Self-Adjusting File: A Review

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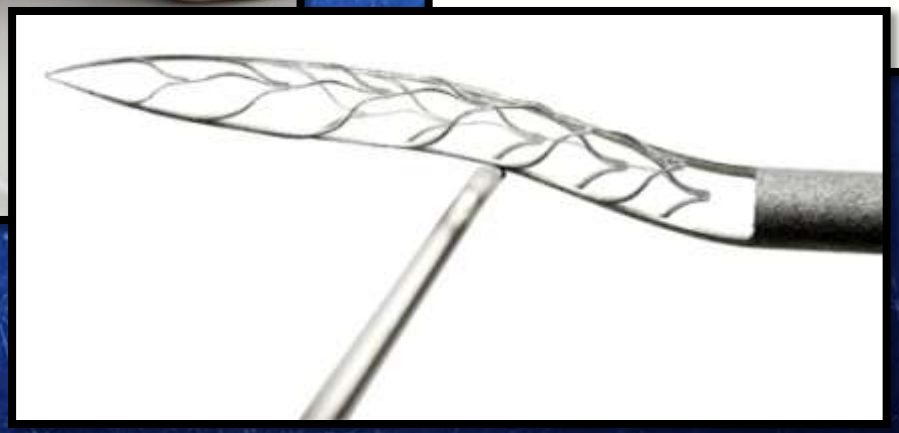
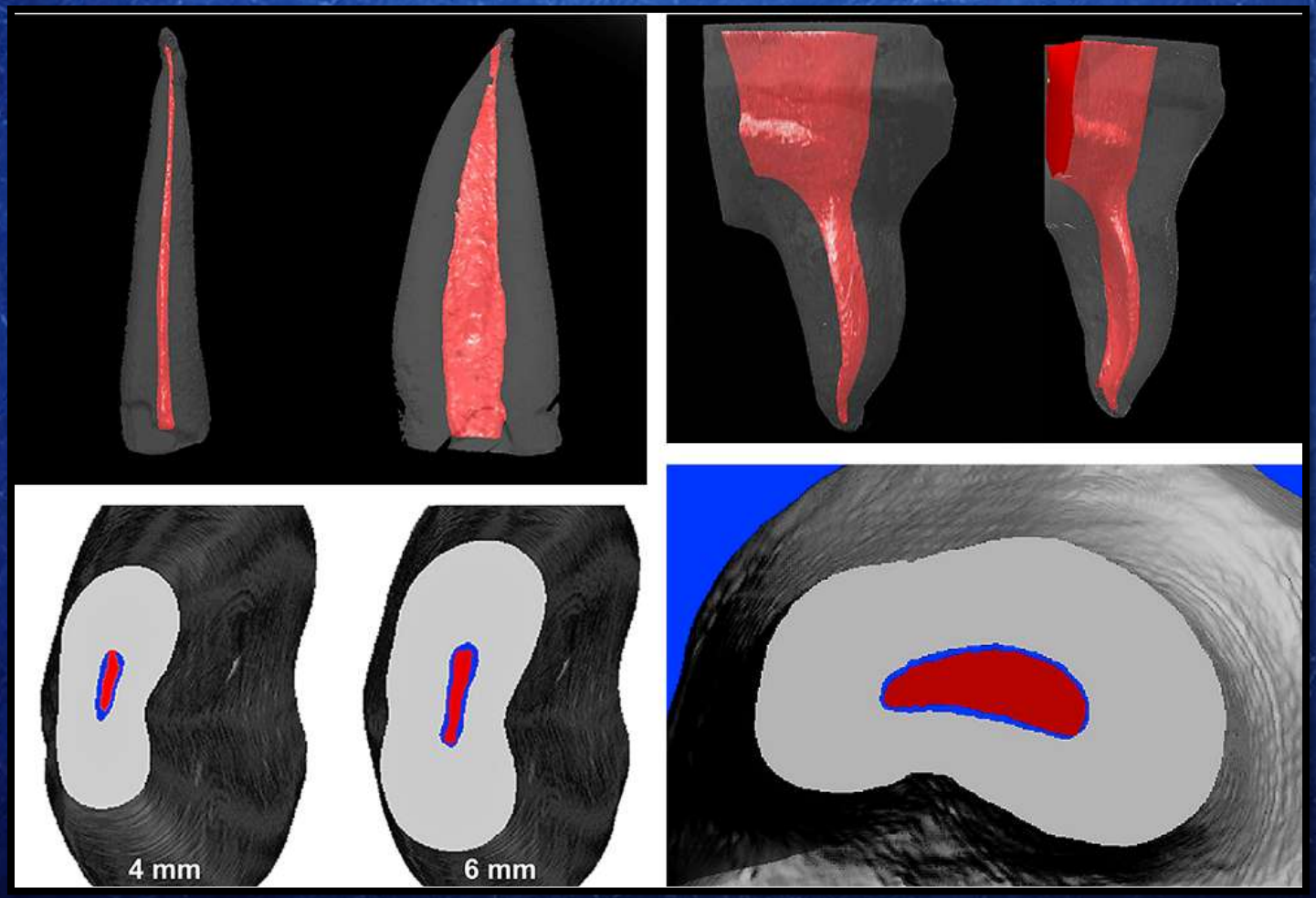


The Self-adjusting File (SAF). Part 1: Respecting the Root Canal Anatomy—A New Concept of Endodontic Files and Its Implementation

JOE — Volume 36, Number 4, April 2010

Zvi Metzger, DMD,† Ehud Teperovich, DMD,† Raviv Zary, DMD,† Raphaela Cohen, DMD,† and Rafael Hof, MSc (Eng)†*



The Self-adjusting File (SAF). Part 1: Respecting the Root Canal Anatomy—A New Concept of Endodontic Files and Its Implementation

Zvi Metzger, DMD,[*†] *Ehud Teperovich, DMD,*[†] *Raviv Zary, DMD,*[†] *Raphaela Cohen, DMD,*[†] *and Rafael Hof, MSc (Eng)*[†]

