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Root canal preparation using continuous rotation: The level of knowledge and the frequency of use by practitioners of the town of Abidjan, Côte d'Ivoire

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Objective: Mechanization of canal preparation has allowed the operative procedures for root canal treatment (RCT) to be less tedious. The objective of the present study was to establish the level of knowledge of dentists in the town of Abidjan regarding mechanized techniques.

Methods: A survey was conducted among 145 practitioners in the town of Abidjan over a period of 3 months. Data collected were with regard to the length of time engaged in the profession, the type of practice, the frequency of the weekly RCTs, and the systems used. A descriptive analysis by the calculation of numbers and percentages was performed using EPI-INFO version 6 software.

Results: The majority of dentists (66%) had been engaged in the profession for >10 years. More than half of the surveyed practitioners performed 5 RCTs/week on average. While 73% of dentists were cognizant of the existence of mechanical preparation, only 22% used it. The HERO system is the most used system (40%), followed by the ProTaper (24%) and "Coronal Median Apical" (CMA) systems (16%).

Conclusion: The present study revealed that practitioners trained in the past 10 years are more knowledgeable of mechanized canal preparation by continuous rotation, but very few of them use nickel–titanium files in practice.

Keywords: Canal preparation; continuous rotation; nickel–titanium files.

Endodontic preparation consists of generating a canal network with the aim of eliminating the pathological content, while also ensuring disinfection, to yield a 3D endodontic filling.[1] It is used to be performed exclusively using manual instruments with stainless-steel files. This method was ultimately found to have limitations due to the implements themselves and the significant shaping time. In fact, the rigidity and the lack of shape memory of these files result in perioperative complications, such as fracturing of the file in the canal, and procedural errors, such as transportations, ledges, and/or perforations.[2]

Approximately 30 years ago, a file made of nickel and titanium (NiTi) was commercialized as an alternative to stainless-steel.[3] Milling of NiTi files yields tools with a

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low elastic modulus that are hyper flexible and resistant to cyclical fatigue and mechanical breakage.[4] In addition to reducing the risk of alteration of the original canal shape, NiTi files are also particularly suitable for shaping canals with extensive curvature.[5,6] Several techniques are used, and canal shaping is automated by the mechanical system of the assembly or by a kit integrating a micromotor and a customized contra-angle handpiece. The motion applied by the mechanism allows an either continuous rotation (CR) motion or reciprocal rotation motion.[7] Such mechanization of the operative procedures leads to highly reproducible outcomes for shaping, when the various steps are followed closely, and this innovation in root canal treatment (RCT) has been shown to result in significant time savings.[4] It also facilitates the removal of canal debris by irrigation. This risk of apical extrusion is reduced, and consequently, there is a low prevalence of postoperative sensitivity, when canals are shaped by the rotating systems.[8,9] These many qualities attributed to NiTi files appear to indicate that mechanized preparation should currently be the only method that is to be used. Moreover, there are different mechanical systems for preparation by CR, and this wide choice of therapeutic means has led to a degree of confusion among the practitioners seeking the "ideal" file.

The aim of the present study was to determine the level of knowledge of dentists regarding mechanical techniques and to analyze the frequency of their use in everyday practice.

Materials and methods

Sampling

A descriptive prospective survey was conducted in the dental practices of Abidjan from January 2016 to March 2016. The studied population comprised dentists of both genders selected from the Board of the National Council of the Guild of Dentist of Côte d'Ivoire. A total of 145 dentists were randomly selected from an average of 612 dentists in the town of Abidjan according to the Schwartz formula.[10] This sample was statistically representative of all of the dentists in the town of Abidjan. Dentists included in the survey resided in the 10 municipalities of the town of Abidjan and its suburbs. These localities were selected because they have a high concentration of practitioners, representative of all of the dentists actively practicing in Côte d'Ivoire. Dentists in training were excluded from the study.

