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Original Research Article

Study and Comparison of Carbon Fibre Post Push out Bond Strength Based on Methods of Cement Application

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Abstract

Background: The posts selection and cementation helps to bond with restorative material. Hence, post retention is responsible for long span survival of endodontically restored teeth. The technique and selection of cement selected for cementation will determine the bearing effect of the post retention. **Aim:** The purpose of the study, evaluate and compare using 3 different techniques about the carbon fibre post push out bond strength at the coronal, middle and apical levels of extracted mandible tooth of single root. ***Methodology:*** The premolars extracted were selected about 50 and based on the technique using lentulo-spiral instrument, to the surface post, with the support of elongation tip the material was injected and divided into 3 groups the post space drilled using rely-x light polymerized. In the acrylic resin the root specimens embedded and sectioned and finally measured using Universal testing machine. The overall effort is to subject for the bond strength push out. The failure bond strength specimens were studied and evaluated using operating microscopes. ***Result:*** The Elongation tip method as well as lentulo-spiral method p (value 0.052 and 0.0089). ***Conclusion:*** Using three techniques Post hoc analysis was done to find out stress bearing capacity at coronal middle and apical levels. The comparison between lentulo-spirals and direct method, the study results such as nil difference in stress bearing capacity.

Keywords: Carbon fibre post, lentulo spiral, elongation tip, operating microscope, push out bond strength.

INTRODUCTION

In recent times, dual – cure self adhesive resin luting cement usually does not require pre- treatment of the root canal. Carbon fibre posts, resin cements and some composite resins consist of similar characteristic several kinds of dental cements have been used for post cementation. The restoration of root canal treated teeth is based on the materials unit compared to modulus of elasticity of dentine. The self-adhesive resin cements are widely used to simplify the procedures of dentin bonding. The resin bond to dentin, takes less time span than other cements. The operative procedure, post type, post space adaptation, adhesive types and in perspective of resin cements the flow-ability, viscosity and also curing methods are various factors which influence the post retention and as well as anatomical and histological characteristics gets affected in the post space due to luting procedure of the cement. In various clinical situation stainless steel can be replaced by carbon fibre post biocompatible, corrosion-resistant, and strong. when compared to other metal post since it is rigid and also allows for bond strength an small diameter is used. Carbon fibre post has modulous elasticity and similar to that of dentine, So it results in less root fracture as well as tooth stress. It is considered to be consisting of greater durability. It has the potential for treatments of surfaces, configuration alteration like serration helps in bond strength to composite resins. In order to cement the post with a syringe of small tipped, or lentulo – spiral or post coating. The use of lentulo-spiral contraindicated due to setting of cement acceleration and also improper seating of post by resin cements. The application method of cement in the post space as well as viscosity of resin cement plays an vital factor that helps in carbon fibre post setting, which relates with the adhesive cement bond strength. The dual cure resin cement application method to the root canal has been taken by the study

report which results in controversial aspects about the methods of application and their post retentive strength.

METHODOLOGY

Nearly 50 extracted premolar teeth (Fig-3) were selected and specimens were stored in saline. The debris present in the crown surface were removed by ultrasonic scaler, the main principles includes: absence of root decay, straight roots, length of root minimum 14mm, absence of defects and cracks. The tooth crown surface were sectioned perpendicular to long axis above the Cemento- enamel junction .The sectioning is done to obtain 14mm long roots and working length established 1mm short of apex. The root canal was performed by instrumentation using S1 and S2 Protaper and nickel titanium rotary instruments (Fig-1 and Fig-2) with a crown down technique. The preparation of the canal size were prepared to size 30. The canal was irrigated with 17% EDTA, 5 % sodium hypochlorite, dried the canal using paper points and obturated using gutta-percha and with sealer (AD seal). After 24 hours, post cementation procedure was done by removing the gutta percha from coronal and middle thirds of root using gates -glidden drill (Fig-6). In the apical seal (Fig-5) apical gutta percha of about 4mm was left to preserve it,post space was prepared using rely x post drill (Fig-7) and to a depth of 10mm ,in the sectioned surfaces. The post space was rinsed with 5 % NaOCl, and the irrigation was done with distilled water and the post space finally dried with absorbent paper (Fig-4) points. Then the tapered carbon fibre post was taken to use in post space. Each group was divided into 3 subgroups and a technique is used to place the cement by rely x (Fig-7) u200 into root canal: by lentulo spiral instrument using size #30 for minimum 3 seconds before seating of post ie group lentulo, post surface cement i.e group direct, a specific elongation tip is used for injecting a material. The resin cement was applied and light polymerised for 40 seconds, by applying to surface of the post (group direct), by elongation tip injected to the post depth (group elongation). In the space the post was seated to depth by applying finger pressure, excess removed by a tiny brush. After the procedure of cementation 30 minutes later, the specimens stored at room temperature at 100% humid condition.

