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INTO KNOWLEDGE, AWARENESS
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ENDODONTICS**

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CULTIVATING EXCELLENCE: A DIVE INTO KNOWLEDGE, AWARENESS AND PERCEPTION ON ROTARY ENDODONTICS

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Abstract - Aim: The primary aim of this study was to assess the awareness about the Rotary endodontics among the dentists. **Objectives:** The main objective of this research was to recognize and analyze awareness about the rotary endodontics and measures that can increase its implementation in practice. **Materials & Method:** A detailed questionnaire comprising 16 inquiries was formulated and distributed via Google Forms to gather data about awareness of rotary endodontics. The questionnaire focused on knowledge and perception about usage and technique of rotary instruments. Data collection was facilitated through online responses. **Result:** The survey findings, obtained through Google Forms, unveiled intriguing disparities in awareness regarding root canal treatment using rotary instruments. The study revealed that a significant majority of respondents used Nickel-Titanium Rotary Instruments (NiTi-RIs). Most users (49%) had been using NiTi-RIs for more than 1 year, and this trend increased with participants' experience and the number of root-canal treatments performed per week. The primary reason for using NiTi-RIs among respondents (50.3%) was faster root-canal preparation. Additionally, the majority (90%) prepared a glide-path before using NiTi-RIs, with stainless steel hand-files being the preferred choice for 49.7% of them. Furthermore, it was observed that the majority of respondents had experienced file separation, particularly in the apical region (68%). Better continuing education was identified by the highest proportion (58.5%) as the most significant factor that could significantly increase NiTi-RIs usage. **Conclusion:** In summary, this study, employing Google Forms for data collection, shed light on adoption of rotary instruments for the root canal treatment. After analysis, it can be concluded that there is an absolute need for more education programs and workshops in the country to increase the knowledge and awareness of dental practitioners, and also to give hands-on experience regarding rotary instrumentation.

Keywords: NiTi, Rotary Endodontics, Awareness, Questionnaire, SS Hand Files, Survey, Glide path, Root canal

INTRODUCTION

The precise instrumentation and thorough preparation of the root canal system are deemed critical stages in endodontic treatment.¹ These phases wield substantial influence over the effectiveness of subsequent procedures in the realm of endodontic therapy²

Initially, the primary goal of root canal instrumentation was to ease the application of medicaments within the root canal, with minimal emphasis on

thoroughly removing organic contents from the canal system. Subsequently, the focus of instrumentation transitioned to preparing the root canal space, streamlining the placement of root canal fillings. However, the techniques employed often lacked alignment with the intricacies of the canal system's anatomy or the specific properties of obturation materials.² In 1974, Schilder revolutionized endodontic protocols by introducing innovative concepts that reshaped the landscape of canal space design and biological objectives. His groundbreaking ideas aimed at achieving optimal shaping of root canal spaces and thorough debridement of root canal systems. The primary goals included creating a smoothly tapered root canal system from orifice to apex, maintaining a small and practical apical foramen in its original position, and ensuring that the preparation followed the natural anatomy of the root canal system.³ Additional objectives involved confining the preparation within the canal space, facilitating the removal of all tissue without pushing necrotic debris through the apical foramen, and ensuring that the final shape supported the placement of medicaments and the exchange of irrigants. Nonetheless, the path from the orifice to the apex presents challenges, and achieving meticulous root canal preparation continues to be recognized as one of the most intricate tasks in the field of endodontic therapy.⁴

Canal scouting and preflaring constitute the initial stages of canal instrumentation, and it has been observed that clinicians are more likely to encounter procedural challenges during these phases.⁵

