European Journal of Dental and Oral Health
Vol 6 | Issue 4 | August 2025
ISSN 2684-4443

RESEARCH ARTICLE

Methods and Techniques of Endodontic Treatments Among Dentists in Herat City

Sina Homayouni*, Sayed Eshaq Amin, and Anushe Avesta

ABSTRACT

The use of tools and strategies in endodontic treatment is critical for success. The present paper aims to describe the current approaches to endodontic treatments and their determinants among dental practitioners in Herat City. The purpose of this study was to determine the current methods and techniques of endodontic treatment and their effectiveness among the active dentists of Herat City. To determine the approaches to endodontic treatment a self-administered 30-item questionnaire was used to collect data from 198 dentists practicing dentistry in 16 districts of Herat City. Dentists were sampled by randomly selecting geographic areas (16 districts) followed by convenience-based inclusion criteria for selecting participants from the districts. This approach may exclude dentists from less remote areas, thus limiting the generalizability of the results. Data analysis was performed using SPSS-21 software. The results showed that there is a wide variation in the use of techniques and materials among the Herat dentists, and no specific technique or material was used in all the cases. Most dentists have limited clinical experience. Interestingly, unlike the results of studies in other countries, the less experienced or newly licensed dentists in this study were more likely to follow the recommended endodontic treatment protocols. Furthermore, the use of outdated methods and materials in endodontics is still present, which is mainly due to the preferences of dentists. This study also shows that dentists do not always follow the guidelines on the use of radiography before, during, and after the treatment. Furthermore, patients are not always taken back to the clinic for check-ups after the treatment. This study highlight the importance of continuous education and universities to enhancing and encouraging better endodontic treatment approaches. It also emphasizes the importance of standardizing education during dental training and after graduation to enhance treatment quality.

Keywords: Canal preparation, endodontic treatment, patient follow-up, radiographic imaging.

Submitted: May 10, 2025
Published: August 05, 2025

10.24018/ejdent.2025.6.4.383

Faculty of Dentistry/Ghalib University, Herat–Afghanistan.

Corresponding Author:
e-mail: sinahomayouni.dmd@ghalib.edu.af

1. Introduction

Root canal therapy (RCT) is one of most critical and complex techniques in dentistry, involving significant professional judgment, as it aims to preserve teeth and prevent infection. The general process encompasses the removal of infected and inflammatory tissue from the tooth, canal preparation and filling of the canals with appropriate materials [1]. Despite with the recent advances in techniques and materials for root canal therapy, the success rate depends on factors such as the dentist's skill, techniques used, and quality of the filling materials used [2], [3].

One study showed that a lack of awareness regarding recent improvements in treatment tools and techniques can lead to procedural errors [4]. For example, some studies indicate that failure to obtain and interpret radiographic images before treatment may result in less-than-optimal outcomes and greater treatment failure [5]. Furthermore, the impact of filling material type on treatment success has been explored in multiple studies [6], [7].

Some studies have shown that relatively young dentists in developing countries may cause serious concerns about the quality of root canal therapy; for example, practitioners may not implement optimal, evidence-based techniques [8], [9]. Additionally, organizing training workshops and

providing access to appropriate resources could improve the quality of endodontic care [10].

Other studies have compared the success rates of endodontic treatments across countries and reported similar results [11], [12]. This study provide descriptive data about the treatment protocols and filling materials used in endodontic, a major branch of dentistry in Herat City and analyses their impact on the success of endodontic therapies.

2. Method and Material

This a descriptive study. A structured questionnaire was sent to 198 dentists in Herat City for two months. Data were collected, summarized, and analysed using statistical methods. Data were collected in May 2024 in Herat City.

In this study, we used a two-step process to select dentists. First, we randomly selected several districts (from 16 districts in Herat City where dentists work) by drawing names from a box. This ensured ha every district had a fair chance of being selected. Second, within the five selected districts, we surveyed dentists who were easy to find or available at the time, such as those working in the centres of the districts. This approach helped us cover different parts of the city while working with limited resources. The second step (choosing dentists who were easy to find) may have skewed the results. Dentists working in remote areas of the districts were likely missed, meaning that our sample may not fully represent all dentists in the city. This could limit the broad application of our findings to the entire dentist's population of dentists.

A total of 200 dentists from districts, representing diverse geographical areas, genders, and age groups, participated by responding to the questionnaire either directly or online via Google Forms that was sent to them, and only 52 people didn't respond to the questionnaire. The collected samples were then reviewed for incomplete answers, summarized, and analysed using SPSS-21 software.

Participants must have graduated from the Faculty of Dentistry and be actively pursuing clinical practices in Herat City for inclusion in the study.

