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Fracture Resistance and Interfacial Adaptation of Prefabricated Exacto Glass Fiber Post vs. Customized Ribbond Fiber Post with Two Post Lengths: A Comparative Study

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Abstract

Aim: The current study aimed to compare the fracture resistance between prefabricated Exacto glass fiber posts and customized Ribbond fiber posts at two different post lengths and assesses their interfacial adaptability. Materials and Methods: Seventy extracted human mandibular first premolars were collected, standardized, and mounted with simulated periodontal ligaments. Teeth were categorized into three groups: control (no post) and two experimental groups (Exacto fiber post and Ribbond fiber post) with two post lengths (12 mm and 8 mm). Endodontic treatment, preparation post space and ferrule effect, cementation of the post, and core build-up were performed. Fracture resistance test was assessed using a universal testing machine while the interfacial adaptability was evaluated utilizing field emission scanning electron microscopy. Data were gathered and examined statistically through one-way analysis of variance and Post Hoc Tukey HSD tests at $P \leq 0.05$. Results: A significant difference in fracture resistance and interfacial adaptation was presented between the two post types, while there was no significant difference in fracture resistance between the posts of length 12mm and 8mm Conclusion: Customized Ribbond posts demonstrated greater fracture resistance and interfacial adaptation than prefabricated Exacto posts. In the examined post systems, lengthening the post was not substantially improved fracture resistance of teeth that treated endodontically.

Introduction:

The prolonged prediction of teeth treated endodontically is largely influenced by the reliability and effectiveness of post-core system, especially with a main coronal destruction of tooth structure that compromises the ability to retain a definitive restoration [1]. Various materials, including zirconia, fiberglass, and metal alloys, have been extensively studied in recent years [2]. However, metal posts present several drawbacks, including galvanic corrosion, metallic taste, allergic reactions, and a discrepancy in elastic modulus between dentin and metal, which compromises the post's performance so that fiber post systems have gained popularity as a substitute for metal posts to their aesthetic advantages and improved performance in restoring pulpless teeth [3,4].Fiber posts are classified into two types: prefabricated and customized. Prefabricated fiber posts, comprising carbon fiber and glass fiber, are readily accessible and offer practical solution for post-core rehabilitation. Exacto fiber posts are prefabricated glass fiber posts consisting of about 80% glass fiber and 20% epoxy resin. Even though their superior mechanical and physical characteristics, clinical utilization of prefabricated posts have shown many kinds of failure, like secondary caries, adhesive failure, root or post fractures, and recurrence of endodontic diseases [5]. Failure rate elevation of prefabricated fiber post restorations, as indicated by longitudinal clinical trials, has been attributed to these issues [6].In contrast, customized fiber-reinforced composite posts are designed to match the specific root canal dimensions and reducing a weak cement interface. One such customized fiber post is Ribbond, a commercially available system composed of ultra-high molecular weight polyethylene fibers where these fibers exhibit exceptional resistance to elongation and deformation, characterized by their bondable, three-dimensional architecture that promotes mechanical interlocking with composite restoration [7,8]. However, Ribbond has some limitations, including limited translucency, discoloration over time, and a sensitive application technique [9]. In spite of these deficiencies, custom-fabricated fiber posts, such as Ribbond, are favored for their superior interfacial adhesion and fracture resistance compared to prefabricated alternatives. Certain studies suggest that prefabricated glass fiber posts exceed Ribbond in mechanical properties [10], however other research indicates that Ribbond posts exhibit superior fracture resistance in clinical evaluations [11]. This discrepancy highlights the need for more investigation into the comparative advantages of each type of fiber post.The optimal post length for enhanced fracture resistance remains a contentious issue in research. Some studies suggest that increasing post length enhances fracture resistance by improving stress distribution [12], while other research confirm that post length has a minimal impact on fracture resistance, with factors such as post material and adhesive techniques being more significant [13].The presence of a ferrule, distinguished by a height ranging from 1.5 to 2 mm and 1 mm width of preserved coronal tooth structure, considerably enhances the fracture resistance of endodontically treated dentition, especially those with substantial coronal damage [14,15].The interfacial adaptation among the dentin, cement, and post is crucial for ensuring the longevity of the restoration at the cement-dentin or post cement interfaces constitutes a primary reason of failure in fiber post restorations. While previous research has focused on the cement-dentin contact, there is limited comprehension of interfacial adaptability at post-cement interface, particularly across different post systems and post lengths [16]. Accordingly, this study aimed to perform a comparative assessment for both fracture resistance and failure modes of prefabricated Exacto glass fiber posts and custom-made Ribbond fiber posts at two insertion lengths (12 mm and 8 mm). Additionally, it seeks to assess interfacial adaptability at post-cement interface via field emission scanning electron microscopy at each third of post system (coronal, middle, and apical). By addressing both mechanical performance and interfacial integrity, the study is expected to enhance the comprehension of the clinical efficacy of fiber post system in the teeth that received root canal therapy.