Conclusions

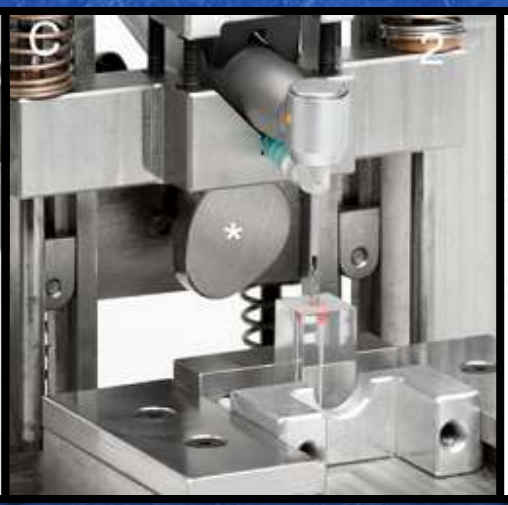
The SAF represents a new approach in endodontic file design and operation. Its main features are as follows:

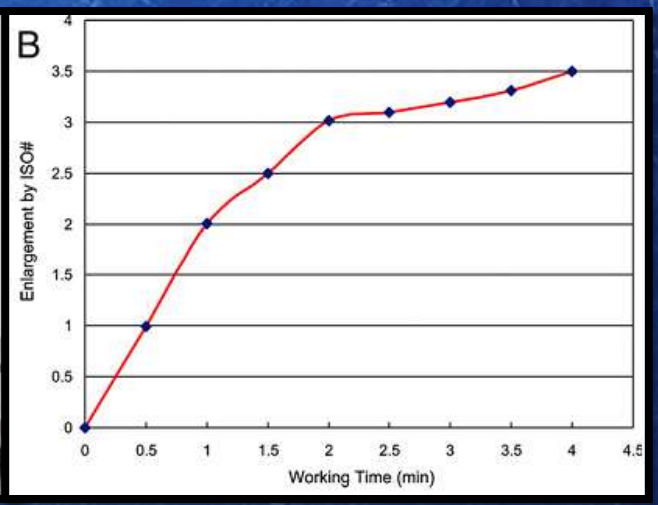
1. A three-dimensional adaptation to the shape of the root canal, including adaptation to its cross-section.
2. One file is used throughout the procedure, during which it changes from an initially compressed form to larger dimensions.
3. Canal straightening and canal transportation of curved canals are largely avoided because of the lack of a rigid metal core. The file does not have "a will of its own."
4. High mechanical durability, thus overcoming the issue of separated nickel-titanium instruments.
5. Hollow design that allows continuous irrigation with constant refreshment of the irrigant throughout the procedure.

The Self-adjusting File (SAF). Part 2: Mechanical Analysis

Rafael Hof, MSc (Eng), Valery Perevalov, MSc (Eng),* Moshe Eltanani,* Raviv Zary, DMD,* and Zvi Metzger, DMD*†*

JOE — Volume 36, Number 4, April 2010





The Self-adjusting File (SAF). Part 2: Mechanical Analysis

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Conclusions

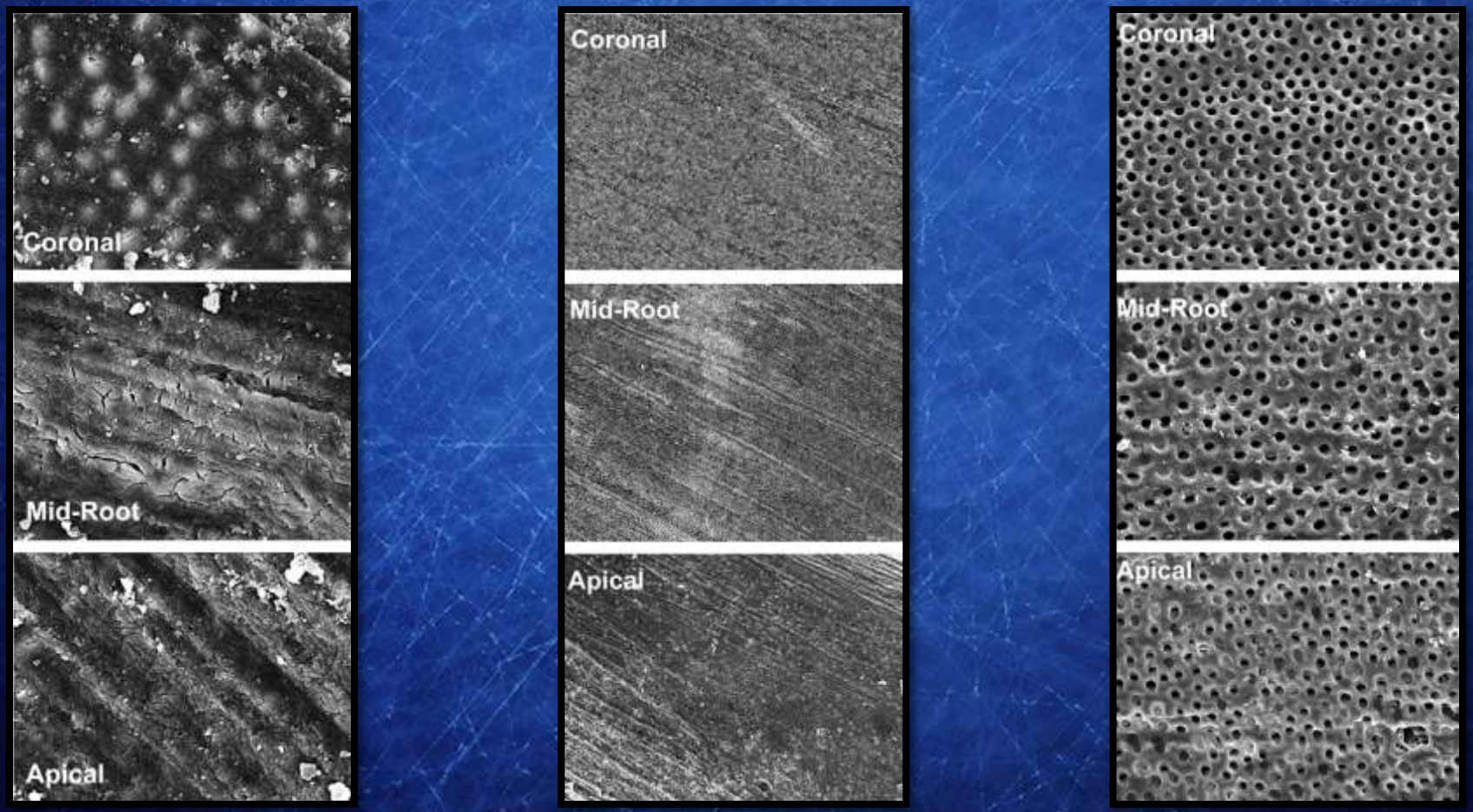
The following conclusions were made:

1. The SAF file may be elastically compressed from a diameter of 1.5 mm to dimensions resembling those of an ISO # 20 K-file.
2. Compressing the SAF file generates circumferential force.
3. The rough surface, combined with the above force and the in-and-out vibration, allows for the removal of dentin by filing.
4. The circumferential force and the ability to remove dentin declines as the diameter of the canal enlarges.
5. The ability to remove dentin declines if the file is reused.
6. The SAF file is mechanically durable for continuous operation for 29 minutes.
7. Application of the SAF does not push the irrigant beyond the apical foramen.

