

ORIGINAL RESEARCH



A Survey of Endodontic Practices among Dentists in Burkina Faso

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ABSTRACT

Aim: Dental surgeons must be aware of the most appropriate endodontic treatments and how to properly conduct them. The aim of this study was to evaluate the knowledge of dental surgeons in Burkina Faso in terms of endodontic treatment procedures.

Materials and methods: This descriptive, cross-sectional study was performed during the regular annual conference of the National Board of Dental Surgeons of Burkina Faso, held on February 27 and 28, 2015 in Ouagadougou, through a questionnaire.

Results: A total of 33 practitioners took part (52.4% of the dental surgeons of Burkina Faso) in the study. The majority of them (90.9%) used sodium hypochlorite as their preferred irrigation solution. Nearly half of the dental surgeons (48.5%) did not know how to use a permeabilization file, and most did not make use of nickel–titanium (NiTi) mechanized instruments (78.8%) or rubber dams (93.9%). Approximately two-thirds of participants did not perform file-in-place radiography (66.7%) or control radiography of the canal obturation (63.6%). The adjusted single-cone technique was the most commonly used (87.9%).

Conclusion: This study highlights that the majority of dental surgeons in Burkina Faso are not using the currently recommended endodontic procedures to perform obturations.

Clinical significance: Dental surgeons in Burkina Faso must commit to regularly upgrading their knowledge and techniques.

Key words: Burkina faso, Cross-sectional study, Dental surgeons, Endodontic treatments, Protocol adherence.

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INTRODUCTION

Endodontic treatment is performed in all cases where there is irreversible inflammation or infection of the dental pulp. Such treatments are geared toward preventing or eliminating infection of the canal system by removing pulp tissue, bacteria, and their toxins, as well as maintaining this disinfection over time by canal and coronary obturation.^{1,2} To achieve this, the canal system is shaped according to biological requirements (e.g., without going above or below the canal) and mechanical considerations (e.g., the shape of the prepared canal must match those of the original canal).¹ Since the introduction of more flexible instruments, shaping is more and more realized with these NiTi mechanized instruments.³ These files allow the reduction of root canal transportation⁴ and the improvement of the chemical disinfection in comparison with stainless steel instruments.⁵ The NiTi instruments make the preparation more effective and enhance the ergonomics for both the patient and the dentist.⁶ Moreover, NiTi instrumentation is constantly improving thanks to geometrical changes, surface and thermomechanical treatments, metallurgic variations, and kinematics of endodontic motors.³ Even

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with these instruments, permeability of the canal, which is a key factor for shaping, must be maintained throughout the duration of the root canal preparation with a low-diameter instrument. This allows confirmation that no blockage has been created, improves irrigant penetration, and permits resuspension of debris in the irrigation solution, thereby facilitating its elimination.⁷

The apical limit of the preparation must conform to the measurement of the working length, which is defined at the start of the endodontic treatment by apex locator and/or radiography with millimeter precision. This objective reference allows the canal to be readily prepared along its entire length without impinging on the periapical tissues beyond the foramen. The complex anatomy of the tooth limits the ability to eradicate pathogens by mechanical means alone. Irrigation is the key to solving this problem.⁸ Regardless of the system used, the canal is irrigated with sodium hypochlorite throughout successive passages of the files.⁹ The objectives of irrigation are to eliminate microorganisms, flush out debris, lubricate root canal instruments, dissolve organic and inorganic debris, and to prevent the formation of a smear layer during instrumentation or to dissolve it once it has formed.^{9,10} To reach these objectives, chelating agents [e.g., ethylenediaminetetraacetic acid (EDTA)] must be used, followed by a final rinse.⁹ All of these aspects, which affect the success of the treatment, are preceded by the placement of a rubber dam.¹⁰ Establishing this type of operating area is the only way to ensure that microbial reinfection does not occur during the endodontic treatment of an infected tooth, and it prevents primary bacterial infiltration during the treatment of a vital tooth. It also prevents inhalation and ingestion of instruments and avoids irrigating solutions escaping into the oral cavity.¹⁰ The advantages of a dam should be considered both from the patient's perspective and that of the practitioner.¹¹ Once cleaning and shaping are complete, the clinician must obturate the canal. There are many different materials and techniques available, but whichever is used, the goal is to seal the entire prepared volume of the root canal.¹² A final X-ray control allows evaluation of the quality of the obturation (in two dimensions) and is a reference to assess the outcome of the treatment in subsequent years.¹³

The main aim of this study was to evaluate the knowledge of endodontic treatment practices by dental surgeons in Burkina Faso. The second aim was to collect social professional data about dental surgeons performing endodontic procedures in Burkina Faso.

