

## THE PARADOX OF SPEED IN CONTEMPORARY ENDODONTICS: TECHNOLOGICAL ADVANCES AND THE OVERLOOKED ROLE OF IRRIGATION TIME

La paradoja de la velocidad en la endodoncia contemporánea: avances tecnológicos y la relevancia subestimada del tiempo de irrigación

Pablo Betancourt,<sup>1,2</sup> Eulàlia Sans-Serramitjana.<sup>1,2,3,4</sup>

---

Received: September 30, 2025. | Accepted: October 25, 2025. | Published online: May 07, 2026

---

Recent advances in metallurgy and heat-treated NiTi instruments have dramatically increased efficiency in root canal preparation, allowing clinicians to complete mechanical shaping in significantly less time and with fewer files.<sup>1,2</sup> This technological progress has undeniable benefits, but it also raises a critical question: Does the acceleration of instrumentation compromise the biological foundation of endodontic therapy?

The complexity of root canal morphology remains a major challenge. Micro-CT investigations have demonstrated that 10–80% of canal surfaces—particularly in oval and flattened canals—remain uninstrumented, irrespective of the instrumentation system utilized.<sup>3</sup> These anatomical complexities mean that irrigation, not instrumentation, is the decisive factor for effective disinfection. Sodium hypochlorite (NaOCl), the most widely used irrigant, requires sufficient contact time to disrupt biofilms and dissolve organic tissue, yet accelerated treatments risk reducing this crucial step.

The trend toward minimally invasive endodontics (MIE) further accentuates this paradox. Conservative shaping preserves dentin and improves structural integrity, but also narrows preparation and limits mechanical debridement, thereby increasing reliance on irrigation protocols.<sup>4</sup> In this context, adjunctive technology such as laser activation holds promise. It can enhance irrigant penetration and exchange, potentially compensating for reduced canal enlargement and treatment time.<sup>5</sup> However, clinical evidence remains limited, and robust trials are needed to confirm its effectiveness in improving periapical healing outcomes.

1. Endodontic Laboratory, Center for Research in Dental Sciences (CICO), Faculty of Dentistry, Universidad de La Frontera, Temuco, Chile.

2. Department of Integral Adult Dentistry, Faculty of Dentistry, Universidad de La Frontera, Temuco, Chile.

3. Center of Excellence in Translational Medicine-Scientific and Technology Bioresources Nucleus (CEMT-BIOREN), Universidad de La Frontera, Temuco, Chile.

4. Millennium Nucleus Bioproducts, Genomics and Environmental Microbiology (BioGEM), Avenida España 1680, 2390123 Valparaíso, Chile.

### Corresponding Author:

**Pablo Betancourt.** Department of Integral Adultos. Faculty of Dentistry, Universidad de La Frontera, Chile. Avda. Francisco Salazar # 01145, Temuco, Chile. **Phone:** (+56-45) 2 325 000. **E-mail:** pablo.betancourt@ufrontera.cl

Betancourt P & Sans-Serramitjana E. The Paradox of Speed in Contemporary Endodontics: Technological Advances and the Overlooked Role of Irrigation time. *J Oral Res.* 2026; 15(1):1-3. <https://doi.org/10.17126/joralres.2026.001>

ISSN Print 0719-2460 - ISSN en línea 0719-2479

In our view, the central challenge for contemporary endodontics is to reconcile speed, biology, and conservation. Technological efficiency must not undermine the biological requirement for thorough disinfection. Irrigation time, enhanced by but not replaced with activation methods, remains essential to achieve predictable long-term success.