The Self-adjusting File (SAF). Part 3: Removal of Debris and Smear Layer—A Scanning Electron Microscope Study

Zvi Metzger, DMD,[*†] *Ehud Teperovich, DMD,*[†] *Raphaela Cohen, DMD,*[†] *Raviv Zary, DMD,*[†] *Frank Paqué, DMD,*[‡] *and Michael Hülsmann, DMD*[§]

JOE — Volume 36, Number 4, April 2010



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JOE — Volume 36, Number 4, April 2010

Conclusions

The SAF, operated with the continuous flow of irrigants alternating between sodium hypochlorite and EDTA, resulted in root canals that were free of debris and almost completely free of the smear layer.

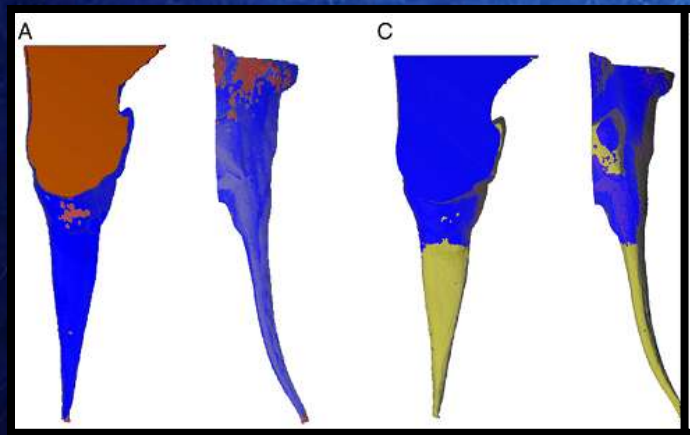
The results were better than those previously published for the coronal and midroot portions of the root canal.

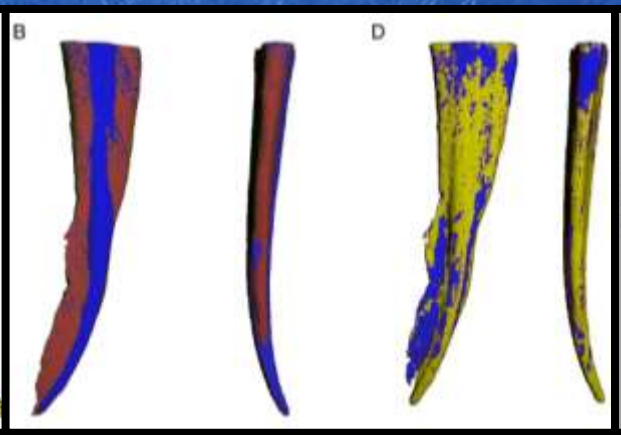
The difference was also pronounced in the apical third of the canal, in which previously published protocols failed to adequately clean the canal, whereas the SAF protocol resulted in debris-free canal walls in all samples and smear layer-free surfaces in most of the samples.

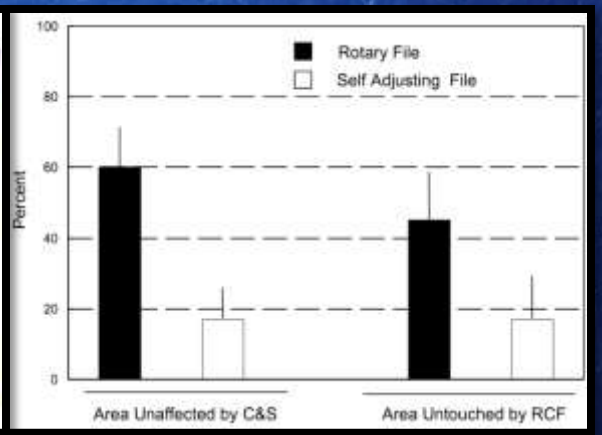
The Quality of Root Canal Preparation and Root Canal Obturation in Canals Treated with Rotary *versus* Self-adjusting Files: A Three-dimensional Micro-computed Tomographic Study

JOE — Volume 36, Number 9, September 2010

Zvi Metzger, DMD,† Raviv Zary, DMD,† Raphaela Cohen, DMD,† Ehud Teperovich, DMD,† and Frank Paqué, DMD‡*







