Comparative Analysis of Different Sizes of Prefabricated Metal Posts Placed in Relation to Premolars- A Retrospective Analysis

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Abstract

Endodontically treated teeth which have extensive structural defects due to caries, access cavity preparation require post and core management for retention purpose.The clinical decision as to whether an endodontically treated tooth requires a post and a crown poses a challenge to dental practitioners.This study aims at comparing different sizes of prefabricated metal posts in relation to endodontically treated premolars.This retrospective clinical study evaluated the patients who received prefabricated metal posts in endodontically treated premolars in Saveetha dental college, Chennai from June 2019 to March 2020. Over 373 patients records of prefabricated metal posts, 157 cases were selected based on the inclusion and exclusion criteria.The collected data was imported to excel sheet , analysed using SPSS software.Results showed that the Group B (post size-2)(diameter of 0.85mm) reported greater preferences than other groups in relation to prefabricated metal posts in endodontically treated premolars.The comparative analysis in relation to endodontically treated premolars with prefabricated metal posts showed post size of 2(diameter of 0.85mm) showed greater preferences than other groups.

Keywords: *Metal posts, Post width, Post size, Premolars, Prefabricated posts.*

Introduction

Intraradicular posts are commonly used to restore endodontically treated teeth when their remaining coronal structure cannot provide adequate support and retention for the restorative material[1]. Cast post and core systems were the standard techniques for many years. However, demands for simpler procedures led to the development of prefabricated posts, initially made from metal and recently from non metallic as the glass fibre posts[2].

A key element in the post selection is the amount of remaining coronal tooth structure and incorporation of ferrule[3].Endodontically treated teeth with moderate to severe coronal tooth loss have demonstrated a success rate of 90.6% after 5 years of service when restored with cast post and cores[4]. Previous invitro and invivo studies showed that non metallic posts should be used when broad coronal dentin is remaining and the crown is well supported by remaining tooth structure; otherwise cast post and core may be used when there is moderate to severe loss of tooth structure[5].

A systematic review showed that the presence of ferrules with 1.5-2mm has a positive effect to ensure proper resistance form to the tooth, prevent fracture from the forces, and dislodgement of the post[6]. Oliveria

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showed that the fracture resistance of the teeth with 0,1,2mm /3mm of remaining coronal tooth structure reinforced with prefabricated non metallic posts did not differ among them and to the group with no remaining coronal tooth structure restored with cast post and cores[7].

Tik et al studied the root widths to determine the best size of the posts, they reported that 1.10 mm size of post is the most appropriate one for the upper central incisors, being responsible by proportion of one third of the root[2,8]. In other studies, best results were obtained with less conservative post diameters. Kivance et al found that posts with increased diameter (roots with 1 & 1.5 mm of remaining coronal structure) presented significant higher fracture resistance than the posts with less diameter[8,9]. Also a finite element analysis demonstrated that when the diameter of the post was 50% of the root, the stress distribution of the post and dentin were most favourable.

Post heads are either flat,spherical, serrated and the most commonly used core materials are composite, glass ionomer cement, resin based luting cement[10–12]. The advantages of glass ionomer cement as core material includes bonding to tooth structure and fluoride release, remineralization in case of carious lesions.

The aim of this study was to compare and analyse the different sizes of prefabricated metal posts in relation to endodontically treated premolars.

Materials and Methods

As it is a retrospective study, several factors such as sample size, sample selection, data collection and analysis influence the validity of this study. This retrospective clinical study evaluated the patients who received prefabricated metal posts (MANI,EG brand) in endodontically treated premolars, Saveetha dental college, Chennai.

DATA EXTRACTION- Over 373 records of prefabricated metal posts cases, 157 cases were selected for this study based on inclusion and exclusion criteria from June 2019 to March 2020.

Inclusion criteria- Patients aged 18- 60 years , endodontically treated premolars treated with prefabricated metal posts(MANI,EG brand).

Exclusion criteria- Teeth other than molars which received posts, teeth which received other post and core systems such as FRC post, acst post were excluded from this study.

The collected data was entered in Microsoft excel sheet and grouping of parameters done in excel sheet. The four parameters in these studies were age of the patient, gender of the patient, teeth number,post size used.

After grouping of parameters , data copied to SPSS software. The statistical analysis between different groups was carried out in SPSS software. Chi square test was done to compare the remaining coronal tooth structure to other three parameters – age, gender. teeth number.

TABLE 1:Based on Age of the patient, grouping done as follows

AGE	GROUP
18-30	1
30-40	2
40-50	3
50-60	4

TABLE 2:Based on Gender of the patient, grouping done as follows

GENDER	GROUP
Female	1
Male	2

TABLE 3: Based on Teeth number of the patient, grouping done as follows

Teeth number	Group
First quadrant	1
Second quadrant	2
Third quadrant	3
Fourth quadrant	4

TABLE 4: Based on Post size used, grouping done as follows

Post size used	Group
Size 1(Diameter-0.65mm)	A
Size 2(Diameter-0.85mm)	B
Size 3(Diameter-1.05mm)	C

Chi square test was done to assess these parameters. The outcome data was represented in the form of tables and graphs. The four tables represent the prefabricated metal posts in premolars done based on the age, gender, teeth number of the patient. The graphs represent the correlation between these parameters- Correlation of age and post size used in endodontically treated premolars, gender and post size used in endodontically treated premolars, teeth number and post size used in endodontically treated premolars.