Execution of the survey on canal preparation by CR

A form for recording the data was devised to collect information regarding the following variables: the type of practice, the length of time engaged in the profession, and the weekly frequency of RCTs. The criteria for the evaluation of the level of knowledge were with regard to mechanized preparation, the indications, the reasons for the use of this preparation technique, and the criteria for the selection of a given system. The survey was conducted from April to June 2016 by the self-administration of the questionnaire. The descriptive analysis was performed using the EPI-INFO version 6 software (Centers for Disease Control and Prevention, Atlanta, GA, USA). This analysis consisted of the calculation of numbers and percentages.

Results

Of the 145 dentists in the survey, 112 completed the questionnaire, thus amounting to a participation rate of 77.24%. The results of the survey are presented in tables and graphs.

Characteristics of the practitioners

The repartition according to the type of practice showed that 16.67% of the practitioners had >5 years of professional experience; 17.59% of the dentists had between 6 and 10 years of job experience, and the majority (65.74%) of them had at least 11 years of experience. Dentists accounted for 46.40% in the private sector versus 53.60% in the public sector, with a sex ratio of 2.39. The practitioners had mainly been trained in Côte d'Ivoire (63.89%). The other practitioners had been trained in France (29.62%), Senegal (4.63%), and Morocco (1.85%).

Knowledge of the CR mechanical systems

More than half (54.50%) of the dentists who were given the questionnaire and who fully participated in the survey (112) stated that they performed between 1 and 5 RCTs/week (Fig. 1). According to the present study, 73.22% of the dentists stated that they were aware of the existence of the rotating systems for mechanical preparation. For those surveyed, they had first heard about this during their initial training (60.72%), during a conference or science days (19.64%), and during training other than what was indicated in the questionnaire (19.64). A high proportion of the practitioners with >11 years of experience (23% of them) were noted to have failed to clearly define mechanical canal preparation by CR and to present the exact indications (Fig. 2). These numbers show that the practitioners who had been in practice for <11 years were a lot more familiar with CR.

Use of the mechanized CR systems

Of the 112 practitioners who were surveyed, 22% (25 dentists) had a rotation system for canal preparation by

CR (Fig. 3). Of these practitioners, 64% reported that they only performed a mechanized canal preparation in case of difficulties, such as the presence of curvature, calcification, or an RCT (Fig. 4). Only 28% of them used it systematically, and 4% used it if time was of the essence (Fig. 4). Finally, the mechanized HERO (40%) and ProTaper (24%) systems were used the most (Fig. 5). The reasons given by those who did not use it were the high cost of the mechanized systems (32.14%) and the lack of dexterity (10.71%) (Fig. 6). Dentists who used the mechanized systems answered that the right time for their use, during canal preparation, was prior to the determination of the working length (25.92%) and continuously without the determination of the working length (7.41%). The majority of the dentists recommended the use of mechanical preparation by CR. For half of those surveyed (57.14%), the association of a manual and a mechanized technique was considered to be more efficient and to allow a successful RCT to be obtained. Some of them (21.43%) thought that a correct RCT could be obtained by the exclusive use of the manual technique, whereas others (7.14%) thought that only the mechanized technique allows a proper RCT to be obtained. Generally speaking, for the surveyed dentists, post-university training was very important as it contributes to the improvement of their daily practice.

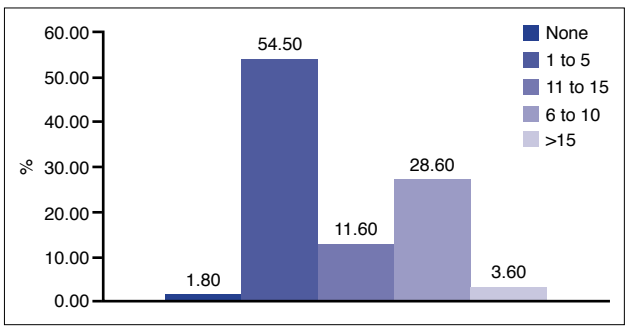

Fig. 1. The frequency of endodontic treatments.

