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FRACTURE RESISTANCE OF ANTERIOR ENDOCROWN VS CUSTOM ONE PIECE POST CROWN (IN VITRO STUDY)

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ABSTRACT

Objective: to evaluate fracture resistance of anterior endocrown versus custom-made one-piece post crown (Hybrid Post Crown), which were fabricated from two different materials (Hybrid ceramics and Lithium disilicate ceramics).

Materials and methods: Sixty freshly extracted upper central incisor teeth were selected; all root canals endodontically treated then divided into two main groups (30 samples each) according to the type of restoration used. The first group (E) was restored with Endocrown (n=30). The second group (P) restored with custom one-piece Post Crown (n=30). Each group was subdivided into two subgroups (15 samples each) according to the type of material used, Subgroup EG: anterior endocrown fabricated from grandioblocs. Subgroup EE: anterior endocrown fabricated from E-max, Subgroup PG: custom one-piece post crown fabricated from grandioblocs, Subgroup PE: custom one-piece post crown fabricated from E-max. Fracture resistance test was done to provide a compressive mode of load at angle 45 degree from long axis of the tooth to all specimens in a universal testing machine. A statistical analysis performed by SPSS 20 (Statistical Package for Scientific Studies, SPSS, Inc., Chicago, IL, USA) for Windows.

Results: The highest mean value was recorded in Anterior endocrown fabricated from E-max (EE) (1396.98±93.97N), and the lowest mean value in Custom one-piece post crown made from Grandio blocs (PG) (913.86±116.09N)

Conclusion: There is no statistically significant difference in the fracture resistance between anterior Endocrown and Monoblock post crown, restorations fabricated from E-max cad showed higher resistance to fracture than that made from Grandioblocs in both types of restorations

KEYWORDS: Anterior endocrown, hybrid post crown, E-max, hybrid ceramics, Grandio blocs, fracture load.

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INTRODUCTION

Restoring endodontically treated teeth that have significant coronal damage presents a clinical challenge, particularly because the extirpation of pulp tissue and adjacent dentin which results in a reduction of strength properties.[1]

It has been demonstrated that the use of Posts increases the fracture resistance of the tooth-restoration complex by better distributing the functional force to the remaining coronal and radicular tooth structure, Correlations between the post material and fracture resistance showed that the higher the rigidity of the restoration, the higher was the fracture resistance without distortion.[2]

An alternative, additional restorative options, such as endocrown restorations have been proposed. These restorations are recommended in cases of damaged crowns, short, narrow, dilacerated or obliterated roots, obturated canals or limited interocclusal space in which it is difficult to obtain adequate thickness of the ceramic covering over the metal or the ceramic substructures.[2]

Endocrowns are made using computer-aided design and computer-aided manufacturing (CAD-CAM) technologies. The design and production process are quicker, less technically demanding, and only requires one step when using CAD-CAM technology as opposed to the conventional approach.[3]

Custom cast posts have been utilized for many years. These specially designed posts enhance the fit of post-and-core systems with the walls of the root canal, eliminating the need for excessive preparation to match the post shape. Recently, tooth-colored custom posts have also become available. Additionally, the use of CAD/CAM technology reduces the number of interfaces between the resin composite core and the fiberglass post, allowing for the production of a post-and-core as a single unit. This approach decreases the chances of structural failure in the material by employing a more precise milling process for creating restorations from a homogenous material.[4]

It is generally known that the adoption of novel materials with improved biomechanical and optical properties, as well as a reduction in the number of clinical sessions, has been made possible by CAD/CAM technology using a prefabricated ceramic block and the CEREC 1 unit, the first CAD/CAM repair was created in 1985. Since then, the method has developed and become more sophisticated, economical, rapid, and accurate.[5]

RNC (Resin nano ceramic) material is made up of 86% inorganic filler embedded in a polymer matrix. These blocks have an elastic modulus of 18.28 GPa and a hardness that are comparable to those of natural tooth structures.[6]

Numerous investigations assessing the clinical performance of glass-ceramic restorations have been carried out following a thorough search for published information. However, there is little data available on how well RNC restores function clinically. Consequently, the goal of this study was to close this gap by contrasting the clinical efficacy of lithium disilicate ceramic materials with machinable RNC (Resin nano ceramic).[7]

MATERIALS AND METHODS

A power analysis was performed to identify the appropriate sample size necessary to observe a statistically significant difference in fracture load between the groups analyzed. With the significance level established at 0.05 and a power of 80% ($\beta = 0.2$), the analysis suggested that a total of 60 samples—15 for each group—would be necessary. These estimates were derived from data obtained in a prior study[8]. The calculation for the sample size was conducted using G Power software version 3.1.9.4 (Heinrich-Heine University, Düsseldorf, Germany), employing a fixed effects model with a one-way ANOVA F-test in an omnibus format.

