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Original Article

Strategies of Endodontically Treated Teeth Restoration: A Survey among General Dental Practitioners and Specialists, in Tripoli, Libya

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Abstract

Endodontically treated teeth (ETT) are more likely to fracture than healthy teeth if left unrestored due to reduced modulus of elasticity and loss of tooth structure. Endodontically treated teeth should be prosthodontically managed properly to add life to the teeth, and hence this study aimed to determine opinions, techniques, and materials used on how to restore ETT among general dentists and specialists in Tripoli, Libya, both in the public and private sectors. A two-section questionnaire was distributed either by email (Google Forms) or in hard copies to dentists in Tripoli, Libya. The first section collected demographic information, and the second section of the questionnaire contained 14 multiple-choice questions focused on the treatment strategies of ETT and the materials and methods used for the treatment. Descriptive statistics were used to analyze the data, followed by Chi-square or Fisher's exact test to compare the responses to different questions among general dentists and specialists. $P < 0.05$ was considered statistically significant. A total of 176 questionnaires were completed. 77% of specialists unbelieve that a post reinforces ETT and reduces fracture probability and they placed posts more frequently as compared to general dentists. 85% of specialists and 58% of general dentists believed that ferrule increases fracture resistance, Fiber reinforced posts were preferred by 100% of specialists. Self-adhesive resin cement was selected by 54% of specialists and 10% of general dentists for post-cementation. Most of the participants reported a frequent or always use of extra coronal restoration in the tooth with treated by post and core. Composite resin (71%) was preferred for the core foundation, followed by glass ionomer (23%) among the general dentists. Composite resins were the core build-up material of choice (71%), followed by glass ionomer (23%). Amalgam was rarely used (3%) among the general dentists. Within the limitations of the present study, there were differences in practices followed in the restoration of ETT among the different specialties and general practitioners studied in Tripoli, Libya.

Keywords: *Endodontically-Treated Teeth, Post, Core, General Dentists, Specialists.*

Introduction

Restoring function, phonetics, and aesthetics are the three main objectives of endodontically treated teeth (ETT) restoration [1]. Because of the loss of tooth structure and the alteration in their physical features, such as reduced modulus of elasticity, teeth that have undergone endodontic treatment are weaker and more susceptible to fracture [2]. It has been reported that the primary cause of endodontic treatment failure is restoration failure rather than the endodontic treatment itself. Consequently, one crucial factor in determining whether a tooth survives endodontic therapy is the placement of an appropriate coronal restoration [3]. Following endodontic treatments, various restoration patterns have been utilized [4], including posts and cores, direct resin composites or amalgam fillings, and partial- or full-coverage crowns. Additionally, clinicians now have more options for restorations because adhesive techniques are now more widely available [5]. Certain factors affect the selection of restoration of ETT. The tooth's location within the dental arch, the amount of coronal tooth structure that remains, and whether or not it acts as an abutment for a fixed or removable prosthesis are the most crucial variables [6,7]. Posts are recommended when the coronal structure is insufficient to support a core build-up [4,8]. To improve the resistance of the remaining dental tissue of ETT, a wide range of post designs and materials have been introduced [9], including metal posts and cores, zirconium posts and cores, fiber posts (FP), and composite cores (CC) [10]. Traditionally, in these cases, cast metal posts and cores have been utilized to provide the required retention for the prosthodontic restoration that follows [11]. Prefabricated post systems are more widely used by dentists due to their practicality, low cost, and minimal invasiveness when compared to cast metal post and core systems [12].

However, fiber posts have gained popularity due to their flexibility and modulus of elasticity, which is more similar to that of dentin when compared to metal posts [13], and the distribution of stress to the tooth and the surrounding structures that protect the tooth against fracture [14]. Numerous studies about post-endodontic restoration practices and knowledge have been published. However, there is a lack of such studies in Tripoli. This study aimed to determine opinions, techniques, and materials used on how to restore ETT among general dentists and specialists in Tripoli, Libya, both in the public and private sectors.

Methods

The questionnaire used in the current study was modified from similar studies performed in other parts of the world [8,15,16]. The questionnaire was developed using an online web-based application (Google Forms), A portion of the questionnaires were distributed electronically, while the remainder were distributed personally to nearby dental clinics. The questionnaire asked for anonymous responses to overcome any reservations about participation. The purpose of the survey was included in the questionnaire. The survey was conducted anonymously, so those who did not respond to the survey could not be identified, and only anonymized data from the respondents were included in the study.