Materials and Methods

This in vitro experimental study was carried out on human teeth that extracted for orthodontic purposes. The study was conducted between November 2024 and March 2025 at the Department of Conservative Dentistry, College of Dentistry at Mosul University. Ethical permission was acquired from the Research Ethics Committee of the College of Dentistry at Mosul University, Iraq, under clearance number REC reference no. UoM.Dent. 25/1014, and all procedures were carried out in accordance with established laboratory protocols.

This study involved the collection of 70 freshly extracted mandibular first premolars from patients aged 20 to 22 years who had tooth extraction for orthodontic reasons. Prior to inclusion, digital radiographs x-ray (Carestream 9000, France) was obtained in bucco-lingual and mesio-distal orientations to ensure the presence of a fully formed apex, a single canal and apical foreman, straight canal and the absence of internal resorption, pulp stones, obstructions, or any previous endodontic treatments. The chosen teeth had a similar crown length (8 mm ± 0.2 mm) and root length (15 mm ± 0.2 mm), with root diameters of 7 ± 0.5 mm bucco-lingually and 5 ± 0.5 mm mesio-distally at the cervical root third.

The teeth were examined under a stereomicroscope (OPTIKA, BG, Italy) at X10 magnification to detect any cracks, fractures, or defects. Subsequently, the teeth were cleaned and disinfected in a 0.1% thymol solution for up to one week. After disinfection, the teeth were rinsed thoroughly with distilled water. To maintain moisture, the teeth were preserved in a glass container with distilled water at 4°C until use. Each tooth was marked 2 mm beneath the cemento-enamel junction with a permanent marker to mimic the physiological link between the bone crest and the tooth. The roots were subsequently submerged in melted wax for 3 seconds to form a 0.2 mm thickness simulating the periodontal ligament. The teeth were centrally positioned within polyvinyl chloride cylinder (20 mm height, 17 mm internal diameter) that filled with self-curing acrylic resin (Voco, China) in dough stage using a dental surveyor. Following resin polymerization, the teeth was pulled from the resin cylinders, and the wax was meticulously eliminated from both the resin sockets and the roots surface. Acrylic socket was filled with light-body polyvinyl siloxane impression material (VERICOM CO., Korea), then the tooth was reinserted subsequently into the acrylic socket, and eliminated any excess of impression material to achieve a consistent 0.2 mm thickness, imitating the natural periodontal ligament [(2)].

The 70 teeth were allocated randomly to three groups based on the type of post system used in current study as following:

- Group I (control): Endodontic treatment with coronal composite restoration without ferrule or post space preparation.
- Experimental groups include Group II (prefabricated Exacto glass fiber post) and Group III (customized Ribbond fiber post): The teeth in these groups were received fiber post systems, ferrule effect and composite core buildup.

Each main group (Group II and Group III) was subdivided into two subgroups according to the mechanical tests performed, which included fracture resistance and interfacial adaptation assessments. Figure 1 provided an extensive overview of the study design. The crown of specimens in Groups II and III were decoronated at 2 mm above the cementoenamel junction via a water-cooled diamond disc (Komet, USA) to provide ferrule, with the tooth securely held in a dental surveyor. This procedure resulted in a total specimen length of 17 mm, consisting of 15 mm of root length and 2 mm of crown length.Endodontic treatment was carried out on the teeth with assistance of a dental surveyor. Access cavity preparation performed using round carbide bur No. 4 (Brasseler, USA) in conjunction with a high-speed handpiece (NSK, Japan), refined the access cavity outline with an Endo-Z bur (Brasseler, USA) to create a straight-line access and using a barbed broach (ROGIN, Germany) for pulpal extirpation, followed by canal preparation with rotary ProTaper NiTi Gold files (Dentsply, Switzerland) in a crown-down mode. Canal shaping began with size S1 and progressed to F4 using the ProTaper rotary system (Endo smart, Germany) at 300 rpm and 3.0 Ncm of torque in crown-down mode. Between each file, 3 mL of 5.25% sodium hypochlorite (NaOCl) was used for irrigation with a 27-gauge monojet needle (Biodent Co., Ltd, Gyeonggi-do, Korea). After instrumentation, the canal was irrigated by 17% EDTA (Prime Dental Products, India) for elimination the smear layer, following by 10 mL of distilled water and drying with F4-sized paper points (DiaDent, Korea) [17, 18].Root canal obturation was performed using the single-cone technique with F4 ProTaper gutta-percha (DiaDent, Korea) and T BioSeal sealer (NEXOBIO, Korea). A digital X-ray radiograph was obtained using a digital radiography unit (Carestream 9000, France) to confirm proper canal obturation. In Group I (control), coronal restoration was completed with G-aenial composite resin (GC, TOKYO, JAPAN), while groups II and III were sealed coronally using glass ionomer cement (Vitremer, 3M, USA). The samples from all groups were maintained in a moist environment by encasing them in saline-moistened gauze within a sealed container and incubated for 7 days at 37°C with 100% humidity in an incubator to facilitate the complete setting of the sealer [18].Post space preparation for all specimens in Groups II and III were conducted using a Peeso Reamer up to the drill #4 (Dentsply, Switzerland), mounted on a slow-speed handpiece that secured into the vertical arm of a dental surveyor to ensure standardized preparation.Post spaces were irrigated sequentially by 5.25% NaOCl (3 mL) and distilled water (5 mL) then 17% EDTA solution (2 mL) and distilled water (5 mL), via a 30-gauge disposable irrigation needle for 1 minute. Post space preparation was verified by digital radiographic x-ray (Carestream 9000, France) to confirm complete sealer removal from the canal walls [19].The ferrule effect (2 mm in height, 1 mm in width) was created for all specimens in Group II and III using a round-end tapered diamond bur (Brasseler, USA).

