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## Protocol for Root Canals' Irrigation in Endodontic Practice in Ivory Coast: A Survey of 100 Dentists

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### Abstract

**Introduction:** In endodontics, a chemo-mechanical preparation is used to disinfect the root canal system. However, due to limitations of endodontic devices, which shape the main canal, this preparation is supplemented by irrigation solutions. In Ivory Coast, late consultations and advanced stages of pathologies characterized the endodontics.

**Objective:** This work aimed to assess root canal irrigation procedures used in Ivory Coast; an unprecedented study in the country.

**Methods:** One hundred dental surgeons practicing in the private and the public sector in Abidjan received a questionnaire to assess the knowledge, attitudes and practices related to root canal irrigation.

**Results:** Results show that practitioners (77%) commonly use sodium hypochlorite solutions for irrigation. However, 76% of them do not know the recommended concentration. Besides, it is dental auxiliaries (73%) who prepare the solution, whereas only half of them know the dilution proportions. Half of the respondents use syringes and intramuscular injection needles while 52% do not withdraw the device before the ejection of the product.

**Conclusion:** As a result, in Ivory Coast, irrigation procedures do not always comply with standards.

**Keywords:** Dentist; Disinfection; Endodontics; Ivory Coast; Root canal irrigation

**List of abbreviations:** KOP: Knowledge; Outlook and Practices; EDTA: ÉthylèneDiamineTétra-Acétique

### Introduction

The principal aim of any endodontic treatment is to eradicate microorganisms that invade the canal system [1,2]. This disinfection is essentially based on a chemo-mechanical preparation where limitations of endodontic devices, which shape the main canal, are made up for by irrigation solutions. The latter cleans the whole canal system, provided that a surgical sequence is met within an aseptic setting. It starts with irrigation as soon as the access cavity opens, during and at the end of the canal preparation, to remove the dental sludge generated by shaping devices.

While devices shape the main canal, irrigation solutions clean the entire canal system out [3,4]. Indeed, in a properly prepared canal, devices are not needed in some parts of the walls. Similarly, these devices cannot access crypts, such as anfractuosités of the ductal system, isthmuses and lateral or secondary canals, which are likely to harbor bacteria. To remedy these issues and since all required objectives cannot be met with a single solution, numerous irrigation solutions are developed. Thus, highlighting the irrigation action during endodontic preparations and explaining how to potentiate these antibacterial solutions is essential. It is the chemical part of canal cleansing and the only effective weapon against the complexity of the root canal system. Without irrigation, organic debris in the endodontic cavity, or those generated during its preparation, are likely to decompose and promote microbial proliferation, a periapical infection vector.

Sodium hypochlorite is still the reference irrigation solution for endodontics and must be combined with an EDTA solution at the end of the preparation [5-8].

In Ivory Coast, late consultations and advanced pathologies characterize the dentistry practice in general and the endodontics in particular.

This work aimed to assess root canal irrigation procedures used in Ivory Coast, an unprecedented study on this theme in the country. This country has 715 dental surgeons regularly registered on the board of the National Council of the College of Dentists. Among these registered, 627 are active throughout the territory of which 500 are located in the district of Abidjan (National Council of the College of Dentists-Dentists of Côte d'Ivoire (CNOCDICI) Update of the staff of Surgeon-Dentists of Côte d'Ivoire 03 March 2016).

In this workforce, the country has only nine endodontists who are teachers in the Training and Research Unit in Odonto-Stomatology. All these specialists were excluded from this study. Only private or public general practitioners from the district of Abidjan were included.

## Methods and Materials

Participants received a survey form containing 31 items divided into five subgroups:

- General information
- Endodontic treatments frequency
- Irrigation devices and techniques
- Irrigation products
- Irrigation procedures.

One hundred dental surgeons practicing in the private and the public sector in Abidjan participated in this study. It was a KOP (Knowledge, Outlook and Practices) survey carried out from June 2016 to October 2016. Participants are selected from a poll of private dental practices, members of the Council of the Order of Dentists-Surgeons and an exhaustive census of all public facilities with a dental practice. In both cases, the questionnaire was self-administered.

The survey excluded teachers from the Endodontics Conservative Odontology unit as well as practitioners outside of Abidjan. Collected data were processed with an Excel spreadsheet and some criteria coded to facilitate the data entry. The SPSS 18.0 software was used for statistical calculations and the threshold significance set at  $p < 0.05$ .

