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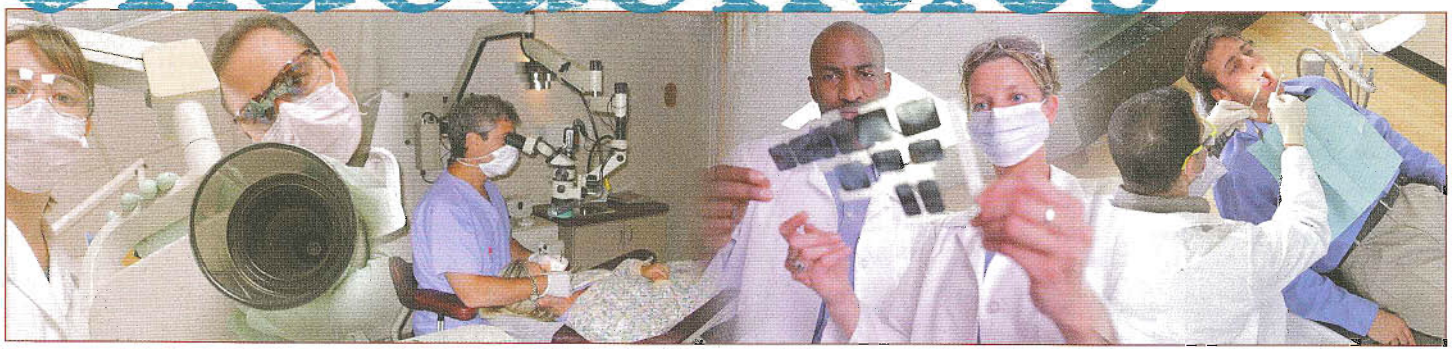

Viral-bacterial Associations in Acute Apical Abscesses

The clinical manifestation of acute apical abscess involves pain and swelling of soft tissues. Advanced and serious cases may lead to fever, regional lymphadenopathy and malaise, with the possibility of cellulitis formation and other complications. The condition is characterized by an acute suppurative inflammatory response of the periradicular tissues to bacteria emanating from the infected root canal system.

Studies have shown that the microbiota associated with acute apical abscesses are mixed and dominated by anaerobic bacteria. Although apical periodontitis is recognizably a bacterial disease, it has been recently hypothesized that viral bacterial coinfection may play a role in its pathogenesis.

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An active viral infection causes local immunosuppressive effects that favor the overgrowth of pathogenic bacteria. It has been suggested that this theory can be applied to acute apical abscesses, with the potential to help explain the development of this condition, which arises from previously asymptomatic apical periodontitis lesions. Viral infection may not have the ability to cause abscesses on its own, but it might serve as a disease modifier or severity factor.

Using samples taken from acute apical abscesses, Ferreira et al from Federal University of Rio de Janeiro, Brazil, investigated the possible associations between 9 candidate endodontic bacterial pathogens and 9 human viruses. DNA extracts from purulent exudate aspirates of 33 cases of acute apical abscesses were surveyed for the presence of 9 selected bacterial species. Single or nested polymerase chain reaction assays were used to detect the human papillomavirus (HPV) and the human herpesvirus (HHV) types 1 through 8.

The authors found that two-thirds of the abscess samples tested positive for ≥1 of the target viruses. Specifically, the most frequently detected viruses were HHV-8 (54.5%);

HPV (9%); and varicella zoster virus (VZV), Epstein–Barr virus (EBV) and HHV-6 (6%). Bacterial DNA was present in all cases; the most prevalent bacterial species were *Treponema denticola* (70%), *Tannerella forsythia* (67%), *Porphyromonas endodontalis* (67%), *Dialister invisus* (61%) and *Dialister pneumosintes* (57.5%). HHV-8 was positively associated with 7 of the target bacterial species and HPV with 4, but these associations were weak. Several bacterial pairs showed a moderate positive association. Viral coinfection was found in 6 abscess cases, but no significant viral association could be determined.

Conclusion

The study results demonstrated that bacterial and viral DNA occurred concomitantly in two-thirds of the samples from endodontic abscesses. Although this may suggest a role for viruses in the etiology of apical abscesses, the possibility also exists that the presence of viruses in abscess samples is merely a consequence of the bacterially induced disease process. Further studies are needed to clarify the role of these viral-bacterial interactions, if any, in the pathogenesis of acute apical abscesses.

Ferreira DC, Rôças IN, Paiva SSM, et al. Viral-bacterial associations in acute apical abscesses. Oral Surg Oral Med Oral Pathol Oral Radiol Endod *2011;112:264-271.*

Final Irrigation Activation Techniques and Smear Layer

As an essential part of root canal debridement, irrigation kills microorganisms, flushes debris and removes the smear layer from the root canal system. The smear layer prevents the penetration of intracanal medicaments into dentinal tubules and influences the adherence of filling materials to the canal wall.