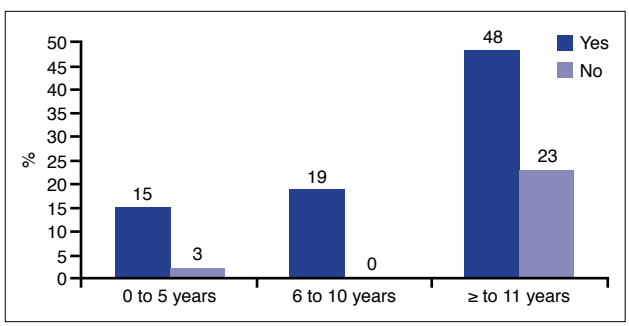

Fig. 2. The length of time engaged in the profession and the knowledge of mechanized canal preparation by continuous rotation.

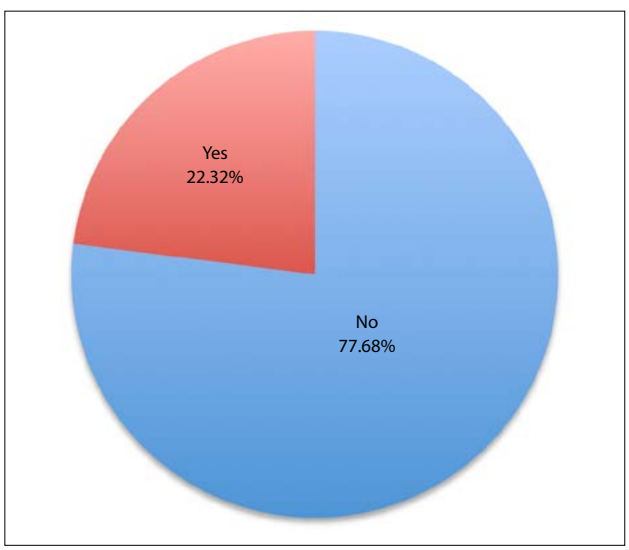

Fig. 3. The use of a mechanized system at the practice.

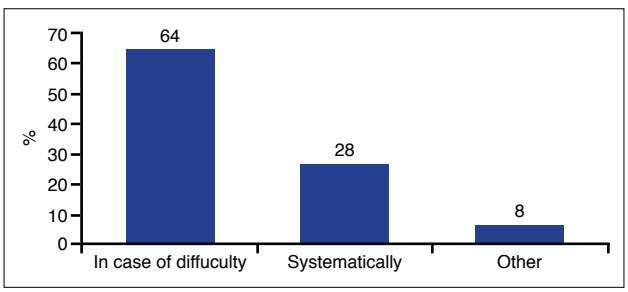

Fig. 4. The indications for the use of continuous rotation according to the practitioners.

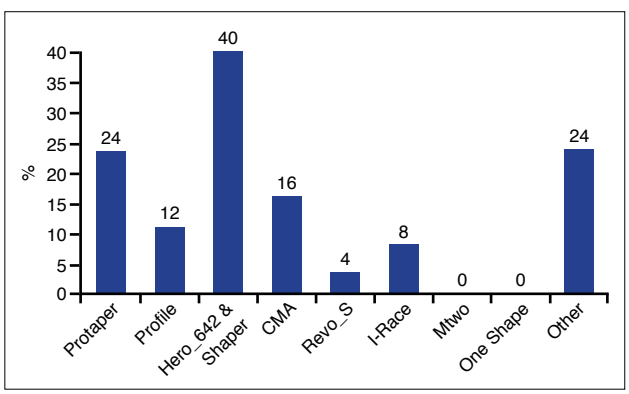

Fig. 5. The repartition of the mechanized canal preparation systems used in daily practice.

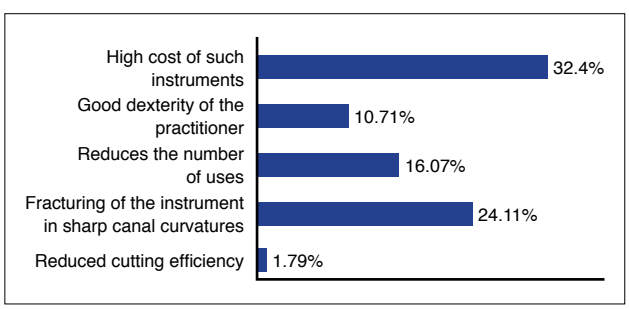

Fig. 6. The factors limiting the adaption of NiTi files by the surveyed practitioners.

