A Professional Courtesy of:

ENDO INC
ROOT CANAL SPECIALISTS
NORTH SHORE

Arnold I. Maloff, DMD, ABE **Sandra R. Makkar, DDS, ABE, FRCD(C)**
Carlene Tsai, DMD, ABE, MPH

2 Winter Street, Salem, MA 01970 | 978.745.6900
85 Constitution Lane, Suite 200 D, Danvers, MA 01923 | 978.750.4500
www.endoincrootcanal.com

Endodontics Newsletter™

Spring 2017

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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.*

YouTube and Patient Education

Most dental patients want to be well educated about procedures. In the past, the dental profession relied on verbally informing patients and giving them pamphlets about different treatments.

Now, for most patients, Internet access to information regarding dental procedures is just a click away. As readily available as this information may be, there is a growing concern about its lack of quality and completeness. In fact, some of this information might come directly from manufacturing companies and suppliers with a commercial bias.

According to a recent study by Biggs et al (*J Laryngol Otol* 2013), the video-streaming website YouTube is one of the sites most commonly visited by patients wishing to access medical information. However, much is unknown about specific information that dental patients, especially those who want to know more about endodontic therapy, can access on this website.

To investigate what is available on YouTube regarding endodontic therapy, Nason et al from Trinity College Dublin, Ireland, employed relevant search terms to collect samples from the website to assess the source of the videos and completeness of the content.

On one specific day, the research teams conducted 3 YouTube searches using the following terms:

- endodontics
- root canal
- root canal treatment

More than a quarter of a million videos associated with the search terms were identified. The authors pared down the sample to a total of 60 acceptable videos (20 for each term). They then assessed the quality of each video.

Overall, they found that only 46% of the videos had been posted on the site by a dentist or specialist. Commercial sources were responsible for 19% of the videos. The vast majority of analyzed videos were intended for a layperson (60%) rather than a dental professional.

This study highlighted the volume of information available on YouTube regarding endodontic therapy. Researchers also found that a majority of the information did not seem to be

subjected to any quality controls other than the laypeople who watch the videos and have the option to report them, add comments, click like or dislike, share and add translations.

This study showed the importance of dental professionals' awareness of the information available on the Internet. Directing patients to appropriate sources of information and minimizing the amount of incorrect information obtained by patients is the practitioner's responsibility.

Nason K, Donnelly A, Duncan HF. YouTube as a patient-information source for root canal treatment. Int Endod J *2016;49:1194-1200.*

Radiographs and Periapical Lesions

An accurate radiograph is the foundation for a periapical diagnosis, as well as required to assess healing after endodontic therapy. In the last 20 years, the use of digital radiography in dentistry has changed endodontic treatment because digital radiographs save time, reduce the radiation dose to the patient, and do not require complex processing and chemicals. In addition, the image can be computer enhanced. Nevertheless, a significant number of dentists continue to rely on film radiography, citing cost and possible inaccuracy.

There is no question that both film and digital periapical radiographs have some limitations in detecting periapical lesions. For one thing, the image rendered is a flat image of a 3-dimensional structure; for another, anatomical structures can obscure the apical area. To address these challenges, additional parallax exposures, where the dentist takes at least 1 additional radiograph with different horizontal angulation, have been advocated. Studies on the accuracy of these additional exposures have been inconclusive; some have found that parallax views improved diagnostic accuracy when periapical pathosis was present, yet others have reported minimal additional benefits. These studies were either conducted using artificially created lesions in cadaver mandibles or performed on live patients. Because it was impossible to confirm the histopathological diagnosis, the reference standard is unknown.

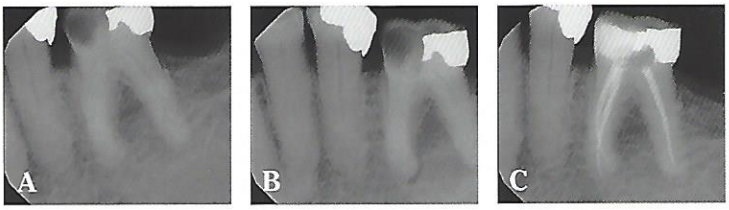

Figure 1. (A) Periapical radiograph taken centered at 90° on a lower molar with percussion sensitivity and spontaneous pain. (B) Periapical radiograph taken at the same time but with an approximately 10° mesial angle. Periapical changes now evident. (C) Periapical radiograph taken 6 months after endodontic therapy with a similar angle, indicating periapical healing. (*Images courtesy of Dr. Asgeir Sigurdsson.*)

To investigate this further, Kanagasingam et al from Universiti Kebangsaan Malaysia collected cadaver specimens to compare the accuracy of film and digital periapical radiographs with a single parallel and multiple parallax exposures to detect apical periodontitis. Using cadaver specimens, they were able to correlate the actual histopathological findings and thereby gain accurate knowledge about the true extent of the periapical lesion (reference standard).