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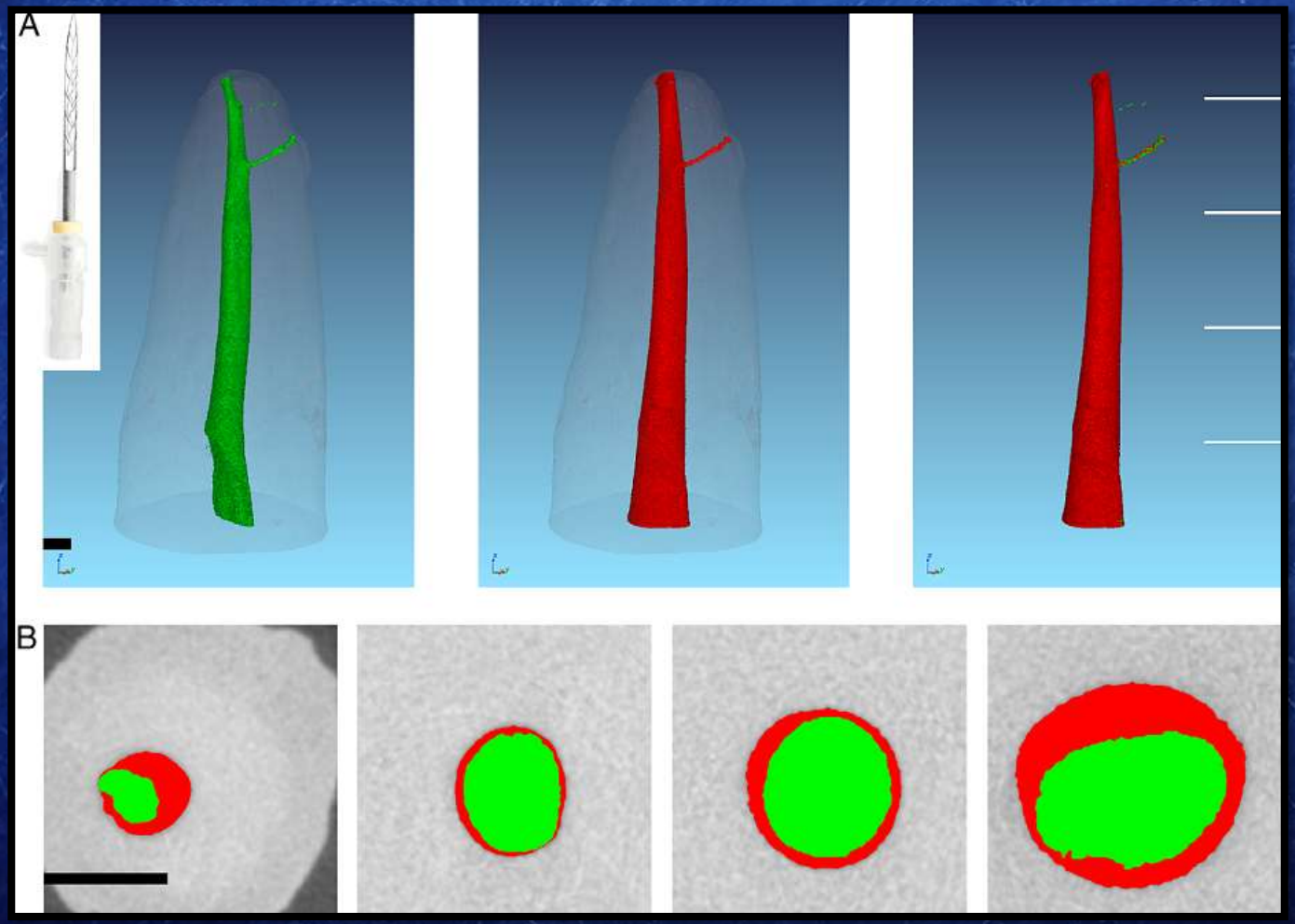
Conclusions

A micro-CT-based quantitative three-dimensional method for analysis of root canal filling adaptation to the canal walls was presented. It may serve as a useful tool to study and compare the quality of root canal fillings. Within the limitations of the present study, the SAFs allowed better cleaning and shaping and better adaptation of the root canal filling than those allowed by rotary files.

Root Canal Preparation with a Novel Nickel-Titanium Instrument Evaluated with Micro-computed Tomography: Canal Surface Preparation over Time

JOE — Volume 36, Number 6, June 2010

Ove A. Peters, DMD, MS, PhD, Claudia Boessler, DDS,† and Frank Paqué, Dr med dent†*



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In conclusion, preparation of straight root canals in anterior teeth with the novel SAF left little canal surface uninstrumented after 5 minutes of activation; there were also no significant procedural errors. The time-frame of clinical application will depend on the amount of desired dentin removal and will be done with an SAF selected on the basis of apical gauging.

Ability of Chemomechanical Preparation with Either Rotary Instruments or Self-adjusting File to Disinfect Oval-shaped Root Canals

JOE — Volume 36, Number 11, November 2010

José F. Siqueira, Jr, PhD, Flávio R.F. Alves, PhD, Bernardo M. Almeida, DDS, Julio C. Machado de Oliveira, PhD, and Isabela N. Rôças, PhD

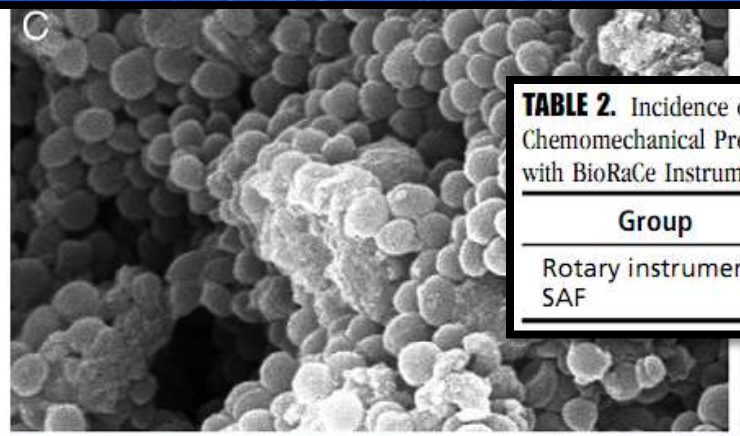

TABLE 2. Incidence of Positive Cultures after (S2a and S2b) Chemomechanical Preparation by Using Either Rotary NiTi Instrumentation with BioRaCe Instruments or the SAF System

Group	S2a	S2b	S2ab*
Rotary instruments	4/20 (20)†	8/20 (40)	11/20 (55)
SAF	1/20 (5)	4/20 (20)	4/20 (20)

