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RESEARCH ARTICLE

CONTEMPORARY CONCEPTS AND TECHNIQUES USED FOR RESTORATION OF ENDODONTICALLY TREATED TEETH BY DENTAL PROFESSIONALS IN NORTH INDIA: A QUESTIONNAIRE-BASED STUDY

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ABSTRACT

Background: Coronal restoration determines the success of endodontically treated teeth. A variety of techniques and materials are available for restoration of such teeth with varied opinions among practitioners. ***Objective:*** To investigate the current belief of the practitioners regarding the restoration of endodontically treated teeth in North India. ***Methods:*** This questionnaire-based survey was conducted among 186 general dentists in North India. The questionnaire containing 18 multiple choice questions about technique and treatment methods, type of post, choice of luting cement, core material, coronal extent of gutta percha and placement of protective coronal barrier was distributed by electronic media. Descriptive statistics were used to analyze the data. ***Results:*** Most of the dentists 69.4% believe that a post reinforces an endodontically treated teeth and reduces fracture probability. Crown was preferred by 40.9% to restore an endodontically treated teeth. Composite resin was the most preferred material for core build up 66.1%. Glass fiber post was more commonly used post 31.2%. Most dentists keep coronal extent of gutta percha either at the level of the orifice or at the level of 1-2mm below Cemento-enamal Junction. Most of the dentists 33.3% don't use base under permanent restoration. ***Conclusion:*** Practitioners had a sound knowledge of the techniques and materials used for restoration of endodontically treated teeth except in relation to the need to establish a good coronal seal by placing base over a root filling.

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INTRODUCTION

Root canal therapy can be considered complete only when the concerned tooth is restored to perform occlusal function and able to stabilise the dental arch[1]. The quality of the coronal restoration has direct impact not only on the survival but on the success of the endodontically treated tooth as well[2]. Unrestored endodontically treated tooth (ETT) is structurally compromised due to the loss of tooth structure like caries, trauma, fracture, previous restoration and endodontic therapy[3].

Properties of dentin do not get altered even after loss of moisture content post endodontic treatment[4]. Therefore, most of the sound dentin should be retained and used to rebuild the tooth[5]. Traditionally to retain the core in a badly broken tooth, post is inserted into the root canal system[6]. The purpose of the post placement is to retain the core foundation rather to reinforce an endodontically treated tooth[7]. Though post space preparation increases the risk of root fracture. Hance the post should only be used when there is no enough tooth structure to brace the core restoration[8]. Due to availability of wide variety of current techniques and materials, it is difficult to select the

It has been found that practitioners do not follow the recommended guidelines[9] rather influenced by qualification, experience and geographic location during restoration of ETT[10]. Several surveys have been performed in various countries[8,10-15] to find out the dissimilarity between the recommendations and actually carried out procedures in the endodontic practice. There is scarcity of surveys published with regard to different post-endodontic restorative procedures carried out in North India. Thus, this study was aimed to investigate the current belief of the practitioners regarding the restoration of endodontically treated teeth.

MATERIAL AND METHODS

The present questionnaire-based survey was designed and distributed among the dental professionals of North India. Survey was conducted in Post Graduate Institute of Dental Sciences, Rohtak, Haryana, India. Prior ethical clearance was obtained from the Biomedical and Health Ethical Committee of the Institute (PGIDS/BHRC/21/42). Total sample size of 185 participants were calculated from the previous study[5] with effect size of 0.3 using α at 5% with a power of 80%.

Inclusion and exclusion criteria: Graduates & post graduates of different working experience, specialty and locations were included. The face and content validity of the questionnaire was assessed with a Cronbach's Alpha value of 0.8 by the faculty from the department of Conservative and endodontics, PGIDS, Rohtak. Total 18 multiple-choice questions were included in the study. The data was gathered by sending the link of online form via emails and participants were contacted through their Dental Associations. The questionnaire was available through an online survey system between 28 May 2021 and 15 August 2021. The practitioners took sufficient time of two and half months to participate. Total 186 responses were collected with response rate of 63% from 295 participants involved in the study. The survey was conducted anonymously, so those who did not respond to the survey could not be identified.

Statistical analysis: The individual responses were collected and expressed on excel sheet. A Statistical Package of Social Sciences (SPSS version 7.5, Chicago, IL, USA) was used for all computational purposes. One-way frequency tables were generated to summarize the responses.

