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Endodontics™ newsletter

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In This Issue:

Is the New EndoVac Irrigating System Efficient?

The fact that root-canal instrumentation by itself is incapable of removing all of the bacteria and microbial byproducts from the walls of an infected root-canal system has been proven many times over. To improve the efficiency of instrumentation, most authorities recommend intermittently irrigating the canal during the filing process with sodium hypochlorite (NaOCl) or chlorhexidine (CHX). Though the copious administration of either of these disinfecting agents assists in mechanically flushing the canal of newly generated organic and inorganic debris, most authorities doubt that the irrigating systems currently used deliver much of the irrigant to the last few millimeters of the canal. Ideally, the delivery system should provide an adequate volume of irrigation solution to bathe the walls of a canal at the working length (WL) and should do so without forcing any of the solution beyond the apex.

The EndoVac (Discus Dental, Culver City, Calif.), a recently introduced delivery/evacuation system, offers a dual delivery/evacuation tip:

- part A is a small syringe that can be filled with any irrigating solution;
- part B is a hollow tube (either a microcannula or macrocannula) that can be attached to the high-speed suction apparatus of most dental units (Figure 1).

The stainless-steel microcannula has 12 small, laterally positioned offset holes (4 rows of 3) and a closed ISO size 32 tip, small enough to reach WL in a canal that has been enlarged to an ISO size 35 or larger. The plastic macrocannula has a tip of ISO size 55 with a .02 taper. Nielsen and Baumgartner from the Oregon Health and Science University compared the efficacy of the EndoVac irrigation system and a 30-gauge ProRinse (Dentsply/Tulsa Endodontics, Tulsa, Okla.) needle irrigation technique in debriding root canals at 2 apical levels (1 mm and 3 mm coronal to WL).

Nineteen pairs of teeth (21 canals) were accessed and WL was recorded at a point where a #10 file was visible in the apical foramen. The coronal two thirds of each root were coated with tray adhesive and all specimens were placed in 1-inch segments of surgical tubing filled with polyvinyl siloxane impression material. All samples were instrumented to WL with an accompanying irrigation technique (randomly selected) in a crown-down fashion with Gates Glidden drills and profile .04 taper rotary instruments (series 29 ISO size 36 or greater). The EndoVac samples were prepared and irrigated as follows:

- the tip constantly delivered 5.25% NaOCl to the pulp chamber;
- the macrocannula was moved up and down as the filing progressed;
- once the microcannula tip reached WL, the irrigation/evacuation system was maintained for 6 seconds;
- the tip was then repositioned 2 mm from WL for an additional 6 seconds;
- the tip was then returned to WL for 6 seconds.

This up-down motion was repeated to ensure that an active irrigation took place at or slightly coronal to WL for 18 seconds. The canal, filled with irrigant, was left undisturbed for 60 seconds. Each canal received 3 microirrigation cycles: 5.25% NaOCl, 15% EDTA and 5.25% NaOCl. The aspirated solution (via the cannula) was collected and measured.

The 30-gauge ProRinse needle samples were prepared and irrigated as follows:

- the needle was inserted to the binding point;
- the needle was placed just short of the binding point;
- a 1-mL supply of 5.25% NaOCl was delivered;
- all overflow was vacuumed and captured (throughout the instrumentation process) with an aspirator;
- the entire filing and irrigating process was repeated with EDTA and again with NaOCl.

The aspirated solution was collected and measured. As a positive control, 5 teeth were accessed and instrumented to WL without irrigation. Every effort was made to ensure that each tooth in each pair received an equal length of irrigation time and amount of solution. The teeth were completely decalcified, and serial histologic sections were made at the WL 1-mm and WL 3-mm levels. Identification of the slides was masked. A light microscope at 100× magnification was then used to identify the sections with the greatest amount of canal debris.

