

October 8, 2007

To: Gary Henkel
cc: ROOTS
RE: Irrigation Activation

Hello Gary,

My friend, it seems your question to me regarding sonic vs. ultrasonic activation, although logical, well founded, and completely innocent, sparked an international incident. ☹ When I responded to your email question, I never realized you would post it on the ROOTS website. Gary, upon reading Dr. Luc Van der Sluis' commentary, I am reminded of Salman Rushdie's sage advice ... "It is not easy to read intelligently and to think precisely." It is not easy to speak fluently and write clearly. It is not easy to study a subject carefully and know it thoroughly. Yet, these abilities are the foundation of the field of endodontics. Please understand this will be my only response at this time. In the interim, evidence-based science will ultimately clarify the sonic vs. ultrasonic debate. My intention is to cordially address Dr. Luc Van der Sluis' comments.

First, let me explain my remark "there is a growing body of evidence that shows sonic activation is superior to ultrasonic activation." In several preliminary studies our group has conducted, we have demonstrated that sonic activation is superior (read "better" if you prefer) to ultrasonic activation, especially in highly curved mesial canals of mandibular molars. The protocol we followed was approved by five internationally recognized professors well known for their work and publications in the field of endodontic disinfection. This preliminary work has led to several formal studies that have been completed and accepted for publication in peer-reviewed journals.

Second, a fellow named Dr. Akveld identified himself as a student of Dr. Luc Van der Sluis and requested that I send him a complimentary EndoActivator for research purposes. The results of this study were reported in a paper entitled "The efficacy of sonic irrigation (EndoActivator) and type of irrigant on removing artificially placed dentine debris from the apical root canal." Although this paper has not yet been published, the preliminary results, done in collaboration between La Sapienza and ACTA, were sent to me by my friend, Dr. Gianluca Gambarini. In this paper the statement is made, "the EndoActivator is a valuable instrument in endodontic treatment because of its superior removal of dentinal debris compared to rinsing with an irrigant only." In Dr. Van der Sluis' ROOTS commentary he states, "sonic irrigation is better than hand irrigation but less effective than ultrasonic irrigation." The latter part of this remark is surprising because a review of the above-mentioned paper reveals there was absolutely no comparison whatsoever between sonic and ultrasonic activation. Perhaps he has other evidence to which he is referring.

Third, a literature review regarding sonic vs. ultrasonic irrigation does not collaborate Dr. Van der Sluis' assertion that ultrasonic activation is better than sonic activation. In fact, there is NO international agreement. A few examples:

- a) Jensen, Hutter et al, J Endod Nov 1999 state there is no significant difference between sonic and ultrasonic activation.
- b) Lumley, Walmsley et al, J Endod Sept 1993 state there is no difference between sonic or ultrasonic activation as to remaining debris or smear layer.

- c) Sabins, Johnson et al, J. Endod Oct 2003 state ultrasonic passive irrigation produced statistically significantly cleaner canals than passive sonic irrigation.
- d) Stamos et al, J Endod May 19, 1987 presented two cases in which a single-visit endodontic procedure used ultrasonics.
- e) Lumley, Laird et al, Int Endod J Nov 1991 state the sonic device produced a larger disturbance around the freely moving oscillating tip. Most important, streaming occurred along the whole length of the file and the sonically driven file movement was not affected by constraint (wall contact).
- f) Walmsley, Lumley et al, Int Endod J May 1989 state that compared to ultrasonics when a sonic file was loaded the mode of vibration was particularly efficient and unaffected by wall contact.

The difference between investigators, although genuine, is most likely related to a number of critical factors, such as the methods used to activate any given reagent, vibrating metal vs. polymer tips, the percentage taper of the deep shape, and the irrigation protocol utilized, such as frequency, volume, temperature, time, etc., etc. I agree with Dr. Van der Sluis' statement "I could explain the rationale more thoroughly, but that takes too much time at this moment."