Canal systems exhibit the potential for multiple geometric planes and can undergo more pronounced curvatures compared to the roots that encase them.² Two-dimensional radiographs are inadequate in capturing these intricate morphological variations.⁶ The instrumentation of canals characterized by multi-planar curvatures and elongated, slender, curved configurations poses a risk of potential procedural errors, whether using hand-file instrumentation or rotary

nickel titanium (NiTi) instruments.⁷ These issues encompass instrument fracture, ledge formation, canal zipping or straightening, strip perforation, apical and elbow formations, as well as apical blockage. Each of these errors has the potential to result in incomplete debridement of the root canal system, thereby contributing to diminished success rates in endodontic therapy.⁴

The majority of procedural challenges linked to attaining optimal shaping of curved canals were attributed to the stiffness of stainless-steel instruments.⁸ The advent of NiTi rotary instruments marked a revolutionary advancement in endodontics, as they possess a lower modulus of elasticity compared to stainless steel instruments. This characteristic results in fewer lateral forces exerted on the dentine walls within curved canals. Despite the enhanced strength and flexibility of NiTi instruments compared to their stainless-steel counterparts, it is important to note that fractures may still occur within their elastic limit.⁹ Instrument breakage can occur without any apparent signs of previous permanent deformation,¹⁰ and it may happen unexpectedly, even in cases where the instrument has not been used previously¹¹. Fracture stands out as the most prevalent procedural error encountered during the clinical application of rotary NiTi instruments. This apprehension about the possibility of fracture often deters clinicians from embracing this technology.¹²

Fractures of rotary NiTi instruments can occur due to cyclic flexural fatigue involving bending stress or through torsion involving shear stress.¹³

Significant canal curvature is regarded as the primary risk factor for instrument fracture, primarily attributed to cyclic fatigue¹⁴

Torsional stress arises under the following conditions:

1. An extensive contact area between the cutting surface of the instrument and the canal wall.

2. The canal cross-section is significantly narrower than the cross-section of the tip of the instrument.
3. Excessive axial pressure is applied to the handpiece during instrumentation.¹⁵

The choice of instrumentation technique and the establishment of a well-prepared glide path play pivotal roles in minimizing torsional stress during endodontic procedures.¹⁶

Maintaining a glide path involves ensuring a consistently smooth passage that can be replicated by sequentially used files within the canal. NiTi rotary instruments typically feature non-cutting tips, and due to their exceptional flexibility, these instruments are not intended for the initial negotiation of the root canal. Bergmans et al. (2001) emphasized that in root canal preparation, no rotary instrument should be employed without prior placement of a hand instrument.³

In light of the evolution involving the use of NiTi rotary instruments in root canal preparation, and recognizing crucial elements such as establishing a glide path with hand instruments for mitigating procedural risks and ensuring success in dental procedures, a questionnaire study was conducted. This study aimed to assess the awareness, prevalence, and factors influencing the implementation of rotary endodontics in dental practice.

MATERIALS AND METHODOLOGY

A cross-sectional investigation was initiated among a randomly chosen group of dental professionals in India, including General Dentists, Post-graduate Students, and Endodontists, with total count of 147 participants. Data collection was executed through a meticulously designed online survey using Google Forms. Survey links were systematically distributed across diverse social media platforms, including WhatsApp, Instagram, and Messenger, ensuring a

comprehensive reach. Participants were provided with a clarifying note outlining the study's objectives.

The survey employed a self-administered and validated questionnaire, consisting of 16 questions crafted in English to ensure clarity and uniformity in responses.

The final online questionnaire was designed to encompass three main facets:

A. Demographic & General Information: Gathering data on the category of participants (GDs, endodontists, others), participants' professional experience, and the weekly number of Root Canal Treatments (RCTs) performed.

B. Usage of NiTi-RIs: Exploring participants' experiences with NiTi-RIs, including the duration of usage and reasons for either adopting or abstaining from their use.

C. Modalities of NiTi-RIs Usage: Investigating aspects such as glide-path preparation before utilizing NiTi-RIs, the sequence of preparations, and the utilization of NiTi-RIs based on teeth types and canal geometries.

The questionnaire was structured to assess the awareness about the Rotary endodontics among the dentists.

