

Bond Strength Analysis of Intracanal Posts used in Anterior Primary Teeth: an *in vitro* study.

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The purpose of this in vitro study is to assess the bond strength of three different posts used to restore primary anterior teeth. These posts were made by composite resin, 0.7mm alpha-shaped orthodontic wire and dentin posts. Thirty roots of extracted primary anterior teeth, with initial physiological resorption, were mounted in a container filled with self cured resin and were endodontically treated. Thirty posts were prepared using three different materials: 10 composite resin posts (Z100), 10 alpha-shaped orthodontic wire and 10 dentin posts. A bulk of composite resin (Z100) was made over the posts using a circular Teflon bisected strip. The specimens were stored in 37°C water solution for 24 hours before tensile bond strength tests in 0,5mm/min speed were performed (Instron model 4442 test machine- Instron Corporation). The results were submitted to the Kruskal-Wallis test and there were no significant statistical differences among the three types of posts assessed ($p=0.8666$). The dentin posts technique might be considered an alternative for rehabilitation in pediatric dentistry, because of the possibility of natural resorption.

Key words: Posts. Composite resin. Orthodontic wire. Dentin post. Bond strength.

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INTRODUCTION

Primary maxillary incisors requiring extensive restorative therapy, due mainly to early rampant caries or trauma, can present a particularly challenging problem to the dentist.^{1,2,3,4} Trauma in primary incisors especially from birth to two years old is normally related to children beginning to walk, run or crawl. The highest frequency of disturbance is in 24 month-old children and the primary maxillary central incisor has the highest prevalence. The injuries that are more often diagnosed in children are fractures involving enamel and subluxation.

Early childhood caries is a term used to describe a condition of rampant caries in infants attributed to the prolonged use of a nursing bottle containing fermentable carbohydrate liquids. It is also seen in children who suck a pacifier dipped in a sweetener, and in children who have been breastfed. The teeth most often involved are the primary maxillary central and lateral incisors, and maxillary and mandibular first primary molars.^{5,6}

The implications of severely affected primary maxillary incisors include, infection atypical tongue position, speech disturbances, development of psychological problems, malocclusion and dysfunction of the masticatory system.⁷

Due to the development of restorative materials and new restorative techniques in dentistry, treatment of primary maxillary incisor teeth cannot be neglected.⁸ Endodontic treatment associated with the use of intracanal posts is necessary prior to coronal restoration because of the reduced crown tooth structure.⁹ The main reason for using a post is to reestablish the shape and form of a severely decayed or fractured maxillary anterior tooth crown while it provides support for the final restoration. The posts also increase the resistance of the restored teeth to mechanical load.¹⁰

In primary teeth, intracanal retention can be achieved using several techniques: a resin composite post building up directly¹; an “inverted mushroom-shaped” undercut in the root canal prior to resin composite short-post placement¹¹; alpha-or-omega-shaped orthodontic wire¹²⁻¹³; stainless steel pre-fabricated posts^{8,14}; nickel-chromium (Ni-Cr) cast posts with macroretentive elements⁹; natural teeth from a tooth bank¹⁵; or reinforced fibers.¹⁶

The purpose of this *in vitro* study was to assess the tensile bond strength of three different intracanal posts: composite resin posts, alpha-shaped orthodontic wire and dentin posts.

METHOD AND MATERIALS

A total of thirty roots of extracted primary anterior teeth with initial physiological resorption were selected from the Human Tooth Bank of Sao Paulo University Dental School. The Tooth Bank is registered in a local registry and follows the basic rules of an organ donation center.¹⁵

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The roots were mounted in small plastic containers filled with self cured resin and were then polished with sandpaper with grain ranging from 320 to 600 microns (Buelher Ltd) using Ecomet 3 equipment (Buelher Ltda) to smooth al the roots surfaces.

Endodontic treatment was accomplished in all root canals using a sequence of 3 kerr endodontic files (Maillefer) under constant irrigation. A thermoplastic material stop (Dentsply) was placed 5mm apical from each tooth in order to standardize posts length and a periodontal probe (Duflex- SSWhite Ltda) was used to measure its width.

Thirty posts were prepared using three different materials. 10 composite resin posts (Z100), 10 alpha-shaped orthodontic wire and 10 dentin posts. All 30 root canals and the 10 prepared dentin posts were etched for 15 seconds with 37% phosphoric acid to receive a dentin adhesive. All 30 posts were cemented with a dual-cured adhesive material (Fill Magic). A bulk of composite resin (Z100) was made over the posts using a circular Teflon bisected strip.

The dentin posts were made from a piece of root from extracted primary teeth selected from the Human Tooth Bank¹⁵.

The specimens were stored in 37°C water solution for 24 hours before tensile bond strength tests in 0,5mm/min speed were performed (Instron model 4442 test machine- Instron Corporation). The results were submitted to the Kruskal-Wallis statistical test.

RESULTS

The Kruskal-Wallis statistical test was applied and no significant statistical differences of the tensile bond strength test among the composite resin, 0.7mm alpha-shaped orthodontic wire and dentin posts were found (p=0.8666). The values of the tensile bond strength test performed in each one of the thirty posts, are shown in table 1. The means and standard deviation are show in table 2 and chart 1.