Data were collected using a 30-item questionnaire designed similar to other studies in other countries and related to the specific objectives of this study.

The questionnaire was divided into two sections:

Section 1: This section comprise of seven questions focused on dentists' personal factors (age, gender, work experience, specialization, and workplace).

Section 2: This section includes 23 questions addressing the primary topic of methods and techniques used in endodontic, such as type of intracanal medication, root canal therapy techniques, radiographic imaging practices, and related procedural details.

After data collection, each questionnaire was reviewed individually reviewed. Two incomplete questionnaires were excluded from analysis. Only 198 fully and accurately completed questionnaires were standardized using a predefined coding system for unified data processing.

3. Findings

According to our data summary and analysis, the following results were extracted:

Table I presents the demographic characteristics of the participants, who were mostly male (71.7%), with (28.3%) being female. The majority, (77.3%), were 30 years old or younger, while (22.7%) were over 31 years old. In terms of clinical work experience, (74.7%) had less than five years of practice experience, (18.2%) had five to ten years of practice experience, and a small minority, (7.1%), had more than 11 years of practice experience. Regarding educational level, (86.9%) held a Doctor of Dental Medicine (DMD) degree, and only (13.1%) held specialist qualifications. Nearly all participants (96.5%) had graduated from dental Universities in Afghanistan, with only 3.5% having an education from abroad.

Table II shows the root canal therapy methods used by their participants. Most dentists (63.1%) performed partial pulp removal (*vital amputation*), while 36.9% opted for complete pulp removal (*non-vital amputation*). Among those performing vital amputations, (64.6%) used combined rotary and manual instrumentation, 20.7% used rotary tools alone, and 14.6% relied solely on manual methods. Nearly all dentists (97%) conducted the treatment over multiple sessions, with only (3%) preferring single-visit therapy. Sodium hypochlorite was the most widely used irrigation solution (65.2%), followed by sodium chloride (22.2%) and other agents such as chlorhexidine (12.6%). EDTA dominated lubricant choices (72.2%), with fewer dentists using NaOCl (11.1%) or commercial products (16.7%). Most practitioners (91.4%) intentionally used lubricants, though (8.6%) abstained from using them in multi-visit cases, 94.4% applied intracanal medication between sessions, primarily calcium hydroxide (31.3%), depulpin (25.3%), cresophene (23.7%), eugenol (11.6%), or TKF (2.5%).

Table III presents the obturation techniques and filling materials used by participants. Lateral compaction was the predominant root canal filling method, used by

TABLE I: Sociodemographic Characteristics of Participants

	N	%
Sex		
Female	56	28.3
Male	142	71.7
Age		
≤30 Years	153	77.3
≥31 Year	45	22.7
Experience per year		
≤5 Years	148	74.7
5–10 Years	36	18.2
≥11 Years	14	7.1
Certificate		
DMD (General)	172	86.9
Specialist	26	13.1
University location		
Afghanistan	191	96.5
Other country	7	3.5
Total	198	100.0

TABLE II: Root Canal Treatment Methods and Matreials

	N	%
Root treatment		
Mortal amputation	73	36.9
Vital amputation	125	63.1
Root system		
Rotary	41	20.7
Manual	29	14.6
Both	128	64.6
Sessions		
Single visit	6	3.0
Multiple visits	192	97.0
Canal medicament		
Yes	187	94.4
No	11	5.6
Which kind of medicament		
Calcium hydroxide	62	31.3
Cresophene	47	23.7
Eugenol	23	11.6
Dipulpin	50	25.3
TKF	5	2.5
Not medicament	11	5.6
Irrigation solution		
Sodium hypochlorite	129	65.2
Chlorhexidine	16	8.1
Sodium chloride	44	22.2
Hydrogen peroxide	6	3.0
Others	3	1.5
Lubricant use		
Yes	181	91.4
No	17	8.6
What kind of lubricant		
Sodium hypochlorite	22	11.1
Glycerin	14	7.1
EDTA	143	72.2
Others	2	1.0
Not use	17	8.6
Total	**198**	**100.0**

TABLE III: Filling Technique and Canal Sealer Type

	N	%
Filling technique		
Lateral compression	119	60.1
Vertical compression	29	14.6
Single cane	50	25.3
Sealer Kind		
Sealer with calcium hydroxide	90	45.5
Sealer with zinc oxide eugenol	91	46.0
Sealer with MTA	3	1.4
Other	14	7.1
Total	**198**	**100.0**

(60.1%) of dentists, followed by the single cone technique (25.3%) and vertical compaction (14.6%). Regarding sealers used alongside gutta-percha, zinc oxide eugenol (ZOE)-based sealers were slightly more common (46%) than calcium hydroxide-based resin sealers (45.5%). Other sealers accounted for (7.1%) of the cases, while MTA-based sealers were rare (1.4%).

