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EFFECT OF SILANIZATION ON INCREASING RETENTION OF GLASS FIBER POST

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ABSTRACT

Aim: This in vitro study was conducted to evaluate the effect of silanization on retention of glass fiber post

Material & Methods: Forty specimens divided to four groups **A, B, C** and **D**in which groups A & C with silanization while groups B and D without silanization.. All samples were stored in deionized distilled water in constant temperature at 37ºfor 24hr. Retention of post was measured with tensile strength using instron testing machine (ISO TR 11405,2003) with cross head speed of 0.5mm/min.

Result: There is no effect of silanization on increasing retention of glass fiber post

KEYWORDS: Silanization, Fiber Post

INTRODUCTION

Silanes is utilized for the surface treatment of glass fiber products, improvement of paints and other coating materials and adhesives, Dental materials offer a continuously challenging form for silane which play an essential role in material development. The majority of clinical results pointed to silane playing a significant role in the adhesion process. [1]

Silane coupling agents belong to a class of organosilane compounds having at least two reactive groups of different types, bonded to the silicon atom in a molecule. One of the reactive groups (e.g. methoxy, ethoxy and silanolichydroxy groups) reacts with various inorganic materials such as glass, metals, silica and sand, to form a chemical bond with the surface of the inorganic material, while the other of the reactive groups (e.g., vinyl, epoxy, methacryl, amino and mercapto groups) is reactive with various kinds of organic materials or synthetic resins to form a chemical bond. Because of possessing these two types of reactive groups, silane are capable of providing chemical bonding between an organic material and an inorganic material. [2]vinylsilane was one of the first silane used for silica powder in polymer, and it proved to reinforce the resin material. [3] Silanization of the filler particle phase yields a better dispersion and wetting for filler particles, it also lowers the viscosity between a filler and liquid resin system, thereby improving the physical properties of composites. [1]

Fiber posts were first introduced by Duret at the beginning of the 90s [4]. Fiber posts can be considered as composite reinforced materials in which the fibers are glass, quartz and even carbon that is composed of fibers (66% in weight, diameter of the single fiber around 10-15 microns) and filler embedded in a matrix of epoxy-resin or methacrylate-resin (i.e. epoxy resin, 33% in weight). Fibers can be pre-treated with a silane-coupling agent to obtain a chemical bond between the fibres and the resin.The post is fabricated through a semi-automated industrial process called pultrusion[5].Fiber posts main advantage is the variability of their modulus of elasticity depending on loading direction: in particular, when considering a transversal loading, the modulus of elasticity has a value close to sound dentin [6]. This property reduces stress transmission to root canal walls and thus the risk of vertical fractures [7].

Superficial treatments: a way to improve bond strength to fiber posts The quality of the bond between the post and the dentin both at the coronal and radicular level is of most importance for post retention [8 -6-10]. Since the introduction of fiber posts, a continuous effort has been made to improve bonding inside the root canal, however radicular dentin still offers less favorable conditions for bonding than coronal dentin [9].

MATERIALS AND METHODS

Glass fiber post A3 shade esthetic light transmitting; Rely X™ 3M ESPE AG Germany (lot 044340612).Glass fiber post A3shade light transmitting post; FRC postec plus™ Ivoclarvivadent Germany (lot o557682).Saline coupling agent ;Monobond S™ Ivoclarvivadent Germany (lot; k01320)

Fourty freshly extracted sound maxillary central incisors teeth were selected. kept in container filled with crystal of thymol solution to avoid dryness. Teeth selected with dimension ranges as; Length of crown about 10-12mmLength of root about 11-13mm Diameter of root at the coronal part 6mm±Diameter of root at the middle part 4mm± Samples preparation; The low speed hand piece and laboratory diamond disk used to sectioned teeth 1mm above the cemento-enamel junction of the tooth. Sectioning process is done were laboratory diamond disc bur was perpendicular to the long axis of the tooth with cooling system The roots of teeth were instrumented with step-back technique according to the international standardization organization (ISO) used file up to size of #60(MAF). Irrigation is done with sodium hypochlorite solution 5.25% then canal dried with paper point size 60.the root canal were filled using lateral condensation technique with guttpercha size 60. Apexit plus sealer was mixed in ratio as manufacture instruction (1:1).Sealer applied inside the canal by lentulo spiral instrument attached to low speed hand piece with slowly pressure to avoid trapping of air bubbles and formation of voids in the canal.

Preparation of post space: Mechanical method used to prepare post space Gates-Glidden drill no.6 used to remove coronal guttapercha.pesso reamer no. 6 used to complete removal of guttapercha (with cooling system) The post space prepared by using Post drill (coinside with the post size), the post space was 8mm in depth and 2 mm in diameter leaving at least 4mm of material at the apical end of the root. (Figure 1)

Figure 1: Post Space Preparation

Samples Grouping; Samples was randomly divided into four groups (n=10), depending on the type of post and application of silanization or without silanization. (Table 1)

Table 1: Samples Grouping

Group A	FRC postec plus post with silanization
Group B	FRC postec plus post without silanization
Group C	Rely X post with silanization
Group D	Rely X post without silanization

The procedure was done in the following sequence;The post space was rinsed with distelled water and dried with air and paper point.Total etching (35%phosphoric acid) was applied into post space according to manufacture instruction.Etching material was rinsing with water Cotton pellet used to blot excess water The post space dried with gentle air blast. Adhesive single bond fifth generation (bonding and prime) was applied inside the post according to manufacture instruction.The access material was removed by paper point.

