

## Original Research

### Fracture resistance of glass fibre, zirconia and metal post with different length

Dr. Vidyut Prince<sup>1</sup>, Dr. Hotchandani Kamal Dhruvkumar<sup>2</sup>, Dr. Bhavika<sup>3</sup>, Dr. Kishan K Choithani<sup>4</sup>, Dr P.S.H.L Parvathi<sup>5</sup>, Dr. Syama Rajan<sup>6</sup>

<sup>1</sup>Assistant Professor, Department of Dentistry, MGM medical college and LSK hospital, Kishanganj, Bihar;

<sup>2</sup>Assistant Professor, Department of Dental Surgery, Pramukhswami Medical College, Karamsad;

<sup>3</sup>BDS, I.T.S. Dental College, Muradnagar, Ghaziabad, Uttar Pradesh;

<sup>4</sup>Consulting Prosthodontist, Bhavnagar, Gujarat;

<sup>5</sup>PG 3rd year, Department of prosthodontics, Lenora institute of dental sciences, Rajanagaram, Rajahmundry, Andhra Pradesh;

<sup>6</sup>PG 3rd year, Department of Prosthodontics, Educare Institute of Dental Sciences, Malappuram, Kerala

#### ABSTRACT:

**Background:** The present study compared glass fibre, zirconia and cast post with different length. **Materials & Methods:** The present study was conducted on 45 recently extracted permanent incisors. Teeth were divided into 3 groups. Group I comprised of cast post, group II had glass fibre post and group III had zirconia post. The teeth were loaded to fracture in the universal testing machine. **Results:** The mean failure load in group I at 6 mm was 270.4 N and at 8 mm was 300.8 N, in group I was 144.2 N and 180.4 N, in group III was 218.2 N and 305.1 N. The difference was significant ( $P < 0.05$ ). The maximum fracture was 8 at 6 mm and 6 at 8 mm root length at apical third in group II. In group II, at cervical region at 6 mm was 10, at 8 mm was 7 and in group III, at cervical region at 6 mm was 8 and at 8 mm was 7. **Conclusion:** Authors found that there was no effect of increasing the length of posts in all groups on fracture resistance.

**Key words:** Post, glass fibre, zirconia

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**Corresponding author:** Dr. Vidyut Prince, Assistant Professor, Department of Dentistry, MGM medical college and LSK hospital, Kishanganj, Bihar, India

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#### INTRODUCTION

Endodontically treated teeth often present with compromised crown structure, which need full-coronal restoration along with post and core restorations.<sup>1</sup> Endodontically treated teeth present with dehydration, altered esthetic, and change in physical characteristics. Hence, successful outcome of pulp-treated permanent teeth needs proper rehabilitation procedure.<sup>2</sup> Post is required to restore radicular part of teeth and core to enhance coronal structure. The prime objectives of post and core procedure are to build missing coronal structure as well as to provide sufficient retention and resistance form to final restoration.

In earlier days, custom-made post and core restoration was one of the popular methods to restore endodontically treated teeth. Later on, prefabricated posts gain importance due to reduced time and feasibility.<sup>3</sup>

The development of zirconia and GFP and effective application of adhesive composite cements may be considered as a step forward in restoring the ETT since clinical and laboratory investigations related to prefabricated zirconia and GFP have yielded promising results.<sup>4</sup> The optimum length of post for restoration of the ETT using a particular type of post remains a controversial topic due to factors such as availability of a wide range of post-core systems,

differences in physical properties of posts, and differences in study designs comparing various lengths of posts. Weinberg advocated that the post length of two-third of the radicular length is the most favorable for the longevity of post-core treated teeth.<sup>5</sup> The present study compared glass fibre, zirconia and cast post with different length.

**MATERIALS & METHODS**

The present study was conducted on 45 recently extracted permanent incisors. This invitro study was started after obtaining ethical clearance from institute. All teeth were endodontically treated and tooth preparations were done followed by the impression of the coronal portion with polyvinyl siloxane

impression material loaded in copper tubes. The coronal portion of each tooth was removed, maintaining a 2 mm ferrule. Teeth were divided into 3 groups containing 15 posts each based on type of posts used. Group I comprised of cast post, group II had glass fibre post and group III had zirconia post. The CP and core patterns were fabricated using post space impressions and core buildup and cast using Nickel–Chromium alloy. After composite resin core buildup of GFP and ZPs treated teeth using the previously made copper tube impressions, the teeth were loaded to fracture in an oblique direction in the universal testing machine. Results thus obtained were subjected to statistical analysis. P value less than 0.05 was considered significant.

