KNOWLEDGE AND PRACTICE OF RESTORING ENDODONTICALLY TREATED TEETH BY DENTISTS IN NORTHERN SAUDI ARABIA

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Abstract

The aim of this study was to determine the knowledge, current approaches, techniques and practices for the restoration of endodontically treated teeth (ETT) among general dentists and specialists in northern Saudi Arabia.A standard questionnaire based survey containing 16 multiple choice questions about techniques and treatment methods, frequency of post, type of post, choice of luting cement, core material, reason for failure of endodontic treatment was distributed by hand and through email among 255 general dentists and specialists. The data was processed by using SPSS statistical software. The majority of clinicians (54%) believed that post reinforces the remaining tooth structure and reduces fracture probability. The ferrule effect was considered an important factor in increasing fracture resistance of the ETT (72%). The preferred technique for restoring ETT was core material along with 1-2 mm of ferule followed by prefabricated post and core build up. On the basis of post material, the most common was metal followed by fiber post. 2/3rd length of the root canal for the post length , 4-5mm apical seal of gutta percha after post placement and for the post diameter, 1/3rd of root diameter was agreed by most of the participants. Composite resin was the most popular material for core foundation followed by amalgam.The majority of surveyed practitioners had not a sound knowledge of the techniques and materials for restoring ETT and they believed that post reinforces the remaining tooth structure and reduces fracture probability.

Keywords: Dentists, Endodontically treated teeth, Knowledge, Restoration, Survey

Introduction

The goal of endodontic and restorative therapy is to restore the normal function and occlusion of the tooth and to maintain the stability of the dental arch. (Heydecke et al; 2002).Teeth that were previously

considered non restorable and extracted can now be retained due to the predictable clinical success rate of endodontic therapy (95%) (Morgano et al; 2004). The restoration of endodontically treated teeth has many problems due to loss of tooth structure by caries, trauma, fracture, previous restoration and endodontic therapy, all of which reduces the fracture resistance of the tooth. (Reeh et al; 1989). The strength of the endodontically treated teeth is directly linked to the bulk of the remaining dentine. Root filled teeth with intact coronal structure have a good long term prognosis (Morgano, 1996).

Studies have reported that the primary cause of endodontic treatment failure is due to the restoration failure rather than endodontic treatment itself (Safavi et al; 1987). The root filled teeth should follow a proper treatment plan with respect to endodontic and restorative therapy. The most important factor for clinical success of endodontic therapy is the final restoration. The improper restoration after root canal treatment may be one of the reasons of tooth extraction (Alsamadani et al; 2012).

There are different guidelines which affect the prognosis of root canal treated teeth. These parameters are amount of tooth structure loss, periapical status of the tooth, position of the tooth, occlusal contacts, number of adjacent teeth, remaining coronal and root dentine, degradation of the collagen, type of final restoration, type of post, core material and presence of a ferrule preparation (if needed) (Bergman et al; 1989; Naumann et al;2005).

The restoration of endodontically treated teeth has long been and still is controversial. The tooth should be assessed for occlusal function, restorability, periodontal status, biological width and crown to root ratio before initiating root canal therapy, so all these factors should be considered in the treatment plan (Varlan et al; 2009).

Amalgam and composite resin are commonly used for core foundations. These are superior to glass ionomer cements (Nagasiri and Chitmongkolsuk, 2005).Traditionally to retain the core in a badly broken down tooth, a post is inserted into the root canal system, followed by a full coverage crown to protect the tooth from subsequent fracture (Colman, 1979). The purpose of the post placement is to retain the core foundation and not to reinforce an endodontically treated tooth (Schwartz and Robbins, 2004). Some studies reported that the stress produced during the post space preparation and subsequent insertion increase the risk of root fracture (Ross et al, 1991).The literature reveals that the post should only be used when there is no enough tooth structure to brace the core restoration (Assif and Gorfil, 1994).A study reported 82% success rate in root canal treated teeth after 10 years restored with posts with failure rate of 2.1% after one year, the median survival rate was 17.4 years. The most important factor in reducing the risk of root fracture is the preservation of as much dentine as possible (Tikku et al; 2010).

Coronal microleakage is considered one of the major causes of endodontic treatment failure. In poorly restored coronal restoration and root canal fillings microorganisms will get into the root canal. The periapical area will be reinfected and dormant microorganisms may be reactivated. Therefore well sealed both temporary and permanent coronal restoration is important for the clinical success of endodontic therapy (Whitworth et al; 2002).

