



RESEARCH ARTICLE

Treatment Concepts for Restoration of endodontically Treated Teeth: A Survey among General Practitioners, Prosthodontists, and Endodontists in India

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ABSTRACT

Aim: To study the treatment concepts for restoration of endodontically treated teeth (ETT) among general practitioners, prosthodontists, and endodontists in India and to compare practices followed by practitioners in India with that of other countries.

Materials and methods: A questionnaire consisting of 16 multiple choice questions was formulated. It was handed out randomly to general practitioners, prosthodontists, and endodontists at respective national conferences by personal handouts. The questionnaire consisted of 16 multiple choice questions that focused on the treatment philosophies of post-endodontic restoration, materials, and techniques used.

Results: 70.7% general practitioners believe that a post reinforces ETT and reduces fracture probability and they placed posts more frequently as compared to prosthodontists and endodontists. 44.6% endodontists believed that ferrule does not increase the fracture resistance. Cast post and cores were preferred by 83.2% endodontists, whereas prefabricated posts were preferred by 78.4% general practitioners. Prosthodontists used cast posts and cores as well as prefabricated posts with relatively same frequency. 70.3% endodontists, 74.1% general practitioners, and 46.3% prosthodontists preferred tapered posts. 76.2% endodontists seal root filling after post space preparation, whereas 77.7% prosthodontists and 79.3% general practitioners do not seal the root filling. 81% prosthodontists and 74.1% general practitioners reported endodontic failure as the most frequent cause of failure, however, 79.2% endodontists reported loss of retention of posts.

Conclusion: Within the limitations of the present study, there were differences in knowledge and practices followed in restoration of ETT among the different specialties – prosthodontists, endodontists, and general practitioners studied in India and also when compared to other countries.

Keyword: Endodontically treated teeth, Post and core, Survey.

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INTRODUCTION

The aim of Endodontic and Restorative Dentistry is to preserve the natural tooth structure and to maintain the stability of dental arch.¹ Endodontic treatment is performed on teeth widely affected due to caries, fractures, or multiple restorations. Endodontically treated teeth (ETT) are weaker and more liable for fracture as there is loss of tooth structure and change in the physical characteristics.²

Studies conducted have proven that the successful outcome of an ETT does not depend as much on the endodontic procedure as much as it depends on the post-endodontic restoration.¹ Post-endodontic restoration of a tooth with deficient tooth structure is often carried out by fabricating a post and core followed by a complete veneer crown. A core is a dental restoration for building up missing tooth structure for future restoration with a crown. A post is a dental material placed in the root of a structurally deficient tooth when additional retention is needed to retain the core and coronal restoration.¹ Post-endodontic restorations are dependent on several factors like substance loss, tooth type, whether or not intracanal anchorage is required, choice of post and core material, length and fit of endodontic post, luting medium, and type of supraconstruction.^{3,4}

Immense literature has been published with regard to knowledge and practices of post-endodontic restoration abroad; however, there is lack of such studies in India.⁵⁻⁷ Clinicians are left with the perplexing task of reading and compiling this information into logical and evidence-based approach to dental treatment. The available information is not clear enough to be put up as proper treatment protocol, in lieu of which clinicians rely more on their past experiences rather than on available literature. The increase in choice of materials and treatment options available for post-endodontic treatment has further added to their dilemma.

As a result, the present survey was undertaken to investigate the frequency of preferred methods, materials, timing, and other concerning factors regarding

restorations of ETT with special emphasis on assessing the knowledge and practices used by prosthodontists, endodontists, and general practitioners in India. The present survey also allowed comparisons of beliefs and practices in restoration of ETT followed by practitioners in India with that of other countries.

MATERIALS AND METHODS

A questionnaire consisting of 16 multiple choice questions was formulated. A cover letter stated the instructions, rationale, and purpose of the survey. It was handed out randomly to general practitioners, prosthodontists, and endodontists at respective national conferences by personal handouts. The questionnaire asked for anonymous responses so as to overcome any reservation about participation.

The first part of the questionnaire consisted of general personal information of the dentist like gender, qualification, number of years of practice, and whether he/she had attended any special course for post and core.