Fiber Post Cementation

Exacto glass fiber posts were sectioned into two different lengths according to study design: 10 mm (8 mm inside the post space) and 14 mm (12 mm inside the post space), leaving 2 mm of the post extended coronally and cemented followed manufacturer's instructions:

1. The canal space was cleansed using alcohol, rinsed with a water/air spray and dried using air and paper points (DiaDent, Korea).
2. The canal was etched using 37% phosphoric acid (Spident, Korea) for 10 seconds, then washing and drying with air and paper points (DiaDent, Korea).
3. G-Premio Bond (GC, Tokyo, Japan) was applied within the post space using a microbrush, dried for 5 seconds with gentle air, and subsequently light-cured for 10 seconds using a curing unit (CICADA, China).
4. Silane (Angelus, Brazil) was applied to the fiber post for 1 minute, then gently air-dried.
5. G-CEM resin cement (GC, Tokyo, Japan) was applied to the canal using an endodontic tip.
6. Exacto glass fiber post (Angelus, Brazil) was introduced into post space and held in place for 7 minutes. Excess cement was carefully removed, and an initial

light cured was performed for 2 seconds to facilitate the removal of the gelled resin cement. A final light cured for 20 seconds to ensure complete polymerization.

Ribbond fiber posts were cut to double the length of Exacto glass fiber posts, as they were positioned in a V-shape within the post area. The utilized lengths were 20 mm (16 mm within post space) and 28 mm (24 mm within post space), resulting in 4 mm extending coronally (2 mm from the mesial and distal sides) in each grouping. The cementation of Ribbond was conducted using the same procedures as Exacto cementation, with the exception that Ribbond (Ribbond Inc, USA) was pre-impregnated with Ribbond Wetting Resin (Ribbond Inc, USA) for approximately 15-20 seconds to guarantee enough fiber saturation before bonding.

Composite Core Buildup

After post cementation, composite core build up was performed for all specimens in Group II and Group III while Group I (control) was restored with only coronal composite restoration. Selecting one tooth, dentin etching was applied for 15 seconds using 37% phosphoric acid gel (Spident, Korea), followed by rinsing, drying without desiccation, and applying G-Premio Bond (GC, Tokyo, Japan). After 10 seconds, the dentin was dried with gentle air for 5 seconds and light-cured for 10 seconds according to manufacturing instructions. The G-aenial universal composite (GC, Tokyo, Japan) was utilized to construct the core. The initial composite layer of core was light-cured for 20 seconds. A transparent mylar celluloid strip (3M ESPE, USA) was then used to contour the final layer of composite, shaping the core to a height of 3 mm and light cured for an additional 20 seconds via the transparent strip. After polymerization, transparent mylar celluloid strip (3M ESPE, USA) was carefully removed, and the core was finished using multi-fluted carbide finishing burs (Meisinger GmbH, Germany) and polished sequentially with Sof-Lex discs (3M ESPE, USA), progressing from coarse to superfine grits.A stamp impression was created utilizing Exaclear polyvinyl siloxane impression material (GC, Tokyo, Japan) to ensure a consistent core measurements across all groups [20]. Following the core buildup, a final digital radiograph (Carestream 9000, France) was taken.

Mechanical Test

For fracture resistance test, all 50 samples from group I, subgroup II A (1 and 2), and subgroup III A (1 and 2) were stored in a dark, light-proof container filled with distilled water at room temperature for one day. Fracture resistance was tested utilizing a universal testing machine (Hongjin, China). A load was applied to the buccal surface of the buccal cusp at 45-degree angle to the long axis of the tooth, at the interface between the core and tooth structure, using a crosshead with 0.5 mm/min speed. A specially designed mounting jig was used to standardize the 45-degree loading orientation [2]. The maximum load causing fracture was recorded in Newtons (N) using computer software. Failure mode was assessed using a digital microscope at X1600 magnification, and classified into [21]:

- Type I: Fracture at crown-core build up interface.
- Type II: Fracture at root cervical third.
- Type III: Fracture at root middle third.
- Type IV: Fracture at root apical third.
- Type V: Vertical root fracture.