RESULTS

Out of the total 186 participants 54.3% of the dentists were males and 66.2% were MDS. Only 37% had been working as dentists for fewer than 5 years whereas remaining participants reported 5 years of professional work experience out of which 28% were more than 15 years. In terms of practice location, most of them were practicing in city 66.1% followed by metropolitan city 18.8% and 15.1% in town. (Table-1).

Table 1. General Information about practitioners.

1.Educational qualification	
BDS	66 (33.8%)
MDS	123 (66.2%)
2.Gender	
Male	101 (54.3%)
Female	85 (45.7%)
3.Associated with	
Private clinics	55(29.6%)
Government hospitals	64 (34.4%)
Teaching institutions	67 (36%)
4.Practice in	
Metropolitan City	35(18.8%)
City	123(66.1%)
Town	28(15.1%)
5.Working experience	
<5 years	69 (37%)
5-10 years	34 (18.3%)
11-15 years	31 (16.7%)
>15 years	52 (28%)

When asked whether they believe that a post will reinforce an endodontically treated tooth and reduce the chances of fracture, 69.4% answered "yes". The most frequent cause of failure of ETT, 40.9% dentist opted "Loss of coronal restoration". Most of the dentists don't use base under permanent restoration and opted option "never" 33.3%. (Table-2)

DISCUSSION

The type of final restoration chosen for an ETT should be taken into account depending on the remaining tooth structure, aesthetics, cost and clinical longevity. Literature suggests several options for final restoration like Full crown, Partial Crown, Onlay, Overlay, Inlay and Post-Core[16]. In the present study, 33.9% & 32.3% of practitioners preferred to provide metal ceramic & all ceramic crowns respectively in anterior and 75.3% full crowns followed by 16.7% direct restorations in posterior teeth as final restoration. Our results are similar to the survey conducted in Central India[17], where 45.6% preferred all ceramic in anterior and 64.2% full crowns in posterior teeth. In Manchester[8] PFM crowns were the preference to restore the ETT. Core build-up contributes to the strength and retain the crown after cementation[17]. In the present study, composite resin is the material of choice for core build up by 66.1% without post and 64% with post to retain the core. The results are in concordance to the study conducted in Central India[17]; 59.1% to 81.9% practitioners had been found to use composite for core build up. In Turkey[15] composite resin was the most preferred material. In Northern Ireland[11] GIC (31.9%) and cermet (8.3%) together were the most popular, followed by amalgam (35.8%) and composite at 24.0%. This was in contrast with Sweden[12], only 3% of practitioners were using amalgam. In Manchester[8] composite resins in anterior 51% and amalgam in posterior teeth 44% were the most popular materials used. In present study, loss of coronal restoration 40.9% was the most common cause of failure for ETT. These results are consistent (44.9%) with the studies conducted in the Central India[17] and Germany[10], whereas crown fracture (45%) was most common opinioned in Saudi Arabia[14]. Most practitioners preferred to place post occasionally in all teeth types. Lesion extent of 4 walls for anterior teeth, 3 walls for molars and 2 walls defects for premolars were the preference to place intracanal post. Present study results for anterior teeth and molars are similar to the study conducted in Switzerland[13] except for premolars where 3 wall defects were the most preferred option instead of 2 wall defects. Literature confirms that removal of substance during post preparation weakens the root hence tends to increase the risk of fracture[7]. Most practitioners 69.4% believed that post strengthens and reinforces ETT. These results were comparable with Central India[17], in which 74.9% believed that post reinforces root. Similarly, in Germany[10], Northern Ireland[11] and Sweden[12] the general practitioners were of the opinion that post strengthen ETT.

To ensure more predictable results of restoration, ferrule (1.5 to 2mm) must be properly executed[18]. In present survey most practitioners 44.6% believed that 1-2mm of tooth structure required for adequate ferrule effect followed by 38.7% of 2mm. Similar results observed in Center India[17] (41.8%), Germany[10] and Northern Ireland[11]. Properly executed ferrule is a positive factor in avoiding clinical failures of ETT[10]. An incomplete ferrule is rather considered a better option than complete absence of a ferule[18]. Practitioners preferred Glass fiber post followed by Cast post whereas Metal post used rarely and Zirconia & Metal screw were not used at all for anterior teeth. Similar result was observed in Central India[17] where preferably fiber post was used, whereas in Manchester[8] cast metal post was more popular. Glass fiber posts and Metal posts were preferred for posterior teeth equally. In Turkey[15] more than half of the participants (56%) utilized fiber posts whereas in Switzerland[13] metal posts were preferred over glass fiber post. The rising popularity of fiber post may be due to their superior aesthetic properties[19] and conservative preparation[2]. Most practitioners (61.8%) aimed for at least 2/3 of root length for post and preferred to leave 4-5mm of Gutta Percha (40.9%) for the apical seal. Similar results were observed in Central India[17], Germany[10], Switzerland[13] and Saudi Arabia[14].

