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The practice of continuous rotation in endodontics: The current situation

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Abstract

Introduction: Due to the very marked disparity in the adoption of continuous rotation and its perceived lack of use in developing countries, the present study aims to determine the factors preventing the adoption of continuous rotation in endodontic practice in Madagascar.

Methods: This is a retrospective cross-sectional descriptive study conducted from November 2022 to October 2023, on 45 Odontostomatologists from the Haute Matsiatra region, selected on an exhaustive basis.

Results: The study reported that no practitioner in the region practiced continuous rotation, mainly due to the high cost of equipment (63.6%), lack of practitioner training (63.6%) and limited knowledge of the technique (48.9%), the unavailability of equipment (50%), frequent power cuts (22.7%), the unprofitability of the technique (18.2%) and practitioners' lack of dexterity (4.5%).

Conclusion: An in-depth study throughout Madagascar would be desirable to determine the prevalence of its use and assess the factors behind its inaccessibility.

Keywords: Endodontic treatment; Mechanized endodontics; Continuous rotation technique; Nickel titanium; Madagascar

1 Introduction

Endodontic treatment is an integral part of the daily practice of Odontostomatologists. Its success is often considered unpredictable and depends on many factors related to the patient and surgical protocols [1].

Thanks to an innovative technique, operating protocols have been simplified by reducing the number of instruments and clinical time, improving ergonomics and ensure better reproducibility of preparations with the use of continuous rotation, which is a new mechanized approach to root canal preparation [2].

In the USA (2014), a study by Savani revealed that 74% of General Dentists (GD) used NiTi. [3]

In France (2012), Treguer showed that 94% of Odontostomatologists (OS), used the mechanized endodontic technique in their clinical practice. Only 6% opted exclusively for manual instrumentation [4].

In Australia (2004), Parashos and Messer found that 22% of GD and 64% of endodontists use continuous rotation [5].

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However, use of this technique is still limited in developing countries. In Abidjan (2019), a study by Avoaka-Boni and *al.* showed that 73% of Odontostomatologists (OS) were aware of the existence of mechanical preparation, but only 22% use it [6].

In Madagascar (2021), Rakotonirina and *al.* observed that only 5.3% of Odontostomatologists practiced mechanized root canal shaping and 7.9% combined mechanical and manual instrumentation for root canal preparation [7].

In view of these findings, this study was conducted to answer the following research question: Why is there such a disproportionate use of continuous rotation from one country to another?

Continuous rotation is still little-known in endodontic practice in Madagascar. To help address this issue, this study was carried out among Malagasy OS.

The general objective of this study is to determine the factors that contribute to the inaccessibility of continuous rotation in endodontic practice in Madagascar.

The specific objectives are to

- Identify the techniques used by Malagasy dental surgeons in endodontics
- Enumerate the reasons for practitioners' reluctance to use continuous rotation.

2 Material and methods

This was a retrospective, descriptive, cross-sectional study conducted from November 2022 to October 2023 in the Haute Matsiatra Region of Madagascar. The study population consisted of 45 OS registered with the national order of Odontostomatologists of Madagascar and practicing in the Haute Matsiatra Region. Exhaustive sampling was chosen to constitute the sample. All dental offices having performed endodontic care were included in the study. Uncooperative dental offices refusing to participate in the survey were excluded from the study.

A pre-established, tested and validated anonymous questionnaire was drawn up for the collection of information.

The following elements and information were recorded:

- Social characteristics (gender, age, place of practice, year of practice)
- Place of initial training (Madagascar, abroad)
- Knowledge of endodontic technique
- Technique used in endodontics: - manual - mechanized (continuous rotation, reciprocity)
- OS's knowledge of the advantages and disadvantages of the continuous rotation technique
- Reasons for practitioners' reluctance to use the continuous rotation technique

A request for authorization from the administrative and health authorities was made before the start of the study, and information was collected in the form of individual interviews. Free and informed consent was obtained from the OS interviewed, after the objectives of the study had been clearly explained to them. Confidentiality of information, professional secrecy and the privacy of participants in the investigation were respected.

The data were analyzed using SPSS 20.0 software. Due to the low representativeness of the sample, no statistical tests were carried out to assess the association of variables, as the conditions for application were not met.

