Evaluation of the evidence of effectiveness of ultrasonic activated irrigation for root canal treatment

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Commentary on

Căpută P E, Retsas A, Kuijk L, Chávez de Paz L E, Boutsioukis C. Ultrasonic Irrigant Activation during Root Canal Treatment: A Systematic Review. *J Endod* 2019; **45:** 31-44.

Abstract

Data sources Cochrane Library, Embase, LILACS, PubMed, SciELO, Scopus databases, endodontic journals and textbooks.

Study selection Two independent reviewers screened the titles, abstracts and/or full-text of the both clinical or *in vitro* studies that used ultrasonic irrigant activation for management of teeth needing root canal therapy.

Results The study included three clinical studies and 45 in vitro studies. The study reported no evidence of any benefit of ultrasonic activation over needle irrigation in improving the healing rate of apical periodontitis. While the study reported that the evidence for disinfection of the root canal was inconclusive it did show evidence of the efficacy of ultrasonic irrigation over needle irrigation when removal of pulp tissue remnants and hard tissue debris was assessed.

Conclusion The study reported that it was essential that there should be more research into the antimicrobial effect on healing in periapical periodontitis when teeth are treated using ultrasonic activation.

Commentary

It is well established that existing root canal instruments only contact part of the canal walls and hence effective chemical disinfection of the root canal system is critical for the success of root canal treatment.[1] The effectiveness of endodontic irrigation relies on not just the mechanical flushing action of the solution but also the irrigant's ability to chemically dissolve tissue.[2] Activating endodontic irrigation fluids is reported to improve the chemical actions of the irrigant, while also allowing better contact to the root canals system.[3,4]

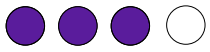
The study by Petrut *et al*. (2018), analysed the literature for evidence of the efficacy of ultrasonic irrigant activation during root canal treatment.[5] The study included three clinical studies and 45 in-vitro studies. The abstract claimed that the failure of ultrasonic activation in improving healing rate of apical periodontitis, when compared with syringe irrigation after primary root canal treatment, should be interpreted with care. This statement was made based on one clinical study by Liang *et al*. (2013),[6] and not based on the 45-vitro studies. The authors indicated that only half of the nineteen studies looking at antimicrobial effects reported better outcomes using ultrasonics. It is, however, important to note that the reported antimicrobial efficacy in some of the included studies were ineffectually reported. The study by Case *et al*. (2012) for example, did not activate NaOCl or EDTA; the study activated saline (control) and ozone solution as a method to compare the activation effects of ozone.[7] With this study a better outcome was observed for ozone agitated groups vs the non-agitated ozone group. Similarly, the study by Neelakantan *et al*. (2015),[8] examined the effect of photodynamic therapy as their primary research aim. The study compared curcumin activated by photodymamic therapy vs ultrasonic agitation. It is important to note that curcumin is a photo sensitiser and hence its action is enhanced by laser light. It is therefore methodologically incorrect to interpret the findings as being dueee to the efficacy of ultrasonic treatment. For the study to make a comparison of the effectiveness of ultrasonics, the authors should have subjected both the curcumin group (ultrasonic and non-ultrasonic) to laser blue light.

Petrut *et al*. (2018) claimed that very few attempts were made prior to their work to summarise the evidence of the effectiveness of ultrasonic irrigation for root canal therapy. This is not true, as is evidenced by the number of literature reviews on the subject.[1,9,10,11,12,13] since the 2007 study by van der Sluis *et al*.[14] What the authors may be referring to, is that the objectives of previous reviews were not as extensive or exactly the same as in their study.

The study highlights the fact that the most commonly utilised liquid in endodontic treatment was sodium hypochlorite. This is because this irrigant has the ability to chemically dissolve tissue.

The study also reported that the majority of canals in the studies were prepared to an apical size corresponding to a size 40 file. However, the selection of the appropriate ultrasonic tip does not seem to directly co-relate to the canal dimensions. This systematic review showed that some of the reported studies used ultrasonic tip sizes that were equal or larger that the apical dimension of the root canal. While it is expected that the tips need to be loose in the canal to generate cavitations, the question is what is the appropriate size? Considerable file-to-wall contact can occur during passive ultrasonic irrigation, hence the amended term 'ultrasonically activated irrigation'.[15] It is reasonable to believe that the use of extremely large files may increase file-to-wall contact and hence decease the efficiency of the ultrasonic.

Teplitsky *et al*. (1987), reported that the benefit of ultrasonic was greater when used in narrow canals with a file size of 30 or

GRADE rating 

lower.[16] The reported study by Hubbezoglu *et al*. (2014), showed no superior effect of ultrasonics in teeth prepared to a size corresponding to a 30/.09 file using activated and non-activated NaOCl. This could be due to the fact that the sampling technique only investigated bacteria in the canal (paper point sampling) and not within the tubules. It could be presumed that if the apical dentine thickness was assessed for bacteria using a different technique, the better contact afforded by ultrasonic streaming and cavitation of NaOCl irrigant could have showed better outcomes, compared to simple conventional irrigation techniques.

With regards to removal of debris and pulp tissue, the study showed that ultrasonics had a positive affect. However, ultrasonic and sonic irrigation techniques may be incapable of removing completely some medicament (eg calcium hydroxide)[17,18] from the root canal walls.

Conclusion

Ultrasonic energy can influence fluid dynamics within the root canal system, which improves the contact of the irrigant fluids with regions of the root canal system that cannot be reached by conventional or modern rotary instruments. Despite the lack of quality clinical research, the currently available literature seems to indicate that ultrasonic irrigation has a place in endodontic practice.

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