

Evaluation of Different Post Endodontic Restorations used in Endodontically Treated Maxillary and Mandibular Anteriors - An Institution Based Retrospective Study

Research Article

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Abstract

Objectives: To evaluate different post endodontic restorations planned for anterior teeth and the factors that govern the choice of these post endodontic restoration.

Methods: This study was carried out in a university set up where data of all post endodontically treated teeth were retrieved from the patient records of a private dental hospital. The retrieved data had 258 anterior teeth restored with fiber reinforced composite (FRC) posts and 50 teeth restored with cast posts which were evaluated by 2 reviewers.

Results: This study showed a statistically significant difference between type of tooth and FRC post size used in anterior teeth and also between type of tooth and remaining tooth structure in anterior teeth restored with cast post (p value <0.05, Chi square test).

Conclusion: Within the limitations of the study, it can be concluded that FRC posts were the choice of post endodontic restoration in most of the anterior teeth and the commonly used drill size for anterior teeth was size 2 while cast posts were the choice of restoration mainly for maxillary central incisors with a remaining tooth structure of 2-4mm and having a ferrule.

Clinical significance: This study also showed an association between the type of tooth and the FRC post size used and also between the type of tooth and the remaining tooth structure in anterior teeth restored with cast posts. So, the choice of post for post endodontic restoration should be done after thorough clinical examination of the tooth structure and evaluation of the probable prognosis.

Keywords: Post Endodontic Restoration; Fiber Reinforced Composite Post; Cast Post; Anterior Teeth.

Introduction

Root canal treatment (RCT) is carried out in teeth with deep caries with pulpal involvement, iatrogenic pulp exposures, physiological changes, management of hypersensitivity that cannot be controlled with desensitizing agents or lasers and teeth subjected to dental trauma like Ellis Class III fracture and avulsion [1-5]. These conditions result in loss of tooth structure and the endodontic treatment that follows, causes drying out of the tooth structure as well as changes collagen crosslinking of dentin leading to compromised strength of the tooth [6, 7]. Prior to initiating RCT, a thorough clinical examination has to be done along with assessment of tooth vitality. The ideal testing device for tooth vital-

ity would be pulse oximeters which can be used even in calcified teeth unlike other devices which might give false negative results in such cases [8, 9].

One of the fundamental aspects of endodontic therapy is cleaning and shaping [10]. In addition to instrumentation, irrigants such as sodium hypochlorite with EDTA or chlorhexidine are often used as initial and final rinses to disinfect the areas that cannot be accessed [11-14]. However, care has to be taken while using a combination of irrigants such that they do not compromise esthetics and the seal achieved during obturation [15]. The final stage of RCT is obturation which is followed by post endodontic restoration that can range from the conservative techniques

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like restoration with post and core systems, composites, bleaching, veneering to the traditional approach of providing full veneer crowns [16-18].

Endodontically treated teeth become more brittle and susceptible to fractures [19-21]. Some authors believe that loss of tooth structure due to trauma or caries would make the tooth more susceptible to fracture and in such cases, post should be placed after endodontic treatment to strengthen or reinforce the tooth [22, 23]. However, there are other studies that believe posts to weaken the tooth as space preparation would result in loss of radicular dentin which eventually would lead to root fracture [24-27]. These studies also state that posts be used only in case of insufficient tooth structure which cannot retain the core restoration. All this data proves that posts retain only the core to support the coronal restoration and do not reinforce the strength of the tooth [28].

Post retained cores are usually not preferred for molars since they have adequate dentin and axial loading conditions unlike anteriors that are loaded non axially. This causes more stress to develop in anterior teeth making it necessary to restore these teeth with post and core restorations [29]. The common post Endodontic restoration that was practiced for anterior teeth since decades was the cast post. Later, with the development of adhesive dentistry, FRC posts came into practice.

The choice of cast post or FRC post relies on clinical assessment and experience of the clinician. Some of the indications of cast post are a) Restoration of endodontically treated teeth (ETT) with moderate to severe loss of crown structure. An excellent success rate of 89-98% can be achieved in such cases for a period as long as 7 years [30, 31]; b) When abutments for prosthodontic treatment are prepared in complicated periodontally involved or worn out teeth [32-34]; c) Restoration of posterior teeth with insufficient tooth structure and diverging roots [35, 36].