## REFERENCES

1. Martins JNR, Silva EJNL, Marques D, Pereira MR, Vieira VTL, Arantes-Oliveira S, Martins RF, Braz Fernandes F, Versiani M. Design, Metallurgical Features, and Mechanical Behaviour of NiTi Endodontic Instruments from Five Different Heat-Treated Rotary Systems. *Materials (Basel)*. 2022;15(3):1009. doi: [10.3390/ma15031009](https://doi.org/10.3390/ma15031009). PMID: [35160955](https://pubmed.ncbi.nlm.nih.gov/35160955/); PMCID: [PMC8840527](https://pubmed.ncbi.nlm.nih.gov/PMC8840527/).
2. Kang YJ, Kwak SW, Ha JH, Gambarini G, Kim HC. Fracture resistances of heat-treated nickel-titanium files used for minimally invasive instrumentation. *BMC Oral Health*. 2025;25(1):126. doi: [10.1186/s12903-025-05487-4](https://doi.org/10.1186/s12903-025-05487-4). PMID: [39849421](https://pubmed.ncbi.nlm.nih.gov/39849421/); PMCID: [PMC11761776](https://pubmed.ncbi.nlm.nih.gov/PMC11761776/).
3. Siqueira Junior JF, Rôças IDN, Marceliano-Alves MF, Pérez AR, Ricucci D. Unprepared root canal surface areas: causes, clinical implications, and therapeutic strategies. *Braz Oral Res*. 2018;32(suppl 1):e65. doi: [10.1590/1807-3107bor-2018.vol32.0065](https://doi.org/10.1590/1807-3107bor-2018.vol32.0065). PMID: [30365606](https://pubmed.ncbi.nlm.nih.gov/30365606/).
4. Kwon SK, Seog M, Kim D, Jung IY. Impact of minimally invasive root canal treatment on healing outcomes in a randomized clinical trial. *Sci Rep*. 2025;15(1):23260. doi: [10.1038/s41598-025-02905-z](https://doi.org/10.1038/s41598-025-02905-z). PMID: [40603366](https://pubmed.ncbi.nlm.nih.gov/40603366/); PMCID: [PMC12222528](https://pubmed.ncbi.nlm.nih.gov/PMC12222528/).
5. Betancourt P, Merlos A, Sierra JM, Arnabat-Dominguez J, Viñas M. Er,Cr:YSGG Laser-Activated Irrigation and Passive Ultrasonic Irrigation: Comparison of Two Strategies for Root Canal Disinfection. *Photobiomodul Photomed Laser Surg*. 2020;38(2):91-97. doi: [10.1089/photob.2019.4645](https://doi.org/10.1089/photob.2019.4645). Epub 2019 Aug 9. PMID: [31397611](https://pubmed.ncbi.nlm.nih.gov/31397611/).

### CONFLICT OF INTERESTS

The authors declare no conflict of interest.

### ETHICS APPROVAL

It is not necessary.

### FUNDING

Does not have a source of financing.

### AUTHORS' CONTRIBUTIONS

All authors have contributed significantly to the development of the ideas presented.

**Pablo Betancourt:** Drafting the manuscript and discussion of ideas.

**Eulàlia Sans-Serramitjana:** Discussion of ideas and final manuscript revision.

### ACKNOWLEDGEMENTS

Pablo Betancourt (P.B.) acknowledges the DIUFRO project PAB24-0021.


Eulàlia Sans-Serramitjana (E.S.-S) from the Chilean Government's National Agency for Research and Development (ANID) project (SIA Project No. 85240304).

### ORCID

**Pablo Betancourt**

 0000-0002-9903-2920

**Eulàlia Sans-Serramitjana**

 0000-0001-5642-6965

### PUBLISHER'S NOTE

All statements expressed in this article are those of the authors alone and do not necessarily represent those of the publisher, editors, and reviewers.

### COPYRIGHT

This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms. ©2026.



### PLAGIARISM SOFTWARE

This manuscript was analyzed Compilatio plagiarism detector software. Analysis report of document ID. 69c8fafcc1f709a3086bb287e293b4ac2a88ae5c

**ISSN Print 0719-2460 - ISSN Online 0719-2479**

<https://joralres.com/index.php/JOralRes>