The research spanned from January 2024 to February 2024 and was carried out in the Department of Conservative Dentistry & Endodontics at Seema Dental College & Hospital, Rishikesh, Uttarakhand. Participants invested approximately 02 to 05 minutes in completing the survey. The questionnaire data were efficiently collected using Google Forms and underwent subsequent analysis to derive meaningful insights.

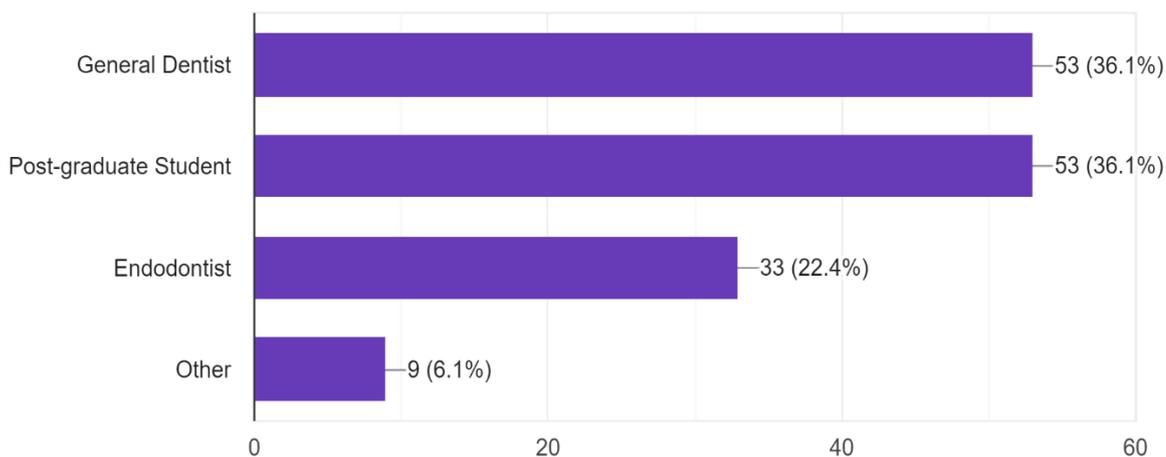
STATISTICAL ANALYSIS

The data retrieved from the responses on Google Forms underwent a comprehensive statistical analysis. Descriptive statistics, encompassing frequencies and percentages, were employed to provide a detailed summary of

the demographic characteristics and essential variables derived from the participants' input.