MATERIALS AND METHODS

This was a descriptive, cross-sectional investigation that involved all of the private, semiprivate, and public practitioners registered with the National Order of Dental

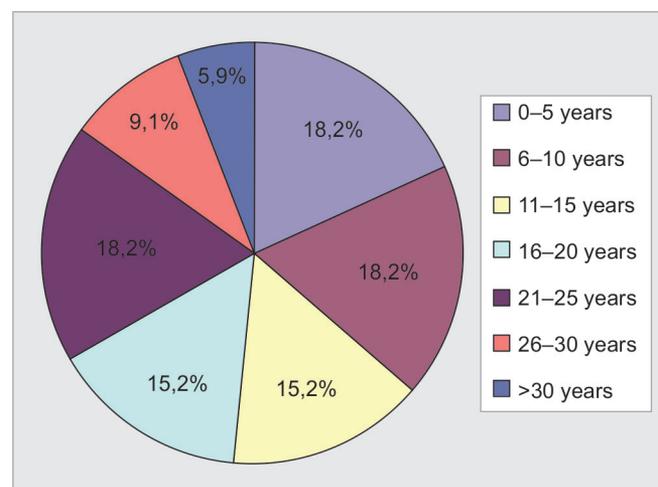
Surgeons of Burkina Faso. The study took place between the February 27 and the May 31, 2015, and complied with Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines. Data were collected using an anonymous survey created with Sphinx Plus 2 software (version 5.0.0.75, Chavanod, France). The questionnaire was in two main parts: The first regarding the civil information of the dental surgeons and the second dedicated to the evaluation of the endodontic procedures that they employ. All dental surgeons gave written informed consent for inclusion in the study. This study was conducted in full accordance with the World Medical Association Declaration of Helsinki, and the protocol was approved by the Burkina Faso Ethics Committee for Health Research (Ministry of Health and Ministry of Scientific Research and Innovation).

RESULTS

A total of 33 practitioners participated in this study. Male practitioners represented 60.6% of the population studied and female practitioners represented 39.4%. Public sector practitioners were the most highly represented at 54.6%, with those in the private sector at 24.2%, the armed forces health services at 15.2%, and the semiprivate sector at 6.1%. The duration of professional involvement of the dental practitioners is presented in Graph 1.

The majority of practitioners involved in this study (66.8%) had been engaged in this profession for fewer than 20 years. Of the dentists surveyed, 84.8% participated in continuous learning, with conference attendance being the most common method, followed by reading from the Internet and books (60.6%). In contrast, 15.2% of the study population engaged in no continuous learning.

Only 6.5% of the practitioners placed a rubber dam before carrying out an endodontic procedure. As an irrigation solution, sodium hypochlorite was generally used



Graph 1: Length of professional involvement in years (shown as percentage of participating dental surgeons)

Table 1: Radiographic procedures used by dental surgeons in Burkina Faso during endodontic treatment

Procedure	Number of dental surgeons n = 33 (%)
Preoperative radiography	2 (6.1)
Radiography with the file in place	11 (33.3)
Control radiography	12 (36.4)

by 90.9% of dentists, but it was uncommon for EDTA to be added to the hypochlorite (24.2%). The recommended concentration for the sodium hypochlorite solution ranged from 5 to 10% for 30.3% of the practitioners, 2.5 to 5% for 45.2% of the practitioners, and 1 to 2% for 15.2%. The recommended concentration was ignored by 9.1% of the practitioners. Hydrogen peroxide was used by 24.2% of the practitioners.

The use of permeabilization files was unknown to 48.5% of the practitioners while 51.5% stated that they have used them. About 21.2% of the practitioners used mechanized NiTi instruments.

Results regarding preoperative, perioperative, and postoperative radiographies are shown in Table 1.

Practitioners reported using several different techniques when performing root canal filling: 78.8% of them used the adjusted single-cone technique, 9.1% used a straight-forward paste, 9.1% used cold lateral compaction, and a single dental surgeon used vertical condensation with heat.

DISCUSSION

Socioprofessional Data

This study was the first survey of dental surgeons' knowledge of endodontic treatments in Burkina Faso. The sample included 33 dental surgeons. In 2014, 63 practitioners were registered in the National Order of Dental Surgeons of Burkina Faso.¹⁴ Ordinal registration is required to practice; therefore, the sample is representative of 52.4% of the dentists in Burkina Faso.