## Results

### Sample characteristics

This study targeted non-specialist general practitioners in endodontics of the district of Abidjan. The country's endodontic specialists, nine in all, were excluded from this study. Male practitioners predominate the survey with a sex ratio of 2/1. In the survey, 58% of practitioners have more than five years of professional experience and 42% with 1 to 5 years of seniority.

The monthly endodontic treatment frequency ranged from 1 to 5 for 36% of practitioners, 6 to 10 for 26%, and 11 to 20 for 29%.

Results of the average duration of a canal preparation session are presented in Table 1.

The last preparation device determines the apical diameter of the final preparation: 34% of practitioners use a file 30 to complete the preparation while 37% use a 35 and 18% a file over 35.

According to 10% of surveyed practitioners, the diameter of the preparation depends on the tooth.

Average duration of a canal preparation session (min)	Number	Percentage(%)
< 15 min	11	11
15 to 20 min	59	59
21 to 25 min	14	14
26 to 30 min	11	11
>30 min	2	2
Did not answer	3	3
Total	100	100

**Table 1:** Average duration of a canal preparation session

### Irrigation devices and technique

All surveyed practitioners use the irrigation technique during preparations. Devices used are listed in Table 2.

Irrigation devices	Number	Percentage(%)
Pipette	22	13
Intramuscular syringe	83	50
Endodontic syringe	12	7
Insulin syringe	41	25
Anesthesia syringe	8	5
Total	166	100

**Table 2:** Distribution of surveyed practitioners according to irrigation devices used

## Irrigation products

All surveyed practitioners use sodium hypochlorite (NaOCl) solution for canal disinfection. Moreover, some use hydrogen peroxide (9.2%), Chlorhexidine (4.6%), physiological serum (5.4%) or plain water (3.8%). The NaOCl solution is used by 77% of surveyed practitioners. While 9% of them pre-dose it, 14% use it as it is or pre-dosed.

Regarding the recommended concentration of the NaOCl solution for endodontics, 76% of surveyed practitioners ignore it. Only 12% prepare the solution themselves, while dental assistants prepare the solution for 73% of them and for 15% it was either the assistant or practitioners themselves. Regarding the dilution proportions, 50% of surveyed practitioners knew it versus 22% who did not and 28% did not provide an answer. The shelf life of the diluted product is 24 hours for 56% of surveyed practitioners, more than 24 hours for 33%, and 11% did not provide an answer. The average amount of solution used per canal preparation session was 10 to 20 ml for 66% of surveyed dental surgeons, 30 ml for 13% and 5 ml for 12%; 9% did not provide an answer. Chelating agents are used by 29% of surveyed practitioners while 71% do not and EDTA is the most used chelator, accounting for 93% of agents' users while 7% use other acidic products.

## The irrigation procedure

When the needle touches the canal walls before the ejection of the product, 48% of surveyed practitioners remove it while 58% do not. The irrigation solution is refreshed by 82% after each instrument pass and 18% after 2 to 3 passes. The average duration of final irrigation is listed in Table 3.

Duration of final irrigation	Number	Percentage (%)
1 min	47	47
1 to 2 min	33	33
3 to 5 min	15	
> 5 min	2	2
Did not answer	3	3
Total	100	100

**Table 3:** The average duration of final irrigation

## Discussion

### Sample

To carry out this study, we surveyed 100 practicing dental surgeons in Abidjan, Ivory Coast. After receiving all fact sheets and from the badly filled out and/or lost cards we wound up with this sample which makes it fairly representative of the 700 Ivorians dental surgeons regularly registered with the National College of Dental Surgeons.

### Endodontic treatment

The study's results show that endodontic treatments are performed at a variable frequency. Only 36% of surveyed practitioners perform between 1 and 5 treatments per month. This could be due either to the cost of this procedure, or consultations being put off with highly deteriorated dental structures, or because practitioners prefer procedures they believe more clearcut for them.

The duration of a canal preparation session is 15 to 20 minutes on average for 59% of surveyed practitioners; enough time for a single rooted tooth or even a multiple-rooted one with straight and wide canals, regardless of the canal preparation technique used. When dealing with anatomical difficulties, however, this time may seem insufficient. For an optimal disinfection, 60 minutes, on average, is recommended [9,10].