3 Results

Table 1 Social characteristics of the sample

| Social characteristics | Effective (n) | Proportion (%) |
|----------------------------------|----------------------|-----------------------|
| Gender | | |
| Male | 24 | 53,3 |
| Feminie | 21 | 46,7 |
| Total | 45 | 100 |
| Age (in years) | | |
| 25 to 34 | 08 | 17,8 |
| 35 to 44 | 05 | 11,1 |
| 45 to 54 | 14 | 31,1 |
| 55 to 64 | 09 | 20 |
| ≥ 65 | 09 | 20 |
| Total | 45 | 100 |
| Place of work | | |
| Isandra | 01 | 2,2 |
| Ambohimahaso | 02 | 4,4 |
| Fianarantsoa I | 35 | 77,8 |
| Vohibato | 02 | 4,4 |
| Ikalamavony | 01 | 2,2 |
| Lalangina | 02 | 4,4 |
| Ambalavao | 02 | 4,4 |
| Total | 45 | 100 |
| Practice status | | |
| Audience | 14 | 31,1 |
| Private | 29 | 64,5 |
| Military | 02 | 4,4 |
| Total | 45 | 100 |
| year of exercise | | |
| 10 years and Under | 09 | 20 |
| 11 à 20 years | 09 | 20 |
| ≥21 years | 27 | 60 |
| Total | 45 | 100 |
| Place of initial training | | |
| Madagascar | 44 | 97,8 |
| Foreign | 01 | 2,2 |
| Total | 45 | 100 |

In the present study, among the 45 Odontostomatologists surveyed, 53.3% were male with a sex ratio of 1.14

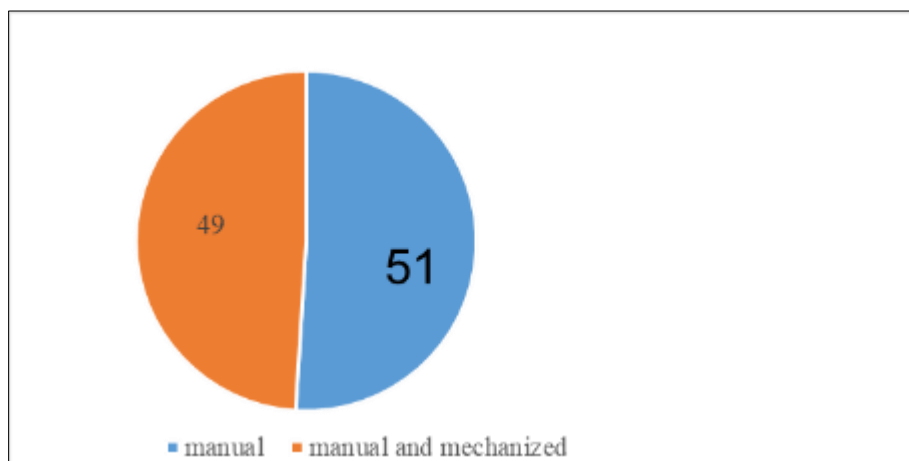


Figure 1 OS Knowledge of endodontic technique

51% of practitioners use mechanized and manual techniques

Table 2 Distribution of OS according to their knowledge of the advantages of continuous rotation

| Continuous rotation advantage | Yes | | No | | Total | |
|---------------------------------|-----|------|----|------|-------|-----|
| | N | % | N | % | N | % |
| Better root canal preparation | 10 | 45,5 | 12 | 54,5 | 22 | 100 |
| Time saving | 17 | 77,3 | 05 | 22,7 | 22 | 100 |
| Comfort | 08 | 36,4 | 14 | 63,6 | 22 | 100 |
| Succesfull pedodontic treatment | 01 | 4,5 | 21 | 95,5 | 22 | 100 |
| Reproducibility | 01 | 4,5 | 21 | 95,5 | 22 | 100 |

77.3% of odontostomatologists confirmed that the use of continuous rotation saves time

Table 3 Distribution of OS according to their knowledge of the disadvantages of continuous rotation

| Disadvantages continuous rotation | Yes | | No | | Total | |
|-----------------------------------|-----|------|----|------|-------|-----|
| | N | % | N | % | N | % |
| Instrument Fracture | 09 | 40,9 | 13 | 59,1 | 22 | 100 |
| Difficult to clean and sterilize | 00 | 00 | 22 | 100 | 22 | 100 |
| High cost | 14 | 63,6 | 08 | 36,4 | 22 | 100 |
| Nickel-titanium allergy | 03 | 13,6 | 19 | 86,4 | 22 | 100 |
| Instrumental Fatigue | 02 | 9,1 | 20 | 90,9 | 22 | 100 |
| Power failure | 03 | 13,6 | 19 | 86,4 | 22 | 100 |
| Canal false root | 01 | 4,5 | 21 | 95,5 | 22 | 100 |
| Canal overhang | 01 | 4,5 | 21 | 95,5 | 22 | 100 |
| Unprofitable | 01 | 4,5 | 21 | 95,5 | 22 | 100 |