The advantages of cast post are i) They are customised to fit the root canal space and since post and core are cases as a single unit, it provides good compressive strength to withstand parafunctional occlusal forces and minimise the chances of separation [28, 37]; ii) The angulation of the cone can be modified in case of anteriorly proclined teeth to produce a more convenient shape of the final esthetic restoration [28, 37]. The disadvantages of cast posts include: i) Esthetic problem as the metal portion would discolour the root which can be seen through the thin gingival tissue [28,38]; ii) The metal portion is seen through all ceramic crowns used for anterior teeth [39, 40]; iii) Requires 2 appointments, laboratory fabrication and is expensive [28] and iv) Difficult to remove from the root.

With the increase in the demand for esthetics, prefabricated fiber posts were designed with the improved physical properties and clinical performance which after luting within the root was restored with resin composite materials. Some of the indications for fiber reinforced composites include: a) For all ceramic restoration of ETT with moderate to severe loss of tooth structure. Use of FRC posts showed a survival rate of up to 96% over a 2 years period [41] and b) Direct resin restoration of endodontically treated anterior without crown coverage where esthetics have been affected and the patient demands for an economical treatment. Such cases have shown a favourable outcome for over 30 months [42].

The advantages of fiber posts include: a) Best esthetics [43]; b) More flexible and requires less dentin removal for its placement [44, 45] and c) Less time consuming, 1 appointment procedure [35, 40]. The disadvantages of FRC posts are i) Causes stress concentration at the adhesive interface due to polymerisation of composite resins [46, 47] and ii) Composite resins used for core build up showed low wear resistance and microleakage [48]. Thus the choice of post after the endodontic treatment should be done after through clinical examination of the tooth structure and evaluation of the probable prognosis.

Methods

Ethical approval: Approval for the project was obtained from the Institutional Review Board of Saveetha Institute of Medical and Technical Sciences, Chennai, India on 24/4/2020. SDC/SIHEC/2020/DIASDATA/0619-0320.

A university setup was selected for this study which provided easy accessibility to data and provided a population of similar ethnicity for this study. There were 2 reviewers to analyse the data that was retrieved. Data was retrieved of 86,000 patients between June 2019 and March 2020 from the patient records of a private dental college which was then analyzed. The data of all anterior teeth restored with post and core was included for this study. Teeth with post and core treatment left incomplete were excluded. The duplicate entries were removed and the data was copied to SPSS software.

After entering the data in SPSS software, the variables were verified and frequency distribution tables were prepared. Association of tooth number with remaining tooth structure, number of walls, post size and cement used for luting was done for FRC post using Chi square test. Similarly association of tooth number with drill size and impression material used was done for cast post using the Chi square test.

Results and Discussion

In this study, the parameters assessed were tooth number, post size and cement used (for FRC posts) and drill size and impression material (for cast posts).

The retrieved data had 258 anterior teeth that were restored using FRC posts and 50 anterior teeth restored with cast post. Association was done between tooth number and remaining tooth structure, number of walls, post size and cement used for FRC posts and tooth number with drill size and impression material used for cast posts.

The association was done using Chi square test which showed statistically significant difference in the type of tooth and FRC post size used. Statistical significant difference was also seen in the type of tooth and the remaining tooth structure restored with cast posts [p value <0.05 chi square test].

This study evaluated the difference post endodontic restoration used for anterior teeth and the factors influencing the choice of the restoration. These are no such similar studies stated in literature.

Fiber Reinforced Composite (FRC) Posts

When tooth number and remaining tooth structure were studied, it was seen that most of the teeth with remaining tooth structure of 2-4 mm were restored with FRC posts followed by teeth with 1-2 mm of remaining tooth structure. This finding showed that FRC posts were being used to restore moderate to severely lost tooth structure which would help to retain the core [28, 41] (Figure 1).

Association of tooth number and number of walls showed that FRC post was used in anterior teeth having 2 missing walls. Restoration of these teeth with direct restoration material would cause dislodgement. Posts were used in these cases to retain the core and re-establish the esthetics and function of the tooth [28, 42] (Figure 2).