Interfacial adaptation test was assessed using field emission scanning electron microscopy. Post length for 20 samples in both subgroups II B and III B was approximately 12 mm inside the root canal. Each root was marked with permanent markers at four lines corresponding to the post length (beginning from the cementoenamel junction to the apex of the post) to facilitate horizontal sectioning into 3 thirds: coronal, middle, and apical. Roots were embedded in translucent cold-cure acrylic (GC, Tokyo, Japan), waiting till complete polymerization, and sectioning was performed using a sectioning disc (Sensoflex, DFS Diamon, Germany) and low-speed handpiece with water coolant by aid of metal vise. Root discs (2 mm thickness) were polished with the Sof-Lex™ finishing and polishing System (3M ESPE, USA) and prepared by soaking in 2.5% NaOCl for 1 minute, rinsing with distilled water, and further treatment with 17% EDTA for 1 minute. After rinsing, the samples were desiccated using ascending concentrations of ethyl alcohol (30%, 50%, 70%, 90%, 100%) and fixed with double-sided carbon tape [22,16]. The root discs were sputter-coated with 15 nm of gold to increase conductivity. Gap widths at post-cement interface were measured using field emission scanning electron microscopy (TE Scan MIRA3, France) at 10 mA and an accelerating voltage of 15 kV. Microphotographs were captured at magnifications of 500–2000x at the interface among dentin, resin cement, and post. Gap measurement was performed using ImageJ software

Statistical Evaluation

Data were statistically analyzed with SPSS version 20.0. After conducting normality tests “Kolmogorov–Smirnov and Shapiro–Wilk” at $P \leq 0.05$, data subjected to parametric statistical analyses (one-way ANOVA and Tukey HSD test) at a significance level of $P \leq 0.05$.

Results

Fracture Resistance Test

The highest value was observed for control, followed by Ribbond 12 mm, whereas the lowest value was noted with Exacto glass fiber 8 mm. There was statistically significant difference ($P \leq 0.05$) among the main groups as indicated by one-way ANOVA (Table 1). Post Hoc Tukey HSD test indicated no statistically significant differences between the both lengths of the same post system (Table 2 and Figure 2).

Mode of Failure

Failure modes distribution was summarized in Table 3. Highest incidence of reparable failures (types I and II) was recorded in the control group, with 100% of specimens exhibiting these types. This was followed by the Ribbond 8 mm and Ribbond 12 mm groups, which demonstrated reparable failure rates of 90% and 80%, respectively. In contrast, the Exacto 8 mm and Exacto 12 mm groups exhibited lower percentages of reparable failures, at 60% and 50%, respectively. Type III failures were most prevalent in the Exacto 8 mm group (40%), followed by the Exacto 12 mm group (20%). Both Ribbond subgroups (8 mm and 12 mm) exhibited a lower incidence of type III failure, at 10% each, while the control group showed no occurrence of this failure type. Type IV failures were not observed in the control, Exacto 8 mm, and Ribbond 8 mm groups. However, the Exacto 12 mm group demonstrated a 30% incidence of this type, followed by the Ribbond 12 mm group with a 10% incidence. Type V failure (vertical root fracture) was not observed in any of the tested groups.

Assessment of Gap Width by Field Emission Scanning Electron Microscopy

Field emission scanning electron microscopy micrographs for evaluating gaps width value at the post-cement interfaces for each third of the post (coronal, middle, and apical) were presented in Figure 3.

Despite the presence of interfacial gaps at post-cement interface for both types of fiber post systems, Ribbond group demonstrated superior interfacial adaptation, characterized by the smallest average gap width. Conversely, the Exacto group exhibited lower interfacial adaptation and a comparatively greater mean gap width. In both systems, post middle third showed the most favorable adaptability, whereas the apical third consistently revealed the poorest interfacial adaptation.

Statistical Evaluation of Gaps Width

Descriptive statistical analysis of gaps width values in micrometer (µm) and one-way ANOVA were represented in Table 4. Current results indicated that while both groups exhibited gaps at the interfaces, a statistically significant difference was observed ($P < 0.05$) within and between the two groups at each post thirds. The Post Hoc Tukey HSD test indicated that Ribbond post exhibited a lower mean gap width relative to the Exacto post at each third of the post. Furthermore, the middle third for both tested groups exhibited the minimum average of gaps width within their groups as seen in Table 5, Table 6, and Figure 4.