The bar charts are represented by percentage- for example, X axis represents the age of the patient, Y axis represents the percentage of post size used in endodontically treated premolars.

These type of correlation were represented for all these parameters such as prefabricated post size used based on age, gender, teeth number parameters

Results and Discussion

In this study, analysing and comparing different prefabricated post sizes used in endodontically treated premolars, Group B (post size-2 having diameter of 0.85mm) reported greater preferences than Group A(post size-1 having diameter of 0.65mm), Group C(post size-3 having diameter of 1.05mm).

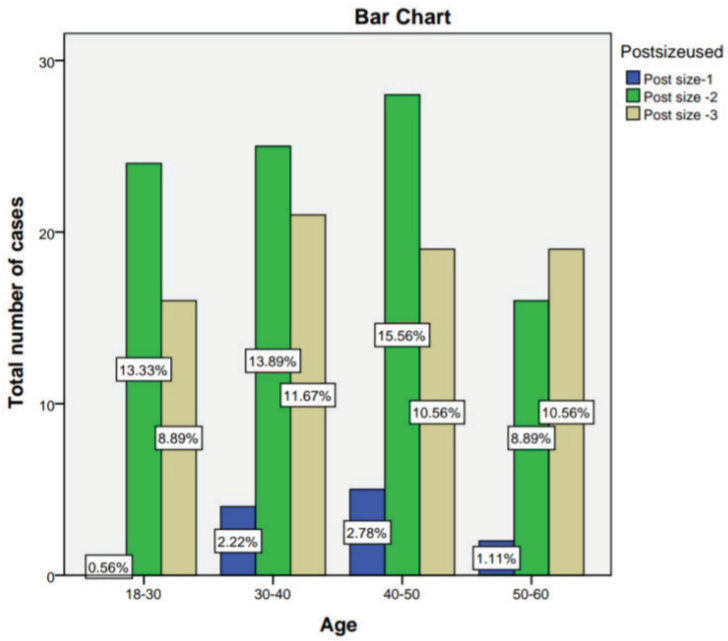

Figure 1- Bar graph showing correlation between age and post size. In the graph, X axis represents the age of the patient and Y axis represents the absolute count. Blue colour represents post size 1, green colour represents post size 2 and grey colour represents post size 3.In this graph, depending on the frequency of post size used based on age group, maximum cases in the age group of 18-60 years accounted for post size of

2 having diameter of 0.85mm. Group B(post size-2 having diameter of 0.85mm) showing greater preferences than other groups.There is a significant difference among groups(p value is 0.02, p<0.05, Chi Square test).

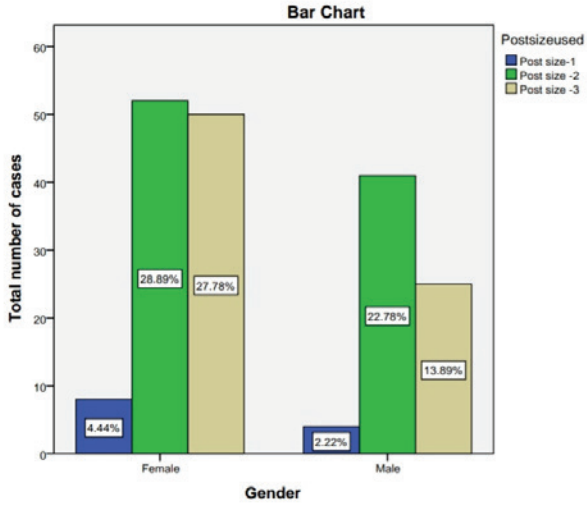

Figure 2-Bar graph showing correlation between gender and post size. In the graph, X axis represents the gender of the patient and Y axis represents the absolute count..Blue colour represents post size 1, green colour represents post size 2 and grey colour represents post size 3. In this graph, depending on the frequency of post size used based on gender, maximum cases in the males and females of 18-60 years accounted for post size 2 having a diameter of 0.85mm.Group B(post size-2 having diameter of 0.85mm) showing greater preferences than other groups.There is a significant difference among groups(p value is 0.03<0.05, Chi Square test).