Statistical significant difference was seen between tooth number and post size. Most of the anterior teeth were restored with FRC post size 2 followed by size 3. Larger diameter posts were placed in anterior teeth with wider canals for providing snug fit within

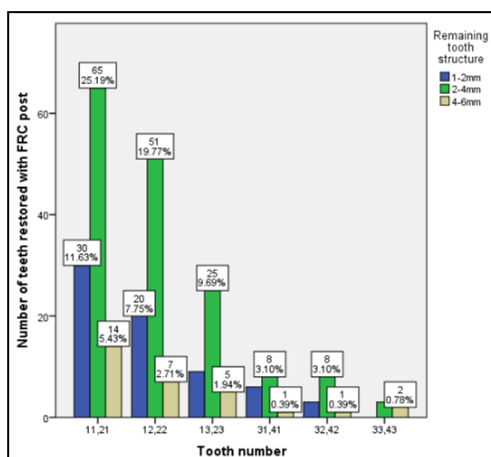
the root canal (Figure 3).

When the cementation material for FRC posts was studied, in most of the cases, FRC posts were cemented using resin cement followed by GIC. Use of resin cements for luting FRC posts results in increased bond strength and better retention of the post [49, 50] (Figure 4).

Cast Posts

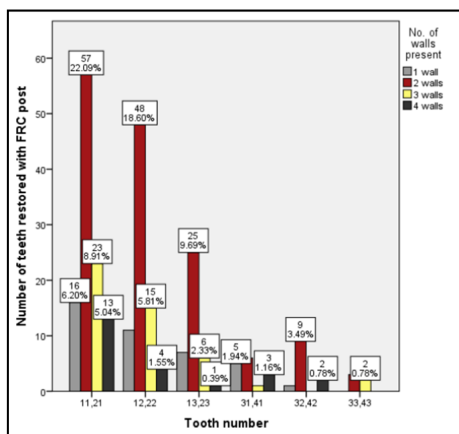
Statistical significance difference was seen when remaining tooth structure was associated with tooth number. Most of the cases receiving cast posts had remaining tooth structure of about 2-4mm. This denotes moderate tooth structure loss which can be restored with cast posts to obtain successful outcomes [30, 31] (Figure 5). Figure 6 depicted the association of tooth number with the number of walls remaining. Most of the central incisors restored with cast post had 2 walls left while lateral incisors and canines had 4 and 3 walls respectively. The moderate to severely lost structures were replaced with cast posts to reinforce the strength of the tooth, re-establish esthetics and retain the final core restoration [22, 29].

Figure 1. Comparison of tooth number with remaining tooth structure for restoration with FRC post.



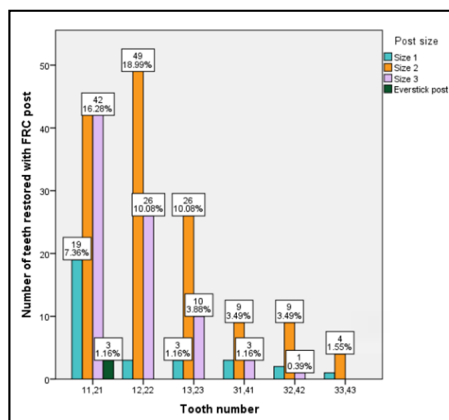
This graph illustrates the placement of FRC posts in different anterior teeth with varying amounts of tooth structure remaining at the end of root canal treatment. Here, blue color denotes 1-2mm; green represents 2-4mm and ivory corresponds to 4-6mm of tooth structure. In this graph, X axis represents the tooth number and Y axis represents the number of teeth restored with FRC post. The Chi square test shows no statistically significant difference [Chi square value-7.663; p value-0.662]. It is seen in this graph that all the anterior teeth (except mandibular canines) with 2-4mm of remaining tooth structure are restored with FRC post following endodontic treatment. In mandibular canines, FRC posts are used when the remaining tooth structure ranges from 2-6mm.

Figure 2. Comparison of tooth number with remaining number of walls for restoration with FRC post.



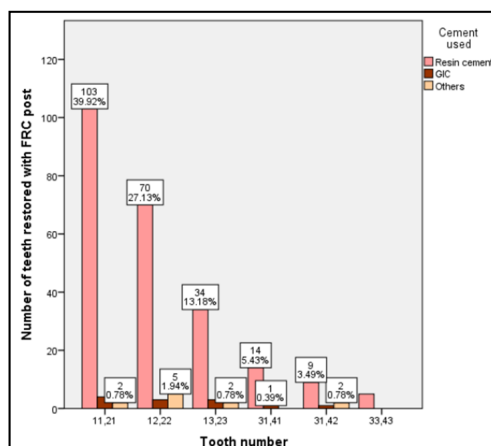
This graph illustrates the number of walls left in different anterior teeth prior to placement of fiber post. In this graph, gray color indicates 1 wall, red indicates 2 walls, yellow corresponds to 3 walls and black for 4 walls. Here, X axis represents tooth number and Y axis represents the number of teeth restored with FRC posts. Chi square test shows no statistically significant difference in the placement of FRC posts in teeth with varying numbers of walls present [Chi square value-19.776; p value-0.181]. However, it is observed that almost all anterior teeth with 2 walls present are restored with FRC posts.

