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*Original Article*

# Effect of Dental Posts used in Restoring Badly Broken Primary teeth

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## Abstract:

Aim: The aim of this study was to evaluate the shear bond strength (SBS) and fracture resistance (FR) of endodontically treated primary anterior teeth restored: with composite resin reinforced with three different post systems. (1) Ribbon fiber posts; (2) glass fiber posts; and, (3) orthodontic metal wire posts cemented by glass ionomer cement (GIC).Methods: This experimental study conducted in a controlled laboratory setting was performed on 60 extracted human primary maxillary incisors. Samples were randomly divided into 3 groups of 20 teeth each: group 1 (ribbon fiber posts and composite core); group 2 (glass fiber posts and composite core) and group3 (orthodontic metal shaped wire posts and composite core). Each main test group subdivided into two subgroups (I, II) of 10 teeth each according to the laboratory test used, shear bond and fracture strength respectively. Mounted specimens were subjected to an Instron testing machine.Results: For shear bond strength, Stainless steel group recorded the highest mean value (14.4±2.4Mpa) followed by Glass fiber group (5.6±4.01Mpa) while ribbon fiber group recorded the lowest mean value (4.9±2.8Mpa). The difference between all groups was statistically significant ($p<0.05$) as indicated by ANOVA test. For fracture resistance, Glass fiber group recorded the highest mean value (146.018±37.96N) followed by ribbon fiber group (133.3±38.222N), while Stainless steel group recorded the lowest mean value (111.48±30.522N). The difference between all groups was statistically significant ($p<0.05$) as indicated by ANOVA test.Conclusion: orthodontic metal wire posts and glass fiber posts proved their advantages regarding the shear bond& fracture resistance respectively.

Keyword : shear bond strength, fracture resistance, endodontically treated teeth.

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## Introduction:

Dental caries is the most common chronic disease of childhood 1. Early childhood caries (ECC) involves the upper anterior teeth early in life and by the time, most of the coronal structure would have been lost 2. Until recently, the extraction of the affected primary anterior teeth was the common treatment option for ECC, which results in unattractive appearance and could interfere with the personality and behavioral development of the child. Moreover, the early loss of primary anterior teeth results in reduced masticatory efficiency, loss of vertical dimension, development of parafunctional habits including: tongue thrusting, speech problems, and malocclusion and space loss 3, 4.In cases where teeth are severely decayed, endodontic treatment and placement of some retentive features are necessary before crown reconstruction5. Restorative treatment options include: direct and indirect techniques using prefabricated crowns, as well as resin composite restorations, sometimes using fiber or metal posts 6. Two different types of fiber-reinforced composites are advocated for use as post-and-core systems: prefabricated posts and customized posts. Customized post-and-core buildups commonly involve the use of glass or polyethylene fibers, which are luted directly into the root canal 7, 8.The use of conventional prefabricated metal posts is a fast, low cost and simple technique, but is not accepted in pediatric dentistry because of potential interference with physiological root resorptio9. Mortada and King 200410 introduce a simpler and efficient method to use an omega loops. In this technique omega loops, wire extensions are placed at the depth of around 3-4mm inside pulp canal and the projected portion of the loop is used for retention of the coronal restoration. The greatest success is that wire does not cause any internal stresses in the root canal.

Polyethylene fiber is a recently developed material reported to have a clinical advantage over the traditional post and core material11-13. These fibers improve the impact strength, modulus of elasticity and flexural strength of composite materials. Due to these reasons, they are the most appropriate and the best esthetic strengtheners of composite materials14.

## Material and Methods:

### Study Design

In-vitro study, A sample size of 60 extracted non-restorable primary anterior teeth was selected for this study. The teeth were cleaned and immersed in 0.1% chloramine T solution for 2 weeks for disinfection, and then stored in distilled water containing thymol till use.