In my opinion, based on the body of emerging research, sonic activation is superior to ultrasonic irrigation, especially in curved canals because the vibrating instrument will invariably contact dentin. Ahmad, Pitt Fort et al, J Endod Mar 1997 and the Lumley papers previously listed (e and f) provide insights to the mechanisms of action between these two activation methods and serve to support my remarks. Dr. Van der Sluis listed a formula to calculate streaming velocity. This very formula shows that both frequency and the square of the amplitude directly affect streaming. Of course, the volume of a well-shaped canal is relatively small. As such, it is possible to interpret this formula differently based on the selected mode of activation. As an example, if one were to study ultrasonic activation, then it would be wise to focus on frequency. On the other hand, if one is to study sonic activation, then it is reasonable to focus on amplitude, as it exponentially affects streaming velocity. The point is sonic vibration, unlike ultrasonic vibration, is not dampened by wall contact in well-shaped canals.

Van der Sluis states "It seems strange to me that an instrument which has its activation from the point is not dampened when placed apically in severely curved root canals." Yet, in the La Sapienza and ACTA study, the paper states, "The end of the tip of the EndoActivator has a bigger amplitude than the upper part..." The paper goes on to state this is a shortcoming in using the EndoActivator or other sonic irrigation devices. ROOTers, this is not a shortcoming; rather, this observation is precisely what contributes to the sonic advantage!

In my email to Gary Henkel, I made the following remark based on several inquiries I have received from international doctors. "Beyond the EndoActivator, our second generation device will irrigate, vacuum, and vibrate all in one cordless handpiece. This device should be available in 2-3 years." In my experience as a clinician, teacher, and inventor, this would be considered PROGRESS. It is completely normal to anyone familiar with the R&D process, to strive to create useful products that have evidence-based science supporting them. Importantly, the inventor's responsibility is to relentlessly strive to refine, perfect, and improve existing products into better products. If I am guilty of that, then I apologize.

Dr. Van der Sluis states, “I am not interested in a fight between ultrasonic or sonic activation. I have no financial interest in whatever system, which makes me free to choose the best system from a scientific point of view, and that makes me a happy person because I do not feel the burden on my shoulders which I should feel if I would have invested a lot of money in a certain system.”

For the record, I am not interested in a fight between ultrasonic or sonic activation either! In fact, as previously stated, I did not know my answer to Gary Henkel’s email question would be publicly posted. With that said, I think it is fine to debate so-called scientific evidence. However, I found this last remark disappointing and somewhat personal. As such, I feel an obligation to international colleagues to respond based on the inferences and potential for misinterpretation.

At the recently concluded ESE Meeting in Istanbul, Acteon presented advertising literature regarding the new Satelec IrriSafe ultrasonic file. This marketing effort states that the IrriSafe file is designed by Dr. Van der Sluis, which undermines the inference that only science guides his product selection. There is available research that reports vibrating metal instruments, like the IrriSafe file, especially around root curvatures, can predispose to broken instruments, internal ledges, apical transportations, and potential for root perforations. Personally, I would rather vibrate a highly flexible and strong medical grade polymer material inside a well-prepared canal. Just like Dr. Van der Sluis testifies that he lets science guide his product selection, we, too, have let science guide our product selection and, as such, endorse the EndoActivator.

ROOTers, I am blessed, happy, grateful, and I sleep very well at night. For more than thirty (30) years, I have been passionate about helping to make endodontics more predictable, more fun, and more successful. Our group is very proud there is a growing body of evidence that will be published completely supporting the efficacy of the EndoActivator. Contrary to what was said, the EndoActivator is very affordable, especially if its costs are compared to ultrasonic technologies, Rins Endo, Endo Vac, PAD, etc. As an example, the handpiece costs \$305 and each disposable tip is less than \$2 (US). Importantly, the EndoActivator is easy to use, ergonomic, and is simple to integrate into existing endodontic procedures.

Back in 1980, Pierre Machtou clinically described and scientifically showed the results of pumping a fitted master cone to activate solutions. Although the results were encouraging, Pierre perfectly understood that virtually no clinician would spend five (5) minutes per canal utilizing this method to improve the exchange of an irrigant. I have great respect and admiration for Paul Wesselink (ACTA) who was a former classmate of mine at Harvard University in the mid 1970's. Although I have not had the pleasure to meet Dr. Van der Sluis, I want to acknowledge what he is doing to elevate our profession.

I send all ROOTers best wishes and encourage all dentists to support any colleague who is honestly trying to improve our great discipline.

Make Yourself Matter!
Cliff Ruddle