Figure 3. Comparison of tooth number with the size of the FRC post used.



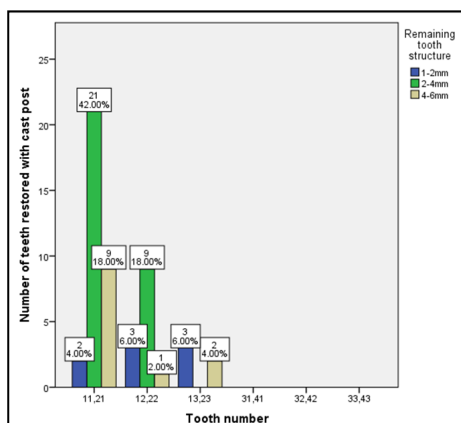
This graph illustrates the various post sizes used for the restoration of different anterior teeth. Here, sky blue represents size 1, orange stands for size 2, lilac for size 3 and sap green for Everstick post. In this graph, X axis represents the tooth number and Y axis for the number of teeth restored using fiber posts. Chi square test shows statistically significant difference in the type of FRC posts used for luting FRC posts in anterior teeth. [Chi square value- 26.447; p value-0.034]. It is seen that maxillary central incisors are restored using FRC posts of sizes 2 and 3. Most of the maxillary lateral incisors, canines and mandibular anteriors are restored with FRC posts of size 2.

Figure 4. Comparison of tooth number with the type of cement used for luting FRC post..



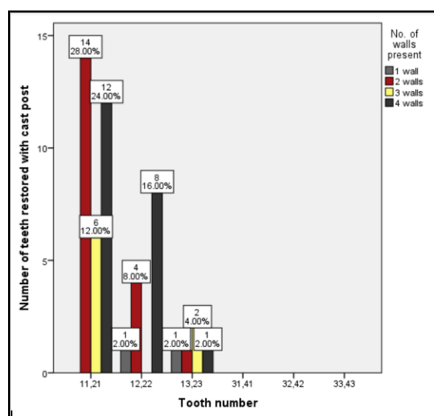
Different cements used for the retention of the post in different anterior teeth have been depicted in this graph. Here, pink indicates resin cement, brown indicates GIC and tan stands for other cements. In this graph, X axis represents tooth number and Y axis represents the number of teeth in which FRC posts are cemented. Chi square test shows no statistically significant difference in the type of cement used for luting FRC posts in anterior teeth. [Chi square value-10.038; p value-0.437]. In this graph it is seen that resin cement is the commonly used luting agent for FRC posts. The maximum number of FRC posts have been luted in maxillary central incisors with resin cement (39.92%).

Figure 5. Comparison of tooth number with remaining tooth structure for restoration with cast post.



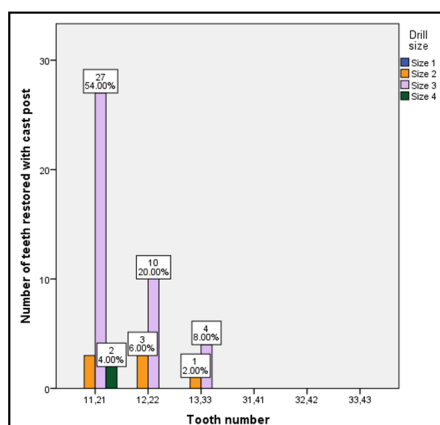
Depicts the casts posts placed in anterior teeth with varying amounts of tooth structure left. Here, blue represents 1-2mm, green indicates 2-4mm and ivory represents 4-6mm of tooth structure. In this graph, X axis corresponds to tooth number and Y axis represents the number of teeth restored with cast posts. Chi square test shows statistically significant difference in the amount of tooth structure remaining and the type of tooth restored using cast post. [Chi square value-13.912; p value-0.008]. It is seen in this graph that maxillary central incisors (42%) and maxillary lateral incisors (18%) with 2-4mm of remaining tooth structure were restored with cast posts. Maxillary canines (6%) with 1-2mm of tooth structure were restored using cast posts.

