



# Knowledge and Practice of Iranian Dentists Regarding Post Space Preparation and Coronal Reconstruction of Endodontically Treated Teeth

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## Abstract

**Background:** Due to severe coronal destruction in endodontically treated teeth (ETT), the canal space is often utilized to provide retention for the core material.

**Objectives:** This study aimed to assess the knowledge level and practices of Iranian dentists regarding post space preparation and coronal reconstruction of ETT.

**Methods:** This cross-sectional study was conducted with 117 dentists at Kurdistan University of Medical Sciences in 2021. Data were collected using a two-part questionnaire. The first part included 6 questions regarding the demographic information of the participants. The second part comprised 10 questions regarding the methods of post space preparation and coronal reconstruction of ETT. SPSS-20 software was used to analyze the data, calculating frequency (%), mean, and standard deviation.

**Results:** 44.4% of the participants used amalgam along with a prefabricated post, 59% correctly identified the definition of the ferrule effect, and 87.2% believed that the ferrule effect increases fracture resistance. Additionally, 39.3% reported preparing the post space immediately after obturation; 91.5% used rotary instruments for removing root filling material, 93.2% reported cleaning the post space prior to cementation of the intracanal post, and 35.9% used saline for this purpose. Moreover, 72.9% believed that teeth with post and core necessarily require a prosthetic crown, and 94% used full-coverage crowns for ETT. Coronal fracture was reported by 62.4% as the most common cause of failure of ETT.

**Conclusions:** The knowledge level of dental clinicians regarding post space preparation and coronal reconstruction of ETT was moderate, while their practice level was poor. The most common variables that had a significant relationship were age and academic degree.

**Keywords:** Coronal Reconstruction, Endodontically, Treated Teeth, Post Space Preparation

## 1. Background

The success of endodontically treated teeth (ETT) depends not only on optimal endodontic treatment but also on effective coronal reconstruction (1). Evidence indicates that failure of restorative treatment, rather than endodontic treatment, is the primary cause of ETT failure (1-3). Reconstruction of ETT can be accomplished using a variety of dental materials and techniques, ranging from direct composite resin or amalgam restorations to post and core and partial or full-coverage prosthetic crowns (4, 5). A core is used to reconstruct the lost coronal structure, while an intracanal post is placed

in the root canal system to support the core (4). An effective restoration should not only restore aesthetics and function but also prevent microbial leakage (5). Besides the type and design of the intracanal post, the amount of residual tooth structure and the presence of the ferrule effect (a minimum of 1.5 to 2 mm of residual tooth structure) are the most influential factors on the long-term success of ETT (6). Endodontic pluggers, Peeso reamers, and Gates-Glidden drills are commonly used for post space preparation. During post space preparation, the root filling material may be displaced or voids may develop in the root filling, potentially leading to bacterial reinfection and failure of

endodontic treatment. The timing of post space preparation—whether immediate or delayed—can affect the outcome of endodontic treatment (7). Despite the existing scientific literature on various reconstruction methods for ETT, no consensus exists regarding a single standard method applicable to all teeth. Dental clinicians adopt different methods for ETT reconstruction based on their experiences and various references.

Several studies have explored the knowledge and practices of dental clinicians in different parts of the world (1, 2, 8-16). However, no similar study has been conducted in Iran to date.

## 2. Objectives

Therefore, this study aimed to assess the knowledge and practices of Iranian dentists regarding post space preparation and reconstruction of ETT. Identifying areas of weakness among dental clinicians can inform the design of continuing education courses to enhance their knowledge and improve their practice.

