumentation alone reduces the bacterial load, using chemical irrigants (i.e. NaOCl) with ultrasonics produces significantly cleaner canals, especially in necrotic cases.[16] An effective irrigation protocol is using full strength NaOCl (5.25%, 6% or 8.25%) and 17% EDTA (1 ml for 1 min per canal) for smear layer removal.[17, 18] During irrigation, ensure the tip is at least 1 mm short of WL. Apply gentle pressure and move the irrigation needle in short "in and out" strokes to prevent binding. These steps minimize sodium hypochlorite accidents. Newer irrigation methods, such as negative apical pressure and side vented irrigation tips, are more effective in smear layer removal, bacterial reduction, reducing apical debris extrusion, and are safer compared to conventional open ended needle irrigation.[19]

Intracanal Medication

Calcium hydroxide (CH) is the most widely used intracanal medication due to its ability to dissolve tissue and reduce bacteria and endotoxins.[20] It is incumbent that providers not leave canals empty between appointments. Various methods are available to deliver CH in a dry canal. A lentulospiral is effective in delivering CH into the most apical portion of the root, but necessitates proper coronal flare to avoid instrument fracture.[21] The NaviTip® does not require as much coronal flaring, has an end vented tip, and should be injected with minimal apical pressure to minimize extrusion beyond the apex, especially in immature roots or apical resorption. A post-treatment radiograph should be exposed to visualize CH placement. While CH is safe when used within the canal system, excessive material extruded into osseous or soft tissue should be avoided,[22] especially in the inferior alveolar canal or the maxillary sinus. These cases indicate an immediate referral to an oral surgeon.

Temporization

A well-placed temporary restoration minimizes coronal leakage. The temporary should be intimately adapted to the chamber walls to form a proper seal. An effective temporary restoration requires a thickness of 3.5 mm.[23] Studies have demonstrated that glass ionomers (GI) and resin modified GI provided a better coronal seal against bacterial leakage for at least four weeks[24] and were more fracture resistant[25] compared to Cavit™ and IRM.

Summary

Performing a thorough pulpectomy requires numerous clinical considerations prior to initiating treatment. Pre-operative assessment using patient history, knowledge of dental anatomy, and radiographic images can assist in predictable outcomes. Following the basic guidelines of obtaining straight-line access, preflaring the coronal access, estimating WL 2 mm short of radiographic apex, shaping to a minimum master apical file size #25, using irrigants, coupled with intracanal medicaments when appropriate, and placement of a well-sealed temporary should reduce the patient's post-operative symptoms and lead to a more predictable outcome.

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A special thank you to CAPT(ret) Gary Goodell for his significant contribution to this clinical update.

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