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Endodontics Newsletter™

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*Do you or your staff have any questions or comments about **Endodontics Newsletter?** Please write or call our office. We would be happy to hear from you.*

Possible Benefits of Cervical Preflaring in Endodontic Therapy

During instrumentation, dentin shavings are generated that, along with tissue remnants and any infected necrotic tissue, should ideally be carried out of the canal coronally rather than pushed farther into the canal and possibly through the apex. When this debris is pushed into the apical area, it can solidify and cause the file to deform the canal. In the worst case scenario, if the debris is pushed through the apex, the patient is more likely to experience postoperative

- inflammation
- infection
- pain

Most endodontic instruments, as well as standard preparation techniques, are designed to reduce this debris; but there is always an inherent risk.

Many have suggested that cervical preflaring prior to instrumentation of the mid and apical parts of the root could affect how much debris is pushed downward through the apex. However,

no previously published studies investigated this correlation.

Borges et al from the University of Cuiabá, Brazil, selected 180 extracted human maxillary central incisors and randomly divided them into 12 groups. In each group, root canals were instrumented using 1 of 5 different rotary and reciprocating systems or motor-driven oscillatory stainless steel K-file instrumentation with and without preflaring with a 35/.06 stainless bur in the cervical and middle thirds of the teeth (Figure 1). For all groups, the apically extruded debris was collected, dried and weighed. A comparison was made between all systems as well as within each system.

Interestingly, the K-files produced more debris than any of the other systems ($p < .05$; Figure 2). All techniques caused some apical extrusion. However, cervical preflaring reduced the amount of apical extrusion for all systems when compared with no cervical preflaring.

This study confirmed that if the recommended methods are followed for whichever instrumentation technique is used, apical extrusion can be reduced. The question remains as to whether it is reasonable and necessary to aggressively

preflare the canals, as was done in this study. If the crown-down approach is used, especially with reciprocation files, the selected file is inserted only one-third of the way into the canal then withdrawn and cleaned with a wet, sterile gauze or sponge. The patency of the remaining canal is confirmed and the canal irrigated. Then the process is repeated with the middle one-third of the canal. If this protocol is followed, there is a good likelihood that the canal will be preflared sufficiently prior to the file entering the apical one-third, thereby minimizing the risk of apical extrusion of debris.

Borges ÁH, Pereira TM, Porto AN, et al. The influence of cervical preflaring on the amount of apically extruded debris after root canal preparation using different instrumentation systems. J Endod 2016;42:465-469.

Coronal Discoloration by Endodontic Reporative Materials

Since mineral trioxide aggregate (MTA; Dentsply Tulsa Dental) was introduced >20 years ago, it has been considered the best pulp-capping agent available because of its low cytotoxicity and good biocompatibility with the pulpal tissue, as well as its sealing ability. However, the original gray MTA has one very undesirable quality: It can severely stain the crowns of teeth when placed in or cervical to natural crowns. The manufacturer responded by introducing a new material, White ProRoot MTA (wMTA) that contained smaller amounts of ingredients such as iron, aluminum and magnesium, which were known to cause staining. Unfortunately, it has been demonstrated that wMTA also stains crowns and is therefore not recommended for pulp capping in esthetic areas.

Two new materials have been recently introduced as alternative pulp-capping agents: Biodentine (Septodont) and EndoSequence Root Repair Material (ERRM; Brasseler USA; Figure 3). Both are calcium silicate-based materials, and, similar to MTA, both have been shown to possess a good sealing ability and healing response. Until now, neither has been tested with respect to discoloration of crowns. Therefore, Marconyak et al from Keesler Air Force Base, Mississippi, compared the discoloration caused by these 2 new materials with 3 commercially available preparations of MTA and wMTA.

Ninety mandibular third molars were collected and randomly assigned to 6 different groups. For 5 of the 6 groups, standard endodontic access into the pulp chamber was made, and the buccal enamel-dentin thickness was reduced to a standard thickness of 3 mm in all teeth. The test materials were then placed in the access above the orifice level of the canals. The access was closed with 3 mm of glass ionomer, and the remainder of the unfilled access cavity was filled with composite matched to the coronal tooth structure. The sixth group was not prepared and served as a negative control. The color of every crown was registered according to Commission internationale de l'éclairage L*a*b* color space prior to access and immediately after placement of the filling material. Color was then assessed for all teeth after 1, 7, 30 and 60 days.

