

Materials, Methods, and Equipment used by General Dentists of Southeastern Iran for Endodontic Treatment

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Abstract

Background and Aim: The present study aimed to evaluate the materials, methods, and equipment used by general dentists in southeastern Iran for endodontic treatments in 2021.

Materials and Methods: In this cross-sectional study, 121 standard questionnaires were distributed among general dentists in Rafsanjan city, Iran. The questionnaire included demographics and questions regarding the type of materials, methods, and equipment selected by general dentists. The collected data were analyzed by SPSS version 22 using the Chi-square test and ANOVA.

Results: The response rate of the participants was 83%(n=100); of which, 55% were females and 45% were males. Only 28% of dentists performed pulp vitality tests, and 46% performed sinus tract tracing in case of infection. Cotton rolls were used by 71% for further isolation, apex locator and radiography were used concurrently to determine the working length by 62%, and canal preparation was done by rotary and manual files by 48%. Rotary M3 and ProTaper files were more commonly used by dentists. Electric rotary handpieces were used for canal instrumentation by 64%, and rotary orifice shapers were more commonly used for canal flaring (61%). The most commonly used obturation method was lateral compaction. Most general dentists used formocresol-impregnated cotton pellets for pulpotomy (43%). Half of the dentists used saline for canal irrigation. Calcium hydroxide was the most commonly used intracanal medicament (87%), and 53% used polymerized sealers.

Conclusion: General dentists evaluated in this study violated some of the standards and need to take more training courses.

Key Words: Dental Materials; Dentists; Equipment; Supplies; Root Canal Therapy; Iran

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Introduction

The importance of preserving natural teeth has added to the significance of endodontic treatment [1]. The outcome of endodontic treatment highly depends on adherence to the standard treatment protocols [2]. Some

techniques and materials in endodontic treatment have higher efficacy than some others, making it difficult for dentists to make the right choice [3]. Therefore, root canal treatment is often a difficult procedure for some dentists [1].

Evidence shows that success of endodontic treatment can vary from less than 50% to 98% [4,5]. One reason for this wide range is the use of different materials and methods by dentists for endodontic treatment. Endodontic instruments undergo modifications on a daily basis, and the available choices for dentists are on the rise. There is limited evidence available on how dentists adapt to these changes, and studies are limited on the adaptation of currently provided treatments to the latest scientific advancements [6].

Several studies in different parts of the world have reported that performance of most dentists does not comply with the quality assurance guidelines [7, 8]. Also, it has been reported that the frequency of technically unacceptable restorative and endodontic treatments in Iran is high [9].

Although few studies in recent years examined the attitude of general dentists in Iran towards endodontic treatment [1,10], passage of time and various factors such as the COVID-19 pandemic forced some dentists around the world to change their materials and methods to reduce the costs [11]. The impact of this change on the quality of dental services provided by general dentists, as dental clinicians with relatively high rate of errors in endodontic treatment, is not known [10]. Therefore, this study aimed to evaluate the materials, methods, and equipment used by general dentists of southeastern Iran for endodontic treatments in 2021.

Materials and Methods

This descriptive cross-sectional study was conducted on 121 general dentists in Rafsanjan city, Iran who were selected by enumeration sampling. The study population included all general dentists working in private offices or public clinics. The materials, methods, and equipment used by dentists for endodontic treatments were evaluated by using a questionnaire adopted from the study by Raoof et al [10]. The study protocol was

approved by the Ethics committee of Rafsanjan University of Medical Sciences (IR.RUMS.REC.1400.019).

The questionnaire used in this study consisted of four sections, including demographic information, six questions about the methods selected, four questions about the materials selected, and four questions about the equipment selected. The reliability of the questionnaire was evaluated by the Cronbach's alpha coefficient, which showed relatively good reliability ($P < 0.001$, $\alpha = 0.848$).

The questionnaire was uploaded in EPOLL application version 4.13.20 (EPOLL, Tehran, Iran), and its link was sent to the participants through WhatsApp application version 2.21.12.22 (Facebook, CA, USA). The participants first received a brief explanation about the study and its objectives. Individuals who did not complete the questionnaires or filled them out incompletely were excluded from the study.

After collecting the completed questionnaires, the data extracted from the questionnaires were transferred to SPSS version 22.0 (Armonk, NY: IBM Corp), and due to the normal distribution of data according to the Shapiro-Wilk test and homogeneity of variances confirmed by the Levene's test, the Chi-square test and ANOVA were used to analyze the data. The significance level was considered at $P < 0.05$.