The high cost as well as the instrumental divide are the most cited disadvantages

Table 4 Distribution of OS according to techniques used in endodontics

| Techniques used in endodontics | Effective (n) | Proportion (%) |
|--------------------------------|---------------|----------------|
| Manual | 45 | 100 |
| Mechanical | 00 | 00 |
| Total | 45 | 100 |

All Odontostomatologists use manual technique

Table 5 Distribution of OS according to their reasons for reluctance to adopt continuous rotation

| Reasons for reluctance | Yes | | No | | Total | |
|------------------------|-----|------|----|------|-------|-----|
| | N | % | N | % | N | % |
| High cost | 14 | 63,6 | 08 | 36,4 | 22 | 100 |
| Lack of dexterity | 01 | 4,5 | 21 | 95,5 | 22 | 100 |
| Lack of training | 14 | 63,6 | 08 | 36,4 | 22 | 100 |
| Expérience time | 00 | 00 | 22 | 100 | 22 | 100 |
| Unprofitable | 04 | 18,2 | 18 | 81,8 | 22 | 100 |
| Not available | 11 | 50 | 11 | 50 | 22 | 100 |
| Power failure | 05 | 22,7 | 17 | 77,3 | 22 | 100 |

High cost and lack training are the main reasons for the disuse of continuous rotation

3 Discussion

The aim of the present study was to determine the factors favouring inaccessibility of continuous rotation in endodontic practice. In order to obtain a more representative sample, it was hoped that the study would cover the whole of Madagascar. However, given the human, technical and financial resources available to carry out the study, it was decided to carry out the research on all the dental offices in the Haute Matsiatra region.

3.1. Social characteristics of the OS

Among the samples studied, the male gender predominates, at 53.3% with a sex ratio of 1.14. This male predominance of practising professionals has been confirmed by the National organization for the Demography of Health Practitioners (ONDPS) in 2021, 52% of practitioners in France are men [8], however, in Madagascar, in the city of Antananarivo and its suburbs, Andrianjafinoro and *al* in 2019 found a female predominance in the OS profession, of 54.4% with a sex ratio of 0.83 [8]. The overall average age was 51 years, with the 45 to 54 age group accounting for 31.1% of the OS studied. This result is similar to a study carried out in France showing an average age of 46 years [9].

According to Place of practice, there was a high concentration of OS in the Fianarantsoa I district (77.8%), compared with 2.2% in Isandra and Ikalamavony. Almost all OS worked in private practice (64.5%). This result corroborates the study by Randriamalala and *al* in Antananarivo and Mahajanga in 2020, which found that 60% of OS worked in the private sector [10]. Similarly, Meghoufel's study in Madagascar confirmed the strong presence of private practices in large cities [11]. This trend could be influenced by the dental surgeon's choiceto work in the city, since most public dental practices and government jobs are located on the outskirts, so dental surgeons have the option of applying to the private sector or opening their own practice.

In terms of year of practice, practitioners with 21 years' experience or more are the most represented (60%), which could be explained by the average age (rather old) of practising dental assistants in the Haute Matsiatra region.

As for initial training, almost all OS in the Haute Matsiatra region did their initial studies in Madagascar (97.8%), which could be explained by the existence of only one Indian Ocean odontology institute in Madagascar. This result is

consistent with a study carried out in Côte d'Ivoire, where since 1990, dental training has been carried out entirely in the country, and the majority of practitioners are trained there (63.89%) [6].

3.2. OS knowledge of endodontic technique

Concerning OS knowledge of mechanized endodontic preparation systems, in particular continuous rotation, the response rate was 48.9% (figure 1). This proportion is relatively low compared with other similar studies carried out by Avoaka-Boni in Abidjan, Côte d'Ivoire, in 2019, which showed that 73% of OS claimed to have knowledge of this technique; as well as the study carried out by Treguer in France in 2012, which showed a result of 95% [4,6]. This discrepancy could be explained by the fact that this technique is not practiced during initial training creating gaps by OS after graduation. As a result, the knowledge of dental surgeons of the continuous rotation technique is still limited in Madagascar compared with other countries, despite the continuing education courses organized by the Learned society SOCEM or Society of Conservative Odontology Endodontics of Madagascar.

As for knowledge of the advantages of continuous rotation, among the various responses put forward, the time-saving of continuous rotation systems was the most well-known among OS with 77.3%, followed by better root canal preparation (45.5%).