Fig 1 & 2: Lentulo 10 Mandibular Premolar Teeth

Fig-3: Group Direct – Mandibular Premolar Teeth

Fig-4: Absorbent Points

Fig-5: Adseal

Fig-6: # 2 Gate Glidden Drills

Fig-7: Relyx post Drill

Bond strength test (push out)

The whole specimen is stored in 100 % humid condition after the procedure. In auto polymerizing resin root specimen embedded then after setting, it was sectioned perpendicularly using a low speed saw by water coolant. Each root consist of 3 slices by sectioning which consist of coronal, middle and apical part of fiber post. The thickness was around 2.0 .and by an indeble marker, slice was marked .The test was performed by mounting on a universal testing machine by applying to each slice a compressive load to the apical region and a punch pin was placed to the post alone. The post diameter measured using a digital micro calliper, since the load was applied to the slice apical surface with a speed of 1.0mm/min. The load of the maximum value recorded (N) and converted in Mpa, including the area of bonding (mm2) of the segment post. The post segment total bonding calculated with a formula $\pi(R + r)$ (h2 + (R –r)2] 0.5.

Where,

$$\pi = 3.14$$

h= slice thickness /mm
R = coronal post radius /mm
r = apical part radius (mm)

The specimen were examined for fractured test using operating microscope, with a magnification of around 25 times. Then it was categorised into 4 different types.

- Dentine cohesive
- Adhesive between fibre post and resin cement
- Adhesive between resin cement and root canal treated teeth
- The post surface covered with mixed resin cement.

RESULTS

In the present study descriptive stastical analysis were carried out. It was presented that leads to measurements in which significance assessed was nearly 5%. In order to study parameters among group of 3-4 patients [1-3] metric parameters was done through post-hoc turkey test which was used to determine the significance of it on continuous scale.

Comparison of Load (N) in three groups in coronal, Middle and Apical				
Load (N)	**Lentulo Spirals**	**Direct Method**	**Elongation Tip**	**P value**
Coronal	33.50±11.80	49.53±24.00	101.76±73.42	0.007*
Middle	69.80±25.36	100.72±43.22	102.71±45.86	0.044*
Apical	113.26±43.65	114.88±62.04	113.39±42.78	0.625

Comparison of load in coronal is such as:
Lentulo spiral – 33.50±11.80
Direct method: 49.53±24.00
Elongation tip: 101.76±73.42, P value :0.007** so the load is
highly strong when load bearing compared among 3 different groups

Comparison of Load in middle region is such as:
lentulo spirals 69.80±25.36,
direct method 100.72±43.32
Elongation tip 102.71±45.86
P value 0.044*. so the load is moderately significant when load bearing compared among 3 different groups

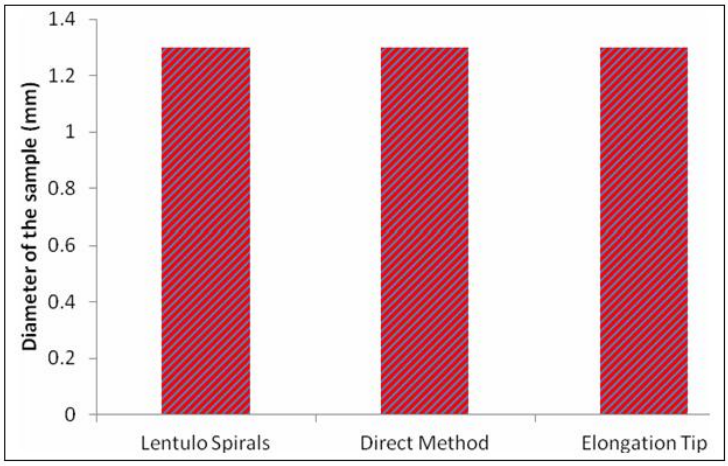
Comparison of Load in apical region is such as:
lentulo spirals 113.26±43.65,
direct method 114.88±62.04
Elongation tip 113.39±42.78
P value 0.625.