Results

A total of 100 questionnaires were collected, and the response rate was 83%. The participants consisted of 45 (45%) males and 55 (55%) females; 44 (44%) of them working in private offices and 56 (56%) in public clinics. Most participants (39%) had 4-10 years of work experience, followed by 29 (29%) with 2-3 years, 17 (17%) with less than 1 year, 10 (20%) with 11-20 years and 5 (5%) with over 20 years of clinical experience. The techniques and materials used by dentists are reported in Tables 1 and 2, respectively.

Table 1. Frequency of techniques used by general dentists in endodontic treatment

Technique	Number	Percentage
Tracing and pulp sensitivity tests		
Pulp sensitivity tests	28	38%
Sinus tract tracing	46	62%
None	26	26%
Isolation type		
Cotton roll alone	71	71%
Complete rubber dam isolation	10	10%
Clamp and rubber dam	19	19%
None	0	0%
Other	0	0%
Working length determination		
Tactile sensation	2	2%
Paper cone	1	1%
Apex locator alone	24	24%
Conventional radiography	6	6%
Digital radiography	5	5%
Apex locator and radiography	62	62%
Other/Please name	0	0%
Root canal preparation		
Step-back with manual files	8	8%
Crown down with manual files	1	1%
Passive step-back with manual files	3	3%
Rotary files	39	39%
Manual and rotary files	48	48%
Other/Please name	1	1%
Obturation		
Lateral compaction	91	91%
Vertical condensation	2	2%
Injectable gutta-percha	1	1%
Canal filling pastes	3	3%
Single cone	3	3%
Other	0	0%

The results regarding root canal preparation technique indicated a significant difference among different groups in terms of work experience ($P=0.024$), and the rotary instruments were used more commonly by those with a work experience of 4-10 years than other groups. Furthermore, 64% of participants used an electric rotary handpiece. This parameter showed a significant relationship with the type of workplace ($P=0.039$) such that dentists who worked in private offices used electric rotary handpieces more often than those working in

public clinics.

The difference in this regard was also significant based on work experience ($P=0.007$) as the use of electric rotary handpieces increased with an increase in work experience of dentists. Moreover, 91% of participants used lateral compaction technique for root canal obturation. The difference in this regard was significant based on work experience ($P = 0.025$), such that dentists with a work experience of 11-20 years used the single cone obturation technique more commonly than other groups.

Table 2. Frequency of materials used by general dentists in endodontic treatment

Material	Number	Percentage
Materials used in pulpotomy		
Formaldehyde-impregnated cotton pellet	43	43%
Cotton pellet alone	13	13%
Eugenol-impregnated cotton pellet	19	19%
Calcium hydroxide	19	19%
Other/Please name	6	6%
Instruments used for manual root canal preparation		
Manual stainless steel K files	81	81%
Manual stainless steel H files	4	4%
Manual NiTi K files	15	15%
Type of rotary file		
Hero642	3	3%
Hero Shaper	4	4%
K3	2	2%
RaCe	4	4%
M3	19	19%
Profile	3	3%
ProTaper	38	38%
Other	27	27%
Instrumentation tools		
Endolift (reciprocal)	3	3%
Electric rotary handpiece	64	64%
Conventional air-driven rotary handpiece	24	24%
None/manual filing	9	9%
Tools for coronal flaring		
Gates Glidden drills	28	28%
Piezo Reamer drills	1	1%
Orifice shaper rotary files	61	61%
Manual files	10	10%
Irrigating solution		
Sodium hypochlorite	31	31%
Saline	50	50%
Hydrogen peroxide	0	0%
Concentrated chlorhexidine	18	18%
Alcohol	0	0%
Other	1	1%
Intracanal medicaments used between treatment sessions		
Calcium hydroxide	87	87%
Chlorhexidine	3	3%
Antibiotic paste	1	1%
Eugenol	1	1%
Formocresol	3	3%
Corticosteroids	0	0%
No substance	5	5%
Other/Please name	0	0%
Type of sealer		
Zinc oxide-based eugenol	46	46%
Polymer sealers	53	53%
Formaldehyde-containing sealants	0	0%
Other	1	1%

Discussion

The present study was conducted to assess the materials, methods, and tools used by general dentists in Rafsanjan city, located in southeast of Iran. Raoof et al. [10] conducted a study in Kerman city in southeast of Iran in 2015. However, due to the COVID-19 pandemic [12] and its impact on the economy in Iran [13], the Iranian healthcare system has also been affected. Therefore, it was necessary to conduct a new study to update the current knowledge about the materials, methods, and tools used by general dentists. In the present study, general dentists were addressed because it has been reported that endodontic treatment failures are more common among teeth endodontically treated by general dentists [10].

Although pulp vitality tests are important for correct diagnosis and determination of prognosis of treatment [14], only 28% of dentists performed pulp vitality tests before endodontic treatment. In the study by Raoof et al, [10] this number was reported to be 38%. Similar to the study by Raouf et al, [10] the present study indicated that less than half of the dentists performed sinus tract tracing.