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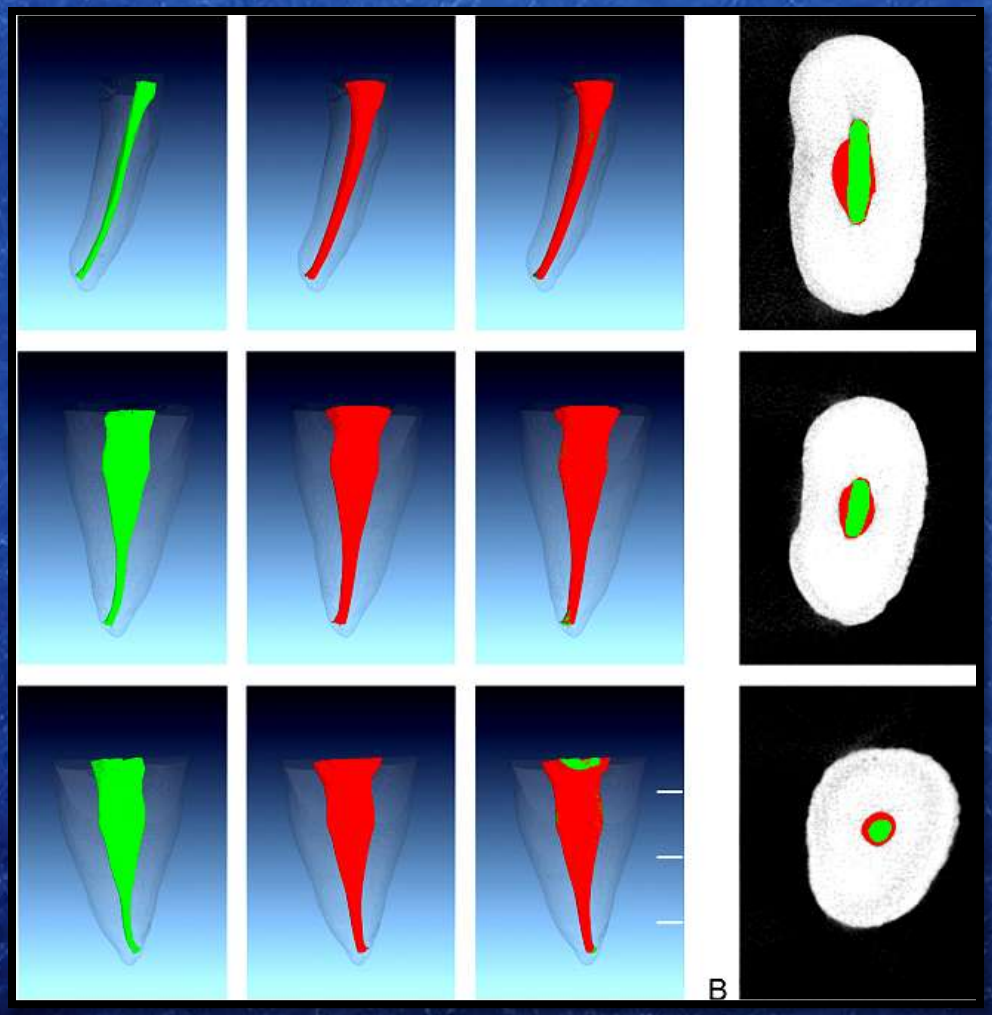
In conclusion, the SAF cleaning-shaping-irrigation system was significantly more effective than rotary NiTi instrumentation used with syringe and needle irrigation in eliminating viable *E. faecalis* cells from long oval root canals *in vitro*. Also, a modification of the sampling technique might be considered to improve bacterial recovery in oval-shaped canals.

Micro–computed Tomography Evaluation of the Preparation of Long Oval Root Canals in Mandibular Molars with the Self-adjusting File

JOE — Volume 37, Number 4, April 2011

Frank Paqué, Dr Med Dent, and Ove A. Peters, MS, DMD, PhD†*



Micro–computed Tomography Evaluation of the Preparation of Long Oval Root Canals in Mandibular Molars with the Self-adjusting File

JOE — Volume 37, Number 4, April 2011

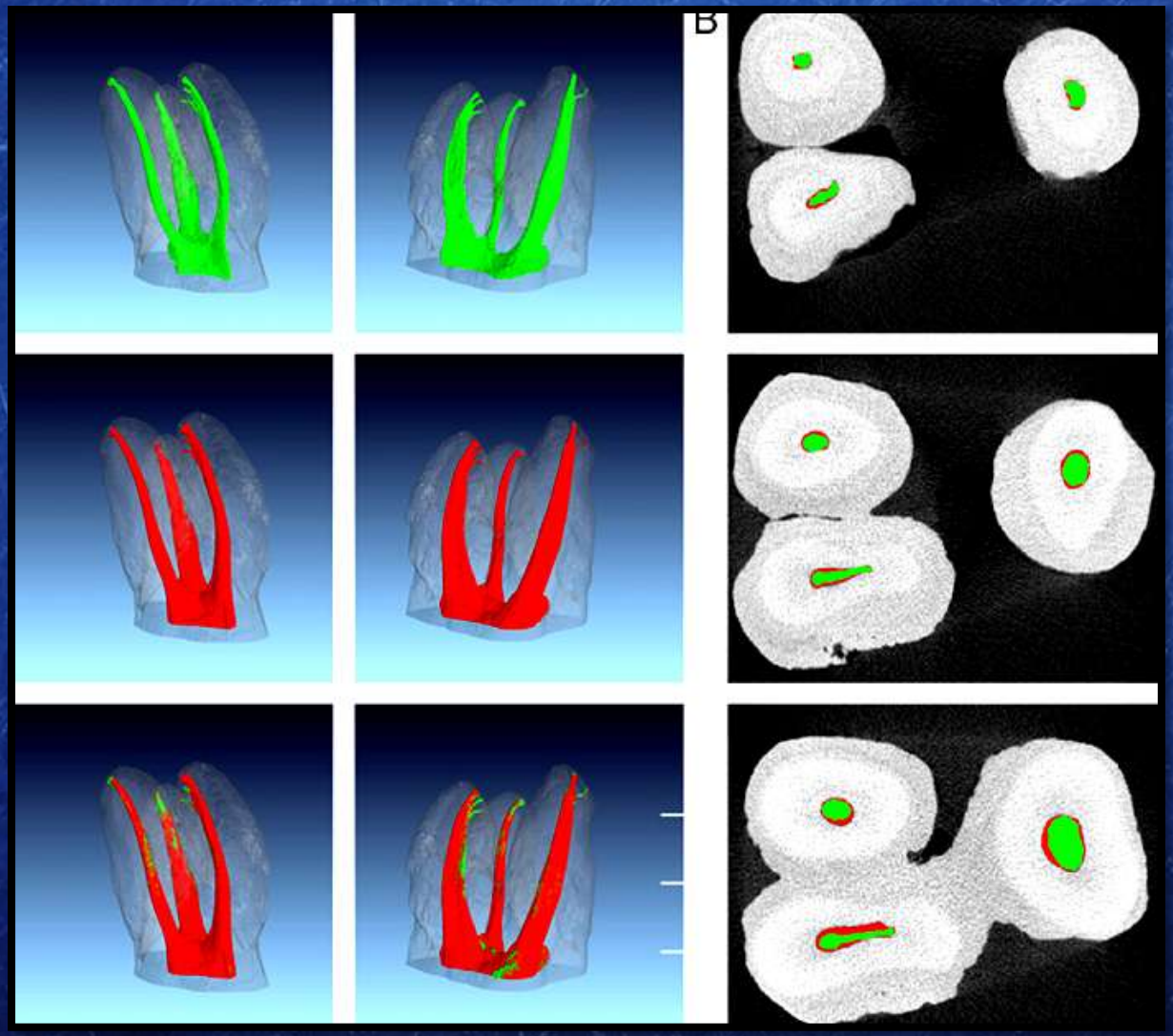
Frank Paqué, Dr Med Dent, and Ove A. Peters, MS, DMD, PhD†*

In conclusion, preparation of long oval–shaped root canals in mandibular molars *in vitro* with the SAF was effective and safe. Moreover, shapes generated with the SAF were more complete compared with rotary canal preparation.

