EDITORIAL

Potential of Operative Torque in Evaluating NiTi Instruments

Gianluca Gambarini[1], Dario Di Nardo[2], Maurilio D'Angelo[3], Antonio Morese[4], Marco Seracchiani[5], Luca Testarelli[6]

The Journal of Contemporary Dental Practice (2020): 10.5005/jp-journals-10024-2773

The role of nickel–titanium (NiTi) in the production of endodontic instruments increased in the last few decades; therefore, the way of evaluation of its performance increased as well. Nowadays, there are several ways to evaluate NiTi instruments, divided into static and dynamic tests. The static ones are cyclic fatigue tests, torsional resistance tests, flexibility, and cutting efficiency tests. These methodologies have been deeply used to evaluate some of the metallurgical properties of the instruments on the market. Up-to-date, we know very well the behavior of NiTi under static conditions, but these knowledges are too fragmented to be relevant for understanding and evaluating the complexities of intracanal instrumentation. Starting from the purpose to introduce the variable of movement in the testing procedure, some dynamic tests have been proposed, such as dynamic cyclic fatigue test.[1,2] Although these kinds of studies were capable of evaluating more precisely the behavior of rotary instruments inside the root canal, they could not take into account, at this moment, the complexities of stresses that instruments undergo during the shaping procedure.[3–5] Therefore, some of these tests are not accepted anymore by the scientific community and on the contrary they do not help the general practitioner to orientate in the large amount of rotary instruments present on the market.[6] This tends to withdraw the general dentistry from the scientific literature, wearing a groove between the practice and the science.[7] Starting from these ideas, in the last couple of years some authors started to think the proper way to real-time evaluation of the performance of NiTi rotary instruments inside the root canal. To do so, a countable and repeatable measurement of instrument's developed stresses was needed. Setzer and Böhme[8] first used the torque generated by Revo-S, Vortex, and ProFile to evaluate their performance during instrumentation. The so-called "operative torque" is the summation of torque generated in each point of the instrument during its simultaneous movement around its own axis and up and down inside the canal. The recorded values are influenced by both torsional and flexural stresses, becoming this way a reliable method to analyze, evaluate, and compare the performance of NiTi instruments inside the root canal.[9] This methodology is applicable for not only *in vitro* but also *in vivo* measurement, as demonstrated by Gambarini et al.[10] The main drawback of this kind of evaluation is the not well-determined correlation between the torsional and the flexural stresses; therefore, it is still unpredictable how each influence the other. In conclusion, the potential of real-time torque measurement is wide and still unexplored, but further studies are needed to better understand how torque is developed inside the root canal.

[1–6]Department of Oral and Maxillofacial Sciences, Sapienza University of Rome, Rome, Italy

Corresponding Author: Luca Testarelli, Department of Oral and Maxillofacial Sciences, Sapienza University of Rome, Rome, Italy, Phone: +39 3381504134, e-mail: luca.testarelli@uniroma1.it

How to cite this article: Gambarini G, Di Nardo D, D'Angelo M, *et al.* Potential of Operative Torque in Evaluating NiTi Instruments. J Contemp Dent Pract 2020;21(2):113.

Source of support: Nil

Conflict of interest: None

References

1. Keleş A, Eymirli A, Uyanık O, et al. Influence of static and dynamic cyclic fatigue tests on the lifespan of four reciprocating systems at different temperatures. Int Endod J 2019;52(6):880–886. DOI: 10.1111/iej.13073.
2. Gambarini G, Piasecki L, Miccoli G, et al. Classification and cyclic fatigue evaluation of new kinematics for endodontic instruments. Aust Endod J 2019;45(2):154–162. DOI: 10.1111/aej.12294.
3. Gambarini G, Miccoli G, Seracchiani M, et al. Fatigue resistance of new and used nickel-titanium rotary instruments: a comparative study. Clin Ter 2018;169(3):e96–e101. DOI: 10.7417/T.2018.2061.
4. Plotino G, Grande N, Mazza C, et al. Influence of size and taper of artificial canals on the trajectory of NiTi instruments in cyclic fatigue studies. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2010;109(1):60–66. DOI: 10.1016/j.tripleo.2009.08.009.
5. Dosanji A, Paurazas S, Askar M. The effect of temperature on cyclic fatigue of nickel-titanium rotary endodontic instruments. J Endod 2017;43(5):823–826. DOI: 10.1016/j.joen.2016.12.026.
6. Hülsmann M, Donnermeyer D, Schäfer E. A critical appraisal of studies on cyclic fatigue resistance of engine-driven endodontic instruments. Int Endod J 2019;52(10):1427–1445. DOI: 10.1111/iej.13182.
7. Hülsmann M. Research that matters: studies on fatigue of rotary and reciprocating NiTi root canal instruments. Int Endod J 2019;52(10):1401–1402. DOI: 10.1111/iej.13194.
8. Setzer FC, Böhme CP. Influence of combined cyclic fatigue and torsional stress on the fracture point of nickel-titanium rotary instruments. J Endod 2013;39(1):133–137. DOI: 10.1016/j.joen.2012.10.001.
9. Viana AC, Pereira ES, Bahia MG, et al. The influence of simulated clinical use on the flexibility of rotary ProTaper universal, K3 and EndoSequence nickel-titanium instruments. Int Endod J 2013;46(9):855–862. DOI: 10.1111/iej.12071.
10. Gambarini G, Seracchiani M, Piasecki L, et al. Measurement of torque generated during intracanal instrumentation in vivo. Int Endod J 2019;52(5):737–745. DOI: 10.1111/iej.13042.

© The Author(s). 2020 Open Access This article is distributed under the terms of the Creative Commons Attribution 4.0 International License (https://creativecommons.org/licenses/by-nc/4.0/), which permits unrestricted use, distribution, and non-commercial reproduction in any medium, provided you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made. The Creative Commons Public Domain Dedication waiver (http://creativecommons.org/publicdomain/zero/1.0/) applies to the data made available in this article, unless otherwise stated.