The first part of the questionnaire related to basic demographic details including educational qualifications, gender, and years of experience. The second part of the questionnaire contained 14 multiple-choice questions focused on the treatment strategies of ETT and the materials and methods used for the treatment. Two of these questions were conceptual and focused on the reason for post-placement and the ferrule concept. The rest of the questions asked about the post type (prefabricated metallic, prefabricated nonmetallic or cast post and core), core type (amalgam, composite resin, glass-ionomer, or other), luting cement type (zinc phosphate, zinc polycarboxylate, glass-ionomer, adhesive resin, or other) and crown type (full metal, full ceramic, metal ceramic, or other).

A pilot study was performed on a random sample of dentists (n = 20), and the questionnaire was modified according to the feedback obtained.

Descriptive statistics were used to analyze the data, followed by Chi-square or Fisher's exact test to compare the responses to different questions according to gender, qualification (general practitioners versus specialists), years of experience, and $P < 0.05$ was considered statistically significant. All statistical analyses were conducted using IBM Statistical Package for Social Science for Windows (SPSS, Version 23, SPSS Inc., IBM, Somers, New York, NY, USA).

Results

Demographic Information

A total of 176 questionnaires regarding the treatment strategies for the restoration of ETT were completed in Tripoli, Libya. The questionnaire was sent to 240 dental practitioners, out of which 176 of them responded. The response rate to this questionnaire was 73.3%.

The demographics of the dental practitioners are shown in (Table 1). Most of the participants were general dental practitioners without a specialty (70.5%), while only (29.5%) were specialists. (38.5%) of the specialists were endodontists, and (38.5%) were prosthodontists, the remaining (23%) were other specialists such as oral surgeons, orthodontists, pedodontists, periodontologists, and oral and maxillofacial radiologists. Most of the participants had clinical experience of less than 5 years (29,5%) and more than 15 years (20,5%). Moreover, most practitioners were females (66%), while only (34%) were males.

Table 1. Gender and educational information of the participants (n=176)

Characteristic	Frequency	%
Gender		
Male	60	34%
Female	116	66%
Qualifications		
General Dentist	124	70.5%
Specialist	52	29.5%
Specialty		
Prosthodontist	20	38.5%

Endodontist	20	38.5%
Other	12	23%
Years of Experience		
1 - 5	52	29.5%
6 - 10	44	25%
11 - 15	44	25%
> 15	36	20.5%

The answers of the participants regarding strategies and materials used in the treatment of ETT according to qualification are shown in (Table 2). Regarding the use of posts in dental treatment, it showed a positive link (P = 0.043). That is, 98% of the specialists use post in treatment of ETT, whereas just 74% of general dentists do the same.

The results of the study indicated that whereas 42% of general dentists think that every ETT should have a post, 100% of specialists disagree. When qualification was cross-tabulated against the belief that the post reinforces an ETT and lowers the fracture probability (P = 0.013) and the belief that producing a ferrule enhances fracture resistance (P = 0.004), the study demonstrated statistical significance. It was reported by specialists (77%) and general dentists (35%), respectively. Additionally, 85% of specialists and 58% of general dentists agreed that adding a ferrule increases the material's resistance to fracture from ETT.

Furthermore, (69%) of the study sample's specialists reported that when deciding between prefabricated and custom-made posts, they restored (ETT) based on the amount of remaining tooth structure, and (23%) of general dentists selected fewer clinic visits.

Of the participants, general dentists made up 55% of those who reported using prefabricated fiber posts, whereas just 6% reported using prefabricated metal posts. Furthermore, prefabricated fiber posts were reported to be used by 99% of specialists. In terms of post designs, tapered posts were preferred by 22% of general practitioners and 31% of specialists.

A statistically significant correlation was observed between the type of custom-made post and core used, and the qualification (P= 0.03). This means that although 7% of specialists use posts made of zirconia, 77% of specialists use base metal, and 16% of general dentists choose posts made from a base metal alloy, (26%) prefer zirconia custom-made posts.