## 3. Methods

A questionnaire was designed with two parts. The first part comprised 6 questions about the demographic information of the participants (age, gender, workplace, work experience, academic degree, and participation in continuing education courses and congresses). The second part included 10 questions regarding the knowledge and practice of Iranian dentists concerning post space preparation and coronal reconstruction of ETT. Some questions were based on previous studies (2, 4, 8, 13, 15-17). The validity of the questionnaire was confirmed by several experts, and its reliability was approved by a statistician. Dental clinicians who performed ETT reconstruction and were willing to participate in the study were enrolled after signing informed consent forms. The questionnaire was administered to 117 dental clinicians. After collection, the questionnaires were coded, and the data were anonymously gathered and analyzed using SPSS version 20 (IBM Corp., Armonk, NY, USA). Frequency distributions were used for descriptive statistics. For analytical purposes, analysis of variance, chi-square tests, and *t*-tests were employed; for non-parametric variables, Mann-Whitney and Kruskal-Wallis tests were used.

## 4. Results

The mean age of the participants was  $38.41 \pm 9.38$  years (range 25 to 58 years). Other demographic factors,

including gender, workplace, work experience, academic degree, and participation in continuing education courses and congresses, are shown in Table 1.

The results extracted from the questionnaires (Table 2) revealed that approximately half (44.4%) of the dental clinicians used amalgam as the core build-up material when using prefabricated posts. About 59% correctly identified the definition of the ferrule effect, demonstrating good knowledge. Additionally, 87.2% believed that the ferrule effect increases the fracture resistance of teeth, indicating strong knowledge in this area. Furthermore, 39.3% reported post space preparation immediately after root canal obturation. The majority of dental clinicians (91.5%) used rotary instruments for the removal of root filling material, and 93.2% reported cleaning the canal prior to cementation of the intracanal post, reflecting excellence in this practice.

Saline was the most commonly used irrigant for cleaning the post space (35.9%). Of all, 72.6% believed that teeth with post and core necessarily require a prosthetic crown, reflecting insufficient knowledge. Additionally, 94% reported using full-coverage crowns for ETT, with a very low prevalence of partial crowns. Over half of the dentists (62.4%) identified coronal fracture as the most common cause of failure of ETT, indicating that their practice in this area was not optimal.

In the analytical results, there was no significant relationship between demographic characteristics and the first, second, third, eighth, ninth, and tenth questions ( $P > 0.05$ ). However, in the fourth question, a significant relationship was found between the age of dentists and their participation in continuing education courses and congresses ( $P = 0.03$ ). Specifically, 53.4% of dentists under 30 years prepared the post space immediately after obturation, while 39% of dentists over 30 years prepared the post space one week after obturation. Additionally, 41.2% of dentists who participated in continuing education courses and congresses prepared the post space immediately after obturation, compared to 45% of dentists who did not participate in such courses and congresses, who prepared the post space 24 hours after obturation.

In the fifth question, a significant relationship was observed between age and the instrument used for removing root filling material ( $P = 0.032$ ). Dentists over 30 years of age predominantly used hand files and endodontic pluggers for this purpose (98.3%), whereas dentists under 30 years used rotary instruments (Peeso reamer and Gates-Glidden drills) more frequently (84.7%).

**Table 1.** Demographic Factors of the Participants (n = 117)

Demographic Variables	No. (%)
<b>Gender</b>	
Male	88 (75.2)
Female	29 (24.8)
<b>Work place</b>	
Private office	65 (55.6)
Private office and dental clinic	52 (44.4)
<b>Work experience (y)</b>	
< 6	34 (29.1)
6 - 10	26 (22.2)
10 - 16	1 (16.2)
16 - 20	12 (10.3)
> 20	25 (21.1)
Retired	1 (0.9)
<b>Academic degree</b>	
General dentist (DDS)	103 (88)
Specialist (MS)	14 (12)
<b>Participation in continuing education courses and congresses</b>	
Yes	97 (82.9)
No	20 (17.1)

For the sixth question, a significant relationship was found between academic degrees and the practice of cleaning the canal prior to cementation of the post ( $P = 0.042$ ). General dentists were more likely to wash the canal compared to specialist dentists (95.2% vs. 78.6%). Among the irrigants used for cleaning, general dentists more frequently used sodium hypochlorite (36.9%), while specialist dentists more often used saline (71.4%). Both groups used chlorhexidine relatively equally (20.4% and 21.5%), and the use of EDTA was reported only by general dentists (7.8%).

