**Irrigation protocols comparison, an in vitro study**

By Dr. Salmerón P, Dr. Camacho F, & Dr. Martínez-Beneyto Y

**Introduction**

The removal of remaining pulp tissue, microorganisms and bacterial toxins from the root canal system is essential to the success of endodontic therapy. It is generally accepted that the best way to carry out removal is by cleaning and shaping the root canal complex; microorganisms that remain in the root canal after treatment (or for some reason return to colonize the root canal after filling) are the main causes of endodontic failure. It is generally accepted that the best way to carry out removal is by cleaning and shaping the root canal complex; microorganisms that remain in the root canal after treatment (or for some reason return to colonize the root canal after filling) are the main causes of endodontic failure. 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action against anaerobic infections, and micronicolyte’s action against aerobic and aerobic infections (Sato et al., 1996). Propolis is a natural resinous prod-
ction of bees that is not found in nature and varying color. It is produced by the Apis mellifera bee from resinous substrates that bees collect from the plants around the hive, which they mix with wax and saliva. Propolis is an organic matrix composed of 160 components that have been identified in propolis, 37% of them being phenolic compounds. The pharmacological action has been at-
tributed to the flavonoids (Bartholomé et al., 2005). This natural product has at-
tracted much interest for endodont-
ic treatments due to its antimicrobial action against many pathogenic mi-
organisms (Santos et al., 2001). The use of propolis as an intracanal disinfector is compatible with periradicular tissues. Its antibacterial and antifungal activity can be enhanced by the com-
pound of polyphenols, flavano-
oids, and vitamin P, terpenes, aromatic acids, and esters (Kayaglu et al., 2011).

At present, NaOCl is the most widely used irrigant agent due to its wide antibacterial activity and its high 
dissolving capacity to dissolve organic remains and debris, reaching the dentinal tubules with different concentrations that range from 0.5% to 18.5% NaOCl. At low concentrations (0.5% NaOCl), mainly necrotic tissue, while at higher concentra-
tions its dissolving capacity and its tissue toxicity are increased, but also its tissue-toxic effects (Nay-
ako et al., 2010). It can also penetrate cellular tissue and is able to affect up to 1.000 µm reaching the cemen
tum, with a great ability to kill microorganisms (Berzin et al., 1997; Peten et al., 2009).

In this context, the penetration ca-
pacity of laser therapies can reduce the rate of endodontic failure. For this reason, several treat-
ment strategies such as photodynamic therapy (PDT) are under investigation in endodontics because of their bacte-
ricial and its long-lasting antimicro-
bial activity against difficult-to-erad-
cate microorganisms and biofilms of species such as Enterococcus, Ac-
tinomyces and Candida (Fellegi et al., 2010). PDT is considered a promising adjunct to other treatments for the control of microorganisms in infected root canals for in vitro exper-
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In the field of endodontics, NaOCl and 2% CHX are the most used irrigant agents. Ger-

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acts against a wide spectrum of mi- croorganisms, including E. faecalis (Schulz & Bossmann, 2003; Gomes et al., 2002) and Candida albicans (Ferguson et al., 2002). To act effec- tively against these microorganisms, CHX concentration must be at least 1%, and obtains better results at 3% (Kusunoki et al., 2003). In the present study, 2% CHX reduced the CFU/mL count with statistically significant difference in comparison with the positive control group, but with no significant differ- ences in comparison with the other treatments. E. faecalis is able to survive for long periods without nutrients; it invades dentinal tubules (where it may per- sist at depths of over 300 μm) (Peters et al., 2001), which protect it against the usual irrigating agents (Lowe et al., 2002). For this reason the penetra- tion capacity of laser therapy or the bactericidal effect of ozone can reduce the failure rate in endodon- tic treatments. E. faecalis inside root canals could be reduced by 97% if treated with PDT alone for 30 sec- onds or by 99.9% if treated with NaOCl, followed by PDT (Ihara et al., 2001). In the pre- sent in vitro study, teeth treated with PDT obtained a CFU/mL count of 5.63 ± 1.61, which was similar to ozone (5.62 ± 0.92), showing statistically significant differences in compari- son with the positive control group but not between the groups of teeth treated with NaOCl and TAP, as in the present study. Cheng et al. (Cheng et al., 2011) used methylene blue as a positive biomarker of infection caused by E. faecalis. As for ozone, most studies of ozone application endodontically have focused on its antimicrobial activity. Nagayoshi et al. (Nagayoshi et al., 2004) found that concentrated water was highly ef- fective in killing both gram-positive and gram-negative microorganisms. Moreover, the antibacterial activity of gaseous ozone has been proved to be greater than that of ozone in liquid form (Robbi et al., 1999). In conclusion, application of PDT, 2% CHX, TAP, propolis and ozone all showed antibacterial potential simi- lar to 2% NaOCl against endodontic infection by Enterococcus faecalis.