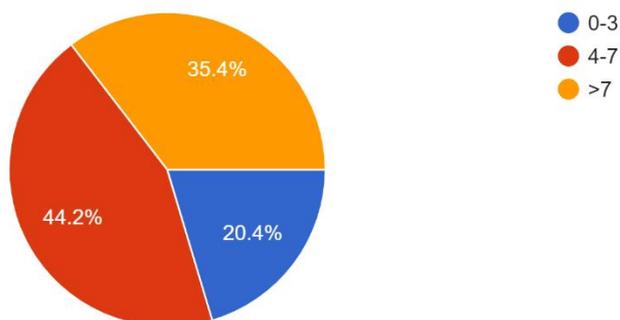
Professional Category

147 responses



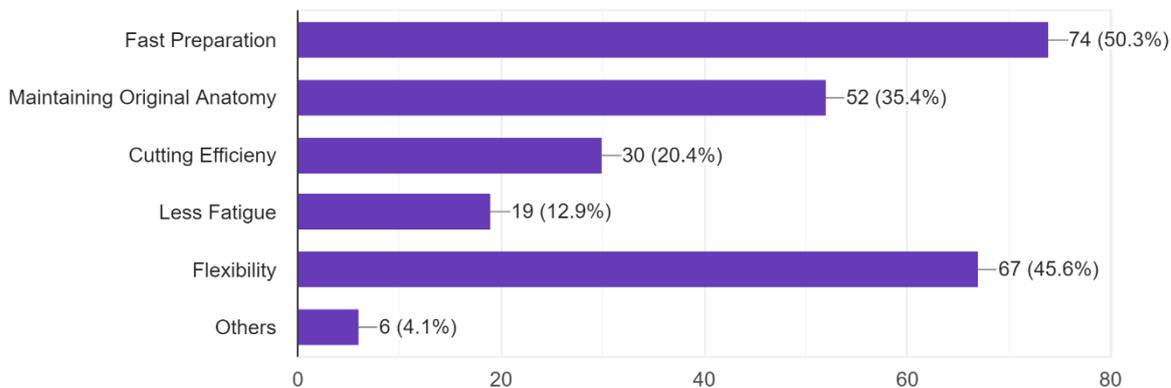
The weekly tally of completed root canal cases

147 responses



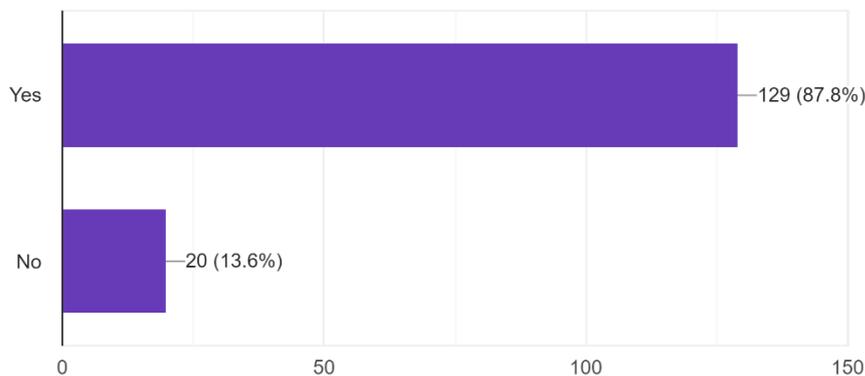
What specific qualities of Ni-Ti instruments make them preferable for certain dental procedures?

147 responses



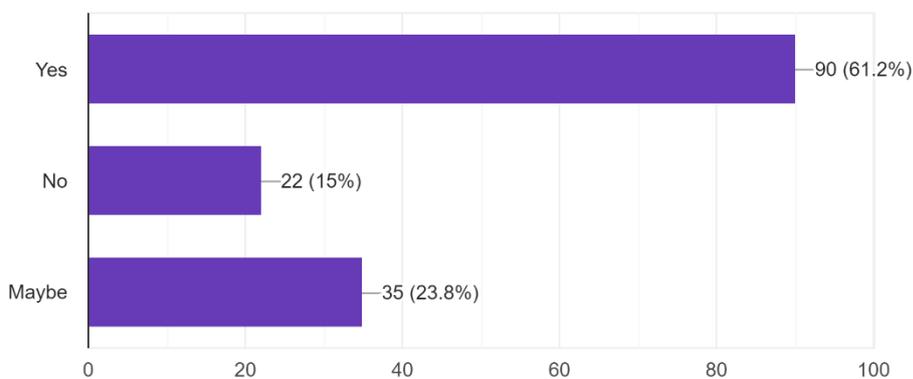
Are you aware about glide path preparation?