## 5. Discussion

The survival rate of ETT is influenced by various factors, including the number of adjacent teeth, occlusal contacts, the position of the tooth in the dental arch, apical conditions, the thickness of residual dentinal walls, and the type of final restoration. Some of these factors can be controlled by dentists (14). Due to inadequate residual coronal structure, the canal space is often used in most ETT cases to provide retention for the core material (18). This study aimed to assess the knowledge level and practice of Iranian dentists regarding post space preparation and coronal reconstruction of ETT.

A total of 117 eligible dental clinicians (103 general dentists and 14 specialists) were enrolled, with a mean age of 38.41 years (range 25 to 58 years). Of the participants, 88 (75.2%) were male and 29 (24.8%) were female. Among them, 65 (55.6%) had only private practice, while 52 (44.4%) worked both in their private office and in a dental clinic. Regarding work experience, 34 (29.1%) had less than 6 years, 26 (22.2%) had 6-10 years, 10 (16.2%) had 10-16 years, 12 (10.3%) had 16-20 years, 25

(21.1%) had over 20 years of experience, and 1 dentist was retired (0.9%). Additionally, 97 dentists (82.9%) reported regular annual participation in continuing education courses and congresses. Due to the small number of specialists in this study, no comparison was made between general dentists and specialists.

In selecting core build-up materials for use with a prefabricated post, amalgam was the most commonly chosen material (44.4%), followed by composite resin (33.3%). This finding aligns with the results of Hussey and Killough (10). However, composite core materials were more commonly used in studies conducted in Germany, Turkey, Saudi Arabia, and India (2-5, 13, 16). In a study by Seow et al. (19), resin materials were more frequently used for anterior teeth, while amalgam was more commonly applied to posterior teeth. The present results indicate that, despite concerns about mercury toxicity and aesthetic issues, amalgam is still widely accepted in Iran. Composite resin, which can form a chemical bond with many intracanal post systems as well as the tooth structure, increases retention. Additionally, composite resin has high tensile strength and allows for crown preparation immediately after polymerization. It is also suitable for use under translucent crowns as it closely resembles the tooth color. However, drawbacks of composite resin include polymerization shrinkage and the need for complete isolation (20). No significant relationship was found between the type of core build-up material and demographic factors.

Regarding the definition of the ferrule effect, over half of the dentists (61.5%) selected the correct definition, while the remainder either chose an incorrect definition or were unfamiliar with the term. The ferrule effect is crucial for the long-term success of

**Table 2.** The Questionnaire Used for Data Collection and the Frequencies and Percentages of Them

Question	No. (%)
<b>In case of using prefabricated posts, which core build-up material would you prefer?</b>	
Composite resin	39 (33.3)
Glass ionomer	3 (2.6)
Amalgam	52 (44.4)
Resin-modified glass ionomer	19 (16.2)
Other	4 (3.4)
<b>Which statement better defines the ferrule effect?</b>	
Part of the cast core with a bevel for the core	17 (14.5)
Cementation of a crown that extends 1.5 to 2 mm apical to the finish line of the core	69 (59)
I do not know	16 (13.7)
Others	15 (12.8)
<b>Does a ferrule under the core increase the fracture resistance?</b>	
Yes	102 (87.2)
No	5 (4.3)
I do not know	10 (8.5)
<b>How long after root canal obturation do you prepare the post space?</b>	
Immediately after obturation	46 (39.3)
24 hours after obturation	36 (30.8)
One week after obturation	31 (26.5)
Several weeks after obturation	4 (3.4)
<b>How do you empty the root filling material to prepare a post space?</b>	
Rotary instruments (Peeso reamer and Gates-Glidden drills)	107 (91.5)
Hand files and endodontic pluggers	9 (7.7)
Solvents like chloroform	1 (0.9)
<b>Do you clean the post space prior to cementation of post?</b>	
Yes	109 (93.2)
No	8 (6.8)
<b>Which of the following do you use to clean the post space?</b>	
Saline	42 (35.9)
Sodium hypochlorite	39 (33.3)
EDTA	8 (6.8)
Chlorhexidine	24 (20.5)
Other	4 (3.4)
<b>Does a tooth with post and core necessarily require a prosthetic crown?</b>	
Yes	85 (72.6)
No	6 (5.1)
<b>Depends on the tooth position (anterior/posterior)</b>	
I do not know	1 (0.9)
<b>Which crown type do you use for ETT?</b>	
Full crown	110 (94)
Inlay crown	2 (1.7)
Onlay crown	3 (2.6)
Overlay crown	2 (1.7)
<b>What is the most common reason for failure of ETT?</b>	
Failure of endodontic treatment	22 (18.8)
Coronal fracture	73 (62.4)
Crown fracture or debonding	14 (12)
Root fracture	7 (6)
Others	1 (0.9)