The second part of the questionnaire consisted of 16 multiple choice questions that focused on the treatment philosophies of post-endodontic restoration, materials, and techniques used. The questions covered the following topics:

Beliefs and Frequency of Use of Intracanal Posts

The participants were asked how frequently they placed posts and their beliefs whether every ETT must receive a post, whether post reinforces ETT and reduces fracture probability, and whether a ferrule effect increases fracture resistance.

Prosthetic Restoration

The participants were questioned about frequency of use of posts depending on tooth location and restoration modalities.

Materials Preferences

The participants were questioned with regard to commonly used post system, post design, material used to construct core, and cement used to lute post.

Techniques of Post Space Preparation

Questions related to timing of post space preparation following endodontic therapy, instruments used to remove root filling material, solution used to rinse canal before cementation, and whether root filling was sealed after post space preparation were asked.

Cause of Failure

The participants were questioned regarding the cause of most frequent cause of failure of post placement.

RESULTS

Demographics

The questionnaire was answered by 116 general practitioners, 121 prosthodontists, and 101 endodontists with an overall return rate of 37%. Majority of prosthodontists and endodontists were males 58.7% to 71.3% respectively; however, majority of the general practitioners were female 66.4%. 50.4% of prosthodontists and 52.5% endodontists had a clinical experience of 0 to 5 years, whereas 41.4% of general practitioners had a clinical experience of 5 to 10 years. A total of 69.4% of prosthodontists and 56.4% of endodontists had not attended any special course, whereas 54.3% general practitioners had undergone special courses to upgrade their skills with regard to restoration of ETT.

Beliefs and Frequency of Use of Intracanal Posts

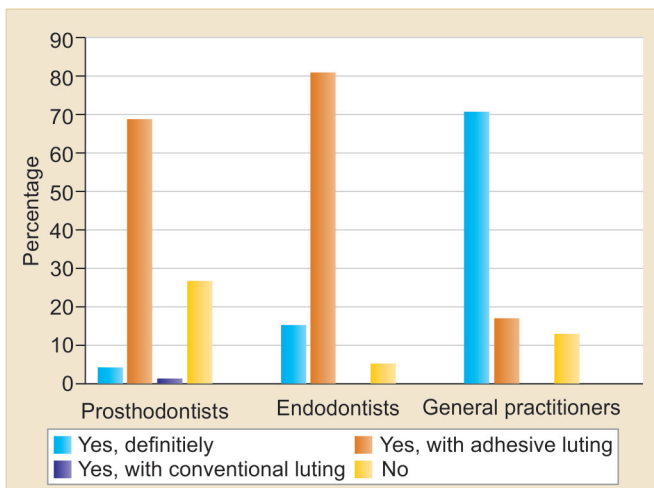
89.3% prosthodontists, 81.2% endodontists, and 90.5% general practitioners believed that every ETT need not receive a post (Table 1). 83.5% prosthodontists and 83.2% endodontists seldom place posts whereas 53.4% of general practitioners frequently placed posts in ETT. 70.7% general practitioners believe that a post definitely reinforces an ETT and reduces fracture probability whereas 68.6% prosthodontists and 80.2% endodontists believe that posts with adhesive luting reinforces an ETT and reduces fracture probability (Graph 1). 82.6% prosthodontists and 75% general practitioners believe that using ferrule increases fracture resistance whereas only 55.4% endodontists believe in fracture resistance effect of ferrule (Graph 2).