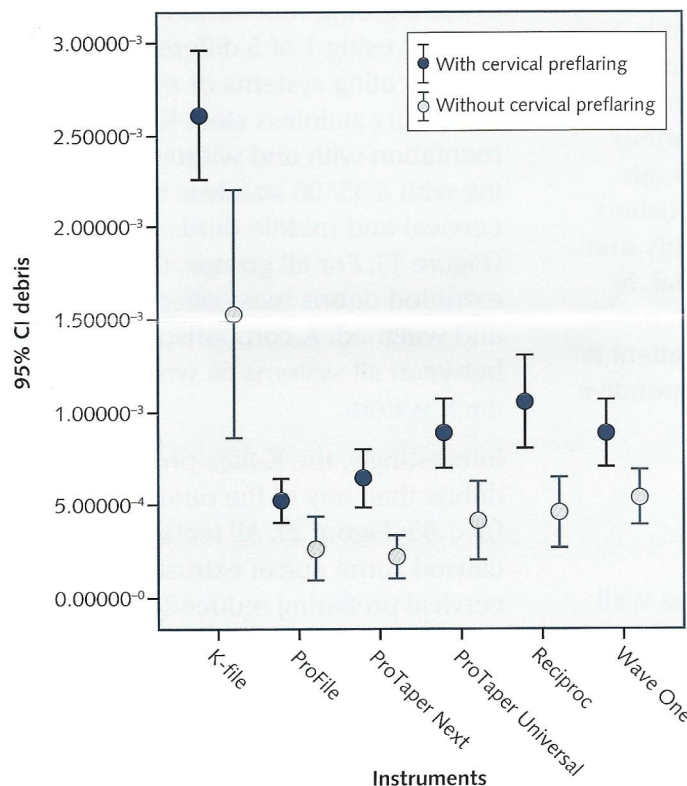
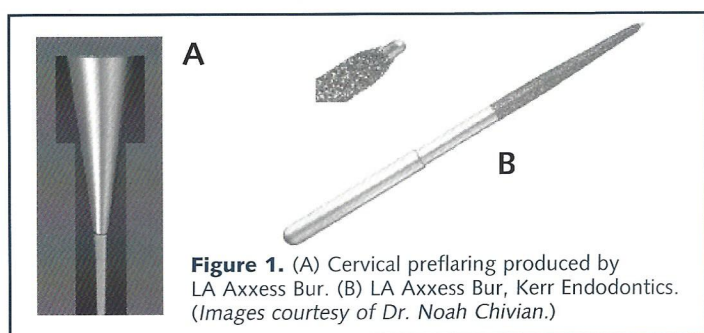
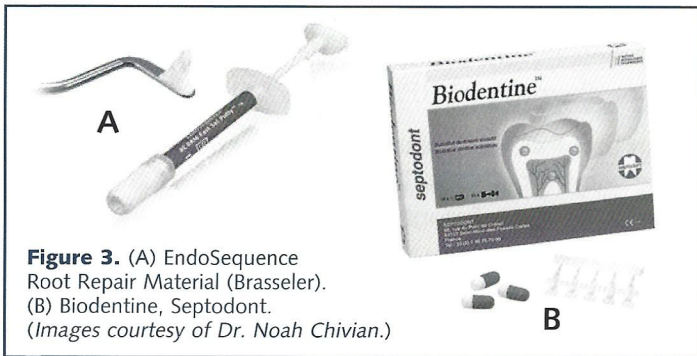


Figure 2. The amount of debris extruded apically after root canal preparation with and without cervical preflaring. CI, confidence interval.



All treated teeth showed clinically noticeable color change on day 1. However, the teeth filled with Biodentine and ERRM did not continue to darken, and for both groups the color change hovered around or below clinically noticeable discoloration at subsequent observation times. All teeth filled with MTA showed severe discoloration, including those filled with wMTA, and the color change remained statistically significant at 30 and 60 days compared with teeth filled with the other 2 materials.

This study indicates that these new materials could be used in the esthetic zone as a capping agent and/or for pulp revascularization. However, the study was only conducted in vitro, and more clinical studies need to be done to confirm that the new materials do not stain anterior crowns over time.

Marconyak LJ Jr, Kirkpatrick TC, Roberts HW, et al. A comparison of coronal tooth discoloration elicited by various endodontic reparative materials. J Endod 2015;doi:10.1016/j.joen.2015.10.013.

Passive Ultrasonic Irrigation vs Irrigation with Reciprocation

The aim of endodontic therapy is to remove all bacteria, bacterial by-products and debris from the canal(s). Different techniques have been suggested to accomplish this using

- hand and engine-driven instruments
- irrigation solutions and mixes with sonic or ultrasonic activation

Most agree that both mechanical instrumentation and irrigation are required to achieve the best cleaning. The so-called smear layer, one by-product of instrumentation, can be hard to remove after completion of instrumentation. This layer, which forms on the canal

walls when they are instrumented with any kind of file, is composed mainly of dentin filings but could contain some organic material, including bacteria. Leaving a smear layer on the canal walls has been shown to affect the dentin permeability and decrease the effectiveness of bacteria removal.