Dr. Pablo Salmerón
Graduating from Muñoz University in Dental Sciences, Dr. Pablo has been working in Dental Endodontology, be- coming proficient in the latest dental technologies. Dr. Pablo went on to specialize in Endodontics, where he has worked as an Endodontist, as well as teaching endodontics at the University of Manchester. Dr. Pablo has been working with Micro- scopes since 2009.

“I am greatly pleased with the work I am able to perform at Dr. Rose & Associates Dental Clinic—being able to use the latest technology and contribute to the latest scientific advancements.”

For their research, Guinde and her colleagues applied geological tech- niques to learn more about gaps in knowledge that have arisen in other disciplines, such as archaeology and anthropology, regarding the find- ings at Tauste. Excavations carried out in this municipality disinterred the skeletal remains of 44 Muslim individu- als who lived between the eighth and tenth centuries. On the basis of this discovery, a research group from the university’s Department of Mineral- ogy and Petrology undertook to ana- lyze dental samples of these human remains to establish the diet of this medieval Muslim community.

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Sampling teeth with a laser tech- nique

Guinde used laser ablation-induc- tively coupled plasma-mass spec- trometry to carry out targeted analy- ses of the teeth. An advantage of laser ablation is that the sample does not need much preparation, thus, it is a practical, practical technique on the fossil remains. This method there- fore allows such remains, which in archaeology are limited, to be pre- served for future studies.

The chemical results uncovered the existence of considerable differences in the diet of adult men compared with that of women and younger people. The research suggested that adult males ate more protein of animal origin than women and younger people, whose diets were richer in pulses and vegetables.

The findings of the research must be interpreted in the context of work by historians, anthropologists and archaeologists. "Numerical data on their own indicate nothing, but they are essential for supporting the hypotheses and discoveries of ar- cheologists and historians," empha- sized Dr. María Cruz Zúñiga, one of Guinde’s PhD supervisors. For exam- ple, even if the analyses do not reveal the origin of the animal protein, "we can assume that it came above all from sheep and goats on the basis of written texts and anthropological knowledge about medieval Muslim society," she explained.

In this respect, studies of this type provide proof that what we are eating, according to Samuel Epstein (1995), a geologist famous for develop- ing methods for analyzing stable isotopes. “What we eat goes on to form part of our bodies and provides us with very valuable information that ends up recorded in us—in this case in our teeth," Guinde said.

The study focused on dentine, as it is more suitable than enamel for es- tablishing diet, according to the re- searcher. "The chemical composition of the dentine is gradually remodel- led throughout our lives and that is why the elements that form part of our diet are recorded during the final years of people’s lives," she stated.

High lead concentrations in dentine

In addition to the new findings on diet, the research discovered high lead concentrations in the dentine of four individuals. “The concentration of lead is so high that it suggests they were poisoned by this element,” Guinde said. The origin of the lead in this case is anthropogenic and, ac- cording to various studies, could be due to a metallic bath these people did, which involved handling lead-bear- ing minerals, possibly in the produc- tion of glass or ceramics.

The study titled “Analyses of hu- man dentine and tooth enamel by laser ablation-inductively coupled plasma-mass spectrometry (LA-ICP- MS)” to study the diet of medieval Muslim individuals from Tauste”, was published in the March issue of the Microchemical Journal.