**RESULTS**

**Table I Distribution of teeth**

Groups	Group I	Group II	Group III
Post	Cast post	Glass fibre post	Zirconia post
Number	15	15	15

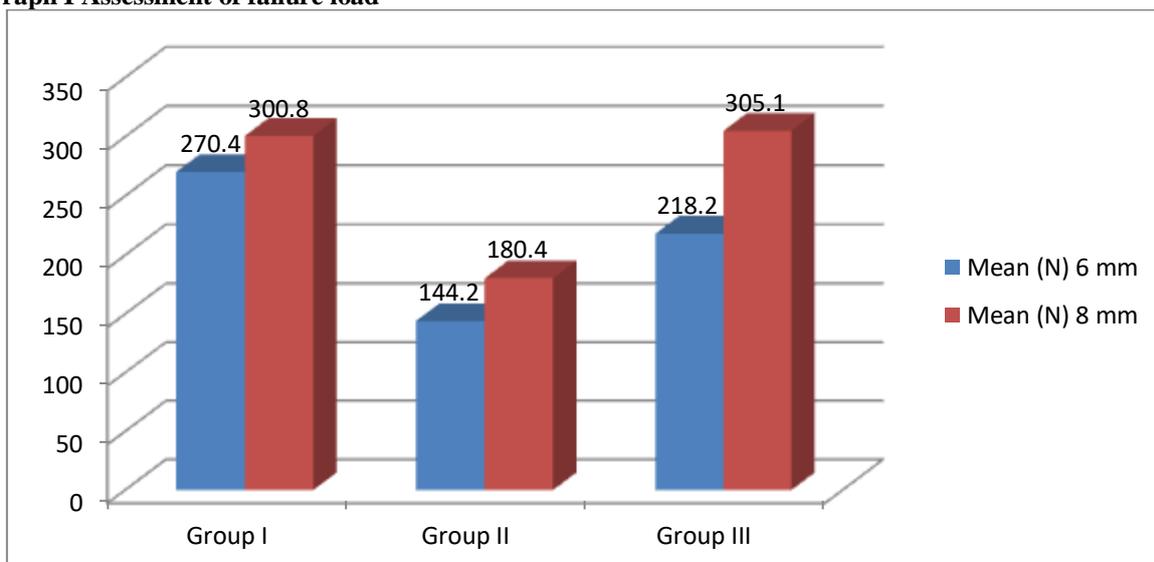
Table I shows type of posts used in the study.

**Table II Assessment of failure load**

Groups	Mean (N)		P value
	6 mm	8 mm	
Group I	270.4	300.8	0.01
Group II	144.2	180.4	
Group III	218.2	305.1	
P value	0.05	0.02	

Table II, graph I shows that mean failure load in group I at 6 mm was 270.4 N and at 8 mm was 300.8 N, in group II was 144.2 N and 180.4 N, in group III was 218.2 N and 305.1 N. The difference was significant (P< 0.05).