Root Canal Preparation of Maxillary Molars With the Self-adjusting File: A Micro-computed Tomography Study

Ove A. Peters, DMD, MS, PhD, and Frank Paqué, Dr med dent†*

JOE — Volume 37, Number 1, January 2011



Root Canal Preparation of Maxillary Molars With the Self-adjusting File: A Micro-computed Tomography Study

Ove A. Peters, DMD, MS, PhD, and Frank Paqué, Dr med dent*[†]

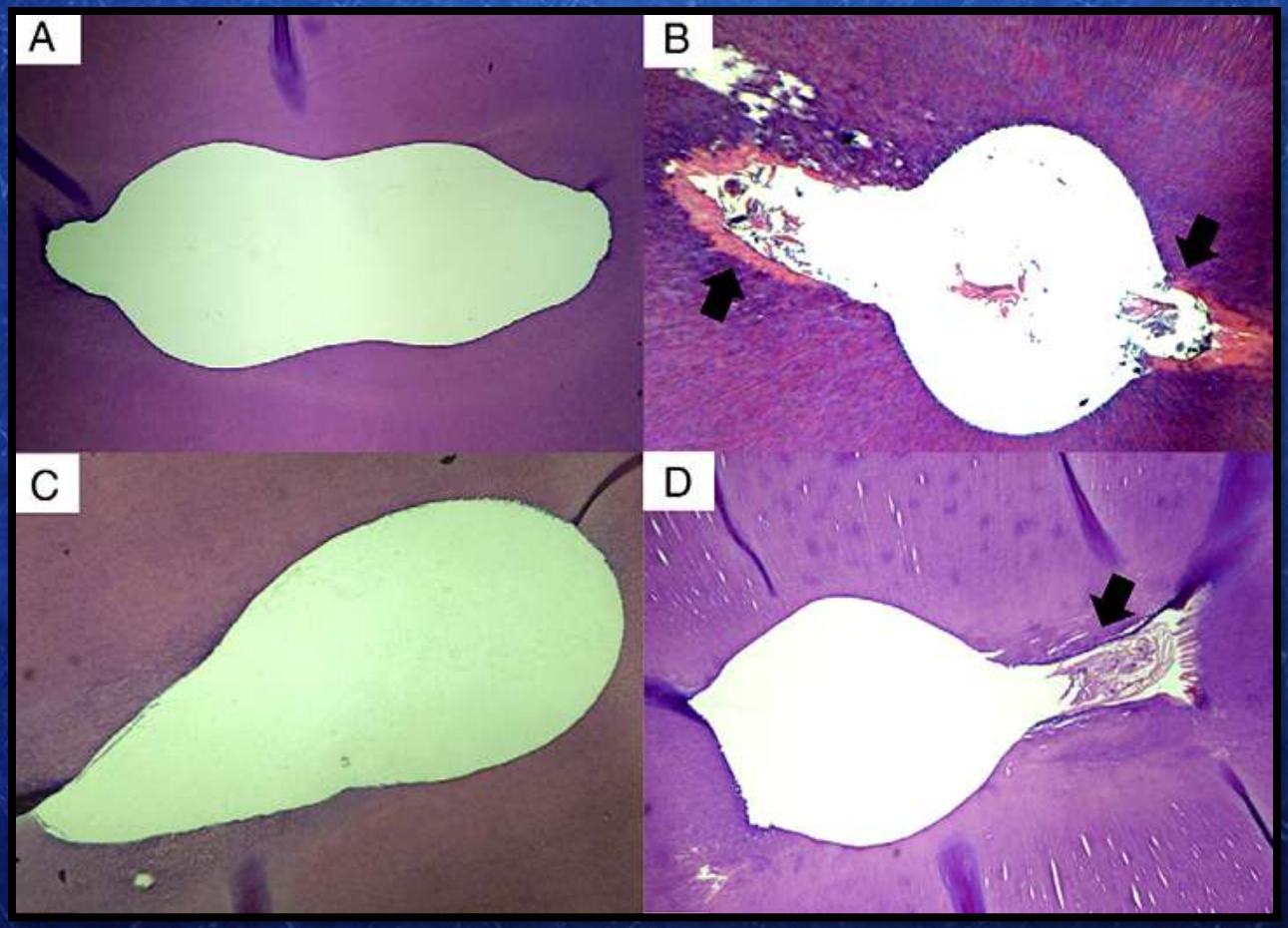
JOE — Volume 37, Number 1, January 2011

In conclusion, by using SAF instruments *in vitro*, canals in maxillary molars were homogenously and circumferentially prepared with little canal transportation or other procedural errors.

The Self-Adjusting File Optimizes Debridement Quality in Oval-shaped Root Canals

JOE — Volume 37, Number 5, May 2011

Gustavo De-Deus, DDS, MS, PhD, Erick Miranda Souza, DDS, MS, PhD,† Bianca Barino, DDS, MS,* Janaina Maia, DDS, MS,* Renata Quintella Zamolyi, MD, MS,‡ Claudia Reis, DDS, MS, PhD,* and Anda Kfir, DMD§*