Discussions

The fracture resistance of endodontically treated mandibular first premolars with severely compromised coronal tooth structure is influenced by the type and length of the post system used [12]. The present study demonstrated that customized Ribbond fiber post exhibited superior fracture resistance related to prefabricated Exacto glass fiber post at both post lengths (12 mm and 8 mm inside the root canal).Previous study was attributed this enhanced performance of customized posts to better canal adaptation, which minimizes the resin cement interface. Fernandes *et al* [23] and Bhaktikamala *et al* [24] have mentioned that a thick cement interface may reduced the fracture resistance of tooth that treated endodontically. The Exacto glass fiber post is composed of 80% longitudinally aligned glass fibers and 20% epoxy resin by weight, whereas the Ribbond post consists of ultra-high molecular weight polyethylene fibers woven in a cross-linked pattern. This multidirectional reinforcement pattern prevents crack propagation, enhances fracture toughness, and allows for even stress distribution along canal walls, thus reducing the likelihood of catastrophic failure. The high flexibility of Ribbond also allows it to adapt to canal anatomy and avoid stress concentration points, thereby further improving its fracture resistance [5,8].Conversely, some literature reports that prefabricated glass fiber posts provide better mechanical performance due to superior adhesion, facilitated by silane coupling agents [10]. However, this disparity may be ascribed to variations in application strategies. In the current study, Ribbond was treated with a Ribbond wetting resin, which significantly enhanced its adhesion properties by improving fiber-resin bonding and increasing fracture toughness [25].The current findings also indicated that there were no statistically significant differences in fracture resistance between 12 mm and 8 mm post lengths within each group. This finding aligned with prior studies Mobilio *et al*. [26] and Palepwad *et al* [13] which similarly reported that extending the post length didn’t significantly enhance fracture resistance while it conflicted with Santos *et al* [23] and Amarnath *et al* [12] which indicated that fracture resistance increased with increase in post length. In the current study, both post lengths were either equal to or longer than the clinical crown height (~8 mm) and extending to at least the half of root length with present the ferrule effect which enough to strengthening the tooth so that additional post space preparation may not be necessary to improve fracture strength as approved by Marinescu *et al* [27].The failure investigation indicated that Ribbond posts produced more favorable and non-catastrophic fractures than Exacto posts. This supports their classification as a more biomimetic post system, consistent with findings by Vartak *et al*. [28], who observed that Ribbond posts led to reparable failure patterns conducive to retreatment. Field emission scanning electron microscopy was used due to its superior imaging resolution, capable of identifying sub-micron features such as fatigue striations and interfacial gaps, with a probe resolution down to 0.5 nm [16].Interfacial gaps are considered weak points that can initiate debonding and compromise the durability of post supportive restoration [29]. In the present study, Ribbond fiber posts demonstrated significantly narrower interfacial gaps than Exacto glass fiber posts across all post thirds (coronal, middle, and apical). The limited bonding ability of prefabricated posts may be attributed to their matrix composition. The epoxy resin matrix in prefabricated Exacto glass fiber posts resists penetration by monomers like HEMA, Bis-GMA, and TEGDMA, which can weaken the bond with resin cement [(30)].Although some manufacturers suggest that dimethacrylate resin matrices enhance chemical compatibility with resin cements, other studies report these matrices as less reactive due to high cross-linking and polymerization conversion [(31)].In contrast, Ribbond's polyethylene fibers, which are plasma-treated, offer enhanced adhesion and wettability, allowing the resin cement to penetrate the fibers and form a strong bond. When impregnated with a Ribbond wetting resin, Ribbond achieves excellent contact with canal walls, minimizing voids formation and improving interfacial adaptation [(32)].The middle third of the post consistently exhibited the most optimal interfacial adaptation, with the smallest gap widths. This may be attributed to the optimal matching between post and canal diameter in the middle region, resulting in a thinner cement layer, reduced polymerization shrinkage, and minimized gap formation [(23)].In contrast, the apical third exhibited the largest gap widths, likely due to limited light penetration, which compromises polymerization in light-cured or dual-cure resin cements. Although light-transmitting fiber posts have been proposed to improve polymerization in deeper regions, studies were shown that light intensity and conversion rates decrease significantly with depth [(33, 34)]. Moreover, the high C-factor in the apical region results in increased polymerization stress and limited stress relief due to the confined space, exacerbating interfacial gap formation [(35)].In spite of thicker cement layer in the coronal third, gap widths were smaller than in the apical region, likely due to higher light intensity and improved polymerization at the coronal end. Additionally, the lower C-factor and greater free surface area in the coronal third may allow more effective stress relief post-polymerization [(36)].The present study was subjected to certain **limitations** including only two type of fiber post systems were evaluated, which limits the generalizability of the findings. Furthermore, Field emission scanning electron microscopy analysis was applied on only one root disc per canal third, which may not fully represent the variability in interfacial adaptation.

Conclusions

Within study limitations, it is possible to conclude that customized Ribbond fiber post had higher fracture resistance, more favorable failure modes and better interfacial adaptation than prefabricated Exacto glass fiber post. Fracture resistance wasn't increased with increase of post length, suggesting that additional post space preparation may not be necessary. The middle third of each post type had the best interfacial adaptation, while the apical third had the worst.

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Conflicts of Interest

No conflicts of interest exist.