Prosthetic Restoration

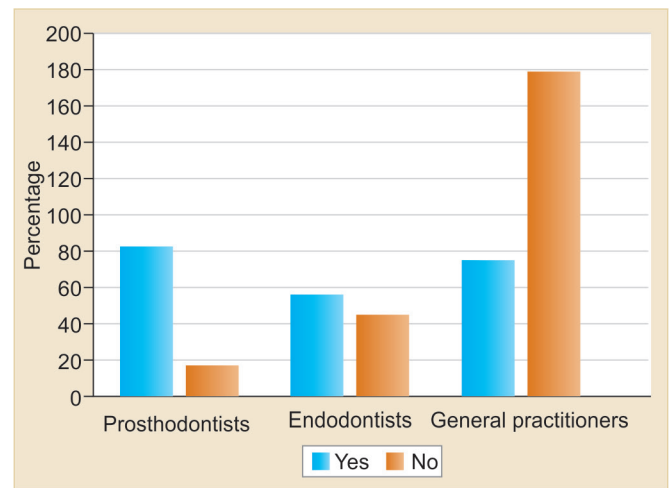
With regard to tooth location, a more equitable frequency of post placement is seen for all tooth locations by prosthodontists, i.e., molars (26.4%), premolars (33.9%), and anterior teeth (39.7%) whereas endodontists and general practitioners place posts more frequently in only premolars and anterior teeth (Table 2). 47.5% endodontists place posts more frequently in premolars whereas 48.5% place more frequently in anterior teeth. 58.6% general practitioners place posts more frequently in premolars and whereas 38.8% place more frequently in anterior teeth. 87.1% endodontists and 85.3% general practitioners use posts more frequently for single-crown therapy, whereas only 68.6% prosthodontists use posts more frequently for single-crown therapy and 21.5% prosthodontists use

Table 1: Responses regarding beliefs and frequency of use of intracanal posts

| Question | Response | Prosthodontist (%) | Endodontist (%) | General practitioner (%) |
|---|------------------------------------|--------------------|-----------------|--------------------------|
| (1) Do you believe that every endodontically treated tooth must receive a post? | (a) Yes | 10.7 | 18.8 | 9.5 |
| | (b) No | 89.3 | 81.2 | 90.5 |
| (2) How frequently do you place post in your dental practice? | (a) Seldom (30% of all ETT) | 83.5 | 83.2 | 45.7 |
| | (b) Frequently (30–70% of all ETT) | 13.2 | 14.9 | 53.4 |
| | (c) Usually (>70% of all ETT) | 3.3 | 2 | 0.9 |
| (3) Do you believe that a post reinforces an endodontically treated tooth and reduces fracture probability? | (a) Yes, definitely | 4.1 | 14.9 | 70.7 |
| | (b) Yes, with adhesive luting | 68.6 | 80.2 | 16.4 |
| | (c) Yes, with conventional luting | 0.8 | 0 | 0 |
| | (d) No | 26.4 | 5 | 12.9 |
| (4) Do you believe that reducing the level of finishing line below the core foundation, thus using a ferrule effect following post cementation increases the fracture resistance? | (a) Yes | 82.6 | 55.4 | 75 |
| | (b) No | 17.4 | 44.6 | 25 |



Graph 1: Comparison of responses of different dental specialties based on belief that a post reinforces an ETT and reduces fracture probability



Graph 2: Comparison of responses of different dental specialties based on belief that a ferrule increases fracture resistance

Table 2: Responses regarding prosthetic restoration

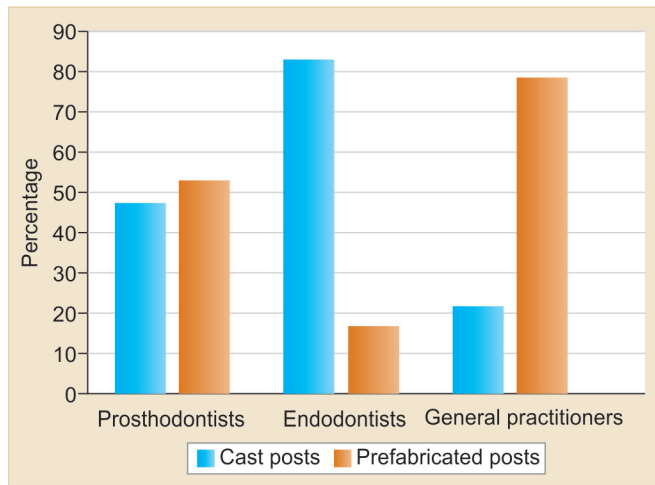
| Question | Response | Prosthodontist (%) | Endodontist (%) | General practitioner (%) |
|--|----------------------------|--------------------|-----------------|--------------------------|
| (1) In which teeth do you frequently use posts for restoration of endodontically treated tooth? | (a) Molars | 26.4 | 4 | 2.6 |
| | (b) Premolars | 33.9 | 47.5 | 58.6 |
| | (c) Anteriors | 39.7 | 48.5 | 38.8 |
| (2) For which of the following restoration modalities do you use posts more often for restoring ETT? | (a) Direct restorations | 9.9 | 1 | 6.9 |
| | (b) Single-crown therapy | 68.6 | 87.1 | 85.3 |
| | (c) Abutment teeth for FPD | 21.5 | 11.9 | 7.8 |

posts more frequently to restore abutment teeth for fixed partial dentures (FPDs).