When it came to the luting cements used for the post-cementation, specialists who made up 54% of the study sample reported using self-adhesive resin cement, compared to dual polymerized adhesive cements used by 38% and resin-modified glass ionomer cements by 8% of the participants. Furthermore, among the general dentists in the study group, 55% reported utilizing dual polymerized adhesive cements.

There were no statistically significant variations seen between the gender and years of experience groups.

Table 2. The answers of the participants regarding strategies and materials used in treatment of ETT according to qualification (n=176)

Question	**General dentists**	**Specialists**	**P value***
1. Do you use post in your treatment?			
Yes	74%	98%	0.043*
No	36%	2%	
2. Which type of post do you usually use?			
Prefabricated posts	61%	85%	0.127
Custom made posts	13%	15%	
I don’t use posts	26%	0%	
3. Do you believe that every ETT must receive a post?			
Yes	42%	0%	0.013*
No	55%	100%	
I don’t know	%3	0%	

4. Do you believe that a post reinforces an ETT and reduces the fracture probability?			
Yes	45%	23%	0.013*
No	35%	77%	
I don’t know	20%	0%	
5. Do you believe that creating a ferrule increases fracture resistance?			
Yes	58%	85%	0.004*
No	0%	15%	
I don’t know	42%	0%	
6. What is the main criterion in choosing between prefabricated and custom-made posts?			
Remaining tooth structure	35.4%	69%	0.199
Ease of use	19.4%	15%	
Reduced number of visits	23%	0%	
Cost	6.4%	0%	
Esthetic purposes	0%	8%	
Tooth location	3%	0%	
Canal width	6.4%	8%	
Other	6.4%	0%	
7. If you use prefabricated posts, which type do you mostly use?			
Fiber reinforced posts	55%	99%	0.035*
Metal-based posts	6%	1%	
Ceramic based posts	13%	0%	
I don't use prefabricated posts	26%	0%	
8. When you use prefabricated metal posts, which design do you mostly prefer?			
Parallel sided	10%	0%	0.048*
Tapered	22%	31%	
Combined parallel-tapered	10%	0%	
Screw type	16%	0%	
Split flexible	3%	15%	
Threads	0%	8%	
Other	0%	15%	
I don't use prefabricated metal posts	39%	31%	
9. Which type of custom-made post and core do you mostly use?			
Base metal	16%	77%	0.003*
Titanium	6.5%	8%	
Zirconia	26%	7%	
I don't use custom-made posts	45%	8%	
Other	6.5%	0%	
10. Which type of cement do you use for post-cementation?			
Dual polymerized adhesive	55%	38%	0.033*
Self-adhesive resin	10%	54%	
Glass ionomer	16%	0%	

Resin-modified glass ionomer	6%	8%	
polycarboxylate	3%	0%	
Other	10%	0%	
11. Which type of core build-up do you mostly prefer to use with prefabricated posts?			
Composite resin	71%	100%	0.191
Glass ionomer	23%	0%	
Amalgam	3%	0%	
Other	3%	0%	
12. When do you usually insert posts into the canal after obturation?			
After 24hrs after obturation	36%	70%	0.06
One week after obturation	32%	15%	
Several weeks after obturation	6%	15%	
Other	26%	0%	
13. Should the tooth with the post and core be crowned?			
Yes	68%	100%	0.066
No	26%	0%	
I don't know	6%	0%	
14 Which crown material do you usually indicate?			
Full metal	7%	7%	0.650
Full ceramic	48%	62%	
Porcelain fused to metal	35%	31%	
Other	10%	%	

**Result of Chi-square statistic. P≤0.05 was considered significant for this study.*

Discussion

Preserving the natural tooth structure and preserving the stability of the dental arch are the goals of endodontic and restorative dentistry [17].

This study aimed to collect additional data regarding the various endodontic post systems and the reasoning behind the selection of these systems by general dentists and specialists employed in the public and private sectors of Tripoli, Libya.

The majority of participants in this survey-based study 98% of specialists and 74% of general dentists used an endodontic post during the treatment of endo-treated teeth (ETT). Furthermore, the results of this study support the findings of other studies of a similar nature [8,18,19]. Showing that 61% of general dentists and 85% of specialists preferred to use prefabricated posts over custom-made posts and cores. This trend may be because the use of prefabricated posts has simplified the restorative procedure, as all steps can be completed chairside in one visit with acceptable clinical success [20].