However, this study shows that a final preparation diameter of 30/100 or more is acceptable regardless of the pulp diagnosis. Yet, for a deep penetration of the irrigation needle, a higher conicity is recommended for the preparation [11]. In this survey, the preparation was manually done with 2% conicity files.

### **Irrigation devices and technique**

Surveyed practitioners commonly use the passive irrigation with syringe method. Nevertheless, contrary to recommendations [12], they frequently use intramuscular injection (50%), insulin (25%) or anesthetic syringes instead of endodontic syringes (7%). The drawback, in this case, is that the needle does not sufficiently penetrate into the canal, either because its diameter is too large or too short, or cannot be blocked when it is the anesthetic syringe which tip-cap is usually smooth. In endodontics, because of the use of hypochlorite, it is necessary to utilize a syringe with a locking system to prevent disconnection of the needle from the syringe. Therefore, irrigation aims are not achieved. Indeed, studies have shown that the irrigation solution is not projected beyond 1mm from the tip of the needle [13]. Yet, with infected teeth, the harmful bacteria are in fact located in these last few apical millimeters [14]. Thus, a deeper penetration into the apical third is necessary for an optimal disinfection [12]. Likewise, at the end of the preparation, an active irrigation is recommended to boost the disinfecting action of the sodium hypochlorite [15].

### **Irrigation products used**

In this study, all surveyed practitioners use sodium hypochlorite for canal irrigation. Nevertheless, few of them, sometimes, use other products, such as Chlorhexidine (4.6%), hydrogen peroxide (9.2%), physiological serum or plain water (9.2%). Of those using the NaOCl, 77% pre-dilute the solution, although the majority (76%) of them does not know the recommended concentration for endodontic applications, which is 2.5%. Moreover, it is chair assistants (73%) who prepare the irrigation solution, whereas only half of them know the dilution proportion. This becomes an issue regarding the proper use of this product. Consequently, commonly used household cleaning solutions measured out 8% or 12% may contain other compound aimed at improving their stability and cleaning properties. They may also contain perfumes which are more or less likely harmful to the oral cavity [14].

“Random” dilution can increase adverse effects and can make the irrigation solution ineffective, as well. It is therefore recommended, for a better quality of care, to document on vials the concentrations and expiration date information on pre-dosed solutions specifically formulated for endodontic irrigation. Only 9% of surveyed practitioners took these precautionary measures. These later allow a better control of the dilution, the storage, and the concentration of solutions.

Our results show that chelating agents are randomly used. Only 29% used these agents while the majority (93%) uses it in the form of EDTA. This finding is contrary to the literature’s recommendations which suggest a NaOCl-EDTA combination [11,16].

### **The irrigation procedure**

Withdrawing the device prior to the ejection of the irrigation solution allows debris to rise occlusally and to avoid pressure in the apical direction with the risk of a lesion to periapical structures [5,17-20]. Yet, more than half (52%) of surveyed practitioners do not actually withdraw the device which is necessary to prevent iatrogenic periodontitis when using endodontic needles.

Regarding the irrigation solution refreshment frequency after each pass of the device, 82% of surveyed practitioners comply with the literature’s recommendations [2,5,9]. At the end of the canal preparation, irrigation with maximum efficiency is possible along the entire canal’s length. This action optimizes the disinfection and the dissolution of organic materials. To achieve it, Arias-Moliz [15] suggests up to five minutes irrigation to better clean the whole canal space and make the cavity walls clean. This study’s results show that 80% of surveyed practitioners perform a final irrigation in less than three minutes. This needs to be corrected to meet root canal irrigation’s aims.

## **Conclusion**

In their daily practice, Ivorian dental practitioners perform little endodontics. Sodium hypochlorite is the most commonly used solution for endodontic procedures, although many practitioners are not cognizant of the recommended concentration or dilution. This solution is often delivered using non-compliant devices, such as intramuscular injection needles and insulin syringes. Furthermore, they randomly use chelating agents. Practitioners generally do not do the final rinse as recommended. On the other hand, the refreshment frequency of the product meets the standards.

This study calls out to dental instructors to insist on therapeutic principles in general for a better quality of our therapeutics.

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