The authors collected a total of 67 teeth with surrounding bone and tissue from 9 fresh cadavers. Periapical exposures were created with

- F-Speed Ektaspeed Plus (Eastman Kodak) film
- Visualix eHD sensor (Gendex Dental Systems) digital image

They took 1 image centered at 90° and then 2 additional exposures with 10° mesial and 10° distal shifts. Five blinded, calibrated endodontists evaluated all images to determine the presence or absence of periapical radiolucencies. Histopathological examination diagnosed 58 of 86 roots with apical periodontitis. The inter-examiner and intra-examiner agreements were calculated and found to be adequate.

From this study, the researchers concluded that the diagnostic accuracy of a single digital periapical radiograph was significantly better than that of the traditional film. Compared with the digital images, the radiographic film appeared to produce more disagreements among the 5 examiners. In the film group, there were more inconsistencies between the initial assessment sessions and reassessment session for individual observers, indicating it was more difficult to reliably read the film than the digital images. While the combination of 2 additional horizontal (parallax)

angulated exposures significantly improved the detection of apical periodontitis, there was no significant difference between film and digital parallax techniques for those images.

Based on this study, there is a strong indication that those who perform endodontic therapy should use digital technology, with at least 1 off-angle radiograph taken to further enhance accuracy (Figure 1). For those who have not adopted the digital approach, 2 different angulations in addition to the parallel view should be the standard when assessing periapical status.

Kanagasingam S, Hussaini HM, Soo I, et al. Accuracy of single and parallax film and digital periapical radiographs in diagnosing apical periodontitis—a cadaver study. Int Endod J *2016;doi:10.1111/iej.12651.*

Antibacterial Effects of Sonic and Ultrasonic Irrigation

Endodontic therapeutic success hinges on removal of bacteria from the root canal system. In necrotic and infected canals, the main bacterial group infecting the apical portion is multispecies anaerobic gram-positive. In persistent, nonhealing lesions, studies have shown that *Enterococcus faecalis* or *Candida albicans* is commonly found.

Traditionally, the irrigant sodium hypochlorite (NaOCl) has been used to help mechanical instrumentation eliminate the canal bacteria. However, instrumentation and irrigation alone do not consistently eliminate all bacteria from the apical area.

Ultrasonic activation of the NaOCl has been used to enhance the effectiveness of the irrigant. The activation causes acoustic streaming deep into the canal, which in turn causes the intraradicular biofilm to rupture so that the complex bacterial ecosystem does not form in the canal and have a direct cavitation effect on the cell membranes.

In ultrasonic activation, a relatively stiff metallic tip delivering the sound wave into the canal systems can damage the root canal wall if it is allowed to vibrate against it; in the most severe cases, it can cause a perforation of the walls. Therefore, it has been recommended that endodontists use only passive ultrasonic irrigation (PUI), in which the tip vibrates freely only in the coronal to middle portion of the canals. If the tip cannot be placed close to the apical portion in curved canals, the approach has minimal effect.

Noncutting plastic tips have been used with low sonic activation (maximum 190 Hz) to allow sonication close to the apex in curved canals. However, this has proven ineffective because this sonic wave does not cause the cavitation needed to disrupt bacterial cell membranes and seems not to bring the irrigation solution to the apex in narrowly tapered and/or curved canals.

To overcome these obstacles, Neuhaus et al from the University of Bern, Switzerland, tested a novel passive sonic activation device with a polyamide tip coupled to a standard air scaler that operates at 6000 Hz in extracted teeth with a variation of root curvatures after inoculation with different strains of bacteria. To mimic a clinical situation, they tested a young culture (3 days) and an established 21-day culture. After irrigating the teeth with NaOCl either manually, using PUI or with the new passive sonic irrigation system, they took samples from the teeth 0, 3, 5 and 7 days after experimental treatment.

Using manual NaOCl irrigation alone led to a significant reduction in the growth of microorganisms. However, after 3 days, there was a significant regrowth in that group compared with the new device or PUI (Table 1).