Sixty freshly extracted single rooted upper central incisor teeth were selected with completed root formation were gathered from the Oral Surgery and Oral Medicine department Faculty of Dentistry, Minia University. Teeth were extracted for periodontal purposes. The criteria for the selection of the teeth were as follows: Round root canal, Straight roots, Absence of any decay, cracks, fractures or previous endodontic treatment. The average length of teeth is 20 ±1 mm. Teeth were ultrasonically cleaned with ultrasonic scaler to remove any surface debris, and an incubator was used to prevent the growth of microorganisms then stored in distilled water.

All root canals were endodontically treated according to standard procedure: Access cavity prepared with round triangular outline by round bur and flared using ENDOZ bur (Verdent, Poland), an initial file 25-K (mani, Japan) was used to obtain working length then a protaper rotary files 20, 25, 30, 35, 40 taper 4 (Dentsply, Sirona, Switzerland) were used to make the filling process. Irrigation with 1% sodium hypochlorite (Cercamed, Poland) between each file change.

Root canals dried using paper point (meta biomed, korea). Obturation accomplished by lateral condensation technique with gutta percha cones (Meta biomed, korea) and resin-based sealer (Addseal plus, meta biomed, Korea), then post operative x ray taken to ensure optimum obturation.[9]

Samples then divided into two main groups (30 samples each) according to the type of restoration used. The first group (E) was restored with Endocrown (n=30). The second group (P) was restored with custom one-piece Post Crown (n=30). Each group was subdivided into two subgroups (15 samples each) according to the type of material used, Subgroup EG: anterior endocrown fabricated from grandioblocs. Subgroup EE: anterior endocrown fabricated from E-max, Subgroup PG: custom one-piece post crown fabricated from grandioblocs, Subgroup PE: custom one-piece post crown fabricated from E-max.

Construction of Anterior endocrown and Mono-block post crown

Decoronation of teeth done with a super coarse wheel diamond Bur WR13 (Meisinger - Germany) to provide the ceramic restoration's thickness and sufficient occlusal reduction, which leads to remaining coronal length of 3 mm, then preparing the ferrule by making a collar around the parallel walls of dentin, in a 360- degree above the preparation as it was done by the same way of the butt joint, but with the addition of chamfer margin located on the vertical wall. This margin has a 1mm width and is prepared in the sound tooth structure. Its main purpose is to counteract shear stresses, improve the marginal load control and maintain stress distribution in the floor of the pulp [10]. The pulp chamber preparation done by removing the undercuts in the access cavity using a conical cylindrical diamond bur with a 7-degree taper, which makes a continuous chamber and access cavity then finishing of the floor and axial walls using finishing stones. It is recommended to remove the gutta-percha from the chamber floor to a depth of 2 mm with heated plugger in order to achieve a saddle anatomy of the floor, which adds greater stability. In addition, the pulp chamber irregularities were filled with a resin composite to remove retentive regions and prevent sliding of the restoration[11] as shown in **(figure 1).**

In cases of Hybrid post crown, a root extension is performed, each tooth's post space was prepared to have a standard length of 9 mm, with 5 mm of gutta percha left in the apical third to preserve the apical seal. After measuring the length at 9 mm, a pilot reamer was used to remove the gutta percha with an endodontic stopper by moving inside and outward. Drills N1 (white, æ1.2-Φ0.6) and N2 (yellow) were next, and drill N3 (red, æ1.8-æ0.9) was the last to be utilized.(8)

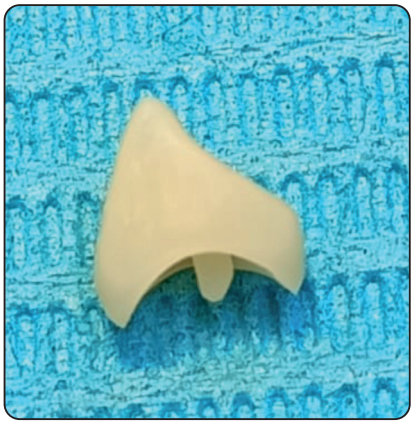

Fig. (1) Anterior endocrown restoration

Fig. (2) Milled Monoblock post crown

Impression taking and extraoral scanning:

