PULP FICTION

A Quarterly Newletter

By Westside Endodonics

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Greetings!

Hello sunshine and warmer temperatures , goodbye sleet and snow (hopefully)! I think that for the most part you can agree with me, however, I must admit I did enjoy the snowfall we had in the city! Well, another year is well underway and has already proven to be a great start! I was fortunate to have been able to attend the International Congress of Oral Implantologists in New Orleans this past January. The meeting was fantastic as was the venue. I left the meeting with heightened enthusiasm about continuing to incorporate socket preservation and osseointegration into my practice. I thank my referring doctors for accepting my incorporation of dental implants in my practice since 2007. My philosophy for endodontics has not changed but I feel I can provide a better service to my patients when I am confronted with a situation where a tooth might not be restorable. I would also like to thank Dr. Vaughn Tidwell for his continued leadership of our study club and for all the participants that continue to grow and learn with us. Congratulations to Dr. Bita Zavari for the opening of her new practice! Start of the second quarter colleagues…enjoy your copy of Pulp Fiction!

Long-term Tooth and Implant Survival Rates

In recent decades, dental implants have served as reliable replacements for missing teeth. However, the use of dental implants as a replacement for so-called “hopeless” teeth has steadily increased. Given the increasing popularity and success of dental implants, clinicians may believe that they are as good as or better than the preservation of natural teeth. This could result in the extraction of salvageable teeth on the basis of convenience.

A critical stage in treatment planning consists of evaluating a tooth’s prognosis. The clinician must consider various factors to select the treatment with the highest probability of success. When considering whether to retain a compromised tooth or extract it and place a dental implant, the clinician should make an evidence-based decision that accounts for the probability of long-term success. Among the factors contributing to outcomes are the patient’s compliance, frequency of maintenance visits, systemic condition and smoking status, as well as the clinician’s background and experience. Furthermore, the lack of information in the literature regarding the long-term survival and success of implants in relation to the patient’s life expectancy raises doubts about the predictability of this treatment modality for young patients.

Because an implant can serve as a replacement for an extracted tooth at any point, clinicians may choose to preserve the natural teeth for as long as possible. Additionally, when a clinician classifies a tooth as hopeless, extraction is not the only viable solution. Many studies have reported the effectiveness of periodontal treatment and long-term maintenance in preventing tooth loss in patients with severe attachment loss.

Levin from Technion–Israel Institute of Technology and Halperin-Sternfeld from Rambam Health Care Campus, Israel, conducted a systematic review of long-term survival rates of teeth and implants. They searched the MEDLINE database for relevant publications up to March 2013, considering studies in which investigators assessed the long-term effectiveness of dental implants or that of tooth preservation. They included only studies that had follow-up periods of 15 years or longer.

The authors selected 19 articles for inclusion. Nine of these studies assessed long-term tooth survival rates, whereas 10 assessed long-term implant survival rates. The long-term (15 years or longer) ranges of the loss of teeth and implants were found to be

- teeth, 3.6% to 13.4%
- implants, 0.0% to 33.0%

An assessment of “risk of bias” in studies of tooth loss and implant loss found that, overall, studies dealing with dental implants tended to present a higher risk of bias.

Conclusion

The results of this systematic review show that implant survival rates do not exceed those of compromised but adequately treated and maintained teeth, supporting the notion that the decision to extract a tooth and place a dental implant should be made cautiously. Even when a tooth seems to be compromised and requires treatment to be maintained, implant treatment also might require additional surgical and prosthetic procedures that might pose some risks. Furthermore, a tooth can be extracted and replaced at any time; however, extraction is a definitive and irreversible treatment.

Levin L, Halperin-Sternfeld M. Tooth preservation or implant placement: a systematic review of long-term tooth and implant survival rates. J Am Dent Assoc 2013;144:1119-1133.

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Inside this issue:

Bacterial Count Reduction After Rotary or Hand Nickel–titanium Instrumentation

One of the major goals of treating infected root canals of teeth with apical periodontitis is to promote maximal reduction in intracanal bacterial populations. This is primarily accomplished through mechanical instrumentation with hand and/or nickel-titanium (NiTi) rotary instruments. However, comparisons between hand and rotary instruments in terms of bacterial elimination from the root canal have been limited. Rôças et al from Está cio de Sá University, Brazil, compared the bacterial reduction achieved by 2 instrumentation techniques: one using hand NiTi instruments and the other using rotary NiTi instruments, in root canals of teeth with necrotic pulps and apical periodontitis.

