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Original Article

Evaluation of the effect of different surface treatments on the surface morphology of two commercially available glass fiber posts: A scanning electron microscopy study

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ABSTRACT

Objectives: To determine the effect of different surface treatments on the surface morphology of two commercially available glass fiber posts using scanning electron microscope.

Materials & methods: Two commercially available glass fiber posts i.e. Easy posts (Dentsply, Mallefer, Ballaigues, Switzerland) and Rely X posts (3M ESPE, Seefeld, Germany) were selected for this study. The glass fiber post were divided into 4 groups according to the surface treatments given i.e. Group I-No surface treatment (control), Group II – Etching with 36% phosphoric acid for 15 s, Group III – Etching with 4.5% hydrofluoric acid for 60 s, and Group IV-Air surface abrasion with 50um alumina oxide particles at 2.5 bar pressure for 5 s. Scanning electron microscope (SEM) under 800× magnifications was used to analyze and compare the untreated i.e. control group and treated groups.

Results: SEM analysis of the posts revealed that in control group, both the posts showed evenly distributed, parallel oriented glass fibers surrounded by uniform matrix. Easy post showed relatively smooth surface compared to Rely X post. Etching with 36% phosphoric acid showed more erosion in Rely X post than Easy post. Etching with 4.5% hydrofluoric acid showed greater impact on both the posts as compared to 36% phosphoric acid etching but the alteration in morphology was seen more extensively in the Easy post than Rely X posts. Air abrasion with 50 um Al_2O_3 particles created rougher surface as compared to 36% phosphoric acid and 4.5% hydrofluoric acid etching. The surface of Easy post was rougher than Rely X post after air abrasion with 50um alumina particles.

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Conclusion: Scanning electron microscopy revealed that the surface morphology of both the brands of glass fiber post was altered after surface treatment with 36% phosphoric acid; 4.5% hydrofluoric acid and Air abrasion with 50um alumina particles. These surface changes were minimum for 36% phosphoric acid group and maximum for Air abrasion with 50um alumina particles.

1. Introduction

Fiber posts chronologically represent the latest solution proposed for restoring endodontically treated teeth. They are composed of unidirectional fibers of quartz or glass embedded in a resin matrix. The fibers are pre-stressed and subsequently resin is injected under pressure to fill the spaces between the fibers giving them solid cohesion.[1] The presence of fibers in the posts is an advantage because fibers distribute stress on a wider surface area, remarkably increasing the load threshold at which the material begins to show micro-fractures. Laboratory based studies have shown that these posts have a high tensile strength[2] and modulus of elasticity[3] similar to dentin. The glass fiber posts have additional advantages, like biocompatibility, mechanical strength, resistance to corrosion, improvement of light transmission, and the optical effects of esthetic restorations.[4] Fiber reinforced posts also reduce the chair time and treatment cost and easy removal is possible if endodontic retreatment is required. Currently there are few published clinical studies of fiber-based post systems that present clinical failure rate of glass fiber posts. It is reported in the literature that the most frequent types of failures of fiber posts were loss of retention and post fractures.[5] Rovatti et al[6] stated that when loss of retention occurs, it is always at the cement/post junction. In order to maximize the bonding of resin cement to glass fiber posts, several surface treatments of posts have been suggested like solvent cleaning by using alcohol, chloroform, hydrogen peroxide, potassium permanganate, use of silane coupling agents to favor chemical bonding. Acid etching using phosphoric acid or hydrofluoric acid, air abrasion using alumina particles, tribochemical coating followed by silanization i.e. Co-Jet. These treatments result in surface micro roughness, creating a mechanical interlock between the two surfaces and/or exposure of the fiber by removal of the matrix, permitting more effective bond between post and resin cement surface. Little information is available in the literature on the effect of these surface treatments on the post morphology. The purpose of this study was to evaluate the effect of different surface treatments i.e. etching with 36% phosphoric acid, etching with 4.5% hydrofluoric acid and sandblasting with 50um aluminum oxide on the surface morphology of the glass fiber posts using scanning electron microscope.

1.1. *Objectives*

The objective of this study was to determine the effect of different surface treatments on the surface morphology of two commercially available glass fiber posts using scanning electron microscopy.

2. Materials and method

Two commercially available glass fiber posts i.e. Easy posts (Dentsply, Mallefer, Ballaigues, Switzerland) and Rely X posts (3M ESPE, Seefeld, Germany) were used in this study. The diameter of the Easy post at apical end was 0.8 mm and coronal end was 1.35 mm, length was 20 mm and taper of 6%. The diameter of the Rely X post at apical end was 0.7 mm and coronal end was 1.30 mm, length was 20 mm and taper of 6% (Table 1).

The posts ($n = 8$) were divided into two groups consisting of 4 posts of each brand. Easy posts and Rely X posts were divided into 4 sub-groups ($n = 1$) depending upon the surface treatment given i.e. no surface treatment (control), 36% phosphoric acid etching, 4.5% hydrofluoric acid and air abrasion with 50um Al_2O_3 particles. The surface treatments given for both the brands of fiber posts were as follows:

Group I. Control: No surface treatment.

Group II. Etching with 36% phosphoric acid: 36% phosphoric acid (Dentsply, Detrey, Gmbh, Germany) was applied to the entire surface of the fiber post with the help of microapplicator (3M ESPE, USA) for 15 s and then the post was thoroughly rinsed with water and then allowed to dry.

Group III. Etching with 4.5% hydrofluoric acid: 4.5% hydrofluoric acid (Ivoclair Vivadent AG, Liechtenstein) was applied to the entire surface of the fiber post with the help of

Table 1 – Materials used in the study.

Sr. No	Material	Brand name	Manufacturer	Batch no./Lot no.
1	Glass fiber post	a) Easy post	Dentsply, Mallefer, Ballaigues, Switzerland	9773060
		b) Rely X Fiber Post	3M ESPE, Seefeld, Germany	179281112
2	36% Phosphoric acid	Detrey conditioner 36	Dentsply, Detrey, Gmbh, Germany	1204000645
3	4.5% Hydrofluoric acid	IPS Ceramic Refill	Ivoclair Vivadent AG, Liechtenstein	R05669
4	Alumina oxide 50 um particles	Korox	Bego, Breman, Germany	113786435
5	Distilled water	–	Aqua technologies, India	98365778

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