Materials Preferences

83.2% endodontists use casts posts more frequently, however, 78.4% general practitioners place prefabricated

posts more frequently whereas 52.9% prosthodontists place prefabricated posts while 47.1% place cast posts (Graph 3, Table 3). With regard to post designs, 70.3% endodontists and 74.1% general practitioners preferred tapered posts whereas when compared to prosthodontists, 46.3% preferred tapered posts, 21.5% preferred



Graph 3: Comparison of responses of different dental specialties based on frequency of post system used

combined parallel sided/tapered posts, and 20.7% preferred parallel posts. Among general practitioners, 49.1% use composite cores and 17.2% use glass ionomer cement cores on prefabricated posts more commonly. Among endodontists, 51.5% used cores other than that mentioned in the options whereas 26.7% used amalgam cores, however among prosthodontists, 30.6% used composite cores more commonly whereas 28.9% used cores other than that mentioned on the options. Among prosthodontists, 41.3% prefer glass ionomer cement, 32.2% prefer resin cement whereas 26.4% prefer zinc phosphate cement to lute the post; however, among endodontists, 37.6% prefer glass ionomer cement and 46.5% zinc phosphate cement. Among general practitioners, 56.9% prefer resin cement and 27.6% prefer glass ionomer cement.

Techniques of Post Space Preparation

80.2% prosthodontists, 78.2% endodontists, and 81.9% general practitioners wait for 1 week after root has been filled to prepare the canal for post (Table 4). Among prosthodontists, 60.3% remove root fillings with conventional burs more frequently whereas 39.7% preferred to use special burs supplied by manufacturers whereas among endodontists, 83.2% preferred conventional burs while 16.8% preferred special burs; however, among general practitioners, 56.9% preferred special burs while 43.1% preferred conventional burs. 76.2% endodontists seal root filling after post space preparation whereas 77.7% prosthodontists and 79.3% general practitioners do not seal root filling after post space preparation. 76% prosthodontists rinse canal with distilled water, 66.3% endodontists rinse with sodium hypochlorite whereas 56% general practitioners do not rinse canal before post cementation. 69.3% endodontists and 62.9% general practitioners apply cement to post to place cement in canal whereas among prosthodontists, 38.8% apply cement to post to place cement in canal while 34.7% apply cement to canal with a lentulo spiral.

Cause of Failure

81% prosthodontists reported endodontic failure while 12.4% reported loss of retention of post as the most frequent cause of failure (Table 5). Similarly 74.1% general practitioners reported endodontic failure while 12.9% reported loss of retention of post as most frequent cause of failure. However, 79.2% endodontists reported loss of retention of posts while 16.8% reported endodontic failure as most frequent cause of failure (Graph 4).