Male practitioners were represented more than female practitioners in this study population (60.6% males *vs* 39.4% females), which does not reflect the population of females (51.7%) in Burkina Faso.¹⁵ This same pattern has been seen in Senegal and India. For example, a study performed by Touré et al¹⁶ in 2007 showed that, in the Dakar area, male practitioners represented 65.1% of the total, and females accounted for 34.9%. Likewise, in a study by Verma et al,¹⁷ 34.2% of dentists in India were women and 65.8% were men.

Of the dental surgeons in this study, 24.2% worked in private practice, whereas 75.8% were in the government sector, which includes public and semiprivate practices in addition to the armed forces. This is representative of the population of workers in Burkina Faso, where the state is

the main provider of employment.¹⁸ This finding could be explained by a lack of universal health insurance and a precarious economy, which makes the government the largest employer in Burkina Faso. This result is in contrast to a study performed in Nigeria.¹⁹ Indeed, a report by the Executive Office of Human Resources and Health System Management in Nigeria showed that the capital city of Lagos has a high proportion (86.4%) of dentists in private practice.¹⁹ According to Akpata,²⁰ the proportion of dental surgeons engaged in the private sector is 78.6% in Nigeria. Furthermore, Touré et al¹⁶ showed that, in the Dakar area of Senegal, 60.4% of dentists were in private practice rather than in the semiprivate and public sectors.

At the time of our study, the majority of the practitioners surveyed (66.8%) had been engaged in the profession for fewer than 20 years. The results of the study by Touré et al¹⁶ in Senegal were essentially the same as those found in our study. Continuous learning has been a requirement for all practicing dental surgeons in several Western countries, such as France for several years.²¹ The aim of this legislation is to ensure that practitioner knowledge remains up to date. In Burkina Faso, continuous learning is recommended but not compulsory. In our study, 87.9% of practitioners reported engaging in continuous learning by attending conferences and reading information on the Internet, although 12.1% reported that they do not engage in any further learning. This is worrying in terms of performance standards and may explain the observed shortcomings in practitioner knowledge.

Endodontic Treatment Procedures

Only 6.1% of the practitioners in Burkina Faso reported utilizing a rubber dam during endodontic treatment. A 2011 study by Vedavathi et al²² concluded that 60% of patients would readily accept placement of a dam, and the reasons patients gave for not wanting a dam did not warrant them not being used. There can be no compromise with regard to the use of a dam; the success of the endodontic treatment depends on it.²³ The dam prevents tooth infection or reinfection, inhalation and ingestion of instruments, and avoids irrigating solutions escaping into the oral cavity.¹⁰

The majority of practitioners (90.9%) in our survey used sodium hypochlorite as an irrigation solution. In the past, numerous products have been used as irrigation solutions in endodontics. Currently, nothing meets the various requirements better than sodium hypochlorite, which is the solution of choice.²⁴ It serves a dual purpose through both physical elimination of organic matter and microorganisms and through its chemical action as an antibacterial and solvent.²⁴ Regrettably, only 21.2% of the practitioners surveyed were aware of this double effect, with 78.8% using it

for its antiseptic activity only. By far the greatest drawback of sodium hypochlorite use is its cytotoxicity, particularly in the case of accidental injection into the periapex.²⁵ It is therefore imperative that dental surgeons are aware of the correct concentration of this product to use. In our study, 45.5% of the practitioners reported using sodium hypochlorite at a concentration of 2.5 to 5%. Several practitioners (30.3%) used a toxic concentration between 5 and 10%,²⁶ while 9.1% of practitioners completely ignored the recommended concentration for use.

The current literature recommends using EDTA to eliminate the smear layer in the final rinse and to alternate it with sodium hypochlorite before obturating the root canal.²⁷ Few dentists (24.2%) in our study used this combination.