restorations involving an intracanal post, as it improves resistance form (20). Given the importance of the ferrule effect for the prognosis of reconstructed ETT, a higher number of dentists should be familiar with this term.

In the present study, 87.2% of dentists believed in the reinforcing effect of the ferrule effect, which is consistent with the results of a study conducted in Saudi Arabia (16) and higher than the rates reported in studies conducted in Greece, Germany, and northern Saudi Arabia (2, 8, 9, 17). According to scientific literature, the presence of the ferrule effect is a key principle in preventing clinical failure (21). In fact, the ferrule effect, rather than the post material, is crucial for preventing treatment failure (22-25).

Regarding post space preparation after root canal obturation, the majority of dentists (39.3%) reported preparing the post space immediately after obturation. The next most common practice was preparing the post space 24 hours after obturation (30.8%). Immediate post space preparation may be preferred by dentists due to their familiarity with canal anatomy. In a study by Alenzi et al. (16), 72% of dentists reported preparing the post space within the first week after obturation. Similarly, Kavlekar (4) found that 78% to 81% of general dentists, prosthodontists, and endodontists prepared the post space one week after root canal obturation. Hussey and Killough (10) also reported that the majority of dentists (42%) performed post space preparation one week after obturation. Scientific evidence indicates that the time

interval between root canal obturation and post cementation significantly affects the retention of fiber posts (26). Aydemir et al. (18) found that while the timing of post space preparation did not significantly affect the apical seal, the quality of root filling was crucial for its durability. A systematic review in 2021 demonstrated that delayed post space preparation negatively affected the apical seal (7). There was a significant relationship between the age of dentists and their participation in continuing education courses and congresses. The majority of dentists under 30 years prepared the post space immediately after obturation, whereas those over 30 years generally prepared the post space one week after obturation. Furthermore, dentists who participated in continuing education courses tended to prepare the post space immediately after obturation, while those who did not participate prepared the post space 24 hours after obturation.

Regarding the method used to empty the canal for post space preparation, the majority of dental clinicians (91.5%) reported using rotary instruments.

In a study by Morgano et al. (11) (1994), over 70% of dentists reported using rotary instruments for this purpose. The high prevalence of rotary instrument use may be attributed to a lack of sufficient knowledge about the possibility of emptying the canal with manual instruments and the unavailability of necessary equipment. When preparing post space immediately after endodontic treatment, an endodontic plugger is preferably used to preserve the apical seal and to prevent unnecessary dentin removal (27, 28). There was a significant relationship between age and the instrument used for removing the root filling material. Dentists over 30 years old mostly used hand files and endodontic pluggers, while dentists under 30 years old more frequently used rotary instruments (Peeso reamers and Gates-Glidden drills).