A direct impression was made for the samples using addition silicone (Elite HD+, Zhermack, Italy). For post crowns, a prefabricated post (Fiber post, Endoart, Turkey) was placed into the root canal after applying the light-bodied material. Once the impression material polymerized, a sectional tray containing putty and light-bodied material was positioned and removed along with the post. Later an extraoral scan was performed using optical recording (Extra oral scanner medit T710) to scan the impression by placing it on the scanner plate, and images were captured from multiple angles. The collected data was then sent to the laboratory for designing and milling the restorations.[12]

Designing and milling of Endocrowns and Monoblock hybrid post crown:

Using CAD software (CAD software Exocad), the post's digital 3D model was created with a virtual cement gap of .05mm for the adhesive bonding. The acquired data were then sent to the milling machine (CAD software Exocad), which employed a wet subtractive process[13] as shown in **(figure 2)**.

Surface Treatment Methods:

After sintering and glazing, all samples were checked for proper seating and adaptation, then cleaned. Lithium disilicate samples (Endocrowns and Posts) underwent surface treatment using 9.5% hydrofluoric acid (BISCO porcelain etch, USA) for 90 seconds, they were then rinsed and coated with a silane coupling agent (BISCO porcelain primer, USA), left to air dry for 5 minutes. [14] Voco Grandio samples received a different surface treatment per manufacturer instructions: sandblasting with Al_2O_3 (25-50 μm) at 1.5-2 bar, from a 10mm distance at a 45° angle for 5-10 seconds per area. A silane coupling agent was then applied for 60 seconds, followed by drying with oil-free air for 20 seconds.[15]

Endocrown and Post Cementation:

The tooth structure was cleaned, rinsed, and thoroughly dried using a paper point (Meta biomed, Korea). Acid etch (phosphoric acid 37%, meta biomed, korea) then used for enamel etching for 30sec, rinsing for 30sec and properly dried with oil free air[16]. TheraCem auto-mix and extension tips were then attached, and the cement was extruded into the tooth crown and root canal. The endocrown and post were immediately inserted within one minute, with moderate pressure applied to ensure full seating along the working length. Excess cement was removed using a bond brush, followed by light curing each surface and margin with an LED polymerization unit for 20 seconds.[17] The cement was then allowed to set for four minutes. A periapical x ray was taken to confirm the correct placement of the endocrowns and posts.

Thermocycling:

By applying periodic temperature changes, an artificial aging process was performed, and each specimen underwent 5000 cycles in a machine (Julabo mechatronik, Westerham, Germany). The protocol comprised of 5000 cycles at 10 seconds between 5 °C and 55 °C. To estimate how many years 5000 cycles simulate; 1000 cycles equal 1 year of clinical service (based on daily exposure to hot and cold foods/beverages being around 20-30 cycles per day), So 5000 cycles equal 6 months of aging under normal condition.[18]

Acrylic resin blocks:

Each sample was placed into a (2.5 x 5 cm) plastic mold that had been painted using a separating medium to make it easy to remove and fixed apically. The mold was then filled with a self-curing acrylic resin (Acrostone, Egypt) to create a block so that the samples could be properly tested.

Fracture Resistance Test

A metallic rod with a round tip (20mm diameter, 25mm length) was used to provide a compressive mode of load occlusally to all specimens in a universal testing machine (Biopdi, S- ao Carlos, SP, Brazil). Every specimen was placed at a 45-degree angle to its long axis on the metallic apparatus. The cross-head speed was set at 1 mm/min until the fracture occurred. Failure modes were examined visually and by Scanning electron microscope and fracture resistance values were statistically assessed after being measured in Newtons as shown in **(figure 3).**

Failure mode:

To evaluate the failure mode, fractured samples were examined using a scanning electron microscope (Quanta 250 FEG; FEI, Netherlands) at a magnification of 40x and an accelerating voltage of 30 kV, **Samples were classified as the following:**

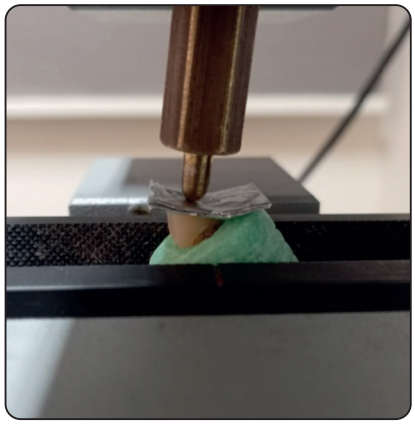

Fig. (3) Fracture Resistance test

Mode A: coronal fracture of the restoration (repairable)

Mode B: cervical fracture of the restoration (repairable)

Mode C: cervical fracture of tooth structure above bone level (repairable)

Mode D: cervical fracture of tooth structure below bone level (catastrophic)

Mode E: restoration debonding with fracture in both tooth and restoration (catastrophic).