The alternate use of sodium hypochlorite (NaOCl) and EDTA (ethylenediaminetetraacetic acid) has been recommended for efficient smear layer removal. These irrigants must be brought into direct contact with the entire canal wall for effective action. Various techniques and irrigant delivery devices have been proposed to increase flow and distribution.

The EndoVac system (Discus Dental, Culver City, Calif.) is an apical negative pressure (ANP) irrigation device that introduces a higher flow of irrigant and produces better debridement 1 mm from working length (WL), compared with needle irrigation. Manual dynamic activation (MDA) involves repeated insertion of a well-fitting gutta-percha cone in short, gentle strokes to WL of a previously shaped canal to hydrodynamically displace and activate an irrigant.

Gu et al (*J Endod* 2009) hypothesized that this technique might be useful to break the air bubble located at the apical 0 to 2 mm of the canal. Passive ultrasonic irrigation (PUI), an irrigation protocol in the presence of an ultrasonically activated file that is noncutting or in contact with the canal walls, has been more effective than syringe needle irrigation to remove pulpal tissue remnants and dentin debris, reduce bacteria and remove smear layer. Saber and Hashem from Ain Shams University, Egypt, compared smear layer removal after final irrigant activation with ANP, MDA and PUI.

Forty single-rooted human mandibular premolars were decoronated to a standardized length of 16 mm. They were cleaned and shaped using ProTaper system (Dentsply Maillefer, Ballaigues, Switzerland) to size F4 and irrigated with 2.5% NaOCl. The specimens were divided into 4 equal groups (n = 10) according to the final irrigation activation technique:

- **Group 1:** Passive irrigation (PI) solutions were delivered by a syringe and a 30-gauge needle (NaviTip; Ultradent, South Jordan,

Table 1. *Mean ± SD values and results of comparison between smear layer scores for different activation techniques*

Segment	ANP	MDA	PUI	PI	*p* value
Apical	$1.43^{b} \pm 0.51$	$1.89^{b} \pm 0.33$	$3.58^{a} \pm 1.00$	$3.50^{a} \pm 0.71$	<.001*
Middle	$1.56^{c} \pm 0.63$	$2.00^{b} \pm 0.76$	$2.07^{b} \pm 1.07$	$2.50^{a} \pm 0.71$	<.001*
Coronal	$1.21^{b} \pm 0.43$	$1.17^{b} \pm 0.35$	$2.00^{a} \pm 0.39$	$2.00^{a} \pm 0.00$	.007*
Total	$1.38^{d} \pm 0.34$	$1.93^{c} \pm 0.22$	$2.29^{b} \pm 0.75$	$2.44^{b} \pm 0.51$	<.001*

*Means with different superscript letters are statistically different according to Mann-Whitney U test. *Significant at p ≤ .05.*

Utah) taken as deep into the canal as possible without binding.

- **Group 2:** ANP (EndoVac); 2 micro-irrigation cycles were used, the first with 2.5% NaOCl and the second with 17% EDTA.
- **Group 3:** MDA; 2.5% NaOCl followed by 17% EDTA were each activated for 1 minute. The canals were flooded with the irrigant, and push-pull strokes were performed manually to the WL using a size 40/.06 taper gutta-percha cone at an approximate rate of 100 strokes/minute for 30 seconds.
- **Group 4:** PUI; 2.5% NaOCl and 17% EDTA were each activated for 1 minute by using #25/0.00 taper stainless steel noncutting ultrasonic tip (IrriSafe; Satelec, Acteon, Merignac, France) at 1 mm from the WL. The tip was operated by a piezoelectronic unit (Pmax XS; Satelec) at power setting 5.

Samples were examined for smear layer. PI and PUI had the highest smear layer scores, with no significant differences between them. They were followed by MDA and ANP, which showed the statistically significant lowest mean score (Table 1; $p \leq .05$).

Conclusion

Differences in smear layer removal were found after the various irrigant activation protocols were used. Within the limitations of this study, it can be concluded that final irrigant activation with ANP and MDA resulted in better removal of the smear layer than with PUI or PI.

Saber SE-D, Hashem AAR. Efficacy of different final irrigation activation techniques on smear layer removal. J Endod *2011;37:1272-1275.*

Table 2. *Duration of soft-tissue anesthesia for the PM and sham groups (minutes ± standard error)*

Arch	PM (n = 46)	Sham (n = 39)	p value
Maxillary, lip/cheek*			
Numbness	99 ± 7.8	134 ± 10.9	.0145
Return to normal sensation†	136 ± 12.1	224 ± 19.1	.0007
Mandibular lip*			
Numbness	121 ± 8.3	145 ± 7.4	.0348
Return to normal sensation†	170 ± 11.9	217 ± 10.8	.0054
Tongue			
Numbness	106 ± 7.5	121 ± 6.3	.1382
Return to normal sensation†	142 ± 10.5	169 ± 8.9	.0649

**There were significant differences between the groups; †absence of pins-and-needles sensation.*

Reversal of Soft-tissue Anesthesia

Soft-tissue numbness lasts considerably longer than pulpal anesthesia and the duration of the typical dental appointment. As a result, residual soft-tissue numbness is likely to leave patients with a perception of altered physical appearance, lack of sensation, and diminished ability to speak, smile, drink and control drooling. Patients may complain that they are unable to eat a meal or talk normally after their dental visit.