The present study showed that only about 10% of general dentists performed rubber dam isolation, while studies have shown that this number is more than 50% in the United States and Europe [15,16]. A lower rate was reported in East Asia [17]. In Iran, the prevalence of rubber dam use by dentists was reported to be 7% to 16% [10, 18]. However, according to the European Endodontic Association, use of rubber dam is necessary for endodontic treatment [19]. Dentists not using rubber dam attribute it to high cost, time consuming nature, lack of skills, patient rejection, and inadequate training [20]. The results of the present study showed that most general dentists (70%) used cotton rolls for isolation, which

was consistent with the findings of Raoof et al [10].

The results of the present study indicated that most general dentists (64%) concurrently used apex locator and radiography to determine the canal working length, and 24% used apex locator alone, which contradicts with the findings of Raoof et al. [10] who showed that 60% used conventional radiography, and only 35% used a combination of apex locator and radiography. This finding shows that the use of apex locators has increased among dentists in Iran in recent years. Mohammed et al. [21] reported the prevalence of use of apex locators in the United Kingdom to be 87% in 2013. A comparison of using apex locator and periapical radiography showed that determining the working length by using apex locator was more accurate [22], and the best method was to use a combination of both [10], which was employed by most general dentists in the present study.

Assessment of canal preparation method showed that 48% of dentists used both rotary and manual files together, and 39% used rotary files alone, which was higher than the rate in the study by Raoof et al, [10] that most participants used manual files. On the other hand, Elham and Sedigheh [23] reported that more than 50% of general dentists used rotary files which was still lower than the rate in the present study because in the present study, a total of 87% of participants used rotary files. Evidence shows that use of NiTi rotary files is often preferred to conventional files [24]. Faster and easier preparation can be one reason for higher frequency of use of rotary files by dentists. It was also found that ProTaper and M3 rotary files were more commonly used by dentists in the present study; while, Raoof et al. [10] reported ProTaper and RaCe files as the most commonly used files.

In the present study, dentists with 4-10 years of work experience used rotary files significantly more than other methods. Most dentists also used an electric rotary handpiece, which was used more commonly by those in the private sector and by more experienced dentists. These findings suggest that the use of rotary files is more common among young and experienced dentists. Orifice shaper rotary files were the most commonly used files for canal flaring; while in the study by Raof et al. [10], most dentists used Gates Glidden drills for this purpose. These findings indicate that the use of rotary systems by dentists has increased over the past few years.

In the present study, lateral compaction was the most common root canal obturation technique. Another study also reported that this method was the most commonly used obturation method by dentists [25]. In Iran, lateral compaction is the most commonly used obturation technique [10]. There is no definite information regarding the superiority of a particular obturation technique. Cold lateral compaction method enables good control over filling of the entire canal length with any type of sealer. However, this technique does not enable optimal filling of root canal irregularities compared with the vertical condensation method [25].

Most dentists used formaldehyde-impregnated cotton pellets for pulpotomy in the present study, which was consistent with the results of other studies in Iran and around the world [10, 26]. Although the use of formocresol has been shown to provide the best results, many dentists avoid it due to its carcinogenic and mutagenic effects [26].

In the present study, the most commonly used root canal irrigants were saline (50%) and sodium hypochlorite (31%). However, use of saline is not recommended, and the

need for an antimicrobial solution is clear [27]. Sodium hypochlorite has been introduced as the gold standard for root canal irrigation due to its strong antibacterial effect and tissue dissolving property. The findings of the present study are consistent with those of other studies conducted in Iran [10, 1]; although evidence shows that most dentists use sodium hypochlorite in developed countries [27,16].

In the present study, similar to the study by Raof et al, [10] the most common intracanal medicament used was calcium hydroxide. It has been introduced as the gold standard intracanal medicament [28], which was used by only 3% of general dentists in the present study. The use of calcium hydroxide has been reported to be below 15% in some studies [16,29], although similar results were obtained in Turkey and Europe [30,31].

In the present study, the most commonly used sealers were resin-based and polymerizable sealers; while in the study by Raof et al, [10] zinc oxide-based sealers were most commonly used. Similar results were obtained in other studies [4,30].

According to the results of the present study, it can be argued that although general dentists perform better now than in the past, they need to be continuously trained. Considering the growing knowledge in endodontics, more practical courses related to endodontics should be designed for dental graduates.

Conclusion

The findings of the present study showed that general dentists in southeastern Iran did not comply with some standards. For instance, they mostly did not perform rubber dam isolation and used saline as root canal irrigant. Thus, specific courses and seminars should be held to improve their professional knowledge.

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Conflicts of Interest

The authors have no conflict of interests to declare.

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