RESULT

Statistical analysis:

Statistical Package for Scientific Studies, SPSS, Inc., Chicago, IL, USA, SPSS 20 for Windows was used for the study. The mean, standard deviation, range, and confidence intervals were used to report the numerical data. Since the data was distributed normally, comparisons across subgroups were made using the Bonferroni's post hoc test, which is performed following a one-way ANOVA test for pairwise comparisons. The groups were compared using independent t-tests. A two-way ANOVA test was also used to evaluate how the research variables interacted with one another. Statistical significance was defined as a p-value of less than 0.05.

Comparison of all subgroups:

The highest mean value was recorded in Anterior endocrown fabricated from E-max (EE) (1396.98 ±93.97N), followed by Custom one-piece post crown E-max (PE) (1357.78±111.31N). The mean value recorded in these subgroups was significantly greater than that recorded in in Anterior endocrown made from Grandioblocs (EG) (922.58±97.28N) and Custom one-piece post crown Grandioblocs (PG) (913.86±116.09N). Moreover, EE and PE were not significantly different **(Table1, Figure 5)**

Effect of type of restoration:

Grandioblocks: Anterior endocrown Grandioblocs (EG) recorded (922.58±97.28N), in comparison to Custom one-piece post crown Grandioblocs (PG) (913.86±116.09N). The difference between groups was not statistically significant (p=0.825)

E-max: Anterior endocrown E-max (EE) recorded (1396.98±93.97N), in comparison to Custom one-piece post crown E-max (PE) (1357.78 ±111.31N). The difference between groups was not statistically significant (p=0.306)

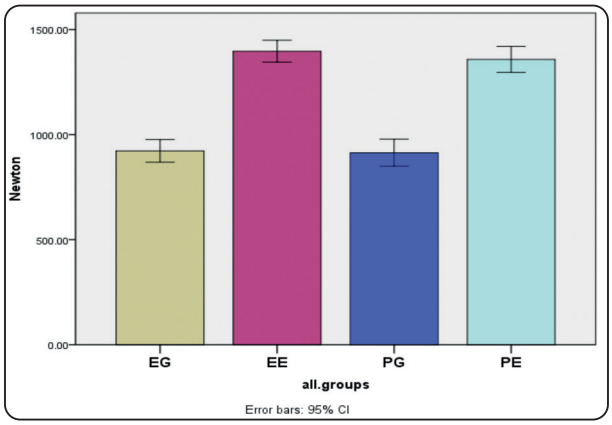

Fig. (4) Bar chart illustrating mean value of fracture resistance (Newton) in all subgroups

TABLE (1) Descriptive statistics of fracture strength (N) and comparison between all subgroups (ANOVA test)

Subgroups	Mean	Std. Dev	95% Confidence Interval for Mean		Min	Max	F value	P value
			Lower Bound	Upper Bound				
EG	922.58[b]	97.28	868.71	976.46	789.85	994.96	95.85	0.000*
EE	1396.98[a]	93.97	1344.94	1449.02	1268.63	1463.69		
PG	913.86[b]	116.09	849.57	978.15	697.33	998.54		
PE	1357.78[a]	111.31	1296.14	1419.42	1185.21	1473.11		

Significance level p≤0.05, *significant

TABLE (2) Descriptive statistics of fracture strength (N) and comparison between corresponding groups (independent t test)

Groups	Subgroups	Mean	Std. Dev	Difference		t value	P value
				Mean	Std. Dev		
Grandioblocks	Endocrown	922.58	97.28	8.72	39.11	0.223	0.825 ns
	Post crown	913.86	116.09				
E-max	Endocrown	1396.98	93.97	39.20	37.61	1.042	0.306 ns
	Post crown	1357.78	111.31				

Significance level p≤0.05, ns=non-significant

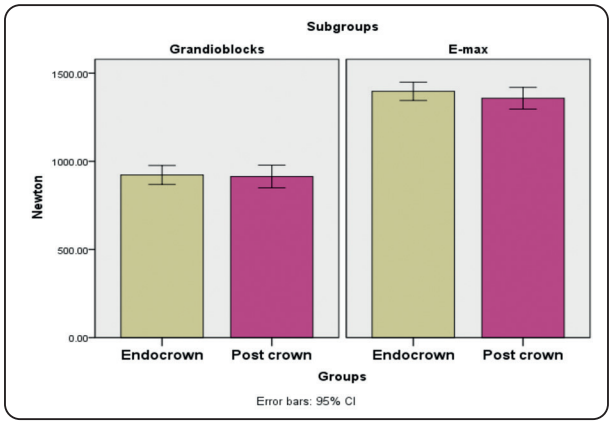

Fig. (5) Chart illustrating mean value of fracture resistance (Newton) according to Endocrown and post crowns groups