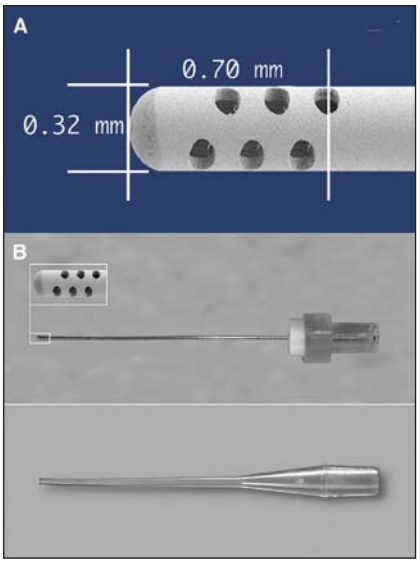

Figure 1. *(A) Scanning electron microscope photograph of the microcannula with measurements. (B) Comparison picture of the closed-end microcannula (ISO size 32) and open-ended macrocannula (ISO size 55). (Photos courtesy of Dr. John Schoeffel.)*

All controls showed debris at the 1- and 3-mm level. Though no significant efficiency difference between systems was noticed at the 3-mm level, the teeth treated with the EndoVac showed significantly less remaining debris ($p = 0.0347$) at the 1-mm level. The volume of irrigant used with the EndoVac system was significantly greater than the volume used with the needle irrigation group ($p < 0.0001$).

Earlier studies have demonstrated that the volume of irrigation and the length of time the solution remained in the canal are key to providing clean canals. By delivering a constant and controlled volumetric flow of fresh NaOCl to the WL, it appears the EndoVac system, though more complex, meets all the requirements of an ideal irrigating system. For that reason, it might be a fine addition to the endodontic armamentarium.

Nielsen BA, Baumgartner JC. Comparison of the EndoVac system to needle irrigation of root canals. J Endod *2007;33:611-615.*

Significance of Pulpal and Periapical Pain

When faced with patients experiencing dental pain, a clinician is forced to make a diagnosis based on facts gathered from the patient's history, clinical signs, verbal description of symptoms, radiographs and responses to a variety of diagnostic tests. According to most pulp biologists, the relationship between a patients' clinical symptoms and the pulpal histopathologic condition is not always consistent. Patients presenting with identical clinical symptoms could be experiencing completely different phases of inflammation, a discrepancy that might cause those patients to respond quite differently to the diagnostic tests and thereby confuse the diagnosis. The purpose of this study by Iqbal et al from the University of Pennsylvania was to develop a logistic regression model that could be used to associate a patient's clinical signs and symptoms with a definitive pulpal and periapical diagnosis.

From the University of Pennsylvania Endodontic Department's electronic patient database, the authors collated clinic registration information: binary variables (intermittent, provoked, throbbing, lingering, spontaneous, radiating, dull, sharp, localized, and diffused pain); clinical test responses (palpation and percussion); location of pain (tooth number); causative factors; and a primary presentation (whether the case presented as an emergency or not). Logistic regression models were then fit to the data and, by using the binary pain symptoms as outcomes and the paired diagnoses as the primary predictor variable, odds ratios for each specified pain response at all 13 diagnosis levels were generated from 951 emergency and 997 nonemergency cases. The authors collapsed the 13 diagnosis levels into 4 diagnostic groups:

- symptomatic pulpal (SPU);
- asymptomatic pulpal (APU);
- symptomatic periapical (SPE); and
- asymptomatic periapical (APE).

These groups were then arranged into the following 4 levels:

1. Symptomatic: spontaneous pain or episodes of pain in response to temperature changes at both the pulpal levels (SPU/SPE) and painful response to percussion and/or palpation tests or intraoral/extraoral swelling at the periapical level. This is essentially a combination of acute pulpitis and acute apical periodontitis.

2. Asymptomatic: absence of swelling and normal responses to thermal percussion and palpation tests at both the pulpal and periapical levels (APU/APE). Its equivalents can range from an operative carious exposure to chronic apical periodontitis based on radiographic evidence.

3. Symptomatic pulpal but asymptomatic periapical: painful response to thermal tests but not, percussion and/or palpation tests (SPU/APE). It can be considered equivalent to acute pulpitis or irreversible pulpitis.

4. Asymptomatic pulpal but symptomatic periapical: no thermal response, but painful response to percussion and/or palpation exhibiting or having had intraoral/extraoral swelling in the past (APU/SPE). It is basically equivalent to acute apical periodontitis or acute apical abscess.

The patient records revealed that root-canal treatments were necessary because of carious pulp exposures (60.0%), restoration-related events (18.4%), apical periodontitis (12.9%), trauma (3.1%), fractures (3.1%) and idiopathic reasons (1.0%). The combined data analysis found 38.5% SPU/SPE, 25.8% APU/SPE, 24.9% SPU/APE and 10.7% APU/APE.

