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Etching Techniques on Airborne-Particle Surface Treated Cast Postand Fiber Posts

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ABSTRACT

In order to produce surface roughening, studies have shown that airborne particle abrasion is applied, allowing materials to have increased bonding capabilities. Therefore the aim was to assess the effect of etching techniques on surface treated with cast & fiber posts. 48 freshly extracted mandibular 1st pre molar were divided into 3 groups I, II & III with 16 samples each , which was further sub-divided into 2 groups a & b with 8 samples each. We found that, ANOVA test , Turkey HSD test and T test showed significance for both the groups & subgroups, except , I(a) with III(a) and I(b) with III(b) and II(a) with II (b) respectively. Post spacing significantly increased the binding strength of fiber posts cemented.

Keywords: *Airborne, Particle, Etching,Techniques, Endodontically Treated, Freshly, Extracted.*

1. INTRODUCTION

Studies have shown that, posts are commonly employed for the rehabilitation of these teeth in instances where there is inadequate coronal tooth structure to support a core for the final restoration. [1,2] Another study have shown that, airborne-particle abrasion is utilized to enhance surface roughness, thereby improving the bonding characteristics of materials.[3] When compared to other types of cement, the use of resin cement has demonstrated a notable enhancement in post retention and tooth fracture resistance.[4] A study have also shown that, it is necessary to make a strong bond between the root dentine and the fiber canal matrix, as well as between the fiber post dentine and the resin matrix, in order to meet the basic requirement.[5] In reality, studies have also shown that, the most prevalent reason for failure is adhesive or cohesive debonding of the post, which takes place predominantly at the cementodentine contact as a result of the insufficient removal of canal-filling materials.[4,6] When compared to metal posts, certain studies have shown that fiber-reinforced metal posts have inferior retention.[7,6] Additional studies revealed no notable differences in the retention rates of fiber-reinforced resin posts compared to metal posts.[7,8]

AIM

To evalate the effect different types of etching techniques on the adhesion of airborne-particle surface treated cast posts and fiber posts to radicular dentine.

2. MATERIAL & METHOD

We have conducted an in-vitro study at the Department Of Prosthodontics, A.J. Institute Of Dental Sciences, Mangalore using adhesion of airborne – particle (110µm) surface on cast & fiber post using total of 3 etch steps i.e. self-etch one step; and 32% phosphoric acid conditioning and self-etch one step techniques.