Comparison of Stress (N/mm2) in three groups in coronal, Middle and Apical				
Stress (N/mm2)	**Lentulo Spirals**	**Direct Method**	**Elongation Tip**	**P value**
Coronal	24.57±12.41	35.07±20.24	76.66±56.38	0.007**
Middle	64.55±25.02	104.83±45.79	129.58±56.42	0.043
Apical	114.66±58.14	123.40±84.15	136.95±53.50	0

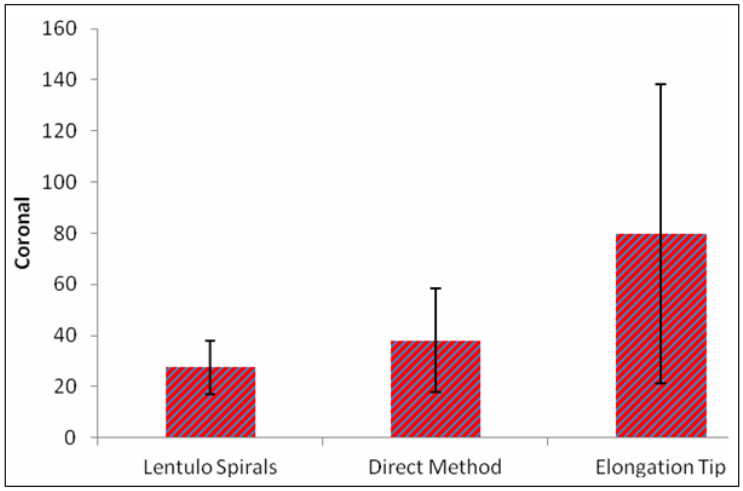
Comparison of stress in coronal is such as:
Lentulo spiral – 24.75±12.41
Direct method : 35.07±20.24
Elongation tip : 76.66±56.42 , P value :0.007** so the load is
Highly strong when load bearing compared among 3 different groups.

Comparison of stress in middle region is such as:
lentulo spirals 64.55±25.02,
Direct method 104.83±45.79
Elongation tip 129.58±56.42
mpared among 3 different group

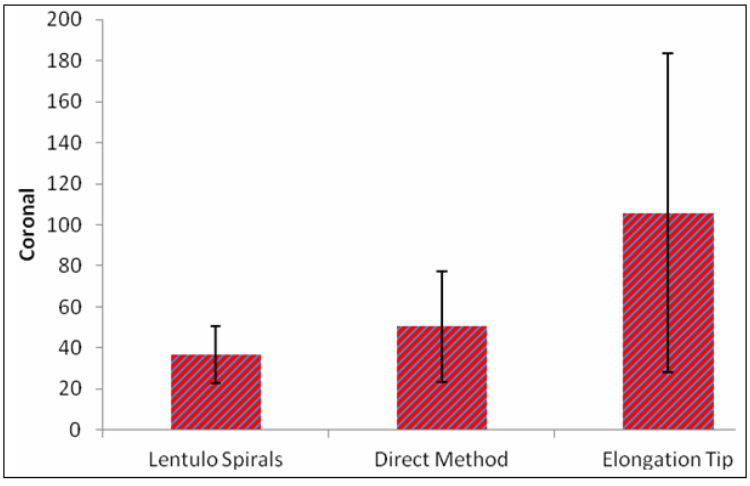
Comparison of stress in apical region is such as:
Direct method 123.40±84.15
Elongation tip 136.95±53.50
P value 0.621
So the load is not significant when load bearing compared among 3 different group



Comparison of study variables in three groups at Coronal level of carbon fibre post using 3 different techniques



Comparison of Load (N) in three groups in coronal, Middle and Apical



Comparison of Stress (N/mm2) in three groups in coronal, Middle and Apical

DISCUSSION

The study aim was to compare and evaluate bond strength push out of carbon fibre post based on methods of cement application [3-6]. In recent study post retention measured with push out tests and also microtensile. It also helps to create three sequential series of sample in order to decrease sample error which results in a big deviation at the level of root. There are various study in vitro values of different techniques of luting to dentin root canal and fibre post .The studies conducted by Jiwan yum *et al.*, revealed that elongation tip resulted to greater bond strength push out than lentulo spiral method as well as direct method. The

study done by other researchers that dual polymerising resin cement in all root segment provided bond strength significantally low [7, 8]. The present study found that direct method as well as P value 0.052 and 0.0089 respectively and Elongation tip was better and strongly significant. It also reported that the resin luting agent with a lentulo spiral instrument in which luting cement distribution through out post space [17] and results in a continuous formation of uniform cement layer [14, 15]. However clinician finally results in the process of cement application within the post space and also to the coronal level of root, bond strength push out is highly significant for elongation tip is stronger because the elongation tip creates adhesion between the post and root canal dentin which withstands high bond strength push out [9, 10]. The failure of cementation occurred at dentin cement interface with lentulo-spiral and direct method due to incorporation on non – homogenous cement mixture and voids [11-13].

CONCLUSION

Post hoc analysis was done and found that elongation tip method is better than direct method as well as lentulo spiral method 0.052 and 0.0089 respectively. The coronal level push out bond strength found to be strongly significant, at middle level moderately significant, apical level no stastical significance and and also no stastical difference for stress bearing at middle and apical level.

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