Table 2. Response of practitioners related to post endodontic restoration

1.How many endodontically treated teeth do you restore in a month?						
Seldom (0 to 30%)			68 (36.6%)			
Frequently (30 to70%)			82 (44%)			
Usually (70 to 100%)			36 (19.4%)			
2.How often do you place a post in an endodontically treated tooth?						
	Very often (Over 90%)	Often (75% to 90%)	Occasionally (50% to75%)	Rarely (25% to 50%)	Never (0%)	
Anterior tooth	15 (8.1%)	22 (11.8%)	**78 (41.9%)**	61 (32.8%)	10 (5.4%)	
Premolar	9 (4.8%)	22(11.8%)	**81 (43.5%)**	63 (33.9%)	11 (5.9%)	
Molar	7 (3.8%)	21 (11.3%)	**76 (40.9%)**	63 (33.9%)	19 (10.2%)	
3.Do you believe that a post will reinforce an endodontically treated tooth and reduce the chances of fracture?						
Yes			**129 (69.4%)**			
No			41(22%)			
Not sure			16 (8.6%)			
4.Upto which lesion extent do you decide to place an intracanal post?						
	Always	1 wall defect	2 wall defects	3 walls defects	4 walls defects with ferrule	Neither wall nor ferrule left
Anterior tooth	15(8.1%)	31(16.7%)	41 (22.0%)	42(22.6%)	47(25.3%)	10(5.4%)
Premolar	5(2.7%)	20(10.8%)	59(31.7%)	51(27.4%)	41(22.0%)	10(5.4%)
Molar	8(4.3%)	18(9.7%)	44(23.7%)	63(33.9%)	44(23.7%)	9(4.8%)
5.Preferred Post length						
1/3 of the root length			38(20.4%)			
½ of the root length			16(8.6%)			
2/3 of the root length			**115(61.8%)**			
Same length as crown			7(3.8%)			
Maximum length possible			10 (5.4%)			
6.How much Gutta Percha should be retained to preserve the apical seal?						
2mm			31(16.7%)			
3mm			29(15.6%)			
4-5mm			**76(40.9%)**			
Depends on the root length			49(26.3%)			
Apical 3rd			01(0.5%)			
7.How often do you restore endodontically treated tooth with a crown?						
Very often (over 90%)			**76(40.9%)**			
Often (75% to 90%)			56(30.1%)			
Occasionally (50% to75%)			32(17.2%)			
Rarely (25% to50%)			11(5.9%)			
Never (0%)			11(5.9%)			
8.How often do you use the following types of post to restore an endodontically treated anterior tooth?						
	Very often (Over 90%)	Often (75% to 90%)	Occasionally (50% to 75%)	Rarely (25% to 50%)	Never (0%)	
Glass-fibre post	**58(31.2%)**	50(26.9%)	43(23.1%)	24(12.9%)	11(5.9%)	
Zirconia post	8(4.3%)	20(10.8%)	47(25.3%)	55(29.6%)	**56(30.1%)**	
Cast post build-up	11(5.9%)	23(12.4%)	**61(32.8%)**	52(28.0%)	39(21.0%)	
Metal post	11(5,9%)	30(16.1%)	51(27.4%)	**54(29.0%)**	40(21.5%)	
Metal screw	6(3.2%)	15(8.1%)	41(22.0%)	60(32.3%)	**64(34.4%)**	
9.How often do you use the following types of post to restore an endodontically treated posterior tooth?						
	Very often (Over 90%)	Often (75% to 90%)	Occasionally (50% to 75%)	Rarely (25% to 50%)	Never (0%)	
Glass-fibre post	44(23.7%)	24(12.9%)	**57(30.6%)**	47(25.3%)	14(7.5%)	
Zirconia post	8(4.3%)	13(7.0%)	45(24.2%)	**64(34.4%)**	56(30.1%)	
Cast post build-up	16(8.6%)	23(12.4%)	48(25.8%)	**56(30.1%)**	43(23.1%)	
Metal post	17(9.1%)	26(14.0%)	**57(30.6%)**	48(25.8%)	38(20.4%)	
Metal screw	11(5.9%)	14(7.5%)	48(25.8%)	**66(35.5%)**	47(25.3%)	
10.Minimum bulk of tooth structure required for adequate ferrule effect.						
1 mm			15(8.1%)			
1-2 mm			**83 (44.6%)**			
2 mm			72(38.7%)			
Not sure			16(8.6%)			
11.Which luting material do you prefer for intracanal posts?						
	Zinc phosphate cement	Resin-based cement	Glass-ionomer cement	Resin modified Glass-ionomer cement		
Metal post	37(19.8%)	29(15.5%)	**72(38.7%)**	48(25.8%)		
Fiber post	11(5.9%)	66 (35.4%)	41(22.0%)	**68(36.5%)**		
12.If you use post, which material do you use most often for core build-up?						