The stored teeth were randomly divided into three groups of 20 teeth each according to the material used (A, B, C): ribbon, glass fiber post and orthodontic wire posts respectively. Each main test group was then be subdivided into two subgroups (I, II) of 10 teeth each according to the laboratory test used, shear bond and fracture strength respectively.

The coronal part of each tooth was sectioned horizontally by diamond disc leaving 2mm of the crown portion above the cementoenamel junction. Pulpectomy was done manually with hedstrom endodontic files. The working length of

each canal was established by inserting a no.15 K-file, until it was visible at apical foramen. And the canals were prepared up to a no. 40K-file. Irrigation was performed with normal saline and dried with absorbent paper points.The prepared canals were, and then obturated by a calcium hydroxide with iodoform paste (Metapex), excess removed with a sharp excavator. A thin layer of fast seating glass-ionomer cement sealer was then condensed over the obturating material.

Each tooth is embedded in a plastic mounting cylinder filled with a self-polymerizing acrylic resin of 0.5-inch diameter and 3cm height block up to 2mm below CEJ.

## Post construction:

### Ribbon fiber post:

Two lengths of 2-mm wide ribbons were cut, each measuring twice the depth of the post space and 3-4 times the height of the core build up, The Ribbon was then be placed in the post space and cemented by luting GIC, then the restorative procedure was completed by building up the tooth using composite resin.

### Glass fiber post:

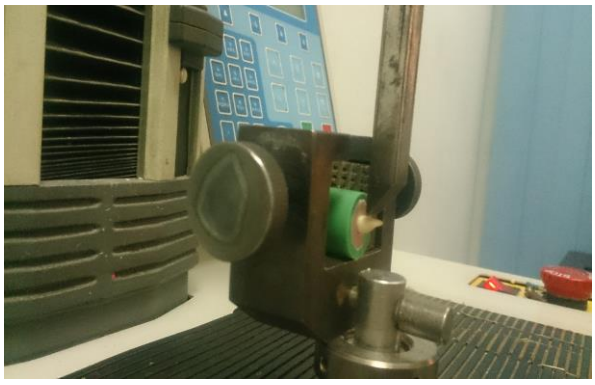
The shearing test was done by compressive mode of the load applied at a composite-tooth interface.

Polyethylene fiber post was cut to a length of 6 mm and to be inserted 2 mm inside the canal and leaving the remaining 4mm to reinforce the core. The fiber post was cemented by glass ionomer luting cement (GIC), and then the crown was reconstructed with a composite resin with an incremental technique.

### Orthodontic wire:

A piece of orthodontic wire 0.7 mm in diameter was cut and bent into a 5- 6 mm long U shape using orthodontic pliers. Then, it was inserted into the canal and cemented by luting GIC and the composite core was built up.

Shear bond strength and fracture strength was evaluated by a universal testing machine (Instron).



## Statistical analysis:

Data analysis was performed in several steps. Initially, descriptive statistics for each subgroup results. One way ANOVA followed by Newman-Keuls post-hoc tests were performed to detect significance between groups. Student t-test was done to compare paired groups. Statistical analysis was performed using Graph-pad Instat-3 statistics software for Windows. P values ≤ 0.05 were considered to be statistically significant in all tests.

## Results:

### I- Shear Bond Strength (SBS):

Descriptive statistics of shear bond strength (SBS) results measured in mega Pascal (Mpa) for all groups were presented in table (1). For ribbon fiber group the mean ± SD values were (4.9 ± 2.8 Mpa with minimum value (1.92 Mpa) and maximum value (12.51 Mpa), while for Glass fiber group the mean ± SD values were (5.6 ± 4.01Mpa) with minimum value (1.57 Mpa) and maximum value (12.74 Mpa), meanwhile for Stainless steel group the mean ± SD values were (14.4 ± 2.4Mpa) with minimum value (10.16Mpa) and maximum value (17.60Mpa).

It was found that Stainless steel group recorded the highest shear bond strength mean value followed by group Glass fiber group while ribbon fiber recorded the lowest mean value. The difference between all groups was statistically significant ($p<0.05$) as indicated by ANOVA test.