The practitioners are treating endodontically treated teeth based on their past experience without restoring to proper treatment guidelines. Surveys can serve as one of the important tools for knowing the knowledge and understanding of treatment approaches of clinicians in endodontically treated teeth (Eckerbom and Magnusson 2001, Scurria et al; 1995).

There are a lot of studies published with regard to restoration of endodontically treated teeth, but the information is not clear enough into a proper treatment protocol for the clinicians. The aim of the present study was to investigate the materials, techniques used in the restoration of ETT by dentists in northern Saudi Arabia. This will help in assessing the knowledge and aptitude of dentists towards restoration of endodontically treated teeth.

Materials and Methods

The questionnaire was taken from the previous study (Naumann et al; 2006) and modifications were made to suit the present study. The validity of the questionnaire was tested by presenting to the four arbitrators from the faculty of dentistry, Aljouf University and accordingly minor modifications were made. The study was approved by the ethics committee of the Aljouf University. The final questionnaire was distributed by hand and through email to the 255 clinical dentists in northern Saudi Arabia. The questionnaire consisted of two parts, first part obtained demographic information and the second part consisted of 16 single answer multiple choice type questions. The dentists were permitted to choose more than one answer, if they desired. The questionnaire collected information about the use of post, type of post, frequency of post, choice of luting cement, core material used and the choice of final restoration after endodontic treatment. Dentists both general practitioners and specialists treating ETT were included while those not treating ETT were excluded from the study.

Statistical Analysis

The data was analyzed using computer software SPSS 16 (SPSS Inc…Chicago, IL, USA). Frequencies and percentages were calculated for various responses of the participants. P value of 0.05 or less was considered statistically significant.

Results

Out of total 255 clinical dentists both general dentists and specialists, 153 returned the completed questionnaire, representing the response rate of 60%. 124 (81%) of the respondents were general dentists while 29 (19%) were specialists. The participants included 120 (78.4%) males and 33 (21.6%) females.

The participants mean years of professional experience, average numbers of restoring endodontically treated teeth per year are presented in table 1. The participant's responses to frequency of post placement in ETT, post reinforcement and increases in fracture resistance by ferule are shown in Table 2. Regarding the frequency of posts most of the participants agreed that post placement depends on the remaining tooth structure. Majority of the respondents believed that posts reinforce and increase fracture resistance of ETT. Participants were of opinion that ferule increases fracture resistance of the tooth. The results were statistically significant ($P < 0.05$).

Table 3. demonstrates preferred technique for restoring ETT, the choice of post in terms of material and shape. The preferred technique for restoring ETT was core material along with 1-2 mm of ferule followed by prefabricated post and core build up. The metal post was the most commonly used post for restoring ETT followed by fiber post. The results of using different post materials were statistically significant ($P < 0.05$).

Table 4. summarizes the length of the post, apical seal of gutta percha after post placement, choice of diameter of the post and esthetic outcome of the post. The appropriate length of the post for most of the respondents (67%) was $2/3^{rd}$ of the root canal. Regarding the apical seal of gutta percha 4-5 mm was the most common choice of the participants while half of the dentists (51%) preferred $1/3^{rd}$ of the root diameter for the post placement. The results were statistically significant ($P < 0.05$).

Sodium hypochlorite was most commonly used as rinsing solution before cementation of post compared to other irrigants. The results were statistically significant ($P<0.05$). More than $2/3^{rd}$ of the dentists (76%) cement endodontic posts with glass ionomer cement followed by resin cement (21%) and zinc phosphate cement (12%). More than half of the participants (60%) used composite resin as core material after ETT followed by amalgam (36%) and glass ionomer (18%). The results were statistically significant ($P<0.05$). The most common reason for failure of ETT was crown fracture (45%), followed by endodontic failure (31%) and root fracture (18%). Table 5.