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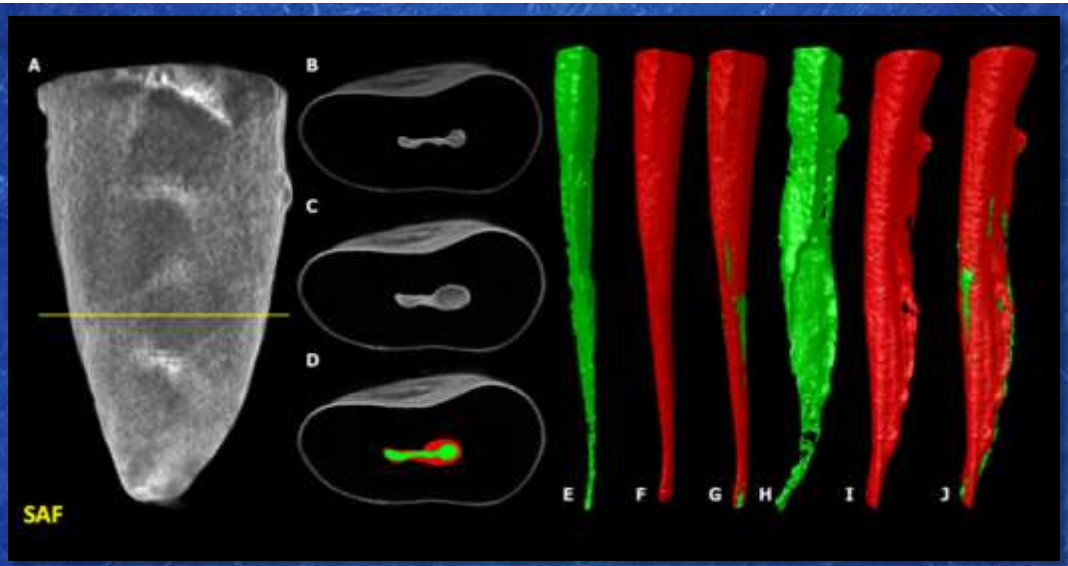
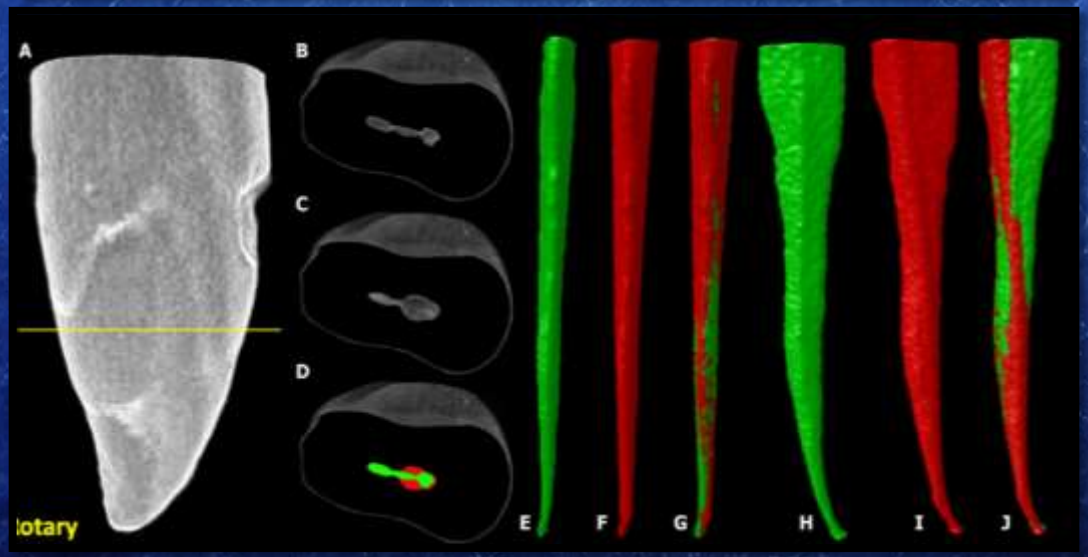
The current results indicate that, in addition to its previously reported better efficiency for circumferentially removing dentin from all canal walls, as has been shown by micro-CT studies (8, 17–19), the SAF system also has an improved debridement and cleaning efficacy in the oval-shaped canals used in the present study. This may, in turn, also aid in explaining the recently reported improved disinfection that the SAF system has in oval canals (14). Further studies should be performed to verify if similar results as those for remaining pulp tissue can be attained also with naturally occurring mixed bacterial biofilms. It would also be interesting to compare the SAF system with a combination of rotary files with one or more of the recently introduced irrigation systems, such as negative pressure and passive ultrasonic irrigation methods.

Flat-Oval Root Canal Preparation with Self-Adjusting File Instrument: A Micro–Computed Tomography Study

JOE — Volume 37, Number 7, July 2011

Marco Aurélio Versiani, MS, Jesus Djalma Pécora, PhD, and Manoel Damião de Sousa-Neto, PhD





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Although the overall quantitative analysis of middle and apical thirds showed no difference between groups, the results clearly showed that instrumentation groups differed from each other in the qualitative analysis. As previously demonstrated, the present results suggest that rotary NiTi instrument alone was unable to adequately prepare the root canal (3, 4, 17), and SAF does indeed result in homogenous preparation and circumferential removal of a layer of hard tissue, favoring root canal disinfection (14) and the accommodation of the root canal filling (16).

Further studies should be performed to compare the cleaning efficacy of the SAF system with a combination of rotary files with passive ultrasonic irrigation method in the flat-oval–shaped canals.

Deformation of the self-adjusting file on simulated curved root canals: a time-dependent study

