EDITORIAL

Heat-treated Ni-Ti Rotary Instruments Influencing the Success of Endodontic Treatments

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Dental pulp could be compromised by mechanical, thermal, or chemical damages developed while performing restoration or by pathogenic bacteria that reach the pulpal tissues,[1] penetrating from extensive primary decay, from a secondary decay that developed underneath a previous restoration, and for many other causes. When the health of dental pulp is compromised, and no longer recoverable, it is necessary to practice root canal therapy before proceeding with any kind of rehabilitation which could be conservative or prosthetic.

However, function, esthetic, and comfort can be achieved by eliminating or significantly reducing pathogenic bacteria, starting from a correct root canal instrumentation and irrigation, and preventing recontamination by a complete sealing of the canal system which could be guaranteed by effective isolation from oral cavity obtained by a congruous restauration.[2]

A significant contribution to the reduction of pathogenic bacteria from the main canals of a contaminated root canal system is performed by mechanical instrumentation. Instrumentation can be affected by the complexity of root canal anatomy and facilitated by the use of lubricants.[3] Ni-Ti rotary instruments' separation is traditionally considered an uncommon event and it can happen often in cases of difficult anatomies:[4] if stresses are excessive, they can lead to endodontic file separation. Ni-Ti instruments can fail due to a mix of excessive torsional or flexural fatigue, with file fracture occurring principally in the apical third, where it is more difficult to understand the real anatomy and the canal is usually narrower or curved.[4,5]

Using cone-beam computed tomography (CBCT), it is possible to better evaluate the three-dimensional endodontic anatomy and to correctly visualize canal trajectories, due to select the most appropriate Ni-Ti rotary instruments for a better approach of that case.[6,7] During clinical practice, CBCT can help to visualize hidden curvatures, confluent or diverging canals, and bifurcations, which are very stressful conditions for the endodontic instrument. Unfortunately, CBCT on a routine basis is nowadays used only by a minority of clinicians due to increased costs and radiation risks.[8]

Since canal anatomy is complex and cannot be modified, the current best way to decrease the percentage of intracanal separation, besides using safer motions during instrumentation, is to use thermally treated or lower mass instruments, which can better resist flexural stresses.[9,10]

The most common studies available in the literature are *in vitro* evaluations and comparisons of mechanical properties of the Ni-Ti instruments which investigate mainly the following properties: flexibility, cutting efficiency, cyclic fatigue, and torsional resistance. Heat treatments and the mass of the Ni-Ti instruments were considered to be the most relevant in determining resistance to bending and torsional stress.

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Regarding heat treatment, a more martensitic file will be more resistant to flexural stress, but less resistant to torsional fatigue.[11] Regarding the amount of mass, at the point of maximum stress, the lower is the mass, the higher flexural resistance will be shown.[12]

To conclude, heat-treated files allow to reach excellent clinical results, with lower intraoperative risks but longer operative times, due to the reduced cutting capacity.[13] Despite this, they represent an important alternative for the treatment of cases with very difficult endodontic anatomies, minimizing the risk of iatrogenic errors and intracanal separation.

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