Table 1: Mean years of Professional experience and Number of endodontically treated teeth per year:

Total Number (N)	Mean years of Professional experience	Standard deviation	Range	Mean Number of endodontically treated teeth per year	Standard deviation	Range
153	7.49	6.47	29	163.2	459.6	3000

Table 2: Responses of the surveyed clinical dentists to questions on frequency, reinforcement effect and ferrule effect of post placement in endodontically treated teeth:

Qualification status	Always	Sometimes	Never	Depends on remaining tooth structure	Total	df	P-value
Q. Showing response to question on frequency of post placement in Endodontically treated teeth:							
General Practitioners	-	48(31%)	6(3.9%)	70(45.7%)	124(81%)	2	0.463
Specialists	-	12(7.8%)	3(1.9%)	14(9.1%)	29(18.9%)		
Total	-	60(39.2%)	9(5.88%)	84(54.9%)	153(100%)		
Q. Showing response to question regarding believe that post reinforces Endodontically treated teeth and reduces fracture probability:							
General Practitioners	22(14.3%)	51(33.3%)	18(11.7%)	33(21.5%)	124(81%)	3	0.103
Specialists	2(1.3%)	9(5.88%)	9(5.88%)	9(5.88%)	29(18.9%)		
Total	24(15.3%)	60(39.2%)	27(17.6%)	42(27.4%)	153(100%)		
Q. Showing response to question that Ferule effect can increase fracture resistance in Endodontically treated teeth:							
General Practitioners	72(47%)	25(16.3%)	12(7.8%)	15(9.8%)	124(81%)	3	0.002
Specialists	6(3.9%)	8(5.22%)	6(3.9%)	9(5.88%)	29(18.9%)		
Total	78(50.9%)	33(21.5%)	18(11.7%)	24(15.3%)	153(100%)		

Table 3: Responses of the surveyed clinical dentists to questions on preferred technique, material and shape of the post for ETT

Q. Showing response to question about preferred technique for restoring endodontically treated teeth:							
Qualification status	Prefabricated post and core buildup	casted post and core	Pins and the post core buildup	Depends on the remaining tooth structure(use of core material along with 1-2mm of ferrule)	Total	df	P-value
General Practitioners	34(22.2%)	9(5.88%)	30(19.6%)	51(33.3%)	124(81%)	3	0.145
Specialists	5(3.2%)	6(3.9%)	6(3.9%)	12(7.8%)	29(18.9%)		
Total	39(25.4%)	15(9.8%)	36(23.5%)	63(41.1%)	153(100%)		
Q. Showing response to question that on the basis of material which type of prefabricated post do you prefer from longevity point of view:							
Qualification	Metal post	Ceramic post	Fiber post	Depends on the remaining tooth structure	Total	df	P-value
General Practitioners	48(31.3%)	3(1.9%)	55(35.9%)	18(11.7%)	124(81%)	3	0.006
Specialists	18(11.7%)	3(1.9%)	8(5.2%)	0(0%)	29(18.9%)		
Total	66(43.1%)	6(3.9%)	63(41.1%)	18(11.7%)	153(100%)		
Q. Showing response to question that on the basis of shape which type of prefabricated post do you prefer from retention point of view:							
Qualification	Parallel sided post	Tapered post	Parallel tapered post	Depends on the canal anatomy and available dentin	Total	df	P-value
General Practitioners	25(16.3%)	30(19.6%)	33(21.5%)	36(23.5%)	124(81%)	3	0.093
Specialists	2(1.3%)	6(3.9%)	6(3.9%)	15(9.8%)	29(18.9%)		
Total	27(17.6%)	36(23.5%)	39(25.4%)	51(33.3%)	153(100%)		

Table 4: Responses of the surveyed clinical dentists to questions on length, apical seal, diameter and esthetic effect of post in ETT

