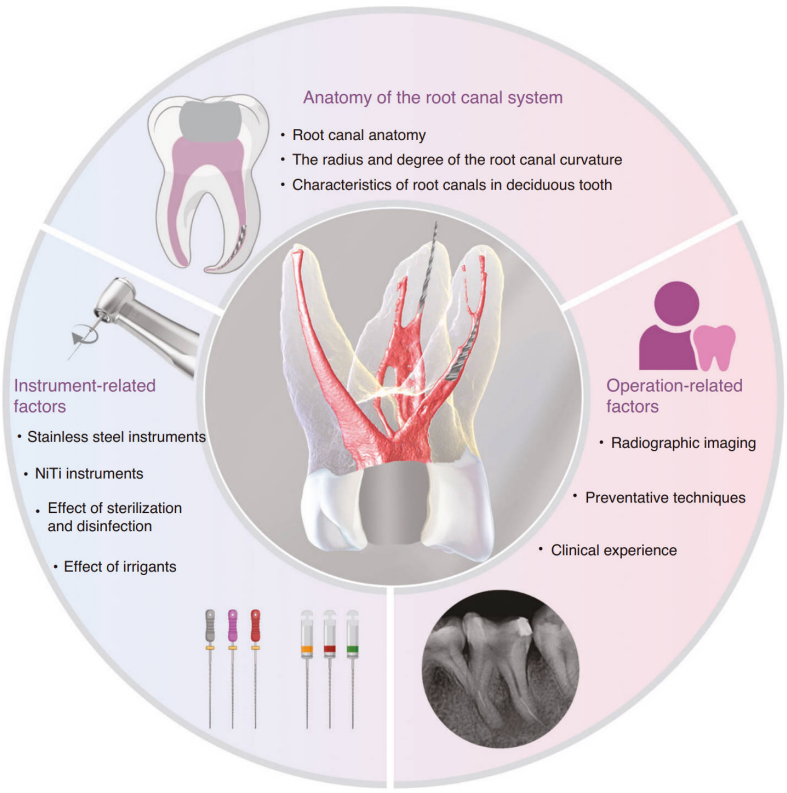
Expert strategies unveiled to tackle fractured instruments in dental procedures

GA, UNITED STATES, July 10, 2025 /EINPresswire.com/ -- An expert consensus addresses the critical issue of instrument separation during root canal therapy, a common complication that jeopardizes treatment success. The study provides a comprehensive framework for understanding the causes, risk factors, and clinical management of fractured instruments, emphasizing strategies to minimize complications and preserve natural teeth. By integrating advanced retrieval techniques and preventive measures, the consensus aims to enhance decision-making and improve outcomes for both clinicians and patients.



Factors related to instrument separation.

Instrument separation, where dental tools fracture inside root canals, occurs in 0.25%–10% of cases, disrupting treatment and causing patient anxiety. Factors like complex root anatomy, instrument fatigue, and operator technique contribute to this problem. Retrieval attempts risk perforations or tooth damage, while leaving fragments may compromise long-term outcomes. The rise of nickel-titanium (NiTi) instruments, though efficient, has increased fracture rates due to material brittleness. Clinicians often face dilemmas in balancing retrieval risks with treatment efficacy. Based on these challenges, there is a pressing need for standardized guidelines to optimize management strategies.

Published on June 9, 2025, in the International Journal of Oral Science, a review (DOI: 10.1038/s41368-025-00372-w) led by experts from Sichuan University and collaborating institutions presents a consensus on managing separated instruments in root canals. The research synthesizes evidence on etiology, risk assessment, and retrieval techniques, offering step-by-step protocols to mitigate complications. Highlighting innovations like ultrasonic

methods and micro-tube systems, the study bridges gaps between clinical practice and emerging technologies, ensuring safer, more predictable outcomes.

The expert consensus provides a comprehensive analysis of instrument separation during root canal therapy, identifying root canal anatomy (including curvature and calcification), instrument-related factors (such as NiTi fatigue and sterilization effects), and operational techniques (like excessive force) as the three primary causes of this common complication. It emphasizes the critical importance of preoperative assessment using advanced imaging like cone-beam CT for 3D localization and risk evaluation, while recommending specific retrieval techniques tailored to different clinical scenarios - ultrasonic methods for loose fragments and micro-tube systems for deeply lodged instruments, both designed to minimize dentin loss and preserve tooth structure. The guidelines highlight preventive measures including limiting NiTi instrument reuse, employing torque-controlled motors, and establishing proper glide paths before instrumentation. Looking to the future, the study points to emerging technologies like AI-assisted imaging for improved fragment detection and nanoparticle coatings to enhance instrument durability as promising solutions. For pediatric cases involving deciduous teeth, the consensus advises extraction when retrieval risks outweigh potential benefits. The research thoroughly addresses potential complications such as root perforation and advocates for minimally invasive approaches, featuring a particularly valuable decision-making flowchart that systematically guides clinicians through the options of retrieval, bypassing, or retention based on specific case factors. This comprehensive approach balances clinical efficacy with patient safety concerns.

Prof. Xuedong Zhou, co-corresponding author, states: "This consensus empowers clinicians with evidence-based strategies to navigate instrument separation confidently. By combining advanced imaging, precision retrieval tools, and preventive protocols, we can reduce procedural risks while maximizing tooth preservation. The integration of AI and biomaterials heralds a new era in endodontics."

The consensus directly impacts dental practice by standardizing instrument separation management, reducing unnecessary tooth extractions, and lowering medico-legal disputes. Clinicians can adopt its protocols to improve success rates, particularly in complex cases involving curved canals or NiTi fractures. Future applications include AI-driven diagnostic tools for real-time decision support and bioengineered instruments resistant to fatigue. For patients, this translates to safer, more efficient treatments and preserved natural dentition. The study calls for global training programs to disseminate these techniques, ensuring equitable access to advanced endodontic care.

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