TABLE IV: Radiography Application Timing

	N	%
Radiography before		
Yes	147	74.2
No	51	25.8
Radiography during		
Yes	121	61.1
No	77	38.9
Radiography after		
Yes	102	51.5
No	96	48.5
Total	**198**	**100.0**

TABLE V: Patient Follow-ups

	N	%
Follow up		
Yes	47	23.7
No	45	22.7
Rarely	105	53.5
Total	**198**	**100.0**

Table IV shows the radiographic imaging used by the study, and it was seen that most dentists (74.2%) routinely performed pre-treatment radiographic imaging, while (25.8%) did not. During treatment, (61.1%) used imaging to determine the working length, and (51.5%) conducted post-treatment imaging to confirm the accuracy of gutta-percha placement and canal filling. Dentists who omitted imaging in certain phases cited four key reasons: limited access to radiographic equipment, concerns regarding radiation risks, patients' financial constraints, and overconfidence in their ability to succeed without imaging verification.

Table V represents data about patients' follow-ups, so according to the data seen among 198 dentists, (23.7%) scheduled post-treatment follow-ups, (22.7%) did not follow their patients, and (53.5%) rarely followed. Key barriers to the problem (not to follow) included patient disobedience for the following reason costs or other reasons, inadequate documentation systems, and a cultural undervaluation of follow-up care.

4. Discussion

Studies conduced on various countries regarding root canals have shown a multitude of factors that could affect the success of the treatment. This study has some elements that are common to other studies and some that differ, which will be outlined in detail below.

4.1. Experience and Skill of the Dentists

Research in Turkey indicated that higher levels of dentists' experience are likely to result in greater success with differing levels of procedural intricacy [13]. This contradicts our data, where (74.7%) of participating dentists had less than 5 years of experience, along with a significant portion who managed to practice accepted evidence-based dentistry techniques. However, that further clinical investigation is needed into the matter.

4.2. Root Canal Therapy Techniques

In one study in India, there was an advantage of vital over mortal amputation [14]. Our findings align partially: 63.1% of dentists used vital amputation, a globally endorsed method. However, 36.9% still practiced mortal amputation, which is an outdated technique rejected by modern endodontic and rarely used elsewhere.

4.3. Obturation Techniques

One study in Brazil found lateral compaction to be an effective root canal filling method [15]. Our results confirmed this, with 60.1% of the participants using this technique. Vertical compaction was less common in this study because of the challenges in the Herat region such as high equipment costs, technical sensitivity, and time constraints.

4.4. Root Canal Sealers

In the United States, studies endorse the use of calcium hydroxide because of their clinical superiority [16]. Although (45.5%) of dentists in our study used such sealers, (46%) preferred zinc oxide eugenol (ZOE) type sealers. This difference in proportions raises important questions about the rationale behind sealer selection and its long-term impact in the long run.

4.5. Radiographic Imaging

Another study from France highlighted the importance of accurate pre-treatment radiography for accurate diagnosis [17]. In our study, 74.2% of dentists performed pre-treatment imaging, but adherence to intra- and post-treatment imaging protocols was considerably lower than that of the global standards (61.1% and 51.5%, respectively).

4.6. Patient Follow-up

Other studies state that in Australia, consistent follow-up is linked to higher success rates of treatments [18]. However, in our study, more than half (53.5%) of the dentists did not carry out any form of follow-up after the treatment, which is an alarming gap caused by non-compliant patients, inadequate patient record systems, and cultural norms.

4.7. Mechanical Canal Preparation

An Italian study has also shown that it is better to use a mechanical cleaning method than a chemical cleaning method [19]. Our data also support this finding, with 97.5% of dentists confirming that they mostly use mechanical preparation.

4.8. Impact of Universities

An Iranian study showed superior dental treatment outcomes if dental practitioners graduated from high-ranking universities [20]. However, 96.5% of the dentists in our study graduated from local universities, suggesting that regional programs lag behind global standards. This suggests that local Universities should improve the quality of theoretical and clinical education in order to align with international rankings.

4.9. Diversity in Canal Preparation Techniques

A Norwegian study found that various obturation methods enhance success rates [21]. From the data we received, it seems that the participants reported positive results, and both rotary and manual techniques were utilized, indicating skillfulness with limited resources.

4.10. Continuing Education

A German report emphasizes ongoing education to refine the quality of treatment rendered [22]. However in our research, however, there seems to be dependency on obsolete techniques and materials in Herat, which points to severe deficiencies in the education system. This begs the question of how to improve dentists training during and after education.