Silanization; Silanization of post is done for samples of groups A and C. The post was clean with ethanol alcohol 96% and dried with air free of water and oil then post coat with silane solution for 60 sec. then gentle air dried.(figure 2 and figure 3)

Figure 2: Type of Silane Used in the Study

Figure 3: Coated Fiber Post with Silane Liquid

Cementation: Cementation of experimental groups posts is done by using self adhesive universal resin cement Rely X unicem™ The composition of resin cement is bi-functional methacry late and the proportional of inorganic filler is about 70%by wt. conventional method lentulo spiral used in cementation according to manufacture instruction then the post fixed to dental surveyor and inserted inside the post space.

Tensile strength (testing procedure); After the storage period the samples were embedded in acrylic resin. The acrylic was prepared by mixing powder and liquid as recommended by manufacturer's instruction in mixing jar. The jar was covered to prevent the evaporation of the monomer. The material was left undisturbed for few minutes until it reached the workable stage. Plastic molds into which the freshly prepared acrylic paste was loaded. The root attached into dental surveyor and embedded in acrylic resin. The material was allowed to cure under cooled water 20ºC, cooled water was necessary to compensate for the anticipated rise in the temperature of the samples Subsequent to the exothermic curing reaction of the cold cure resin. The acrylic mold were allowed to cure completely for at least 30min as recommended by the manufactures [26] All the samples were stored in deionized distilled water, placed in incubator a in constant temperature at 37C° for 24 hours. Tensile bond strength was evaluated with Instron testing machine, with a cross head speed of 0.5mm/min (ISO TR 11405, 2003).The head of clamp was modified and change from normal head that is tow piece into three pieces clamped the sample in all direction (figure 4) The specimen was clamped in a fixed base so that the samples parallel to the head of clamp to prevent the interface Lead to produce shearing stresses. The specimens Were pull-out until dislodgement of the post from the post hole.Tensile strength was recorded in neuton unite (N) For each specimen (figure 5)

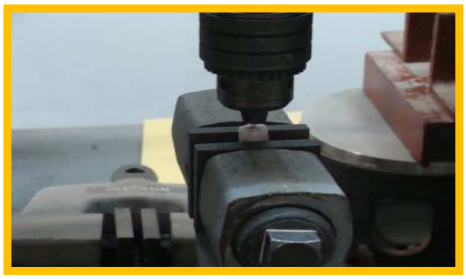

Figure 4: Testing Procedure

RESULTS

After using ANOVA test, student t-test was performed to compare between the means of group A,B,C and D as shown in table (2) also using ANOVA test, student t-test was performed to compare between the means of groups (A & B). And between the means of groups (C& D) as shown in table (3).There was no effect in application silanization to increase retention of post. There was significant increase retention of FRC postec plus post when compared with Rely X post

Table 2: Descriptive Statistics of All Groups in Neuton (N) Unite

	Group A	Group B	Group C	Group D
Mean	232.5±	228.1±	208.3±	215.5±
SD	4.375	4.912	4.803	5.099

Table 3: Student T-Test Compare between Paired Groups

Groups	T-Test	P-Value	Sig
A&B	2.032	0.098	NS
C&D	2.077	0.062	NS

**P>0.05 Non significant

DISCUSSIONS

Posts are probably dislodged when the cement fatigues and the bond to dentin is eventually lost.. In this study, tensile force was applied to the posts to determine their retention. Recommendations effort was made to ensure that the tensile tests are carried out in the long axis of the post. it does not directly reflect intraoral dislodging forces, does indicate retentive properties of these posts. [11]

Tensile strength used to measure retention of post in pullout technique. In addition, this agree with; Arora 2006; Luciana et al 2007[12-13.]Unfortunately, there is no practical method to simulate the oral conditions although every effort has been made to select specimens of comparable physical characteristics and to standardize the procedures accurately. Result of comparison between two types of glass fiber post. Ideal posts should impart minimal stress to the tooth, provide adequate retention to the core, and be easily removed to permit endodontic retreatment. Preservation of sound tooth structure is regarded as one of the most important aspect in increasing the survival rate of endodontically treated teeth [14-15-16.]

Effect of silanization (surface treatment) of glass fiber post on retention: There was no significant difference between glass fiber post silanized with silane coupling agent MonobondS™and glass fiber without silanization. its agrees withSahafi et al 2003;Perigao et al. 2006;Bitter et al. 2006[2-23-19.] While not agree withGoracci 2005;Aksornmuang et al. 2004[24-25] Silanization in this study depend on chemical bond only.it consider strong but infrequent. [20] Moreover, silane-coupling agent is considered a technique sensitive step. Among factors influencing its efficacy, the composition (PH,

solvent content, molecular size etc.)In addition, Solvent evaporation plays an important role since an incomplete removal may compromise coupling [21] also Self-adhesive resin cement used in this study do not required any pretreatment of post surface as manufacture instruction; once the cement is mixed, application is accomplished through a single clinical step [22]

FRC postec plus post composed of glass fiber(7o%vol),dimethacrylate resin matrix(21%vol) and ytterbium fluoride YbF3(9%vol). Ytterbium fluoride is not found in composition of Rely X Fiber Post and this nanoparticles modified the setting characteristics, strength and surface hardness of post [17]. Moreover the cementation method used lentulo spiral (conventional method),its lead to trapping air bubbles and creating voids and lead to debonding in cement-post adhesions surface[18,]also glass filler adherence more than zirconia filler [19] and from chemical composition of Rely x post there is zirconia filler in composition,which lead to decrease in retention value for this post.

CONCLUSIONS

Under the limitation of this in vitro study, the following conclusions drawn: Surface treatment of post with silane coupling agent depending on chemical adhesion not increase the retention of glass fiber post.Suggestions evaluate the retention of post by microtensile strength.

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