147 responses



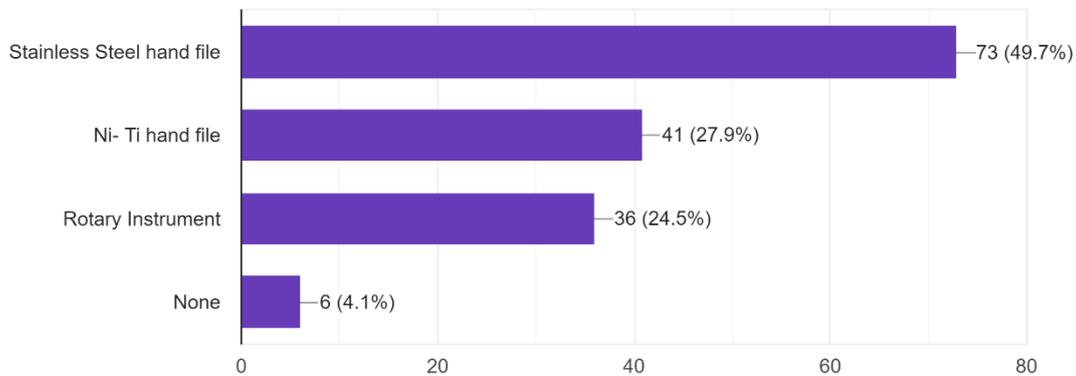
Is glide path preparation a routine part of your dental practice?

147 responses



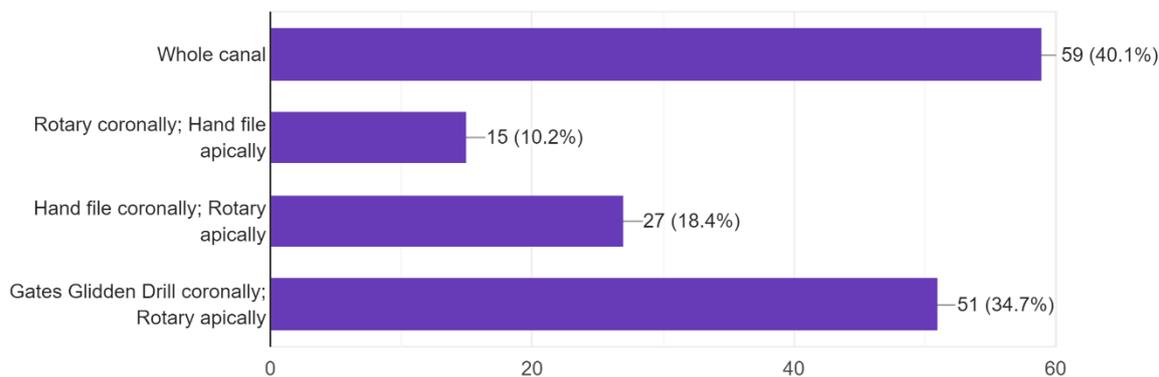
Instrument preferred for glide path preparation?

147 responses



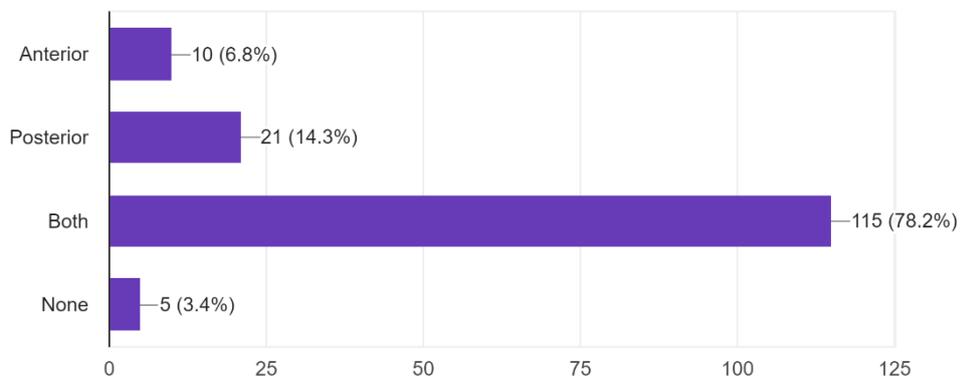
What kind of preparation sequence do you prefer?

