Potential of Operative Torque in Evaluating NiTi Instruments

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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. 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. 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. This tends to withdraw the general dentistry from the scientific literature, wearing a groove between the practice and the science. 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 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. This methodology is applicable for not only in vitro but also in vivo measurement, as demonstrated by Gambarini et al. 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.

References


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