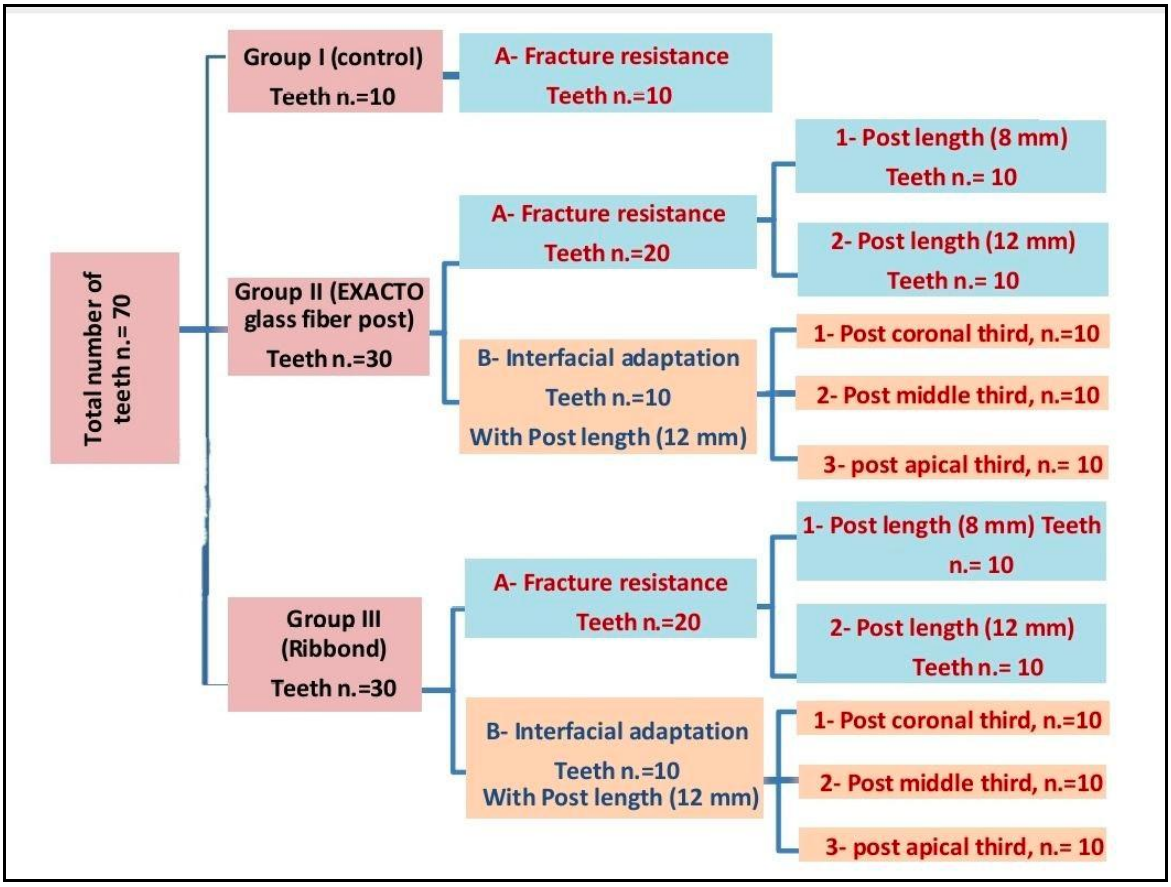

Figure 1: Schematic representation of the research design

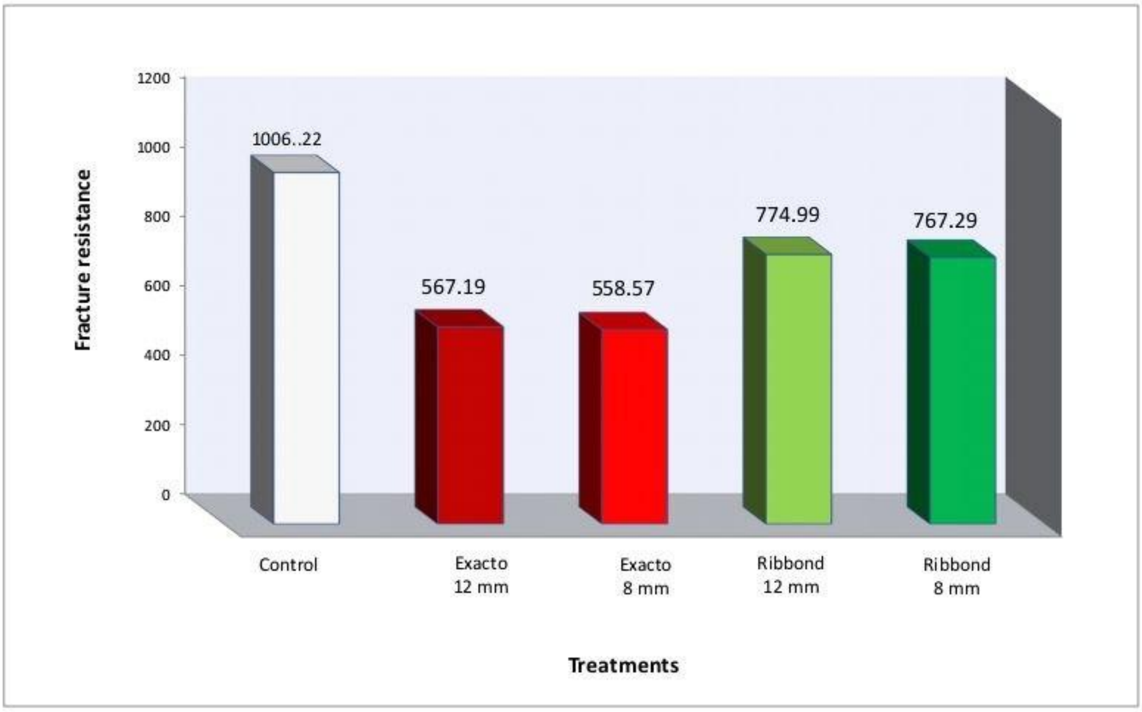

Figure 2: Bar chart represented the mean fracture resistance and Tukey HSD test for all tested groups.