However, the response rate on the success of treatment in pedodontics showed a low proportion (4.5%). Conversely, Manchanda confirmed in his study a clinical and radiographic success rate equivalent to the manual of continuous rotation in pedodontics [1]. However, it is important to note that one of the key factors that can impact on the success rate of any treatment in a child is the duration of the procedure, which can affect the level of cooperation. [12]

3.3. Knowledge of the disadvantages of continuous rotation

In terms of OS knowledge of the disadvantages of the continuous rotation technique, high cost was the most well-known among OS (63.6%), followed by instrument fracture (40.9%). These proportions are reduced compared with Treguer's study showing the same disadvantage with a proportion of 92% [4]. Elsewhere, problems such as nickel-titanium allergy, instrument fatigue, difficulty of cleaning and sterilization, false canal and overturning were minimal. The reason for this could be a lack of acquired knowledge of OS, as well as a lack of information on the innovative technology of dental materials and equipment.

3.4. Techniques used in endodontics

In the present study, manual endodontic technique is exclusively the most practiced technique by all OS in the Haute Matsiatra region (100%), so mechanized endodontic techniques such as continuous rotation and reciprocity are not yet practiced. A similar finding was observed by Rakotonirina and *al* in Mahajanga Madagascar (2021) with only a 5.3% utilization rate [7], so it could be that continuous rotation is still a myth in Madagascar, hence its low use.

In addition, Avoaka-Boni in Côte d'Ivoire in 2019 also mentioned this low adoption of the mechanized technique (22%) [6]. In view of its various results, it was found that the use of continuous rotation is still restricted in developing countries. One possible reason could be the high cost of the instrument.

Conversely, in developed countries a high proportion of use has been observed, namely in the USA (74%) [3], France (94%) [4], UK (93%) [13], and finally, Switzerland (80%) [14]. However, controversial results have been observed from one country to another, in Saudi Arabia, classified as a developing country, there are 71.9% of users [15] while in Australia, a developed country, 22% of General Dentists and 64% of endodontists of endodontist users [5].

these results show that in developing countries, the continuous rotation technique is still based on awareness of its existence, whereas in developed countries, they are quite inclined to put it into practice.

3.5. Reasons for reluctance to adopt the continuous rotation technique

Practitioners cited several reasons for their reluctance to use the continuous rotation technique: high cost and lack of training (63.6%), followed by unavailability of equipment (50%), power failure (22.7%), lack of profitability (18.2%) and lack of dexterity (4.5%).

Similar studies in Côte d'Ivoire and Saudi Arabia cited the same main reason, with proportions of 32.4% and 85.3% respectively [6] [15]. However, in France, this high cost was only second to instrumental fracture, which accounted for 80.9% [4]. These results reflect the fact that the main reason for a country's reluctance to practice continuous rotation depends above all on its level of development.

Another main reason for not using the continuous rotation technique is lack of training. This same reason was also found in Wales, but in second place [16,17].

According to Mozayeni's survey of practitioners in Tehran in 2011, 46.7% of practitioners cited this lack of availability [18]. It may be that materials for the continuous rotation technique are still less available in developing countries.

However, it is important to highlight the power cut, which is another reason and has become almost a national problem in Madagascar. This could be explained by the frequent power cuts in Madagascar. [19]

In addition, it is also important to highlight the unprofitability of using this technique, which is apprehended by some practitioners (18.2%). This apprehension is largely understandable since the poverty intensity in this region is higher compared to the national situation [20]. However, a study by Koch and al in 2012 showed the profitability of this technique following appropriate training [21].

Lastly, even though the lack of dexterity (4.5%) of the OS is ranked last in the present study, Avoaka-Boni also highlights it in his study. Thus, this lack of dexterity is also a well-founded reason for the lack of use of continuous rotation in this region of Madagascar [6].

It's also worth noting that experience time is one of the reasons not considered in this region, yet there's no experience without practice.

4 Conclusion

In conclusion, endodontics has evolved significantly in recent years with the introduction of the mechanized continuous rotation technique, offering many advantages over traditional stainless steel instruments.

At the end of this study, it was determined that the practice of the continuous rotation technique remains relatively low in Madagascar, due to a number of inaccessibility factors, notably the high cost and unavailability of equipment, lack of training, frequent power cuts, lack of profitability of the technique and lack of dexterity on the parts of practitioners.

Finally, an in-depth study throughout Madagascar would be desirable to determine the prevalence of its use and assess the factors behind its inaccessibility.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to declare

Statement of informed consent

The study was carried out after heads of the oral consent of the respondents. Before the administration of the questionnaires, we explained the objective of the survey, insisting on the total respect of the confidentiality of the data in order to encourage the respondents to answer the questionnaire with honesty. All information collected on individuals was kept confidential, respect for anonymity was enforced by using codes for each file.

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