Figure 3:

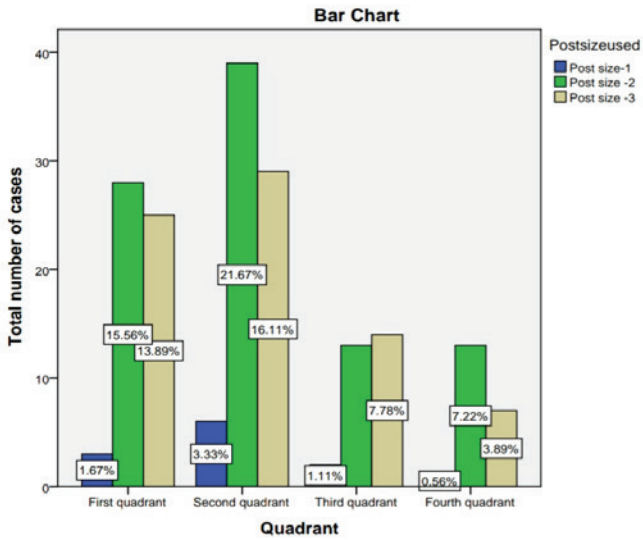

Figure 3-Bar graph showing correlation between teeth number and post size. In the graph, X axis represents the teeth number of the patient and Y axis represents post size used. In this graph, depending on the frequency of post size used based on teeth group, maximum cases in all quadrants accounted for post diameter 2 having a diameter of 0.85mm except in the third quadrant in which post diameter 3 having a diameter of 1.05mm is preferred.Group B(post size-2 having diameter of 0.85mm) showing greater preferences than other groups.There is a significant difference among groups(p value is 0.02<0.05, Chi Square test).

Achieving a post diameter that is strong to support the occlusal loads and does not interfere with the resistance of the remaining tooth structure is one of the major aims in rehabilitation. The comparison of different post thickness (1 and 1.5mm) showed no statistically significant differences in both materials[13]. This results suggests that when restoring anterior endodontically treated teeth, thin post can be indicated. Thus, with a minimum preparation of root canals, the capacity of reinforcement and the resistance to fracture is maintained[14].

Studies showed that a smaller post diameter might be used to avoid excessive wear of inner root dentin during the post size preparation once the amount of remaining dentin wall around the post is directly related to fracture resistance of tooth[15].However some studies indicated that posts with increased diameter were more resistant and provided more resistance to restored teeth and led to less stress distribution of remaining dentin. Another study indicates a more conservative root canal preparation being a 1mm size (one third of the root) able to perform proper resistance[16].

Understanding the biomechanical factors that affect the ability of post to retain a restoration and to protect the remaining tooth structure is essential for the design of post core systems[17]. Parameters such as length,diameter,configuration,surface roughness, material used in the post affects its retention and strength[18].

Parallel sided posts have more retention than tapered posts and longer, wider the posts, greater is its strength and retention. Yet,over enlargement of the channel for insertion of large diameter post may weaken the root because of loss of dentin and results in root fracture under functional load[19].

Stress also increases as the post diameter increases. Therefore the need to preserve and protect the remaining dentin for maximum root strength is equally as important for retention[20].Hock stated that strength of root is directly related to bulk of dentin. Trabert found that teeth with 1.25mm diameter steel dowels were less prone to fracture than either untreated control teeth.

Colmon suggested a maximum diameter of 1.1mm and recommended that dowel diameter be one third the diameter of the root. Standlee proposed that at least 1mm of sound dentin be maintained around the entire circumference of channel.In addition, a sufficient buccal dentin wall must be conserved in maxillary anterior teeth because of its function as fulcrum towards horizontally directed force[21].

Dowel channels with 1 mm buccal dentin walls were more prone to fracture. Two patterns of root fracture were identified[22] such as Oblique fracture, Horizontal fracture at post's end.

Dowel channels with 3mm buccal dentin walls generally failed due to cement failure rather than root fracture[23].If remaining buccal wall at the entrance of dowel channel is 1mm/less, a parallel sided dowel form should be avoided in tapered root to prevent perforation/ undermining of dentin wall at dowel's end. It may also produce root fracture at the region of dowel's end under horizontal impact[24].

The influence of remaining coronal structure on the survival of root canal filled teeth has been noted to be at greater extent.Finally among the multiple factors that have influenced the prognosis of restorations with posts, excessive removal of root dentin when preparation decreases resistance to fracture and it should be avoided.It is similar to many factors that influence the endodontic therapy such as proper disinfection, shaping, placement of intracanal medicament[25–30].Similarly, many factors influence the vital status of pulp in case of inflammation, traumatic injury,calcified canal[31,32].The pulpal diagnosis should be made properly with advanced armamentarium[33,34].

Many luting cements used for post and core cementation have many advantages such as aesthetic property[35,36], proper adaptation of the post to the walls.

To avoid a wedge like action from a tapered dowel, the dowel and core should have a positive stop/seat. This can be obtained from core design well adapted undersurface, perpendicular to the root axis, to prevent the dowel from entering the canal beyond the predetermined limit[37].

Limitations

The limitations of this study were confined to a smaller number of populations.For comparing between

maxillary, mandibular premolars, criteria should have been different as the canal anatomy differs.

Future scope

The future studies can focus on the sizes of prefabricated metal posts in relation to molars with a larger population included in comparison.

Conclusion

Within limitations of this study, it can be concluded that the prefabricated posts of size 2 having a diameter of 0.85mm were highly preferred in relation to endodontically treated premolars with prefabricated metal posts.

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Ethical Clearance: It is taken from "Saveetha Institute Human Ethical Committee" (Ethical Approval Number- SDC/SIHEC/2020/DIASDATA/0619-0320)

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