147 responses



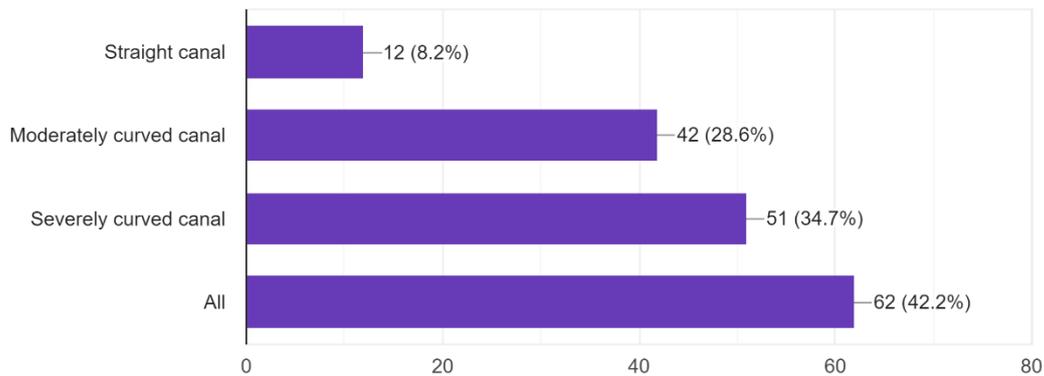
Choice of teeth selection for usage of rotary file

147 responses



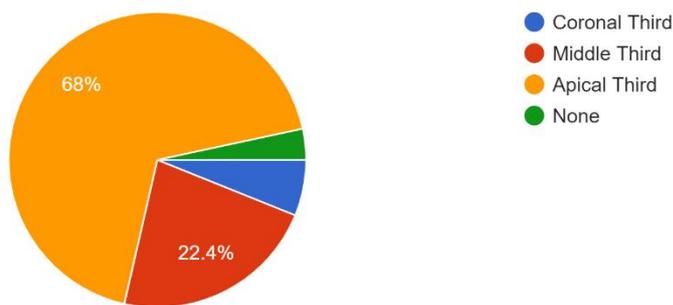
Choice of teeth selection with curved canals for usage of rotary file

147 responses



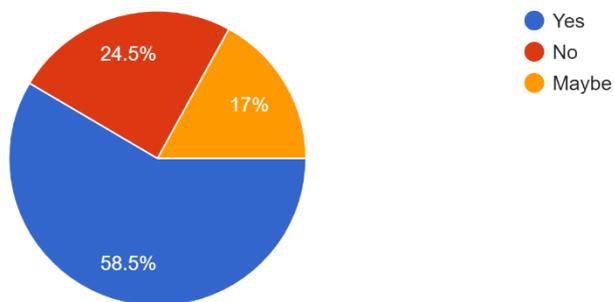
Most common site encountered in case of file separation

147 responses



Do you believe there is a demand for educational programs focused on rotary endodontics?

147 responses



DISCUSSION

Effective root-canal cleaning and shaping are crucial for successful RCTs. Advances, notably in NiTi Rotary Instruments (NiTi-RIs), over the last 30 years have improved safety and predictability in root-canal instrumentation.¹⁷ The utilization of NiTi-RIs for cleaning and shaping the root-canal system has been reported to exhibit superiority over Stainless Steel Instruments (SSIs). A prior study indicated a notably higher success rate for teeth prepared using NiTi hand files compared to those prepared with Stainless Steel (SS) K-files.¹⁸ In a recent study, teeth instrumented with NiTi-RIs demonstrated significantly better outcomes compared to those instrumented with Stainless Steel Instruments (SSIs)¹⁹ Furthermore, clinicians endorse NiTi instruments for safer and more efficient instrumentation of root-canal systems. Despite numerous studies exploring the use of NiTi-RIs in dental practices worldwide, there remains a gap in information regarding usage modalities and factors influencing dentists' and specialists' preferences. This gap is particularly noteworthy considering the unique characteristics and influencing factors within each dental community.

This study revealed that a significant majority of respondents, comprising postgraduates (36.1%), general dentists (36.1%), and endodontists (22.4%), were utilizing NiTi-RIs.