Odds ratios indicated that sharp pain responses favored symptomatic pulps over symptomatic periapical conditions; dull pain responses were higher with symptomatic periapical conditions when compared with asymptomatic periapical conditions; percussion and palpation tests were significant in differentially diagnosing pulpal and periapical conditions; pain descriptors, such as intermittent, provoked, radiating, spontaneous, throbbing, localized, and diffused, did not show any significant correlations with the eventual endodontic diagnoses. A slightly higher percentage of asymptomatic pulpal and periapical conditions was found in the nonemergency case reports and, as would be expected, the percentage of symptomatic pulpal and periapical conditions was found to be higher in emergency patients. The results confirm the power of sharp and dull pain and percussion and palpation tests in determining the differential diagnosis, but pain descriptors alone could not lead to a definitive diagnosis.

All of the diagnostic conclusions appear to have a great deal of value from an academic viewpoint. For those in clinical practice, this article should help reinforce the mental guidelines used to make the differential diagnosis that leads to deciding whether or not to initiate endodontic treatment.

Iqbal M, Kim S, Yoon F. An investigation into differential diagnosis of pulp and periapical pain: a PennEndo database study. J Endod *2007;33:548-551.*

The Effect of Chemical Disinfectants On Gutta-percha

Though it is imperative that the cleaning and shaping of a canal be efficient, it is equally important that the filling of a canal be equally efficient to prevent reinoculation and subsequent reinfection. Gutta-percha (GP) is widely used to fill root canals and, although pure GP may possess antibacterial characteristics, GP cones are subject to contamination during the manufacturing process and through exposure to the clinical environment. Since GP cones are not readily sterilized by heat and EO (ethylene oxide) gas sterilizers are not normally available in a dental office, authorities recommend decontaminating the cones before use by bathing the GP cones in a chemical disinfectant. Pang et al from Yonsei University, Korea, aimed this study at identifying the microorganisms that might be found on the surface of GP cones and determining if soaking the cones in a disinfecting solution might alter their physical properties.

One hundred fifty GP cones that had been stored for >3 months in 2 hospital-based endodontic clinics were randomly divided into 3 groups of 50 each. To assess the level of precontamination, 30 GP cones were taken from 10 freshly opened boxes and used as controls. All 30 GP cones tested directly from freshly opened boxes yielded negative cultures. Twenty-nine of the 150 GP cones (19.4%) opened and exposed in the clinics were positive for surface bacteria (1 or 2 types of bacteria on each GP cone). Thirteen GP cones yielded 1–10 bacterial colonies, 12 yielded 11–100 bacterial colonies, and 4 yielded ≥101 colonies. Analysis of the contaminated cones found several types of *Staphylococcus* organisms; *S. epidermidis* and unidentified species were most prevalent (62.5%).

Each contaminated cone group was then immersed in either 5.25% sodium hypochlorite (NaOCl), 2% chlorhexidine (CHX) or ChloraPrep (a 1:1 [v/v] mixture of 70% isopropyl alcohol and 2% CHX; Mediflex, Leawood, Kan.) for 1, 5, 10 or 30 minutes. One-minute immersion in all 3 disinfectants was adequate for disinfection of GP cones against *Staphylococcus* species. The tensile strength between the NaOCl- and CHX-soaked groups was significantly different ($p < .05$), but there was no significant difference between the NaOCl- and ChloraPrep-soaked groups ($p > .05$). All disinfectants significantly increased the elongation rate of the GP cones compared with fresh GP cones ($p < .05$). This was especially true with those in the ChloraPrep group.

These results showed that GP cones may be considered sterile when the box is first opened but contaminated from that point on. For that reason, the rapid sterilization of GP cones with either 5.25% NaOCl, 2% CHX, or ChloraPrep for 1 minute is highly effective, and there is no reason it should not be a routine step in treatment procedure. For cold lateral compression of GP cones, the physical property changes exposed in this study might be considered significant. However, those changes would probably be irrelevant when a thermal compaction technique was used.

Pang N-S, Jung I-Y, Bae K-S, et al. Effects of short-term chemical disinfection of gutta-percha cones: identification of affected microbes and alterations in surface texture and physical properties. J Endod *2007;33:594-598.*

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Next…

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— 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.