Discussion

The repartition according to the type of practice allowed us to show that 46.40% were in the private sector and that 53.60% were in the public sector. Other studies have reported similar results.[11,12] Nonetheless, there have also been reports that private practice is the most common.[8,13,14] The surveyed practitioners were, for the most part (63.89%), trained in Côte d'Ivoire. The other practitioners received their training in France (29.62%), Senegal (4.63%), and Morocco (1.85%). Since 1990, the training of dentist has been done entirely in Côte d'Ivoire. This why there was such as high rate of dentist in the sample who had been trained in this country. The sample was representative of all years of experience brackets, and the most active categories were the 6–10 years of experience and the >11 years of experience.

Canal instrumentation by CR has considerably revolutionized RCT. Indeed, canal shaping has gone from the use of an extensive series of stainless-steel manual files to the use of a small number of NiTi files or even a single file.[4,11] The present study has shown that the frequency of RCTs is still high, which is in keeping with the frequency of delayed consultations. Therefore, it appears relevant to consider the optimization of the means used by practitioners during RCT to increase the success rate.

The majority of dentists know how to perform a mechanized canal preparation by CR, but in the current practice, canal shaping is nonetheless usually performed by manual instrumentation. Practitioners trained in the past decade were more knowledgeable of assisted therapies. Recent graduates are the most open to try new canal preparation techniques as reported in the literature.[12] The reality is that this technical platform requires investment to purchase the equipment, on the one hand, and training of the practitioner in the method of use, on the other hand. The survey revealed that understanding of mechanized preparation by CR was, for the most part, acquired when dentists received their initial training and then by post-university training. Nonetheless, rotating instrumentation for canal shaping is not used much in the practices of dentists of Abidjan. It is also sometimes used poorly, as 32% of the surveyed dentists did not use it at the most appropriate time. These findings underscore the importance of training.

The main reason that limits the adoption of NiTi in daily practice is due to the purchase cost of the device and the level of reimbursement of RCT. Several other studies have also shown this to be the case, while also adding a second link, namely a lack of training, which was also similar to the present study.[13,14] These findings underscore the importance of emphasizing these techniques in the initial training of dentists and of promoting these skills by continued training by further discussion forums and workshops.

Those who reported using mechanized systems tended to only use them in case of canal difficulties, such as the presence of curvature. Systemic use has not yet taken hold, even when the practitioner has the equipment. Practitioners use these types of devices sparingly in Côte d'Ivoire. This investigation has shown that the HERO system is by far the most used, followed by the ProTaper, as is the case in other countries.[15] The use of a given system is linked to the habits of each dentist, and the two systems mentioned above belong to the first generations of commercialized NiTi files.[3] It is particularly important to adhere to the recommended methods for use to minimize the risk of fracturing the instruments. Although NiTi files have become commonplace, there are still issues relating to cyclic fatigue and the final shape imposed on the canal.[6] Moreover, not all clinical situations are amenable to rotational mechanical canal preparation, mainly due to variable degrees of experience and anatomical complexity.[5] Enhancing knowledge regarding its use based on solid evidence is the first step in promoting the use of instruments made of NiTi alloy.

Despite an acceptable level of knowledge regarding NiTi instrumentation, practitioners still need to acquire the fundamental principles and the directions for the safe use of such files;[11] particularly as currently, the trend is to undertake canal preparation using a single reciprocal motion file.[9,16]

The present study has limitations. The limitations were that it did not include questions regarding the preparation techniques when using such files, the length of time the files were used, and the prevalence of instrumental fractures.

Conclusion

In conclusion, although this method is not adopted enough by practitioners, the preparation of canals by CR is thought to improve the clinical outcomes of RCTs. The present study underscores the relevance of increasing the need for training and awareness among practitioners of mechanized canal preparation by CR.

Conflict of interest: None declared.

Authorship contributions: Concept: M.C.A.B.; Design: M.C.A.B., S.X.D., W.A.D.K.; Supervision: Y.G.K.; Data: S.X.D., C.N.G.N.; Analysis: M.C.A.B., S.X.D.; Literature search: M.C.A.B., S.X.D., C.N.G.N.; Writing: M.C.A.B.; Critical revision: Y.G.K., W.A.D.K.

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