**Graph I Assessment of failure load**

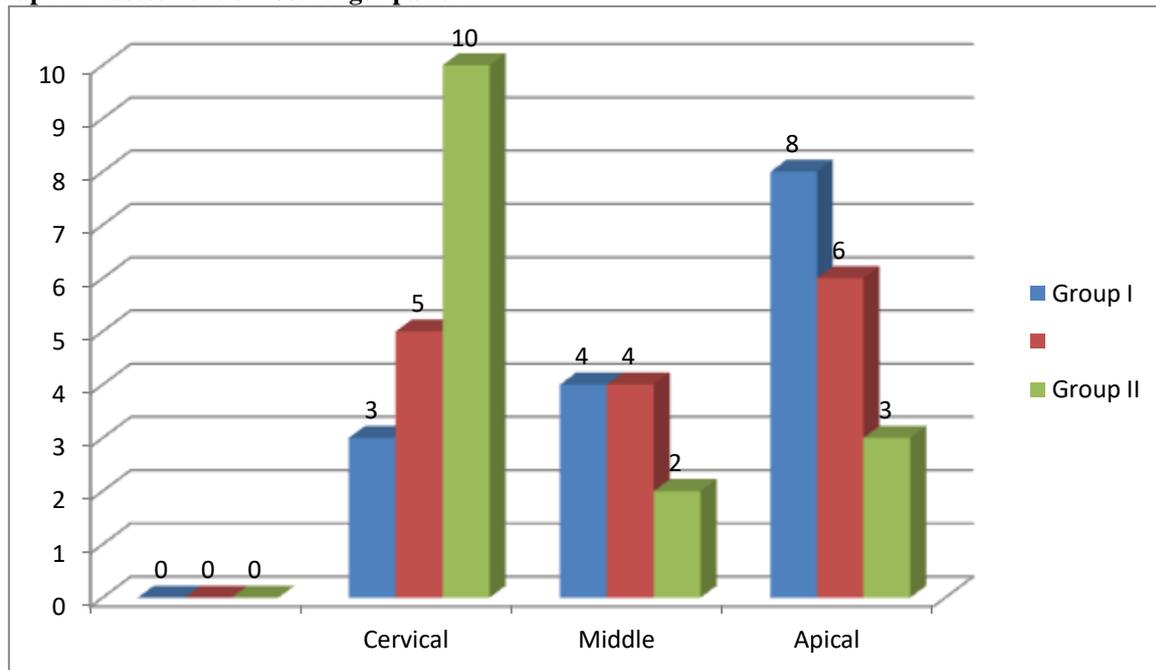


**Table III Assessment of root length pattern**

Fracture site	Group I		Group II		Group III	
	6 mm	8 mm	6 mm	8 mm	6 mm	8 mm
Cervical	3	5	10	7	8	7
Middle	4	4	2	5	4	3
Apical	8	6	3	3	3	5

Table III, graph II shows that maximum fracture occurred at apical region in group I and at cervical region of root in group II and III respectively. It was 8 at 6 mm and 6 at 8 mm root length at apical third in group II. In group II, at cervical region at 6 mm was 10, at 8 mm was 7 and in group III, at cervical region at 6 mm was 8 and at 8 mm was 7.

**Graph II Assessment of root length pattern**



**DISCUSSION**

Various tooth-colored posts are gaining popularity such as glass fiber post, zirconia, and composite post. Use of fiber-reinforced post has reduced the risk of root fracture with higher survival rate and has biomechanical properties compatible to that of dentin.<sup>6</sup> Glass fiber post can bond to composite core and retain strength.<sup>7</sup> Zirconia posts are newer development in esthetic prefabricated posts. Previous studies observed that prefabricated steel post or custom post is non-esthetic and has higher failure rates due to internal stress.<sup>8</sup> The present study compared glass fibre, zirconia and cast post with different length.

In present study, Group I comprised of cast post, group II had glass fibre post and group III had zirconia post. Each group had 15 teeth. Padmanabhan<sup>9</sup> from his study concluded that prefabricated stainless steel post has significantly higher fracture resistance at failure compared to ceramic or carbon posts and similarly, Sadeghi<sup>10</sup> from his study found that cast post has higher fracture resistance as compared to zirconia or fiber posts.

We found that mean failure load in group I at 6 mm was 270.4 N and at 8 mm was 300.8 N, in group I at 6 mm was 144.2 N and at 8 mm was 180.4 N, in group III at 6 mm was 218.2 N and at 8 mm was 305.1 N. Palepwad et al<sup>11</sup> found that the highest and lowest values of fracture resistance were reported with ZP8 and GFP6 groups, respectively. There was no significant difference in fracture resistance between the posts of length 6 mm and 8 mm in CP, GFP, and ZP groups. There was no significant difference ( $P = 0.953$ ) in fracture resistance between CP (284.8 N) and ZP (258.31 N) groups, while the GFP group (160.61 N) had a significantly lower value of fracture resistance than the CP and ZP groups. Two-way ANOVA test for fracture resistance of the post systems and post lengths showed that there was no significant correlation between the post systems and post length on the fracture resistance. There was a greater percentage of favorable fractures in GFP and ZP groups (65% each), than the CP group (20%). For the post systems tested, extending the post length does not significantly increase the fracture resistance of the restored teeth. The ZP represents a viable

alternative to the cast metal post during the esthetic restoration of endodontically treated anterior teeth.

We found that fracture posts were 8 at 6 mm and 6 at 8 mm root length at apical third in group II. In group II, at cervical region at 6 mm was 10, at 8 mm was 7 and in group III, at cervical region at 6 mm was 8 and at 8 mm was 7. Maximum fracture occurred at apical region in group I and at cervical region of root in group II and III respectively. Saritha et al<sup>12</sup> in their study forty-five human premolars were subjected to root canal treatment and obturated with gutta-percha. All the teeth were decoronated and mounted in acrylic block. Then, teeth were equally divided into three groups: (a) carbon, (b) glass fiber, and (c) zirconia post group. Post space was prepared and particular post was cemented in post space. Core buildup was made with composite. A compressive load was applied using universal testing machine and fracture force was measured in MPa. Zirconia endodontic post had good fracture resistance (489.2 MPa) when compared with carbon (258.4 MPa) and glass fiber-reinforced post (348.7 MPa). Fracture resistance was statistically significant between test groups  $P > 0.001$ . The shortcoming of the study is small sample size. Only 3 posts were compared.

## CONCLUSION

Authors found that there was no effect of increasing the length of posts in all groups on fracture resistance.

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