Q. Showing response to question that what is the most appropriate length of the post:\							
Qualification status	1/3rd the length of the roort canal	1/2 the length of the root canal	2/3rd of the length of roort canal	Depends on the remaining tooth structre	Total	df	P-value
General Practitioners	24(15.3%)	7(4.5%)	84(54.9%)	9(5.88%)	124(81%)	3	1.38
Specialists	3(1.9%)	5(3.2%)	18(11.7%)	3(1.9%)	29(18.9%)		
Total	27(17.6%)	12(7.8%)	102(66.6%)	12(7.8%)	153(100%)		
Q. Showing response to question that what you believe should be the apical seal after post placement:							
Qualification status	2mm	3mm	4-5mm	Depends on the remaining tooth structure	Total	df	P-value
General Practitioners	15(9.8%)	15(9.8%)	67(43.7%)	27(17.6%)	124(81%)	3	0.000
specialists	12(7.8%)	6(3.9%)	5(3.2%)	6(3.9%)	29(18.9%)		
Total	27(17.6%)	21(13.7%)	72(47%)	33(21.5%)	153(100%)		
Q. Showing response to question that what you believe should be the diameter of the post:							
Qualification sataus	1/3rd of the root diameter	1/2 of the root diameter	2/3rd of the root diameter	Depends on the remaining tooth structure	1/3rd of the root diameter	df	p-value
General Practitioners	67(43.7%)	24(15.3%)	12(7.8%)	21(13.7%)	124(81%)	3	0.032
Specialists	11(7.1%)	3(1.9%)	3(1.9%)	12(7.8%)	29(18.9%)		
Total	78(50.9%)	27(17.6%)	15(9.8%)	33(21.5%)	153(100%)		
Q. Showing response to question that which type of post affects esthetic outcome especially with composite buildups.							
Qualification status	Gold plated metal post	Metal post(Silver color)	Fiber post	Depends on the remaining tooth structure	Total	df	p-value
General Practitioners	18(11.7%)	42(27.4%)	64(41.8%)	0(0%)	124(81%)	3	0.000
specialists	3(1.9%)	6(3.9%)	14(9.1%)	6(3.9%)	29(18.9%)		
Total	21(13.7%)	48(31.3%)	78(50.9%)	6(3.9%)	153(100%)		

Table: 5 Responses of the surveyed clinical dentists to questions on rinsing solution, type of cement, core material and frequent failure of ETT

Q: Showing response to question that which do you commonly use for rinsing canal before post cementation?							
Qualification status	Saline	Sodium hypochlorite	EDTA	Chlorhexidine	Total	df	p-value
General Practitioners	54(35.2%)	49(32%)	18(11.7%)	3(1.9%)	124(81%)	3	0.048
Specialists	6(3.9%)	14(9.1%)	6(3.9%)	3(1.9%)	29(18.9%)		
Total	60(39.2%)	63(41.1%)	24(15.3%)	6(3.9%)	153(100%)		
Q: Showing response to question that what type of cement do you commonly use for cementation of post?							
Qualification status	Zinc Phosphate	Glass ionomer	Poly carboxylate cement	Resin cement	Zinc Phosphate	df	p-value
General Practitioners	12(7.8%)	94(61.4%)	3(1.9%)	15(9.8%)	124(81%)	3	0.186
Specialists	0(0%)	23(15%)	0(0%)	6(3.9%)	29(18.9%)		
Total	12(7.8%)	117(76.4%)	3(1.9%)	21(13.7%)	153(100%)		
Q: Showing response to question that which core material do you use frequently?							
Qualification status	Amalgam	Composite	Glass ionomer	Cast core	Total	df	p-value
General Practitioners	22(14.3%)	84(54.9%)	18(11.7%)	0(0%)	124(81%)	3	0.000
Specialists	14(9.1%)	9(5.88%)	0(0%)	6(3.9%)	29(18.9%)		
Simple BDS	36(23.5%)	93(60.7%)	18(11.7%)	6(3.9%)	153(100%)		
Q: Showing response to question that what is the most frequent failure of endodontically treated tooth?							
Qualification status	Endodontic failure	Crown fracture	Root fracture	No failure	Total	df	p-value
General Practitioners	36(23.5%)	58(37.9%)	21(13.7%)	9(5.88%)	124(81%)	3	0.279
Specialists	12(7.8%)	11(7.1%)	6(3.9%)	0(0%)	29(18.9%)		
Total	48(31.3%)	69(45.0%)	27(17.6%)	9(5.88%)	153(100%)		

Discussion

The response rate of the participants of the present study (60%) was satisfactory. It was better than the previous published studies (Eckerbom and Magnusson 2001, Naumann et al; 2006). The prosthodontists, endodontists and restorative dentists were considered as specialists who were treating ETT. Another shortcoming of the survey was that there was no distinguish between anterior and posterior teeth restoration.

More than half of the participants (55%) agreed that post placement in ETT depends on the remaining tooth structure while more than one third did so some times (39%). The results are similar to the findings in Germany and United Kingdom that every ETT does not need a post (Naumann et al; 2006). According to the evidence based studies the post only retain the core,

it does not reinforce the tooth. Most of the participants, both general dentists and specialists (54%) regardless of professional experience believed that post strengthen ETT. The results are similar to the findings of studies among general practitioners in Sweden, Germany and Northern Ireland (Eckerbom and Magnusson 2001, Naumann et al; 2006, Hussey and Killough, 1995). In United stated both board certified prosthodontists (43%) and general dentists (59%) were of the same opinion that post reinforces an ETT (Morgano et al; 1994).