Table 3: Responses regarding materials preferences

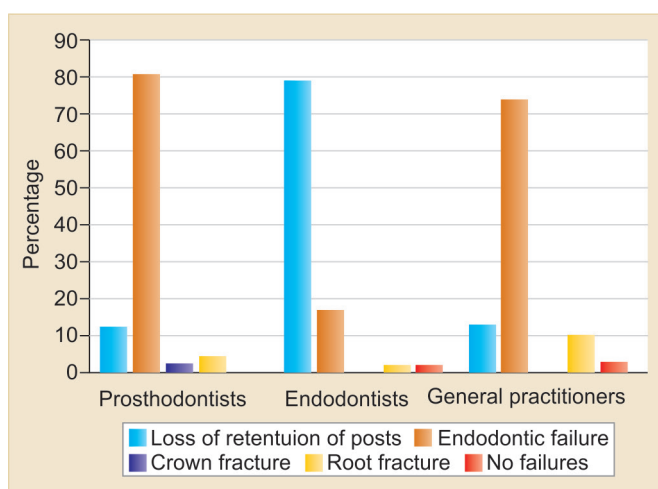
| Question | Response | Prosthodontist (%) | Endodontist (%) | General practitioner (%) |
|--|--|--------------------|-----------------|--------------------------|
| (1) Which post system do you use more frequently? | (a) Cast posts | 47.1 | 83.2 | 21.6 |
| | (b) Prefabricated post | 52.9 | 16.8 | 78.4 |
| (2) Which of the following post designs do you prefer? | (a) Tapered posts | 46.3 | 70.3 | 74.1 |
| | (b) Parallel posts | 20.7 | 27.7 | 17.2 |
| | (c) Combined parallel-sided/tapered | 21.5 | 1 | 4.3 |
| | (d) Screw type | 9.1 | 1 | 2.6 |
| | (e) Split flexible post | 2.5 | 0 | 1.7 |
| (3) Which material do you use more commonly to construct core on prefabricated post? | (a) Composite | 30.6 | 13.9 | 49.1 |
| | (b) Glass ionomer cement | 18.2 | 7.9 | 17.2 |
| | (c) Resin modified glass ionomer cement | 6.6 | 0 | 12.1 |
| | (d) Amalgam | 15.7 | 26.7 | 6 |
| | (e) If other than these (please specify) | 28.9 | 51.5 | 15.5 |
| (4) Which cement do you use to lute a post? | (a) Zinc phosphate cement | 26.4 | 46.5 | 15.5 |
| | (b) Glass ionomer cement | 41.3 | 37.6 | 27.6 |
| | (c) Polycarboxylate cement | 0 | 0 | 0 |
| | (d) Resin cement | 32.2 | 15.8 | 56.9 |

Table 4: Responses regarding techniques of post space preparation

| Question | Response | Prosthodontist (%) | Endodontist (%) | General practitioner (%) |
|--|--|--------------------|-----------------|--------------------------|
| (1) When do you prepare the canal for post? | (a) Immediately after root has been filled | 10.7 | 19.8 | 1.7 |
| | (b) Wait for 1 week after root has been filled | 80.2 | 78.2 | 81.9 |
| | (c) If other than these (please specify) | 9.1 | 2 | 16.4 |
| (2) How do you remove the root filling material? | (a) Conventional rotary instruments, e.g., Gates Glidden drills, pezoreamers | 60.3 | 83.2 | 43.1 |
| | (b) Special burs supplied by manufacturers | 39.7 | 16.8 | 56.9 |
| | (c) Round burs | 0 | 0 | 0 |
| | (d) Hand reamers | 0 | 0 | 0 |
| | (e) Heated instruments | 0 | 0 | 0 |
| | (f) Solvents | 0 | 0 | 0 |
| (3) Do you seal the root filling after preparing the canal for a post? | (a) Yes | 22.3 | 76.2 | 20.7 |
| | (b) No | 77.7 | 23.8 | 79.3 |
| (4) Which solution do you use to rinse the canal before cementing the posts? | (a) Distilled water | 76 | 30.7 | 36.2 |
| | (b) Hydrogen peroxide | 5.8 | 1 | 3.4 |
| | (c) Sodium hypochlorite | 9.1 | 66.3 | 2.6 |
| | (d) EDTA | 2.5 | 0 | 1.7 |
| | (e) Chlorhexidine | 2.5 | 0 | 0 |
| | (f) Do not rinse | 4.1 | 2 | 56 |
| (5) Which method do you use to place the cement in canal? | (a) Apply it to the post before placing in canal | 38.8 | 69.3 | 62.9 |
| | (b) Applying cement to canal by probe | 19.8 | 26.7 | 23.3 |
| | (c) Applying cement to canal with a lentulo spiral | 34.7 | 0 | 6.9 |
| | (d) Applying cement to canal with small plastic tube | 6.6 | 4 | 6.9 |

Table 5: Responses regarding cause of failure

| Question | Response | Prosthodontist (%) | Endodontist (%) | General practitioner (%) |
|---|--------------------------------|--------------------|-----------------|--------------------------|
| (1) Which is the most frequent failure? | (a) Loss of retention of posts | 12.4 | 79.2 | 12.9 |
| | (b) Endodontic failure | 81 | 16.8 | 74.1 |
| | (c) Crown fracture | 2.5 | 0 | 0 |
| | (d) Root fracture | 4.1 | 2 | 10.3 |
| | (e) No failures | 0 | 2 | 2.6 |

**Graph 4:** Comparison of responses of different dental specialties based on most frequent failure

DISCUSSION

The overall return rate of the questionnaire was 37% which is in line with other studies.^{5,6} Due to anonymous nature of the study, it was not possible to send reminders.