Root canals from single-rooted teeth were instrumented using either hand NiTi instruments in the alternated rotation motion technique or rotary BioRaCe instruments. The irrigant used in both groups was 2.5% sodium hypochlorite. DNA extracts from samples taken before and after instrumentation were subjected to quantitative analysis by real-time polymerase chain reaction (qPCR).

All 40 preinstrumentation (S1) samples incubated in thioglycolate broth tested positive for bacterial growth. Intergroup comparison involving the postinstrumentation (S2) samples showed no significant differences (p equals .74). All S1 samples also tested positive for the presence of bacteria in qPCR analysis. Data on the incidence of positive qPCR results for S2 are shown in Table 1. The difference between the groups was statistically significant (p equals .01). Intergroup comparison of quantitative data showed no significant difference in the ability of the 2 techniques to reduce intracanal bacterial counts (p equals .14).

Conclusion
There was no significant difference in bacterial reduction in infected canals after instrumentation using hand or rotary NiTi instruments, provided canal enlargement and irrigation parameters were similar. In terms of the incidence of positive results for bacteria, cultures also showed no significant differences between the groups; however, the rotary NiTi instrumentation resulted in more negative results in the more sensitive qPCR analysis.

Rôças IN, Lima KC, Siqueira Jr JF. Reduction in bacterial counts in infected root canals after rotary or hand nickel–titanium instrumentation—a clinical study. Int Endod J 2013;doi:10.1111/iej.12045.

Table 1. *Incidence of positive results in qPCR and culture analyses after canal instrumentation*

Group	Culture S2	qPCR S2
Hand NiTi instrumentation	9/20 (45)[a]	19/20 (95)
Rotary NiTi instrumentation	7/20 (35)	12/20 (60)

[a]Number of cases with positive result/number of cases examined (%).

Mandibular Molar Mesial Canals Prepared by 3 File Systems

Thorough cleaning, shaping and disinfection of the infected root canal system are required for optimal clinical outcomes. Several studies have shown that, regardless of the instruments, irrigants and technique used, chemomechanical procedures are unable to promote a thorough cleaning, disinfection and shaping of the entire root canal system, especially in curved canals or cases with unusual anatomies.

To circumvent limitations, modifications in instruments and techniques have been devised. Using micro–computed tomographic (µCT) imaging, it has been shown that a large area of the main root canal wall remains untouched after preparation, regardless of the instrument or technique used.

The purpose of this ex vivo study by Siqueira et al from Estácio de Sá University, Brazil, was to evaluate the disinfecting and shaping ability of 3 instrumentation protocols used in the preparation of mesial root canals of mandibular molars. The mesial canals of extracted mandibular molars were contaminated with Enterococcus faecalis for 30 days. They were then assigned to 3 groups based on their anatomic configuration as determined by µCT analysis according to the preparation technique:

- Self-adjusting File (SAF)
- Reciproc
- Twisted File (TF)

In all groups, 2.5% sodium hypochlorite (NaOCl) was the irrigant. Microbial samples were taken before (S1) and after instrumentation (S2), and bacterial quantification was performed using culture methodology. Next, these mesial roots were subjected to additional µCT analysis to evaluate shaping of the canals.

Intragroup quantitative analysis evaluating bacterial reduction from S1 to S2 in all groups showed that chemomechanical preparation using the 3 instrumentation systems promoted a significant bacterial reduction (Table 2; p less than .001). No significant differences were observed between groups either for quantitative or qualitative analysis. All techniques were significantly better than the control group (irrigation without canal instrumentation) in reducing the bacterial levels (p less than .001).

Regarding the µCT analysis, no statistical difference was observed between Reciproc, SAF and TF instruments regarding the mean percentage of volume increase, the surface area increase and the unprepared surface area. Intragroup analysis disclosed a statistically significant difference regarding the volume and surface area before and after root canal preparation.

Conclusion
The 3 evaluated systems exhibited similar disinfecting and shaping performance in the preparation of mesial canals of mandibular molars. Refinements in the analysis used may contribute to more comprehensive assessment.