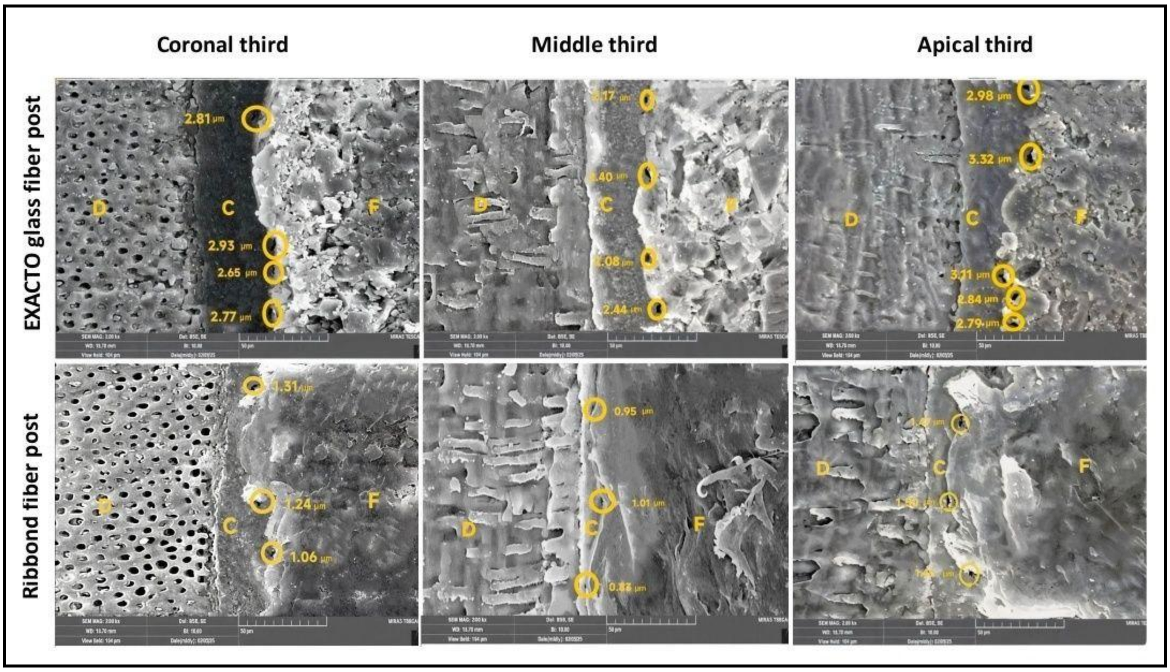

Figure 3: Field emission scanning electron microscopy micrographs at × 2000 to examine the gaps width in micrometer for both types of fiber post at each post third. D: Dentin; C: Resin cement; F: Fiber post.