Figure 6. Comparison of tooth number with number of remaining walls for restoration with cast post.



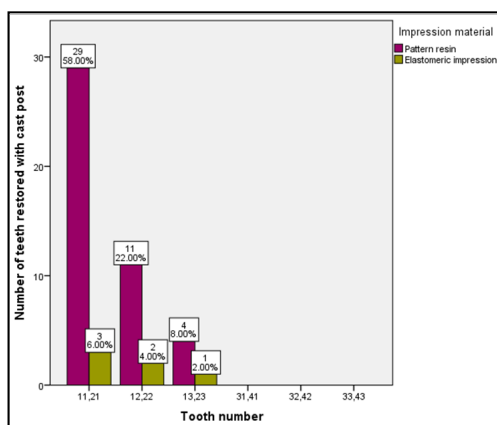
Illustrates the association between anterior teeth and varying numbers of walls present for cast post fabrication. Here gray color indicates 1 wall, red stands for 2 walls, yellow for 3 walls and black for 4 walls. In this graph, X axis represents the tooth number and Y axis represents the number of teeth restored with cast posts. Chi square test shows no significant difference in the number of walls in the type of tooth and to be restored with cast posts. [Chi square value-11.750; p value-0.068]. It is seen that maxillary central incisors (28%) with 2 remaining walls are restored with cast posts while maxillary lateral incisors (16%) with 4 remaining walls are restored using cast posts. It is also seen maxillary canines (4%) with 3 remaining walls are restored using cast posts.

Figure 7. Comparison of tooth number with the drill sizes used for post space preparation for restoration with cast post.



Represents the different drill sizes used for post space preparation in anterior teeth. Here, sky blue represents size1, orange represents size 2, lilac stands for size 3 and sap green for size 4. In this graph, X axis represents the tooth number and Y axis represents the number of teeth restored with cast posts. Chi square test shows no statistically significant difference in the type of tooth and post space preparation drill size for cast posts. [Chi square value-2.573; p value-0.632]. It is seen that all the maxillary anterior teeth restored with cast posts have their post space prepared with drill number 3 (54% of maxillary central incisors, 20% of maxillary lateral incisors and 8% of maxillary canines).

Figure 8. Comparison of tooth number with the type of impression materials used for restoration with cast post.



Depicts the various elmpression materials used for recording the post space prepared for cast post in anterior teeth. In this graph, mauve indicates pattern resin while olive green indicates elastomeric impression material. Here, X axis denotes the tooth number while Y axis represents the number of teeth restored with cast posts. Chi square test shows no statistically significant difference in the type of tooth and post space in the type of tooth and post space in the type of tooth. [Chi square value-0.653; p value-0.721]. It is seen that pattern resin is the commonly used impression material for recording the post space prepared in anterior teeth (58% in maxillary central incisors, 22% in maxillary lateral incisors and 8% in maxillary canines).

There was no significant difference in tooth number and drill size used to prepare the post space but for most of the teeth a drill size 3 was used for post space preparation (Figure 7). Figure 8 showed that most of the post space impressions were made using pattern resin. Pattern resin was more convenient to use as voids could be eliminated by additive method.

The limitations of this study were that the sample size was small and so the results couldn't be generalised to a larger population. The outcome of these post endodontic restorations were not evaluated in this study. Further studies can be conducted to correlate the remaining tooth structure and the survival rate of the teeth as well as durability of post endodontic restorations and their failure rates.

Conclusion

Within the limitations of the study, it can be concluded that FRC posts were the choice of post endodontic restoration in most of the anterior teeth and the commonly used drill size for anterior teeth was size 2 while cast posts were the choice of restoration mainly for maxillary central incisors with a remaining tooth structure of 2-4 mm and having a ferrule.

Clinical significance

The study results revealed that FRC posts are commonly being used for post endodontic restoration in anterior teeth. This study also showed an association between the type of tooth and the FRC post size used and also between the type of tooth and the remaining tooth structure in anterior teeth restored with cast posts. So, the choice of post for post endodontic restoration should be done after thorough clinical examination of the tooth structure and evaluation of the probable prognosis. Further studies can be designed to evaluate the survival rate of teeth and durability of post endodontic restorations and their failure rates.

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