Majority of the respondents, 89.3% prosthodontists, 81.2% endodontists, and 90.5% general practitioners were not of the opinion that every ETT must receive a post which is commensurate with the consensus in the literature.

Most prosthodontists and endodontists place posts in 30% of all ETT whereas most general practitioners place posts in 30 to 70% of all ETT which is less frequent than a comparable study carried out in Germany.⁷

Studies have demonstrated that a post does not reinforce ETT and reduce fracture probability.⁸⁻¹² Contrary to this, a large percentage of general practitioners were of the opinion that a post reinforces ETT which is much higher than studies carried out in Sweden, Germany, and United States.^{7,13,14} This may be the reason for majority of general practitioners placing posts frequently in ETT. However, in the present study, majority of prosthodontists (68.6%) and endodontists (80.2%) believed in reinforcement effect when posts were used with adhesive luting whereas in Germany, only a minority believe in reinforcement effect when post placement is performed either adhesively or conventionally.⁷

As compared to studies in Sweden, United States, and Germany, a higher percentage of prosthodontists and general practitioners believed that a reinforcement effect by using a ferrule exists which is in agreement with literature which suggests posts made with ferrule have increased resistance to failure. However, in the present study, lesser percentage of endodontists believe in fracture resistance effect of ferrule.^{7,13-17}

According to literature, anterior teeth with minimal access cavity can be restored with composite resin. Premolars and molars with minimal access cavities can be restored with amalgam or composite resin in combination with a resin bonding system. Posterior teeth with large access cavities following extensive carious lesions carry greater occlusal loads and therefore require protection against possible fracture by cuspal coverage.^{11,18} However, majority of endodontists and general practitioners place posts more frequently in premolars and anteriors. This may be due to extensive caries in these teeth or due to discoloration requiring coverage in esthetic areas. In a similar study in Sweden, it was more common to use posts in endodontically treated molars and premolars.¹³

Most prosthodontists, endodontists, and general practitioners use posts more commonly for single-crown therapy; however, few prosthodontists also use posts for abutment teeth for FPD. The possible explanation may be to increase the retention of crown or due to belief of reinforcement effect of posts. In the study in Sweden, the use of posts for abutments for FPDs was much more common compared to single-crown therapy.¹³

It was more common among endodontists to use cast posts whereas most general practitioners use prefabricated posts more frequently, which may be due to the fact that prefabricated posts are easy to use and require less chairside time. However, among prosthodontists, cast posts were used with same frequency as prefabricated posts. In Germany and UK, there was a preference for prefabricated posts, however, Swedish and British dentists preferred cast post and core.^{5,7,13,19} In Sweden and United States, use of cast posts was more common among prosthodontists compared to general practitioners.^{13,14}

Endodontists and general practitioners preferred tapered posts though according to literature tapered posts have higher failure rates than both prefabricated and cast parallel-sided posts except for teeth with ovoid canals.²⁰⁻²² However, among prosthodontists, most preferred tapered posts, while a minority preferred combined parallel-sided/tapered posts and parallel posts. In Germany, screw-type posts were the preferred post design which was followed by tapered posts.⁷

Most general practitioners and prosthodontists use composite cores more frequently on prefabricated posts whereas most endodontists used cores other than that

mentioned in the options in the present study. In the United States and UK, amalgam cores are more popular whereas majority of German and Swedish dentists use composite resin cores.^{5,7,13,14}

Glass ionomer cement was the preferred cement to lute posts for most prosthodontists and endodontists whereas majority of general practitioners preferred resin cement. In Sweden, zinc phosphate was preferred cement among both prosthodontists and general practitioners whereas in United States and Northern Ireland, glass ionomer was preferred among general practitioners while only few prosthodontists used this cement for luting.^{13,14,19}

Most prosthodontists, endodontists, and general practitioners preferred to wait for 1 week after root had been filled to prepare canal for posts which is comparable to a study in Northern Ireland. This result is, however, contrary to Swedish dentists who prefer to prepare the canal for posts immediately after root has been filled.^{13,19}