Ultrasonic activation of irrigation solution (5.25% sodium hypochlorite [NaOCl]) at the end of the instrumentation cycle has been cited as the best way to disrupt the smear layer and aid in washing it away. Not everyone in the field agrees that ultrasonic activation is better than mechanical instrumentation and agitation with an irrigant. This is because ultrasonic activation is affected by the power intensity released by the device used along with the free space within the canal, and the fact that the ultrasonic tip has to be able to move completely unobstructed in the canals.

Kato et al from São Leopoldo Mandic Center for Dental Research, Brazil, compared these 2 approaches—passive ultrasonic irrigation (PUI) and irrigation with reciprocating mechanical activation—using extracted teeth to evaluate the removal of debris from root canal walls at 6 predetermined apical levels.

Ten mandibular molars were accessed, the glide path to the apex was confirmed and the coronal part was reduced so that all teeth had the same total length. A #30 file with .05 taper was used in an in-and-out motion up to working length in all teeth to standardize the canal taper and size. The mesiofacial roots were split so the inside of the canals could be evaluated by environmental scanning electron microscopy. To ensure the best comparison, the 2 halves were inserted in elastic material, which kept them close together, enabling researchers to use the same teeth for different experimental groups. One of the experimental groups was treated with PUI in the canal space close to working length using an irrigation of 2.5% NaOCl followed by 17% EDTA and then NaOCl again. In the other experimental group, a plastic instrument with an “aircraft wing” profile reciprocated 180° clockwise followed by 90° counterclockwise in the same cycle of irrigation solutions and for the same amount of time as the ultrasonic tip. All canals were scanned after each session and then evaluated by examiners.

The authors found that the reciprocating activation produced cleaner walls in the apical third of the root

canal compared with PUI. It may be that ultrasonic acoustic streaming has difficulty delivering the necessary energy in the apical areas because the required space needs to be $>3\times$ the diameter of the tip used, and the apical third does not necessarily provide that much space. The plastic reciprocation device is actually likely to clean better by the mechanical drag of adhered debris. Based on this finding, it might be beneficial to agitate the last rinse of NaOCl with a vertically pumping hand file or to use reciprocation.

A study like this must be read with caution because it is an in vitro study. It did not assess the ultimate goal of endodontic therapy—the tooth being retained asymptotically in the patient's mouth.

Kato AS, Cunha RS, da Silveira Bueno CE, et al. Investigation of the efficacy of passive ultrasonic irrigation versus irrigation with reciprocating activation: an environmental scanning electron microscopic study. J Endod 2016;doi:10.1016/j.joen.2016.01.016.

Cone-beam Computed Tomography to Detect Vertical Root Fractures

One of the most challenging diagnoses for clinicians is ruling out vertical root fractures (VRFs) in teeth that need or have had endodontic therapy. The symptoms can be quite confusing, and they are not specific to these fractures. Some patients may present with minor or no complaints, while others may have various symptoms, ranging from biting sensitivity to hot and/or cold sensitivity to spontaneous pain. Compounding the problem is the fact that most diagnostic tests have been shown to have a limited reliability in confirming VRF. The key issue is that if the root is vertically fractured, the prognosis of the tooth is usually hopeless, and endodontic therapy or endodontic retreatment will not help. Therefore, it would be beneficial for all if there were a method to conclusively diagnose these fractures.

Recently, cone-beam computed tomography (CBCT) has become available to most clinicians, either by the purchase of a machine or through CBCT services in the area. CBCT has enhanced the ability to diagnose bony lesions and aided clinicians in understanding and tackling all kinds of anatomical anomalies in both the dental roots and surrounding bone. With the

increased resolution (smaller voxel size) in the latest machines, it may be that CBCT could offer a definitive tool for diagnosing VRF.

Given that this technique is new, the literature on its value is rather scarce. Therefore, Chang et al from the University of Toronto, Ontario, conducted a systematic review of literature that included in vivo clinical diagnosis of VRF using CBCT. They were able to locate only 4 articles that met the inclusion criteria, reporting on 130 patients who had a diagnosis of VRF after endodontic therapy. All 4 articles were of poor methodological quality, containing items identified as subject to high or unclear risk of bias, so their value was questionable.

The authors concluded that due to the very limited data available, there was insufficient evidence to suggest that CBCT is a reliable tool for detecting VRFs in endodontically treated teeth. Therefore, the clinician should carefully consider the potential risks and harms of the additional radiation associated with CBCT before recommending it for suspected VRF.

Chang E, Lam E, Shah P, Azarpazhooh A. Cone-beam computed tomography for detecting vertical root fractures in endodontically treated teeth: a systematic review. J Endod 2015;doi:10.1016/j.joen.2015.10.005.

In the next issue

Autumn 2016

- Pulpal health and early detection of disease by vitality tests in permanent teeth
- Treatment of ankylosis and the efficacy of the decoronation technique

Our next report will focus on these issues and studies that discuss them, as well as other articles exploring topics of vital interest to you as a practitioner.

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