CHART 1: Means and standard deviation of population studied

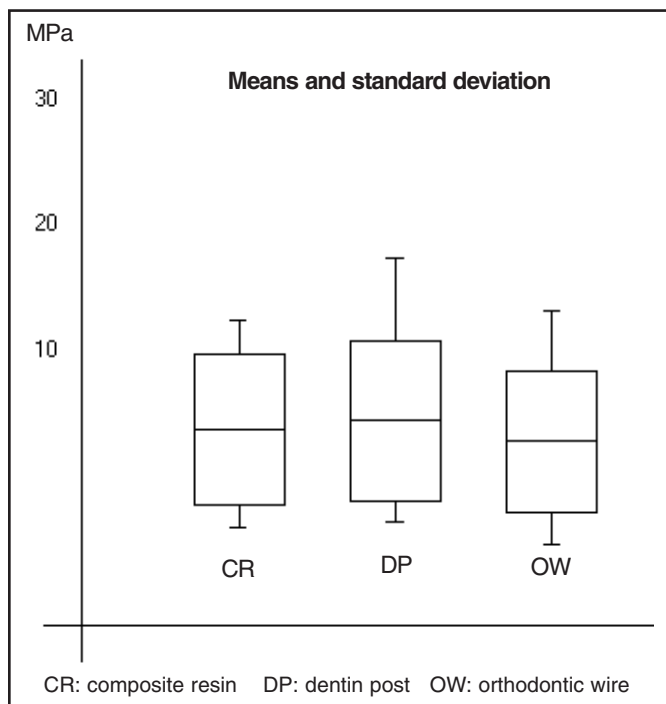


TABLE 1: Values of the tensile bond strength test of each post according to the groups (MPa)

| Composite Resin | Dentin Post | Orthodontic Wire |
|-----------------|-------------|------------------|
| 18.14 | 10.58 | 13.40 |
| 13.08 | 14.30 | 9.22 |
| 8.72 | 10.74 | 15.56 |
| 10.19 | 16.64 | 7.80 |
| 19.00 | 17.80 | 10.38 |
| 16.55 | 8.97 | 10.34 |
| 13.82 | 12.60 | 14.83 |
| 15.54 | 11.23 | 19.43 |
| 11.43 | 22.08 | 13.06 |
| 8.65 | 14.61 | 15.20 |

TABLE 2: Arithmetic means and standard deviation

| CR | DP | OW |
|---------------|---------------|---------------|
| 13.51 (3.75)* | 13.95 (4.00)* | 12.92 (3.51)* |

*p = 0.8666

CR: composite resin DP: dentin post OW: orthodontic wire

DISCUSSION

The range of values shown in table 1, as a result of the tensile bond strength test performed in each post, might be due to the cement spread that was not the same in all posts, to the different amount of smear-layer present in the root canal, to differences in the degree of moisture in dentin, to a not standardized method to introduce the posts in the root canal to assure similar positions and to pulpal tissue conditions when the teeth were extracted.¹⁰ Therefore, bond strength tests do not reproduce the clinical situation and the values obtained should be regarded as an exercise in the quality control of the material.¹⁷

Considering all the limitations of *in vitro* studies, the results showed that there were no significant difference among composite resin posts, alpha-shaped orthodontic wires and dentin posts. Our results agree with Casellato *et al*¹⁸, since the threaded posts (FKG, FKG Dentaire), Ni-Cr posts with macroretentions, alpha-shaped orthodontic wire, biologic posts, and root canal filled with resin composite showed similar fracture resistance values when submitted to shear bond strength tests.

The composite resin short post (inverted mushroom shaped) had 100% success rate in 92 primary maxillary incisors evaluated¹¹ and good clinical performance after 6 months clinical and radiographic evaluation in a 30 month old patient.¹⁹ A final crown length, approximately three quarters of a natural tooth, is contoured over the composite resin short post to remove occlusal interferences with the opposing primary anterior teeth and to assure more durability¹¹. On the other hand we must consider that the absence of occlusal interferences and physiological contact between the tooth and the restoration could disrupt the maxillary and mandibular growth.

The technique with light-cured resin composite cured in layers directly into the root canal associated with celluloid strip crowns was described in literature. The technique offers the advantages of using one restorative material, improving esthetics and reducing chair-time and cost²⁰.

The composite resin post (inverted mushroom shaped or the com-

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posite resin placed in layers directly into the root canal) and the alpha shaped orthodontic wire have to be placed in the canal root no longer than 5 mm apical to the gingival margin in order to not disrupt the natural root resorption. The dentin posts are naturally resorbed as part of the process of exfoliation of the primary teeth. This could be an advantage when compared to resin or metallic posts although more studies must be done. Another important aspect to be considered during the process of natural resorption of the root and the dentin posts is how the cement is resorbed.

The use of biological restorations with dentin posts and the use of natural crowns resulted in clinical success as well as recovered the function and esthetics. The biological technique is a promising alternative to prosthetic restoration for primary teeth with severe caries.^{15,21}

CONCLUSION

There was no statistically significant difference in bond strength among the three groups of posts assessed and the dentin posts presented the possibility of natural resorption supporting the evidence that the dentin posts technique might be considered an interesting alternative for rehabilitation in pediatric dentistry.

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