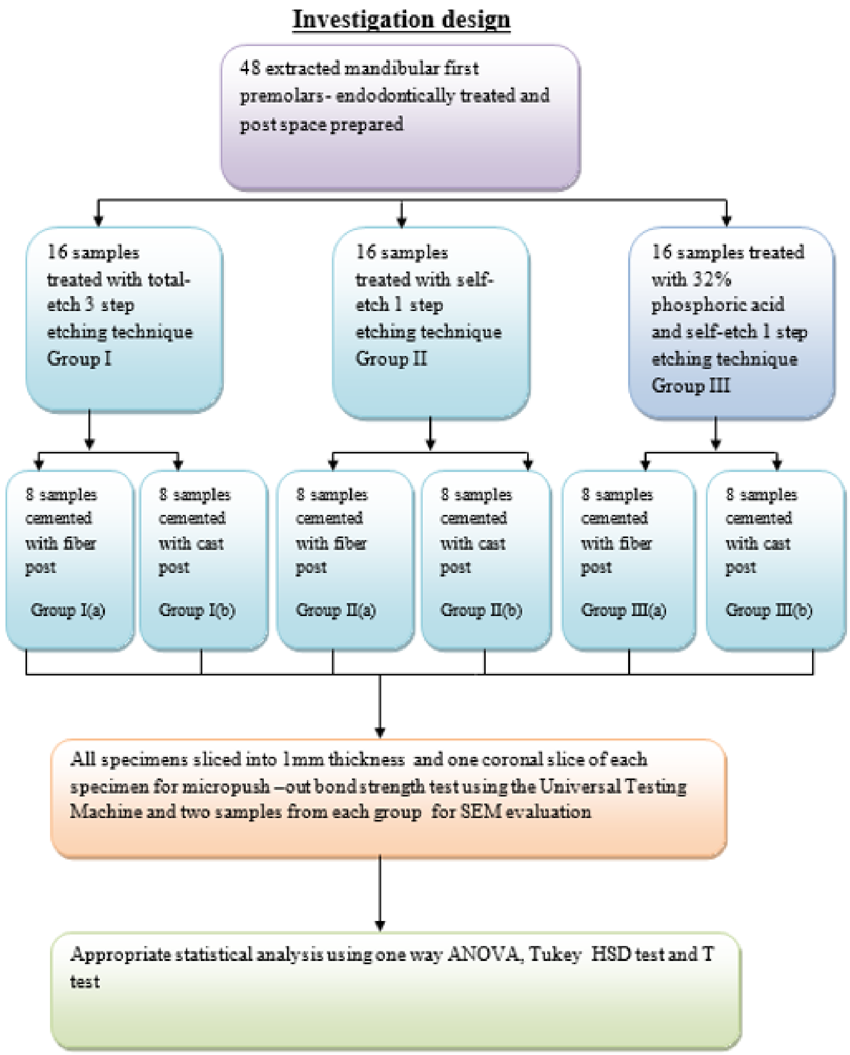
MATERIAL

Sl. No.	Material	Manufacturer
1.	Freshly extracted human mandibular first premolar teeth (Fig:1)	
2.	Type II Dental Plaster (Fig:3)	Kaldent, India
3.	Tenax Fiber Trans Posts TFT 13 (Fig:11)	Coltene Whaledent, Germany
4.	Inlay casting wax (Fig:14)	Bego, Germany
5.	Base metal alloy(Nickel Chromium) (Fig:15f)	Bellabond Plus, Bego, Germany
6.	Phosphate bonded investment (Fig:15d)	Bellasun ,Bego, Germany
7.	Tungsten carbide burs	Edenta, U.K.
8.	Separating diamond discs (Fig:19b)	DFS, DiaMon, Germany
9.	Endodontic files (Fig:4)	Denstply Maillefer, Germany
10.	Tenax Fiber Trans Drill TED 13 (Fig:7)	Coltene Whaledent, Germany
11.	Gutta percha points (Fig:6a)	Denstply Maillefer, Germany
12.	Zinc oxide eugenol endodontic sealer (Fig:6b)	DPI, India
13.	EDTA (Precanal Gel) (Fig:5b)	Pyrax, India
14.	5% Sodium Hypochlorite (Fig:5a)	Reachem Laboratory, India.
15.	All-Bond2, Total-etch adhesive (Fig:8a)	Bisco, U.S.A.
16.	32% Phosphoric Acid (Fig:8b)	Bisco, U.S.A.
17.	One Coat 7.0 (Fig;9a)	Coltene Whaledent, Germany
18.	Selfcem, Dual curing resin cement (Fig:10)	Medicept, U.K.
19.	Aluminium oxide powder (110µ)	Bego Duostar, Germany
20.	Die lubricant/ separator (Fig:13)	Han Dae Chemical Co., Korea

Equipment

Sl.No.	Equipment	Manufacturer
1.	Vacuum power mixer (Fig:16a)	BegoEasymix311011, Germany
2.	Burnout furnace (Fig:17a)	Sirio Dental SNC, Italy, SR730L
3.	Induction casting machine (Fig;17b)	BegoFornaxT26140, Germany
4.	Sandblasting Unit (Fig18a)	BegoDuostar, Germany
5.	Alloy grinder (Fig:18b)	Ray Foster alloy grinder, U.S.A.
6.	Light Curing Unit (Fig:9b)	QHL75, Dentsply, Germany
7.	Micromotor(Marathon4) (Fig:19a)	Saeyang Microtech, Korea
8.	Universal Testing Machine (Fig22a)	Instron; Model 3366
9.	Scanning Electron Microscope (Fig24)	Jeol, JSM-6380LA, Japan

3. METHODOLOGY



4. RESULT

Group	N	Mean	Std. Deviation	Mean Square	F	Sig.
Group I(a)	8	15.24375	0.838416	146.801	181.497	<0.001
Group II(a)	8	7.89	1.010488			
Group III(a)	8	15.37375	0.838143			
Total	24	12.83583	3.674758			
Group I(b)	8	12.9575	0.436537	102.127	56.843	<0.001
Group II(b)	8	7.03625	1.893892			
Group III(b)	8	13.46125	1.269864			
Total	24	11.15167	3.243619			

TABLE 1: INTRA-GROUP COMPARISON

In table 1, we found that after evaluating with ANOVA, both the groups a and b of I , II & III showed statistically highly significant diffrence between the variables as the p value was <0.001.

(I) GROUP	(J) GROUP	Mean Difference (I-J)	Std. Error	P value
I(a)	II(a)	7.35375	0.449677	<0.001
	III(a)	-0.13	0.449677	0.955
II(a)	III(a)	-7.48375	0.449677	<0.001
I(b)	II(b)	5.92125	0.670196	<0.001
	III(b)	-0.50375	0.670196	0.736
II(b)	III(b)	-6.425	0.670196	<0.001

TABLE 2 : INDIVIDUAL COMAPRISON

Table 2 shows that, after evaluating with post hoc analysis (Turkey HSD test), on comparing I(a) with II(a), II(a) with III(a) ,I(b) with II(b) and II(B) with III(b) found a statistically highly significant difference between them as the p value was <0.001. While on the other hand, I(a) with III(a) and I(b) with III(b) showed non-significant difference between them as the p value was 0.955 and 0.736 respectively.