In a very recent study, it was observed that dentists conducted a significantly greater number RCTs when employing NiTi-RIs compared to manual preparation methods.²⁰ In the current study, the majority of respondents (50.3%) favored Nickel-Titanium Rotary Instruments (NiTi-RIs) primarily due to the expedited root-canal preparation they provide. This finding aligns with previous research by Parashos & Messer (80%) and Mozayeni et al (69%), where a faster canal preparation was similarly identified as the most crucial factor influencing instrument preference.²¹ While achieving faster root-canal instrumentation is a desirable advantage, it should not be overemphasized. Preserving the original

shape of the root-canal system, established as a gold standard long ago, remains one of the main objectives in endodontics.²²

Glide-path preparation involves negotiating and enlarging the original canal anatomy to establish access to the apical region of the root canal, creating a path for subsequent instruments.²³ Manufacturers typically recommend creating a glide-path up to a size #15 or #20 hand file, particularly SSIs, at working length before using NiTi-RIs. In the current study, a significant majority of respondents (87.8%) adopted the practice of preparing a glide-path, showcasing clinicians' awareness of the advantages it can provide. Glide-path preparation contributes to reducing torsional stresses on NiTi-RIs, consequently enhancing their resistance to fracture.²⁴ A glide-path can be prepared using Stainless Steel (SS) hand files, Nickel-Titanium (NiTi) hand files, or NiTi rotary files²². In the current study, the highest proportion (about 49.7%) prepared the glide-path using SS hand files. However, diverse results have been reported concerning the most effective instruments for creating a glide-path²⁵. Notably, a majority of respondents (40.1%) in this study utilized NiTi-RIs for preparing the entire root-canal system. Most NiTi-RIs manufacturers produce integral systems, including opener shapers and files with different tapers for the comprehensive preparation of root canals. However, these findings diverge from a previous study where the majority (69.8%) preferred using Gates-Glidden (GG) drills to flare the coronal part before employing NiTi-RIs for the apical portion.²⁶

In contrast, the second-highest proportion of respondents (34.7%) in the current study practiced pre-flaring of the coronal third with GG drills and then using NiTi-RIs for the apical portion, aligning with the findings of Parashos & Messer²¹. Pre-flaring the coronal third typically facilitates easier insertion of NiTi-RIs into the apical portion and reduces the risk of instrument fracture²⁴. Despite manufacturers' claims that Nickel-Titanium Rotary Instruments (NiTi-RIs) can be used in all cases, irrespective of their difficulties, clinical experience has

demonstrated that there are instances where complete preparation with NiTi-RIs may not be achievable.²⁷ The most challenging cases typically involve severely curved canals or those with irregular cross-sectional shapes. In such instances, the main concerns include the risk of instrument fracture, difficulty in navigating through severely curved canals, and inadequate cleaning and shaping of root canals.¹⁷ The current study also revealed that the most common location for instrument fracture was the apical region for 68% of respondents.

The questionnaire survey highlights dentists' awareness of the limitations of new technology. While recognizing the benefits of rotary (NiTi) instruments, dentists also acknowledge potential procedural problems. Additionally, a significant portion (58.5%) believes that quality training through Continuing Education (CE) courses serves as a compass for successful NiTi rotary usage and contributes to successful outcomes in root canal therapy.

CONCLUSION

Unleashing the potential of NiTi rotary instruments for root canal preparation is a journey of effectiveness and safety. Navigating this path requires not just knowledge but a profound understanding of root canal anatomy and the unique principles of the chosen rotary system. Each canal, with its distinctive length, width, and curvature, deserves personalized attention for an informed preparation strategy. Quality training through Continuing Education (CE) courses acts as the compass for successful NiTi rotary usage. Embracing these guidelines allows clinicians to seamlessly and confidently prepare the majority of root canals, mastering the art with nickel-titanium rotary instruments.

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