Prosthodontists and endodontists preferred to remove root fillings with conventional burs which is similar to the practice followed by dentists in Sweden and United States whereas most general practitioners in the present study prefer special burs supplied by manufacturers.^{13,14}

It has been recommended to seal the root filling after post space preparation to obtain a dense seal to prevent risk of coronal leakage which is a causal factor for root canal failure.²³⁻²⁷ Most endodontists seal root filling after post space preparation whereas majority of prosthodontists and general practitioners do not seal. In a comparable study in Sweden, 48% prosthodontists and 34% general practitioners practiced sealing root filling. Most commonly used material for this was zinc oxide-eugenol cement.¹³

Rinsing of canal is recommended before post cementation to remove the smear layer formed after instrumentation of root canal.²⁸ Most prosthodontists use distilled water, while endodontists preferred sodium hypochlorite, however most general practitioners do not rinse canal before post cementation. All prosthodontists and 92% of general practitioners in Sweden followed this recommendation. Hydrogen peroxide + alcohol and Tubulicid (Dental therapeutics) were the commonly used rinsing solutions used by them.¹³

Endodontists and general practitioners preferred to apply cement to post to place cement in canal whereas among prosthodontists, 38.8% apply cement to post to place cement in canal while 34.7% apply cement to canal with a lentulo spiral. In Sweden, 32% general practitioners applied cement to the post before placing it in the canal whereas 37% prosthodontists used a small plastic tube to perform this procedure.¹³

Most prosthodontists and general practitioners reported endodontic failure as the most frequent cause

of failure, however, most endodontists reported loss of retention of posts as a cause of failure. In a study in Germany, loss of retention (43%) was the most common reason for failure followed by endodontic problems (36%) and root fractures (29%).⁷

The present study exhibited variations in the knowledge and practices among clinicians in different countries and different specialties in India. The inconsistency in treatment modalities could be due to the fact that long-term studies on success rate of different restoration techniques are scarce. If long-term randomized trials are conducted in the community then a homogenous clinical trial-based dental practice will emerge. Due to contradictory responses, it is not possible to recommend a standard treatment protocol for restoration of ETT.

CONCLUSION

Within the limitations of this study, the following conclusions were drawn:

- 89.3% prosthodontists, 81.2% endodontists, and 90.5% general practitioners were not of the opinion that every ETT must receive a post.
- 70.7% general practitioners were in the false belief that a post reinforces ETT and reduces fracture probability and place posts more frequently as compared to prosthodontists and endodontists.
- 44.6% endodontists were in the false belief that ferrule does not increase the fracture resistance.
- Cast post and cores were preferred by 83.2% endodontists whereas prefabricated posts were preferred by 78.4% general practitioners. Prosthodontists used cast posts and cores as well as prefabricated posts with relatively same frequency.
- 70.3% endodontists, 74.1% general practitioners, and 46.3% prosthodontists preferred tapered posts which is contrary to the present consensus that tapered posts have a higher failure rate.
- 41.3% prosthodontists and 37.6% endodontists preferred glass ionomer cement to lute posts whereas 56.9% general practitioners preferred resin cement.
- 60.3% prosthodontists and 83.2% endodontists preferred conventional burs to remove root fillings whereas general practitioners preferred special burs supplied by manufacturers.
- 76.2% endodontists seal root filling after post space preparation whereas 77.7% prosthodontists and 79.3% general practitioners do not seal the root filling.
- 76% prosthodontists use distilled water, while 66.3% endodontists use sodium hypochlorite to rinse the canal and 56% general practitioners do not rinse canal before post cementation.
- 69.3% endodontists and 62.9% general practitioners apply cement to post to place cement in the canal

whereas among prosthodontists, 38.8% apply cement to post to place cement in canal while 34.7% apply cement to canal with a lentulo spiral.

- 81% prosthodontists and 74.1% general practitioners reported endodontic failure as the most frequent cause of failure, however, 79.2% endodontists reported loss of retention of posts.
- There were difference in knowledge and practices followed in restoration of ETT among clinicians in different countries as well as between the different specialties – prosthodontists, endodontists, and general practitioners studied in India.

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