Table 1. Number of samples with bacteria detectable at days 0, 3, 5 and 7 after irrigation/reincubation

Microorganisms	Group	0	3	5	7
Enterococcus faecalis	Control	6/6	6/6	6/6	6/6
	PSI	0/6	4/6	4/6	4/6
	PUI	0/6	4/6	4/6	5/6
	MI	0/6	5/6	5/6	5/6
Candida albicans	Control	6/6	6/6	6/6	6/6
	PSI	0/6	3/6	3/6	4/6
	PUI	0/6	3/6	5/6	5/6
	MI	0/6	4/6	5/6	5/6
Streptococcus gordonii/ Actinomyces oris	Control	6/6	6/6	6/6	6/6
	PSI	0/6	0/6	0/6	0/6
	PUI	0/6	0/6	0/6	0/6
	MI	3/6	4/6	4/6	4/6
Streptococcus gordonii/ Fusobacterium nucleatum	Control	6/6	6/6	6/6	6/6
	PSI	0/6	0/6	0/6	0/6
	PUI	0/6	0/6	0/6	0/6
	MI	2/6	2/6	2/6	3/6

MI, manual irrigation; PSI, passive sonic irrigation at 6000 Hz.

The authors found that some type of sonic or ultrasonic activation of the NaOCl irrigation solution should be used when performing endodontic therapy on necrotic teeth. For sonic activation, the new polyamide tip designed to oscillate at 6000 Hz should be used rather than tips designed to operate at lower frequencies.

Neuhaus KW, Liebi M, Stauffacher S, et al. Antibacterial efficacy of a new sonic irrigation device for root canal disinfection. J Endod *2016; doi:10.1016/j.joen.2016.08.024.*

Self-adhesive Resin Cement Strength

When root perforations are diagnosed or inadvertently occur during endodontic therapy, the key to successful treatment is to create a hermetic seal in the perforation as soon as possible. If any bacteria leak through the root perforation into the periodontal ligament (PDL), the ongoing inflammatory reaction will ultimately lead to bone loss and therapy failure.

Various materials have been suggested for root perforation repairs, such as

- mineral trioxide aggregate (MTA)
- glass ionomer
- Portland cement

These materials have been proven to seal the perforation well. MTA and Portland cement are well tolerated by the PDL.

One concern is that when a post is cemented in a tooth with a root perforation, the repair material will come in contact with resin cements, which may compromise the post's retention. Most studies on perforation materials measured the adhesiveness of the repair material to the dentin but not the interface between the repair material and internal restoration. Little is known about the bond strength between self-adhesive resin cements and different root perforation sealing materials, so Lemos Martins Sicuro et al from Positivo University, Brazil, devised an experimental model to test the microshear bond strength of adhesive resin cements in relation to sealing materials.

Table 2. Microshear bond strength means and standard deviation (SD) of self-adhesive resin cement in relation to different root perforation sealing materials ($n = 16$)

Root perforation sealing material groups	Microshear bond strength mean ± SD*
Mineral trioxide aggregate	3.36 ± 1.56*
Portland cement	1.39 ± 0.77*
Glass ionomer cement	2.90 ± 1.49*

**Means followed by asterisks are not significantly different according to the Tukey test ($p > .05$).*

By using a wire loop in a universal testing machine until the bond broke, the authors measured the force needed to debond a self-adhesive resin cement block that had been attached to the testing materials. This process was repeated 16× for each material. Surprisingly, there was no statistical difference between the glass ionomer and MTA, but the Portland cement had significantly less shear strength with the self-adhesive resin (Table 2). The researchers speculated that the difference could be related to variances in composition, size of filler particles and surface characteristics of the materials, because the bonding mechanism of MTA and glass ionomer allows for micromechanical retention and is similar to that of resin materials and etched enamel.

Based on their findings, the authors came to the conclusion that when using Portland cement to repair root perforations, to improve shear bond strength with self-adhesive resin cement, a glass ionomer may be used as a base.

Lemos Martins Sicuro S, Gabardo MCL, Castiglia Gonzaga C, et al. Bond strength of self-adhesive resin cement to different root perforation materials. J Endod *2016;doi:10.1016/j.joen.2016.08.019.*

In the next issue Summer 2017

- Swedish general dental practitioners on reasons for accepting substandard root filling quality
- Understanding external cervical resorption patterns in endodontically treated teeth

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.