Ferrule effect of 1-2mm increases the fracture resistance of ETT (Stankiewicz and Wilson, 2002). In the present study 72% of participants were in agreement with this belief. This is in line with the studies in United States (73%) and Germany (72%) where dentists believe that ferrule effect is a key factor in avoiding clinical failures of ETT (Naumann et al; 2006; Morgano et al; 1994).

The most preferred technique for restoring ETT was the core material with 1-2mm of ferrule followed by the prefabricated post and cast post and core. In Germany the dentists use the prefabricated post while in the United Kingdom and Sweden the dentists preferred to use cast post and core (Eckerbom and Magnusson 2001, Naumann et al; 2006, Hussey and Killough, 1995). The use of prefabricated metal post was more common compared to fiber post. The same results were obtained by studies in Sweden and United Kingdom (Eckerbom and Magnusson 2001, Hussey and Killough, 1995).

There are various guidelines for optimum post length. These are that the post length should be equal to 2/3 of the root canal, that it should be equal to the length of the clinical crown or there should be 4-5mm apical seal of gutta percha (Sorensen and Martinoff, 1984).Most of the practitioners in the present survey consider post length to be 2/3rd of the root canal or to leave 4-5mm gutta percha at the root apex. This approach is clinical based and measurement taken from periapical radiograph during ETT. The same results were obtained by a study in United Kingdom. In another radiographic study 47% was the mean percentage of root canal length occupied by post, while only 5% of the posts occupied 2/3rd or more of the root canal length (Martin and Jedynakiewicz, 1989).

The diameter of the post should be 1/3rd of the root diameter. The studies showed that as the amount of dentine removal increases, the fracture resistance of ETT decreases (Deutsch et al; 1985). Majority of practitioners in the present survey held the same belief that post diameter should not exceed 1/3rd of the root diameter. The research confirmed that increase in the post diameter creates internal stresses within the root and does not contribute to the retention of the post (Ruemping et al; 1979, Mattison and Von Fraunhofer, 1983).

Various irrigants like saline, sodium hypochlorite, EDTA and chlorhexidine are used to remove smear layer after post space preparation and before cementation of post. The participants of the study preferred to use sodium hypochlorite followed by saline for rinsing the root canal (Bitter et al; 2013).

Very little is known about the long term clinical performance of various cements used for the cementation of posts.Almost all of the participants of the survey both general dentists and specialists used glass inomer for luting the post. This is contrast to the findings in Northern Ireland, United States and Sweden, where the most commonly used cement for post cementation is zinc phosphate. More recently resin cement has been introduced to embrace the remaining tooth structure (Seow et al; 2003, Saupe et al; 1996). In the present survey 13% of the participants like this approach for post placement.

The most frequently used core material was composite resin (61%) followed by amalgam (23%) and glass ionomer (13%) in the current study. The results are in consistent with the findings in Germany, where composite resin is the most commonly used core material followed by glass ionomer and amalgam. The rare use of amalgam in Germany may be due to mercury toxicity. The studies conducted in United States and United Kingdom indicates that amalgam is the preferred core build up material followed by composite resin among the participants. The composite resin and amalgam are recommended core materials, while glass ionomer is used for small defects only (Mendoza et al; 1997).

Crown fracture was the most common reason for failure of ETT followed by endodontic failure and root fracture in the present study. In one study in Germany the loss of retention while in another study the endodontic failure was the common reason for failure of ETT among the respondents of the study (Balkenhol et al; 2007).

Conclusion

Within the limitations of the present survey, it was concluded that most of the practitioners believe that post reinforces the remaining tooth structure. The use of prefabricated metal post was more common compared to fiber post. Composite resin core material was preferred by participants compared to amalgam. Cementation of post was popular with glass ionomer cement followed by resin luting cement.

Recommendations

The dental curriculum needs to incorporate a clear protocol for the restoration of endodontically treated teeth. An important implication from the findings is that there is clearly a need for continuous medical education

for the dentists to improve their knowledge and skill about the restoration of endodontically treated teeth.

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