Siqueira Jr JF, Alves FRF, Versiani MA, et al. Correlative bacteriologic and micro–computed tomographic analysis of mandibular molar mesial canals prepared by Self-Adjusting File, Reciproc, and Twisted File systems. J Endod 2013;39:1044-1050.

Effects of Irrigation Techniques and Systems on Wall Shear Stress

The root canal is shaped and cleaned with mechanical instrumentation under constant irrigation to remove the inflamed and necrotic tissue, bacteria, biofilms and other debris. One of the main goals of instrumentation is to facilitate effective irrigation, disinfection and filling. As an irrigant moves through the root canal system, it produces a shear force parallel to the surface of the canal wall, which is known as wall shear stress (WSS). The WSS is responsible for mechanical de bridement of the root canal space by a particular irrigant.

Several new irrigation techniques have been developed in the past decade, while classic strategies such as ultrasonic activation have been modified and/or combined with new techniques to enhance WSS. Goode et al from Georgia Regents University examined the effects of WSS in a curved canal by comparing the efficacy of debris removal by 9 irrigant delivery and/or agitation techniques in an inaccessible recess of a curved root canal model.

The authors used an irrigant flow rate of 1 mL/minute that was previously determined to produce apically directed pressure that is less than the central venous pressure. A reusable, curved canal cavity containing a simulated canal fin was milled into mirrored titanium blocks. Calcium hydroxide (Ca[OH] 2) paste was used as debris and loaded into the canal fin. The titanium blocks were bolted together to provide a fluid-tight seal.

For all the techniques examined, sodium hypochlorite was delivered at a flow rate of 1 mL/minute that produced either negligible or no irrigant extrusion pressure into the periapex.

Nine irrigation delivery/agitation techniques were examined:

- NaviTip passive irrigation control
- Max-i-Probe side-vented needle passive irrigation
- Manual dynamic agitation (MDA) using nonfitting and well-fitting gutta-percha points
- EndoActivator sonic agitation with medium and large points
- VPro EndoSafe irrigation system
- VPro StreamClean continuous ultrasonic irrigation
- EndoVac apical negative pressure irrigation

The method of irrigant delivery or agitation significantly affected Ca(OH) 2 removal from the simulated canal fin (p less than .001). EndoVac was the only delivery technique that consistently removed more than 99% Ca(OH) 2 from the canal fin (median percentage cleanliness equals 99.88%; p less than .05). This group was significantly different from the other groups; the other 8 groups resulted in incomplete Ca(OH)2 removal.

VPro StreamClean (continuous ultrasonic irrigation), the second-highest group (median percentage cleanliness equals 10.32%), was not significantly different from the 2 EndoActivator groups and MDA. Except for VPro StreamClean, there were no significant differences among these other groups and MDA, VPro EndoSafe, the Max-i-Probe and the NaviTip control. The NaviTip control had the lowest median canal cleanliness (0%).

Conclusion

The ability of the EndoVac system to significantly clean more debris from a mechanically inaccessible recess of the model curved root canal may be caused by robust bubble formation during irrigant delivery, creating higher WSSs by a 2-phase air–liquid flow phenomenon well known in other industrial debridement systems.

Goode N, Khan S, Eid AA, et al. Wall shear stress effects of different endodontic irrigation techniques and systems. J Dent 2013;41:636-641.

Table 2. E. faecalis *counts at S1 and S2 using 3 different systems*

Group	n	S1 Mean	S1 Median	S2 Mean	S2 Median	S1 to S2 reduction mean, %
Reciproc						
Bacteriologic analysis	24	9.13E + 05	1.15E + 05	1.34E + 02	0	99.6
Correlative bacteriologic/μCT analysis	12	9.11E + 05	1.10E + 05	2.60E + 02	0	99.2
SAF						
Bacteriologic analysis	24	1.43E + 05	9.00E + 04	5.25E + 01	0	99.8
Correlative bacteriologic/μCT analysis	12	2.29E + 05	2.15E + 05	1.67E + 01	0	99.9
TF						
Bacteriologic analysis	24	4.53E + 05	1.83E + 02	1.20E + 05	0	99.8
Correlative bacteriologic/μCT analysis	12	7.98E + 05	4.15E + 05	4.58E + 01	0	99.9
Positive control	6	4.48E + 05	5.50E + 04	2.03E + 04	1.40E + 03	95.1