Tooth type and remaining tooth structure (remaining walls) are the primary determinants of tooth longevity [21]. Posts are recommended when the coronal structure is insufficient to support a core build-up [4], results obtained in this study showed that, the majority of participants (100% of specialists and 55% of general dentists) disagree with the opinion that all ETT should be treated with a post and core restoration. These findings were supported by Alenzi A et al 2018 [8], who explained that teeth that have experienced a less material loss can be restored without posts. Also, the results of the current study were contrary to the consensus in the literature [22, 23].

Tooth resistance to fracture is largely dependent on the amount of root dentin that remains after access cavity preparation and post-space preparation [24]. The main purpose of the post is to preserve the integrity of a coronal restoration on a tooth with extensive loss of coronal structure [10,25]. The current study found that (77% of specialists and 45% of general dentists) believed that a post does not reinforce ETT and reduce fracture probability. Kavlekar A et al 2016 [26], have a similar pattern of agreement with our result.

The ferrule is considered a key element in tooth preparation when restoring a tooth using a post. It helps to resist occlusal forces, maintain cement tightness, and minimize stress concentration on restoration using posts [27]. The percentage of the respondents who believed in the ferrule increase fracture resistance averaged approximately (85% of specialists and 58% of general dentists). This finding concurs with Karzoun W et al 2015[28] and Kim AR et al 2017[29], who found that the presence of ferrule is considered a cornerstone for avoiding clinical failures. Some authors have reported that ferrule placement does not improve the fracture resistance of teeth restored with cast dowels and prefabricated metal dowels [30].

Several factors influence the choice of post type, which can be either custom-made cast post and core or prefabricated. In the current survey, 35.4% of general practitioners and 69% of specialists claimed that the main factor influencing the decision to use a prefabricated post or custom-made post and core system was the amount of tooth structure that remained. This finding could have one explanation in that the need for custom-made posts and cores increases with the loss of tooth material. Unlike prefabricated posts, these components allow for closer adaptation to the post space [31]. Since the custom-made design provides a good fit for the prepared post space, it is indicated for elliptical or flared canals where the prefabricated posts fail to adequately adapt to the canal [31].

Among dentists who use prefabricated posts, most of them use the fiber-reinforced post. 99% of the specialists use fiber post in their treatment of ETT, whereas just 55% of general dentists do the same. This could be because fiber posts have a similar modulus of elasticity to that of dentin, which may decrease the chances of root fracture in ETT [32,33]. On the other hand, prefabricated metal posts were preferred by dentists in Germany, and Switzerland [22, 34].

Regarding dentists who use custom-made post and core, 77% of the specialists utilized a base metal, custom-made cast post and core. The lower cost of the material compared to custom-made zirconia posts and cores, as well as gold and titanium alloys, can be used to explain this outcome.

Study participants, comprising 55% of general dentists and 100% of specialists, expressed a preference for composite resin as the most commonly used core build-up material when used with prefabricated posts. This explains why resin-based composite core materials are more widely used because of their ability to chemically bond to the tooth structure and resemble it in terms of hardness and fracture toughness [35]. This finding is in agreement with Naumann M et al 2015, who concluded that Adhesive composite core build-ups with and without fiber posts were the predominant treatment approach to restore ETT in Germany [19].

Among the participants, 100% of specialists and 68% of general dentists, reported restoring ETT with post and core followed by the crown, In this study, regarding the use of the luting cement for the cementation of the post, 54% of the specialists, reported using self-adhesive resin cement and 38% using dual polymerized adhesive, whereas, 8% of them using resin-modified glass ionomer In addition, 55% of the study sample were general dentists, reported using resin cements,16% of them using glass ionomer. The result of the present study can be explained by the fact that resin-based materials exhibited more favorable physical and chemical properties than glass ionomer cements [36]. In contrast, a study by Syed RH et al 2014, in his study concluded that glass ionomer as luting cement was common [16].

The limitation of this survey-based study is that no distinction was made between the restoration of anterior and posterior teeth.

Conclusion

This study showed that there were differences in practices followed in the restoration of ETT among the different specialties and general practitioners studied in Tripoli, Libya.

The use of the posts for restoring ETT was common among the participants, and the majority unbelieved that it reinforces the ETT. The use of fiber-reinforced posts was the preferred technique, and the use of composite resin as a core material and adhesive resin as a luting cement was common.

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