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Editorial: Current trends in Nickel-Titanium instruments for endodontic applications

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Editorial on the Research Topic
Current trends in Nickel-Titanium instruments for endodontic applications

Introduction

In the ever-evolving field of Endodontics, the search for efficient and effective instruments remains paramount. Nickel-Titanium (NiTi) instruments have revolutionized endodontic procedures, offering flexibility, durability, and enhanced clinical outcomes.

Root canal treatment aims to effectively address apical periodontitis through disinfection and sealing of the root canal system. While there is a consensus on the ideal radiographic appearance of a well-shaped root canal system, variations exist in shaping outcomes, leading to disagreement on clinical approaches. Mechanical objectives include thorough canal preparation and the retention of dentine to prevent weakening of the root structure. However, achieving complete mechanical preparation is challenging, and errors like ledge formation can impede disinfection. The ideal preparation shape should facilitate efficient removal of infected pulp and dentine for optimal antimicrobial efficacy. There's ongoing debate regarding the final apical preparation size and taper, with arguments for both larger sizes and smaller tapers. Achieving clinical goals requires meticulous techniques and modern instrumentation.

This Editorial provides an overview of recent research contributions focusing on the current trends in NiTi instruments for endodontic applications.

Evaluation of shaping characteristics

The first study delves into the shaping characteristics of two recent NiTi systems, ProTaper Ultimate and BlueShaper. Utilizing micro-computed tomographic imaging technology, the study compared the shaping efficacy of these systems in extracted mandibular molars. Interestingly, both systems demonstrated similar canal enlargement and transportation outcomes. However, a noteworthy observation was the significant presence of untreated surfaces, particularly in distal canals. This study highlights the need for further refinement in NiTi instrument design to address such challenges.

Enhancing pediatric endodontic practice

In pediatric dentistry, where time efficiency and user experience play pivotal roles, the choice of NiTi instruments becomes crucial. The second study compares reciprocating T-endo MUST (TEM) and continuously rotating AF Baby File (ABF) systems in terms of instrumentation time and fracture resistance. Results indicate superior fatigue resistance of TEM files over ABF, irrespective of the clinician's experience level. Additionally, TEM demonstrated shorter instrumentation times, emphasizing its suitability for pediatric endodontic procedures.

Impact of usage and sterilization

Understanding the effects of usage and autoclaving on NiTi instrument performance is essential for clinical practice. The third study evaluates the torsional fracture resistance of ProTaper Gold and TruNatomy Prime files under various conditions. Interestingly, ProTaper Gold exhibited higher torsional strength post-usage and sterilization, while TruNatomy Prime demonstrated reduced torsional strength. These findings underscore the intricate interplay between instrument geometry, alloy characteristics, and mechanical stresses encountered during clinical use and sterilization processes.

Cyclic fatigue resistance

The final study explores the cyclic fatigue resistance of different NiTi instruments under varying modes of displacement and environmental conditions. Results reveal distinct performance differences among ProTaper Universal F2, ProTaper Next X2, and WaveOne Gold Primary files. WaveOne Gold exhibited the highest cyclic fatigue resistance, emphasizing the influence of design, material, and mode of rotation on instrument durability. Notably, the absence of striations on fracture surfaces suggests unique failure mechanisms warranting further investigation.

Conclusion

The collective findings from these studies underscore the dynamic landscape of NiTi instruments in endodontic practice. While advancements have been made in terms of shaping efficiency, fatigue resistance, and sterilization tolerance, inherent challenges such as untreated surfaces and fracture susceptibility persist. Addressing these challenges necessitates continued research efforts aimed at refining instrument design, optimizing manufacturing processes, and enhancing clinical protocols. By embracing innovation and collaboration, the endodontic community can further elevate patient care standards and promote sustainable advancements in the field.

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Conflict of interest

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