Continue …

Amalgam	7(3.8%)
Composite resin	**119(64%)**
Glass ionomer	9(4.8%)
Modified glass ionomer (e.g., Ketac…)	30(16.1%)
Glass ionomer reinforced	15(8.1%)
13If you don't use any post, which material do you use most often for core build-up?	
Amalgam	13(7%)
Composite resin	**123(66.1%)**
Glass ionomer	12(6.5%)
Modified glass ionomer (e.g., Ketac-Silver)	23(12.4%)
Glass ionomer reinforced	15(8.1%)
14.What type of final endodontic restoration do you routinely provide for Endodontically Treated anterior teeth?	
Direct restoration (Composite/GIC/other)	55(29.6%)
Metal-ceramic crown	**63(33.9%)**
All ceramic crown	60(32.3%)
Ceramic veneer	8(4.3%)
15.What type of final endodontic restoration do you routinely provide for Endodontically Treated posterior teeth?	
Direct restoration (Amalgam/Composite/GIC/other)	31(16.7%)
Onlays	10(5.4%)
Inlay	3(1.6%)
Full crown	**140(75.3%)**
Endocrowns	2(1.1%)
16.Which is the most frequent cause of failure of Endodontically Treated Teeth?	
Loss of coronal restoration	**76(40.9%)**
Endodontic failure	45 (24.2%)
Crown fracture	46(24.7%)
Root fracture	19(10.2%)
17.If not using post, what should be the coronal extent of gutta percha?	
Anywhere inside pulp chamber	8(4.3%)
At the level of the orifice	62(33.3%)
At the level of CEJ	35(18.8%)
1-2 mm below CEJ	62(33.3%)
Depends on clinical situation	19(10.2%)
18.Do you apply base under permanent restoration while restoring Endodontically Treated Teeth?	
Always	36(19.4%)
Often	29(15.6%)
Sometimes	59(31.7%)
Never	**62(33.3%)**

Presence of most lateral canals in the apical third, root seal is important to avoid further infections[20]. Primary function of Luting cements is to fill the space at post-tooth interface and mechanically lock the post in place to prevent its dislodgement. In the present study 38.7% practitioners preferably used Glass ionomer cement as a luting agent for Metal post cementation followed by 36.5% Resin modified Glass-ionomer cement. Resin based cement preferred for Fiber post whereas Zinc phosphate cement used rarely. These results were consistent with Central India[17] and Switzerland[13], whereas contrasting results were observed with Sweden[12] and Northern Ireland[11] where zinc phosphate was the most commonly used materiel. To prevent coronal microleakage additional placement of protective coronal barrier or base had been recommended[21]. Gutta percha should ideally be kept at osseous level and glass-ionomer or dual cure composite base may be placed directly over gutta percha, which further enhances coronal seal[2]. In the present study most practitioners 33.3% preferred keeping coronal extent of gutta percha either at the level of orifice or 1-2 mm below CEJ though practitioners were not found intended to apply base under permanent restoration while restoring ETT. The design of present study may be assumed as a limitation as it relies on the individual reports of dental practitioners which provide a low level of evidence, moreover with small sample size. Further studies are required to confirm these findings with larger sample size and should be compared with different speciality and working experience of the practitioners with fewer parameters unlike the present study. These results do not represent to all the North Indian practitioners as it is difficult to derive a generalizable, clear and structured restorative concept for ETT.

CONCLUSIONS

Within the limitations of the present study, it was concluded that most of the practitioners believed that post reinforces the remaining tooth structure. Glass fiber post was commonly used among prefabricated posts. Composite resin was the most popular core material. Full crown was most preferred for final endodontic restoration. The practitioners surveyed had a good understanding of the concepts except in relation to the need to establish a good coronal seal by placing base over a root filling.

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Glossary of Abbreviations

- CEJ: Cemento-enamal Junction
- ETT: Endodontically Treated Teeth

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