Group		N	Mean	Std. Deviation	t	df	Sig. (2-tailed)
I	I(a)	8	15.24375	0.838416	6.841	14	<0.001
	I(b)	8	12.9575	0.436537			
II	II(a)	8	7.89	1.010488	1.125	14	0.28
	II(b)	8	7.03625	1.893892			
III	III(a)	8	15.37375	0.838143	3.555	14	0.003
	III(b)	8	13.46125	1.269864			

TABLE 3 : INTER-GROUP COMPARISON

Table 3 shows that, after evaluating with T test analysis, on comparing I(a) with I(b) showed statistically highly significant difference as the p value was <0.001 and fon comparing III(a) with III(b) , we found significant difference as the p value was 0.003 . While on the other hnad, on comparing with II(a) with II (b), showed non- significant difference as the p value was 0.28 respectively.

5. DISCUSSION

Due to insufficient removal of canal-filling materials, adhesive or cohesive is the main cause of failure, primarily at the cementodentine interface.[4,6] Root canal dentine differs in structure from flat coronal dentine; it has greater sclerosis, which impacts acid treatment and bonding. Dentine tubule density and direction can impact root dentine adhesion quality. [9] Root dentine bond strengths may not grow to their full potential due to factors such as the bonding material's uneven adaptation or incomplete polymerization, both of which are associated with the difficulty in accessing the root canal walls while handling the material. The adhesive cements' weaker bond strengths at the root tips and middle parts could be explained by these factors.[10] A study have shown that, the ratio of bonded to unbonded surface areas within cavities, presents a highly unfavorable condition that enhances the polymerization stress of resin-based materials along the canal walls.[11] Goracci C et al. have reported that the C-factors in root canals may vary between 20 and 100, influenced by the diameter and length of the canal.[10] In light-curing materials, the unfavorable geometrical layout of the root canal's dentin walls may generate enough resin stress to separate the resin composites, resulting in the formation of interfacial gaps. Light curing resins are not advisable for the cementation of fiber posts due to insufficient depth of cure in the apical regions of the root, regardless of the use of translucent posts. Consequently, it is recommended that dual-cured and self-cured resin cements be utilized for the cementation of fiber posts. But research by Scotti N et al. has shown that resin cements that need two curing processes are incompatible with self-etching adhesive systems that only require one phase. [5]

In the present study, a dual-curing resin cement (Selfcem, Medicept, U.K.) was employed which was light cured as recommended. Drawing from prior experience with the microtensile method, the push-out methodology implemented in this study was developed as a 'micropush-out' type test, aimed at minimizing specimen size to achieve a more uniform distribution of stress. The assertion regarding a notably non-uniform stress distribution, as presented by some authors in opposition to the push-out method, is valid, particularly in light of the testing procedures employed to date, which involve loading thick specimens or the entire post. [1,6,9] However, in this study, Group I and III were much stronger in Group I(a) and III(a) than in I(b) and III(b), with the fiber post having the strongest overall bond strength.The findings align with the results which support the study of Lanza A et al. said that a very rigid post can make it hard for the tooth to work naturally, which can cause tension and shear zones to form in the dentine and where the luting cement meets the post compatibility with Bis-GMA resin utilized in bonding procedures, allowing for their secure adhesion within the root canal using adhesive resin cement and bonding systems.[12] Research by Shashikala K et al., indicates that endodontic or restorative failure may occur when higher-modulus components, such as cast post or core, transmit functional stresses to dentine, which has a lower modulus. Lower interfacial stress and failure occur when all components have comparable elastic-moduli, which also leads to a uniform distribution of stress. A term "monobloc" has been used to describe this phenomenon. All parts of a dental restoration must have dentine-like elastic moduli for it to be "monobloc," or move, bend, and stress together. Posts made of fiber include this phenomenon.[13]