In endodontics, a concentration of 2% chlorhexidine is recommended as a solution for irrigation and/or intracanal medication as either a liquid or a gel.²⁸ The effect of chlorhexidine on microbial biofilms is significantly inferior to that of sodium hypochlorite.⁹ However, chlorhexidine is effective against *Enterococcus faecalis* and can be used in cases of retreatment because it prevents reinfection.²⁹ Chlorhexidine can also be used in endodontic surgery as an alternative irrigation solution to disinfect the surgical site in case the patient is allergic to sodium hypochlorite.²⁹ Whatever the solution, it must be agitated mechanically and renewed so that it makes contact with the tissue;³⁰ however, only 6.1% of the practitioners knew the appropriate amount to use (1 mL) between each passage of the instrument. A permeabilizing file with a small diameter (010) is used after each irrigation. Irrigation between each cycle of instrument use and permeabilization with a K 010 file prevents the formation of blockages and promotes true chemical and mechanical trimming.⁷ In our study, 51.5% of dental practitioners in Burkina Faso reported utilizing a permeabilization file, while 48.5% ignored or were unaware of its potential usefulness. Moreover, they rarely prepared or shaped root canals with mechanized NiTi endodontic instruments (21.2%). This rate may seem low, particularly in comparison with the adoption rates of NiTi rotary instrumentation in other countries. The NiTi instruments were actually used routinely by 67 and 40% of the responding general dental practitioners respectively, in the recent surveys in Wales (United Kingdom)³¹ and Iran.³² A lack of continuous learning and the cost of this technique may explain the low uptake among dentists in Burkina Faso.

The National Executive Health Body in France has issued specific recommendations regarding the various X-rays that should be taken during the course of endodontic treatment.³³ At least three X-rays are required: Preoperative, perioperative, and postoperative.^{10,33} Preoperative images provide information about the

anatomy of the canal and the periodontal integrity. They also constitute a reference of the condition of the tooth. Perioperative images allow the stages of treatment to be controlled, determination and control of the working length of the file, and control of the adjustment of the master cone before obturation.¹⁰ A postoperative X-ray allows for verification of the quality of the obturation and provides a reference for the follow-up of the patient.⁸ Detection of the apical constriction by feel alone is not reliable enough to consistently determine the working length. Indeed, even with experienced operators, it was not adequately determined in 64% of cases.³⁴ Only one-third of the practitioners of this study took a perioperative radiograph. In light of this apparent failure to adequately gauge the apical limit, underobturation or overextension must occur with some frequency because of underpreparation or overpreparation. In this context, it should be noted that the use of an apex locator could be useful. Unfortunately, they are not widespread in Burkina Faso because of their cost. Overextension and underobturation can be the direct result of errors not only in evaluating the working length but also of failing to take into account the mechanical principles involved in shaping or due to lack of adjustment of the master cone during obturation.³⁵ Postoperative radiography permits control of the quality of the filling and is a reference to assess the outcome of the treatment in subsequent years.³⁵ Unfortunately, only 36% of dental surgeons in our study reported utilizing postoperative radiography.

Practitioners in our study reported using the adjusted single-cone obturation technique (78.8%) and a straight-forward paste (9.1%). Currently, canal filling techniques based on paste alone or on a single-cone associated with paste are still used but are not recommended; techniques based on cold or hot gutta-percha condensation associated with canal sealing cement are recommended instead.³⁶ The single-cone technique is difficult to control and reproduce and is associated with underobturations, fractures of the lentulo spiral, or severe consequences, such as pushing zinc oxide-based paste into the sinus or the inferior alveolar nerve.³⁷ Although this technique is not recommended, it is widely used in Burkina Faso. At best, it results in filling of the main canal, rather than allowing for a genuine obturation of the canal system. The single-cone technique is characterized by having fewer gutta-percha filled areas and more sealer-filled areas than the recommended techniques.³⁸ The sealer has a pronounced retraction, thereby causing a lack of proper sealing. Several studies suggest that only techniques using hot gutta-percha associated with sealing cement allow for three-dimensional obturation of the canal network. It provides a better degree of obturation of the canal spaces and a better obturation of the canal system

than the cold-condensed gutta-percha techniques.^{39,40} Only 3% of dental surgeons in our study who report using the vertical hot condensation method in Burkina Faso are in line with this current recommendation.

CONCLUSION

Treatment of endodontic pathologies requires that the dental surgeon remove inflamed and/or infected tissue from the inside of the tooth. The success of this therapy involves four fundamental steps: The placement of a dam, formation of the access cavity, shaping and irrigating, and obturation of root canal. To master these key stages, dental surgeons in Burkina Faso must commit to regularly upgrading their knowledge and techniques.

CLINICAL SIGNIFICANCE

This study highlights that the majority of dental surgeons in Burkina Faso are not using the currently recommended endodontic procedures to perform obturations. Dental surgeons in Burkina Faso must commit to continued professional development and training to remain abreast of developments in endodontic knowledge and improved techniques.

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