Table (1): Descriptive statistics of shear bond strength results for all groups

| | Ribbon fib | Glass fiber | Stainless steel |
|---|---|---|---|
| **Minimum** | 1.92 | 1.57 | **10.16** |
| **Maximum** | 12.51 | 12.74 | **17.60** |
| **Mean** | 4.97 | 5.64 | **14.4** |
| **Std. Deviatio** | 2.87 | 4.01 | **2.48** |
| **Std. Error** | 0.91 | 1.26 | **0.78** |
| **Median** | **4.18** | **4.10** | **14.63** |

### II-fracture resistance:

Descriptive statistics of fracture resistance results measured in Newton (N) for all groups were presented in table (2). For Glass fiber group the mean ± SD values were (146.018 ± 37.96N) with minimum value (98.08 N) and maximum value (220.09 N), while for ribbon fiber group the mean ± SD values were (133.3 ± 38.222 N) with minimum value (87.21 N) and maximum value (194.87 N), Stainless steel group the mean ± SD values were (111.48 ± 30.522N) with minimum value (63.89 N) and maximum value (147.61 N).

It was found that Glass fiber group recorded the highest fracture resistance mean value followed by ribbon fiber group while Stainless steel group recorded the lowest mean value. The difference between all groups was statistically significant ($p<0.05$) as indicated by ANOVA test.

**Table (2):** Descriptive statistics of fracture resistance results for all groups

| | Ribbon fiber | Glass fiber | Stainless steel |
|---|---|---|---|
| **Minimum** | 87.21 | 98.08 | **63.89** |
| **Maximum** | 194.87 | 220.09 | **147.61** |
| **Mean** | 133.3 | 146.018 | **111.48** |

| | | | |
|---|---|---|---|
| **Std. Deviation** | 38.222 | 37.96 | **30.522** |
| **Std. Error** | 16.4 | 15.3 | **5.8** |
| **Median** | **162.36** | **202.72** | **115.47** |

## Discussion:

The orthodontic metal wire in this study had higher shear bond strength than the other fiber posts used. This comes in agreement with Aminabadi et al 2009 15, who demonstrated good results with long-term durability when Omega loops were used to restore severely damaged primary teeth.

The ribbon fiber post and glass fiber post showed lower shear strength than metal wire post in this study. This is in agreement with Meiers et al 200316, who concluded that the higher modulus of elasticity and lower flexural modulus of the polyethylene fiber have a modifying effect on how the interfacial stresses are developed along the etched enamel/resin boundary.

The glass fiber post in this study showed the highest fracture resistance. This agrees with different studies17, 2, 15, 18. This due to FRC posts might possess some advantages over metal posts in many vitro studies due to their modulus of elasticity being closer to that of dentin. Since fiber posts have reduced the risk of root fractures. Other factors include better bonding of these posts to cementing media, good adaptation to the root canal, 19, 20.

On the other hand the results disagree with those obtained by other author's in vitro studies21, 22, where higher fracture resistance values were obtained for metal posts. However, this result is may be doubtful because the adhesion between Omega wire and the dentinal wall is mechanical. The wire adaptation to the internal walls is inadequate, leading to dislodgement of the wire, and radicular fracture due to excessive masticatory forces.

Also, the results of this study revealed higher fracture resistance of ribbon posts compared to the metal posts. This comes in agreement with other researches23, 24, this may be explained by the ribbon fibers that improve the impact strength, modulus of elasticity and flexural strength, providing high fatigue resistance, preserving the architectural shape, maintaining fiber orientation during application 25.

## Conclusions:

From this laboratory study, it can be concluded that the used different types of prefabricated tooth-colored posts can be used successfully in restoring mutilated primary anterior teeth. Further studies with prolonged follow-up period are needed to assess the clinical performance of the fiber-reinforced posts.

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