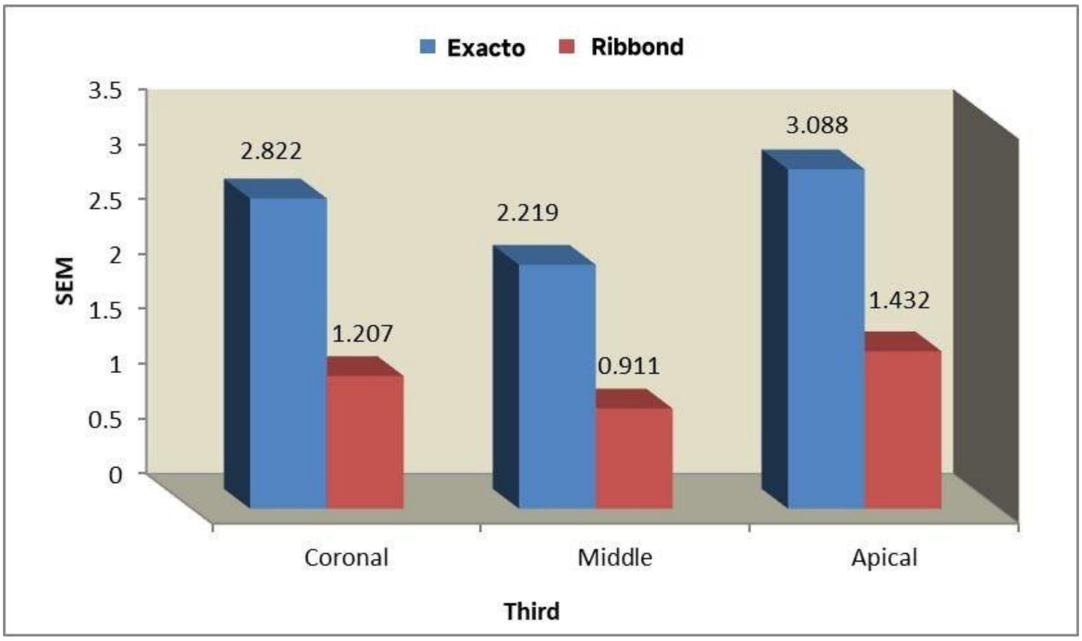

Figure 4: The bar chart represented the mean gap widths and the Tukey HSD test results for each third of both post types.

Table 1: Descriptive statistic and one-way ANOVA for fracture resistance test.

Descriptive statistic				**ANOVA**	
Group	**N**	**Mean**	**Std. Deviation**	**F**	**Sig.**
Control	10	1006.2250	11.77716	2820.276	.000*
Exacto 12 mm	10	567.1980	12.01361		
Exacto 8 mm	10	558.5780	11.38739		
Ribbond 12 mm	10	774.9990	10.17215		
Ribbond 8 mm	10	767.2930	9.18338		

* Statistically significant.

Table 2: Tukey HSD for fracture resistance test.

[redacted]				
		1	**2**	**3**
Exacto 8 mm	10	558.578		
Exacto 12 mm	10	567.198		
Ribbond 8 mm	10		767.293	
Ribbond 12 mm	10		774.999	
Control	10			1006.2250
Significant		0.410	0.522	1.000

Significant > .05: Statistically not significant

Table 3: Percentage of failure modes subsequent to the fracture resistance test.

Mode of failure	**Treatment**					
Type	**Control**	**Exacto 12 mm**	**Exacto 8 mm**	**Ribbond 12 mm**	**Ribbond 8 mm**	**Total**
I	60%	20%	30%	40%	50%	20
II	40%	30%	30%	40%	40%	18
III	0	20%	40%	10%	10%	8
IV	0	30%	0	10%	0	4
V	0	0	0	0	0	0
N. of specimens in each group	10	10	10	10	10	50

Table 4: Descriptive statistic and one-way ANOVA of gaps width at the post-cement interface for both types of post at each post third.

Descriptive statistic				ANOVA	
Group	**N**	**Mean**	**Std. Deviation**	**F**	**Sig.**
F1 Coronal third	10	2.8220	.17466	2.820E3	.000*
F1 Middle third	10	2.2190	.10682		
F1 Apical third	10	3.0880	.20016		
F2 Coronal third	10	1.2070	.07072		
F2 Middle third	10	.9110	.07505		
F2 Apical third	10	1.4320	.05978		

F1: Exacto / F2: Ribbond. * Statistically significant.

Table 5: Post Hoc Tukey HSD test of posts impact on gaps width within and between tested groups

Groups	Mean Difference	Std. Error	Sig.
F1 Coronal third vs F1 middle third	.60300	.05662	.000*
F1 Coronal third vs F1 Apical third	-.26600	.05662	.000*
F1 Middle third vs F1 Apical third	-.86900	.05662	.000*
F2 Coronal third vs F2 middle third	-.29600	.05662	.000*
F2 Coronal third vs F2 Apical third	-.22500	.05662	.000*
F2 Middle third vs F2 Apical third	-.52100	.05662	.000*
F1 Coronal third vs F2 Coronal third	-1.61500	.05662	.000*
F1 Middle third vs F2 Middle third	-1.30800	.05662	.000*
F1 Apical third vs F2 Apical third	-1.65600	.05662	.000*

F1: Exacto / F2: Ribbond / *: Statistically significant

Table 6: Post Hoc Tukey HSD test was shown mean comparison of interfacial adaptation among each third for two types of fiber posts.

Group	N	Subset for alpha = 0.05					
		1	2	3	4	5	6
F2 Middle third	10	.9110					
F2 Coronal third	10		1.2070				
F2 Apical third	10			1.4320			
F1 Middle third	10				2.2190		
F1 Coronal third	10					2.8220	
F1 Apical third	10						3.0880

F1: Exacto / F2: Ribbond.

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