Ilgın Akçay, DDS, PhD,[a] Senem Yiğit-Özer, DDS, PhD,[b] Özkan Adigüzel, DDS, PhD,[b] and Sadulah Kaya, DDS, PhD,[b] İzmir and Diyarbakir, Turkey
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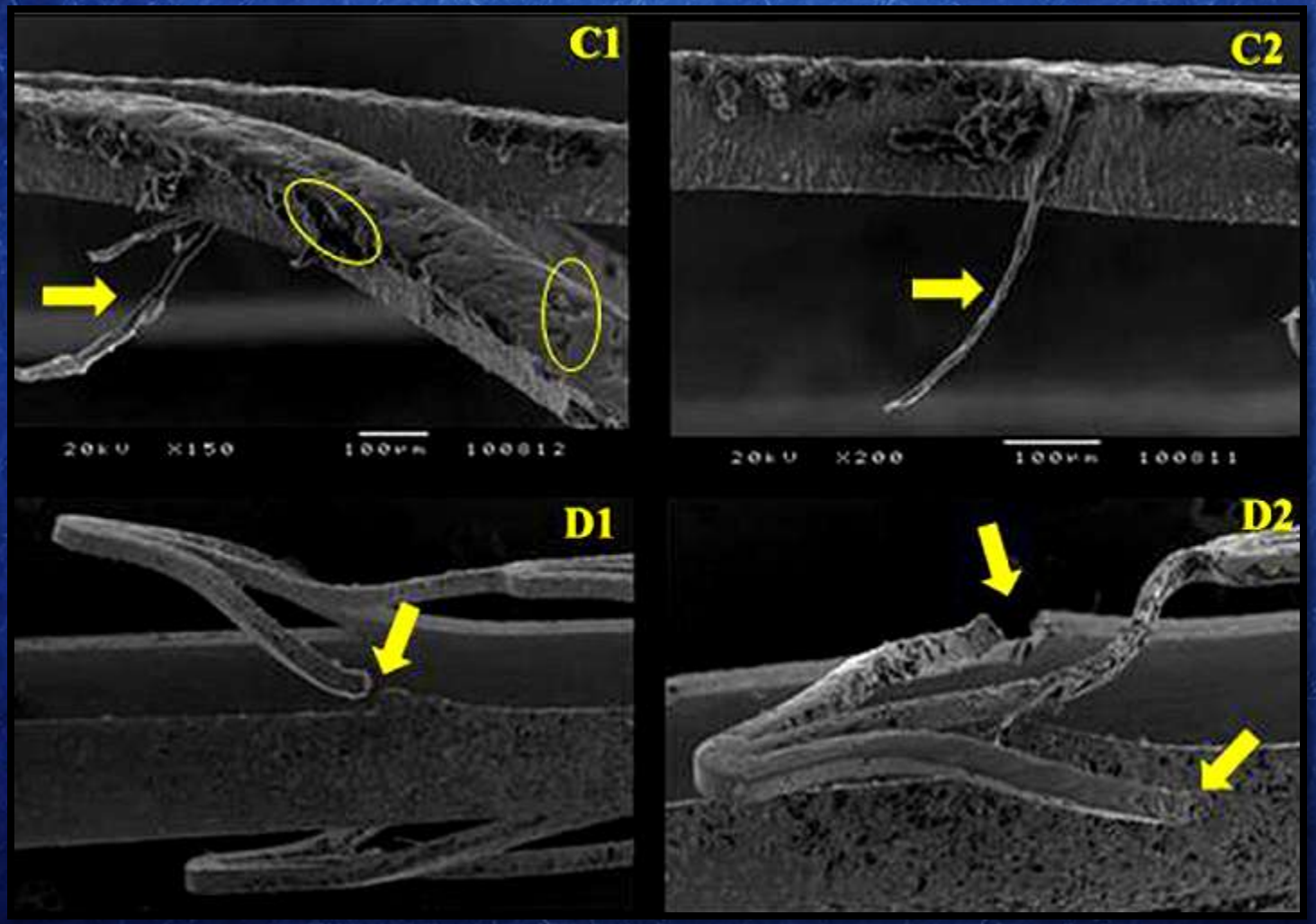

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EGE UNIVERSITY AND DICLE UNIVERSITY

CONCLUSIONS

During root canal preparation of curved and multi-rooted teeth, it might be advisable to use more than one SAF to prevent deformation of the lattice. For this reason, our original hypothesis was not proven. However, one must consider that the instruments were tested in a metal environment in the present study and the conclusions cannot be compared directly with the clinical conditions where dentin is treated. Thus, future research evaluating the cutting ability of this system in extracted teeth with curved root canals may aid our understanding of the efficiency of the SAF.

Time-dependent Antibacterial Effects of the Self-Adjusting File Used with Two Sodium Hypochlorite Concentrations

Flávio R.F. Alves, PhD, Bernardo M. Almeida, MSc, Mônica A.S. Neves, MSc, Isabela N. Rôças, PhD, and José F. Siqueira, Jr, PhD

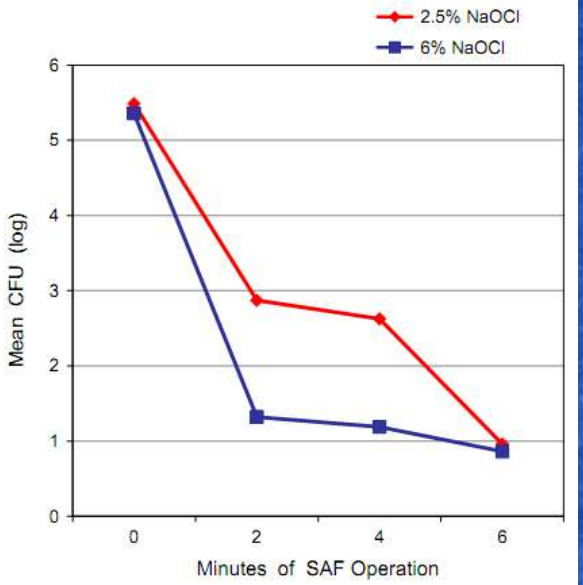

Figure 1. A reduction in the intracanal CFU counts after chemomechanical preparation with the SAF for 2, 4, and 6 minutes using two NaOCl concentrations.

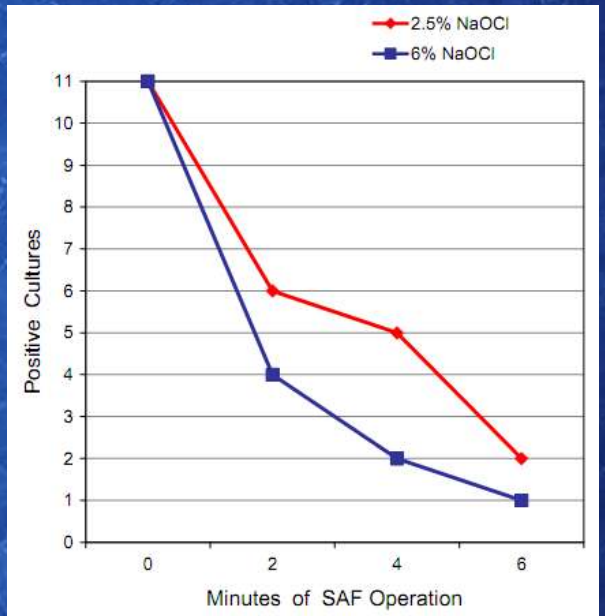

Figure 2. The incidence of positive cultures after chemomechanical preparation with the SAF for 2, 4, and 6 minutes using two NaOCl concentrations.

TABLE 2. The Incidence of Positive Cultures after Chemomechanical Preparation Using the SAF and Two NaOCl Concentrations for 2, 4, and 6 Minutes

Groups	2 min	4 min	6 min
SAF/2.5% NaOCl	6/11 (54.5)*	5/11 (45.5)	2/11 (18)
SAF/6% NaOCl	4/11 (36)	2/11 (18)	1/11 (9)

*The number of cases with positive culture/number of cases examined (%).

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In conclusion, our general findings revealed that the SAF cleaning-shaping-irrigation system promoted a significant reduction in bacterial populations even after only 2 minutes regardless of the NaOCl concentration. However, the most impressive results were obtained after 6 minutes. Whether comparable results using the SAF after 6 minutes can be reproduced in the real clinical setting against a mixed bacterial community, this system holds the potential to significantly improve single-visit disinfection. Further clinical research is warranted.