48 freshly extracted, intact, caries-free, and visually assessed fracture-free human mandibular first premolar teeth with comparable root lengths were selected for the study. Following the debridement of the root surfaces, each tooth was sectioned at the cementoenamel junction (CEJ) in a manner perpendicular to the long axis of the tooth. The teeth were embedded perpendicularly for support in blocks made of type II dental plaster (Kaldent, India). They were endodontically instrumented using the crown-down technique to the established working length, enlarging the apex to size 30, 0.02 taper (Dentsply Maillefer). Irrigation was performed alternatively with 5% sodium hypochlorite (Reachem laboratories, India) and EDTA (Pyrax, India) using a 2-ml syringe and a 25-guage needle. They were obturated with gutta-percha (Dentsply Maillefer) and endodontic sealer (DPI, India). After 24 hours, the dowel space was prepared to a depth of 10mm using Tenax Fiber Trans Drill TED 13 (Coltene Whaledent, Germany). They were randomly divided into three groups of 16 samples each according to the type of radicular dentine etching performed. Each group was further subdivided into two groups of 8 samples each based on the type of post to be cemented. 24 prefabricated fiber reinforced posts (Tenax Fiber Trans TFT 13, Coltene Whaledent, Germany) and 24 cast metal posts of nickel chromium alloy (Bellabond Plus, Bego, Germany)) and with a maximum diameter of 1.3mm and a length of 10mm were airborne-particle abraded with 110μm aluminum oxide powder (Bego Duostar, Germany) for 5 seconds at 2.5 bar pressure from a distance of 1cm and cemented to full depth with a dual-curing resin cement (Selfcem, Medicept, U.K.) in the prepared post spaces in their respective groups. Specimens were sectioned perpendicularly to the post axis using a low speed separating diamond disc (DFS, DiaMon, Germany) in a micromotor handpiece (Marathon4, Sayeang Microtech, Korea) under water cooling to obtain 1mm root slices for the micro-push out bond strength on a universal testing machine (Instron; Model 3366).

6. CONCLUSION

Compared to the one-step self-etch technique, the bond strength of fiber posts and cast posts cemented to radicular dentine was significantly increased by post space conditioning with 32% phosphoric acid before applying a self-etch adhesive ($p < 0.001$). When comparing the three-step total-etch method with the one-step self-etch technique that used 32% phosphoric acid, the results were not statistically significant. Fiber posts in Group I and Group III (mean bond strength values of 15.24 N and 15.37 N, respectively) demonstrated significantly higher bond strength than cast metal posts in Group I & III.

REFERENCES

[1] Choi Y, Pae A, Park EJ, Wright RF. The effect of surface treatment of fiber-reinforced posts on adhesion of a resin-based luting agent. The Journal of prosthetic dentistry. 2010 Jun 1;103(6):362-8.

[2] Dejak B, Młotkowski A. Finite element analysis of strength and adhesion of cast posts compared to glass fiber-reinforced composite resin posts in anterior teeth. The Journal of prosthetic dentistry. 2011 Feb 1;105(2):115-26.

[3] Balbosh A, Kern M. Effect of surface treatment on retention of glass-fiber endodontic posts. The Journal of prosthetic dentistry. 2006 Mar 1;95(3):218-23.

[4] Albashaireh ZS, Ghazal M, Kern M. Effect of dentin conditioning on retention of airborne-particle-abraded, adhesively luted glass fiber-reinforced resin posts. The Journal of Prosthetic Dentistry. 2008 Nov 1;100(5):367-73.

[5] Scotti N, Rota R, Scansetti M, Migliaretti G, Pasqualini D, Berutti E. Fiber post adhesion to radicular dentin: The use of acid etching prior to a one-step self-etching adhesive. Quintessence International. 2012 Jul 1;43(7).

[6] Akgungor G, Akkayan B. Influence of dentin bonding agents and polymerization modes on the bond strength between translucent fiber posts and three dentin regions within a post space. The Journal of prosthetic dentistry. 2006 May 1;95(5):368-78.

[7] O'Keefe KL, Miller BH, Powers JM. In vitro tensile bond strength of adhesive cements to new post materials. International Journal of Prosthodontics. 2000 Jan 1;13(1).

[8] Qualtrough AJ, Chandler NP, Purton DG. A comparison of the retention of tooth-colored posts. QUINTESSENCE INTERNATIONAL-ENGLISH EDITION-. 2003 Mar 1;34(3):199-202.

[9] Radovic I, Mazzitelli C, Chieffi N, Ferrari M. Evaluation of the adhesion of fiber posts cemented using different adhesive approaches. European journal of oral sciences. 2008 Dec;116(6):557-63.

[10] Goracci C, Tavares AU, Fabianelli A, Monticelli F, Raffaelli O, Cardoso PC, Tay F, Ferrari M. The adhesion between fiber posts and root canal walls: comparison between microtensile and push-out bond strength measurements. European journal of oral sciences. 2004 Aug;112(4):353-61.

[11] Radovic I, Monticelli F, Goracci C, Cury AH, Coniglio I, Vulicevic ZR, Garcia-Godoy F, Ferrari M. The effect of sandblasting on adhesion of a dual-cured resin composite to methacrylic fiber posts: microtensile bond strength and SEM evaluation. journal of dentistry. 2007 Jun 1;35(6):496-502.

[12] Lanza A, Aversa R, Rengo S, Apicella D, Apicella A. 3D FEA of cemented steel, glass and carbon posts in a maxillary incisor. Dental materials. 2005 Aug 1;21(8):709-15.

[13] Shashikala K, Sharma S. Clinical and radiological evaluation of cast metal and quartz fibre posts in endodontically restored teeth. Endodontology. 2011 Jul 1;23(2):37-46.

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