Root canal irrigation is recommended prior to intracanal post cementation to eliminate debris and the smear layer created during root canal treatment (4). Among the irrigants compared, saline was the most commonly used by dentists in the present study (35.9%), followed by sodium hypochlorite (33.3%). In a study by Habib et al. (13), saline and sodium hypochlorite were used by 45% and 41% of dentists, respectively. Kavlekar (4) found that the majority of prosthodontists (76%) and general dentists (36%) used saline, while most endodontists (66%) preferred sodium hypochlorite. Akbar (2) reported that sodium hypochlorite was the first choice of participants, followed by saline. Evidence indicates that sodium hypochlorite does not significantly affect the bond strength of fiber posts to

canal walls (29). There was a significant relationship between academic degrees and canal cleaning before post cementation. General dentists were more likely to wash the canal compared to specialist dentists. Among the irrigants used for cleaning, general dentists more frequently used sodium hypochlorite, while specialist dentists preferred saline. Both groups used chlorhexidine relatively equally, and only general dentists mentioned using EDTA.

Regarding the need for a prosthetic crown for teeth with post and core restoration, the majority of dentists (72.6%) responded positively. In a study by Alenzi et al. (16), 95.1% of participants agreed with this statement, while 50 - 70% of participants in a study by Magdalena et al. (1) also agreed. These findings suggest that ETT are more susceptible to fracture than vital teeth due to the extensive removal of tooth structure during endodontic treatment and carious dentin removal. Therefore, a prosthetic crown is needed to preserve their structural integrity (16). The selection of the final restoration for ETT should be based on the quantity and quality of the residual tooth structure, occlusion, esthetics, cost, and whether the tooth is anterior or posterior (19). No significant relationship was found between the need for a prosthetic crown for teeth with post and core restoration and demographic characteristics.

Regarding the selection of crown type for ETT, 94% of dentists chose full-coverage crowns, while a lower percentage (1.7% to 2.6%) selected partial-coverage crowns, similar to the findings of Seow et al. (19). This preference may be due to dentists' low familiarity with conservative partial restorations or the high degree of destruction often seen in ETT. No significant relationship was found between the choice of crown type and demographic characteristics.

Regarding the reasons for the failure of ETT, coronal fracture was the most commonly reported cause (62.4%), followed by failure of root canal treatment (18.8%). Akbar (2) reported that coronal fracture was the most common cause of failure (45%), followed by endodontic treatment failure (31%) and root fracture (18%). In a study by Kavlekar (4), the majority of prosthodontists and general dentists reported that endodontic treatment failure was the most common cause of treatment failure, while endodontists believed that loss of retention of the intracanal post was the most common cause. No significant relationship was found between the reason for the failure of ETT and demographic characteristics.

Understanding the type of treatment failure in different populations can enhance knowledge and improve dental practices. This can be achieved through

educational workshops and continuing education courses. The high prevalence of coronal fracture reported in this study may be attributed to the poor performance of the study population regarding the method of coronal reconstruction in ETT.

### 5.1. Conclusions

- Amalgam was the most commonly used restorative material for core build-up along with prefabricated posts.

- Most dentists selected the correct definition of the ferrule effect.

- The majority of dentists reported using rotary instruments to remove gutta-percha from the canal.

- Most dentists reported cleaning the post space prior to cementation of the intracanal post.

- Saline was the most commonly used irrigant for cleaning the canal prior to cementation of the intracanal post.

- Most dentists stated that teeth with post and core would require prosthetic crowns.

- The majority of dentists selected full-coverage crowns for ETT.

- Coronal fracture was reported as the most common cause of treatment failure in ETT.

- Among the demographic variables, age and academic degree were the most common variables with a significant relationship.

- The knowledge level was moderate, while the practice level was poor.

### Footnotes

**Authors' Contribution:** Shiva Mahboubi and Elahe Kebriyai participated in the design of the study and monitored the progressive report of the study and writing the article.

**Conflict of Interests Statement:** The authors declare no conflict of interest.

**Data Availability:** The dataset presented in the study is available on request from the corresponding author during submission or after publication.

**Ethical Approval:** This article is the result of a thesis with the ethics number: [IR.MUK.REC.1398.283](#) was approved by ethics committee of the Kurdistan University of Medical Sciences on Feb 17 th 2020.

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**Informed Consent:** Dental clinicians who performed ETT reconstruction and were willing to participate in the study were enrolled after signing informed consent forms.

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