Phentolamine mesylate (PM), a nonselective, α-adrenergic blocking agent that has been available in the United States since 1952, may accelerate the return of soft-tissue sensation after routine dental procedures. Previously used for the reversal of accidental extravasation of catecholamines during intravenous administration and for the diagnosis of pheochromocytoma, the use of PM for dental treatment was approved by the U.S. Food and Drug Administration in May 2008. It is available in 1.7-mL cartridges prepared for local injection in the same manner as local dental anesthetics.

A preliminary, prospective, randomized, single-blind study conducted by Fowler et al from Ohio State University evaluated the reversal of soft-tissue anesthesia using PM in asymptomatic endodontic patients. Injection site pain and postoperative pain were also studied.

Eighty-five adults having an asymptomatic tooth requiring endodontic therapy received either PM or sham treatment(s) at the end of an endodontic appointment. Patients monitored their soft-tissue anesthesia every 15 minutes for 5 hours and reported postoperative injection site pain and tooth pain using a visual analog score every 30 minutes for the first 2 postoperative hours and every hour for the next 3 hours.

The authors reported a statistically significant difference in time to return to normal sensation for the maxillary lip/cheek and mandibular lip. Patients who received PM reported an 88-minute decrease in

time to return to normal maxillary lip/cheek sensation and a 47-minute decrease in time to return to normal mandibular lip sensation (Table 2). Postoperative complications—mild hypotension, headache and mild increased blood pressure—in other studies were minimal and infrequent, and no clinically significant adverse reactions to PM were reported.

Conclusion

PM would be beneficial for asymptomatic endodontic patients who would like to experience a faster return to normal soft-tissue function and sensation after the administration of local anesthesia. Perhaps patients could be asked if they would like to have a reduction in soft-tissue numbness and, if so, PM could be administered.

Fowler S, Nusstein J, Drum M, et al. Reversal of soft-tissue anesthesia in asymptomatic endodontic patients: a preliminary, prospective, randomized, single-blind study. J Endod *2011;37:1353-1358.*

Effect of Maintaining Apical Patency on Irrigant Penetration

Instrumentation and irrigation of the root canal system are crucial steps in root canal treatment. Their main purpose is to eliminate pulpal tissue and microorganisms from the root canal system. However, complete debridement of all areas in the canal has proven to be difficult because the root canal system is anatomically complex, especially in the apical third of the canal.

The penetration of the most commonly used irrigating solution, sodium hypochlorite (NaOCl), into the apical third of root canals is influenced not only by internal anatomy but also by the mode of delivery, the volume of solution and its physical and chemical properties, and the presence of air bubbles within the apical canal. Vera et al from University of Tlaxcala, Mexico, conducted a study to determine whether maintaining apical patency improved the delivery of irrigants consisting of a contrast medium and 5.25% NaOCl into the apical third of human root canals after using passive ultrasonic irrigation (PUI) in vivo.

Exclusion criteria were allergy to any of the components of the formula, pregnancy or failure to obtain the patient's authorization. Forty human root canals were randomly divided into 2 groups:

- Group 1 ($n = 21$): Apical patency was maintained during shaping and cleaning procedures with a #10 K-file inserted 1 mm beyond the working length (WL).
- Group 2 ($n = 19$): No apical patency was achieved or maintained.

In both groups, the canals were shaped with the ProTaper system (Dentsply Maillefer, Ballaigues, Switzerland). Irrigation was performed with 1 mL of a solution prepared with a radiopaque contrast medium and 5.25% NaOCl. After the shaping procedure, PUI was applied for 20 seconds. Digital images were taken to determine the presence or absence of the irrigating solution in the apical third of the canal.

After PUI, significantly more canals had irrigant in the apical third when apical patency was maintained with a #10 file 1 mm beyond the WL than when apical patency was not maintained throughout the cleaning and shaping procedures ($p = .02$), but the presence of NaOCl does not guarantee that the apical third has been properly cleaned and disinfected. Enough time, NaOCl concentration and contact are needed to dissolve organic tissue and affect the microorganisms protected by the biofilm.

Conclusion

Every effort should be made to use an irrigating technique that predictably delivers the solution early in the cleaning and shaping procedure. Within the limitations of this study, maintaining apical patency and then using PUI improved the delivery of irrigants into the apical third of human root canals.

Vera J, Arias A, Romero M. Effect of maintaining apical patency on irrigant penetration into the apical third of root canals when using passive ultrasonic irrigation: an in vivo *study.* J Endod *2011;37:1276-1278.*

In the next issue:

- Ibuprofen and acetaminophen for postoperative pain in patients with pulpal diagnosis of necrosis
- Properties of calcium hydroxide
- Herpesviruses and periapical lesions

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