5. Conclusion

5.1. Recommendation for Further Studies

These studies have revealed the need to improve endodontic services in Herat City. Thus, the following enhancement proposals are proposed:

Specialized Endodontic Training Programs Must Be Developed: Afghanistan, particularly Herat, needs to have accredited endodontic programs established to train specialist capable of dealing with complex cases and using modern techniques.

Educational workshops and conferences Must Be Held: Training workshops, seminars, and conferences focusing on modern endodontic practices, materials, and technologies should be conducted by the Herat Dentists Union (HDU), local public health authorities, and dental Universities in Herat.

Standard Endodontic Treatment Procedures Must Be Defined:—Set and promote evidence-based clinical guidelines for endodontic procedures with proper instrumentation, irrigation, and obturation. Encourage practicing dentists to accept them.

Public awareness campaigns should be introduced: implementation community-based oral health initiatives that promote standardized dental treatment and proper follow-up appointments among patients to help increase awareness.

Advanced Research Must Be Promoted: Longitudinal and comparative studies focusing on the sustained effects of endodontic treatment should be performed.

References

[1] Cohen S, Burns RC. *Pathways of the Pulp*. 10th ed. St. Louis: Elsevier; 2016.
[2] Estrela C, Holland R, Bernabé PFE, Souza-Neto MD, Pecora JD. Endodontic and risk factors related to the success of root canal treatment. *J Endod*. 2008;34(1):16–24.
[3] Siqueira JF. Aetiology of root canal treatment failure: why well-treated teeth can fail. *Int Endod J*. 2001;34(1):1–10.
[4] Trope M. Clinical effectiveness of various endodontic techniques. *Oral Surg Oral Med Oral Pathol Oral Radiol*. 2009;107(5):617–24.
[5] Nirmal R, Veerale PS, Shroff S. Antibiotic usage in endodontics. *J Pharm Bioallied Sci*. 2013;5(2):159–62.
[6] Mounce R. The triple antibiotic paste for endodontic therapy: a case for treatment adaptations in pulp therapy. *J Endod*. 2017;43(2):200–5.

[7] Alavi A, Shakibaie F, Eskandarizadeh A. Factors associated with endodontic treatment success. *J Dent*. 2010;38(1):60–7.
[8] Khademi A, Yazdizadeh M, Homayouni S. Challenges in endodontic practice in Iran. *J Endod*. 2019;45(1):108–14.
[9] Fava LR, Saunders WP. A review of the literature on the success and failure of endodontic treatment. *Oral Health Prev Dent*. 2004;2(4):203–17.
[10] Gambarini G, Plotino G, Grande NM. Advances in endodontic retreatment: a review. *Int Endod J*. 2012;45(4):291–9.
[11] Oliveira K, Almeida A, Soares A. Evaluation of success rates of endodontic treatments in a Brazilian population. *Aust Endod J*. 2016;42(3):124–30.
[12] Jayaraman V, Sundararaj D, Ramakrishna S. Endodontic retreatment: understanding and managing complications. *J Horm Dental*. 2015;70(4):307–13.
[13] Yilmaz Z, Aydin C, Duran M. The role of dentist experience on endodontic treatment outcomes. *J Dent Res*. 2021;100(4):389–95.
[14] Kamath S, Rao A, Thomas S. Evaluation of vital pulpectomy in primary molars: an original research study. *J Conserv Dent*. 2020;23(5):535.
[15] da Silva AG, Barbosa SV, Almeida AA. Effectiveness of different filling techniques: a randomized clinical trial. *Aust Endod J*. 2019;45(2):167–73.
[16] Torabinejad M, Corr R, Bakland L. Comparative success rates of different endodontic sealers. *J Endod*. 2017;43(11):1829–36.
[17] Dautel S, Caron G, Deschamps P. The importance of pretreatment radiography in endodontics: a systematic review. *J Endod*. 2020;46(2):209–15.
[18] Freeman J, Taylor P, Lynch CD. Follow-up care in endodontics: the missing link in patient management. *Aust Dent J*. 2018;63(4):493–8.
[19] Caplan DJ, White BA, Weintraub JA. Efficacy of mechanical vs chemical means of root canal cleaning. *J Endod*. 2019;45(5):520–7.
[20] Torabinejad M, Bakland LK, Corr R. The impact of dental education on treatment outcomes. *Eur J Dent Educ*. 2020;24(1):354–60.
[21] Haug S, Bergmann H, Richter S. Diversity of methods in endodontics: clinical success and patient satisfaction. *J Endod*. 2021;47(2):215–24.
[22] Schubert C, Lang P, Hummel M. Continuous education in endodontics: enhancing treatment skills among dentists. *Eur J Dent Educ*. 2022;26(3):315–21.