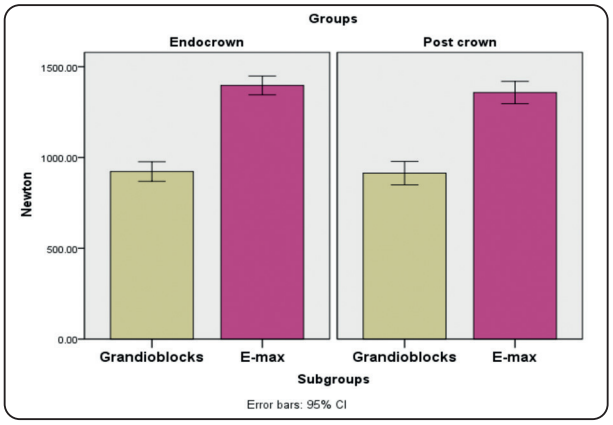

Fig. (6) Bar chart illustrating mean value of fracture resistance (Newton) according to Grandioblocks and E-max subgroups.

TABLE (3) Descriptive statistics of fracture strength (N) and comparison between corresponding subgroups (independent t test)

Groups	Subgroups	Mean	Std. Dev	Difference		t value	P value
				Mean	Std. Dev		
Endocrown	Grandioblocks	922.58	97.28	474.40	34.92	13.58	0.000*
	E-max	1396.98	93.97				
Post crown	Grandioblocks	913.86	116.09	443.92	41.53	10.69	0.000*
	E-max	1357.78	111.31				

Significance level p≤0.05, *significant

Effect of material

(A) Anterior endocrown Grandioblocks: Anterior endocrown E-max (EE) recorded (1396.98±93.97N), which was significantly greater than Anterior endocrown Grandioblocks (EG) (922.58±97.28N). The difference between groups was statistically significant (p=0.000)

(B) Custom one-piece post crown: Custom one-piece post crown E-max (PE) recorded (1357.78±111.31N), which was significantly greater than Custom one-piece post crown Grandioblocks (PG) (913.86±116.09N). The difference between groups was statistically significant (p=0.000)

Failure mode results:

TABLE (4) Assessment of failure mode

Group	Endocrown		Post crown	
Subgroup	E-max	Grandio	E-max	Grandio
Repairable	4 (27%)	8 (53%)	6 (40%)	10 (66%)
Catastrophic	11 (73%)	7(47%)	9 (60%)	5 (34%)

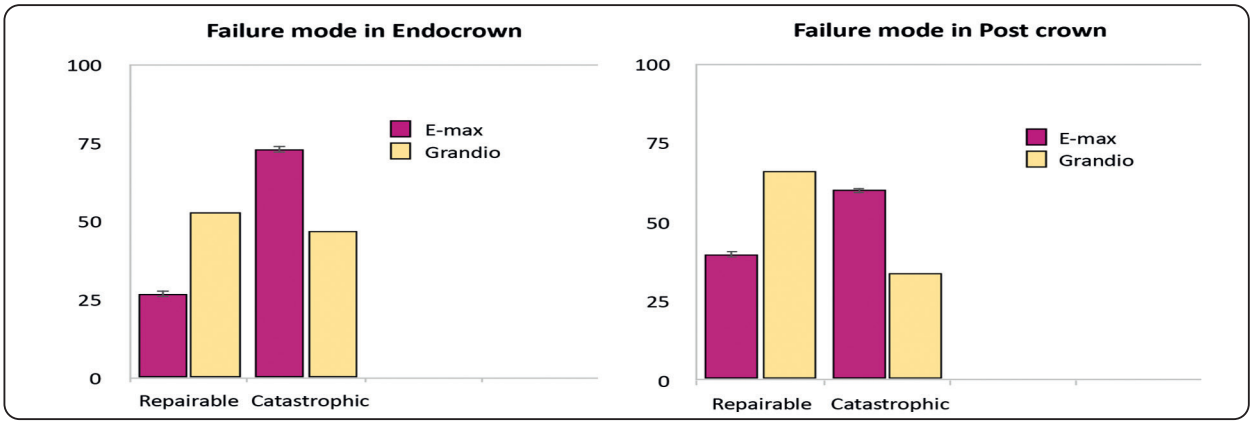

Fig. (7) Bar chart illustrating failure mode of Endocrown and Post crown.

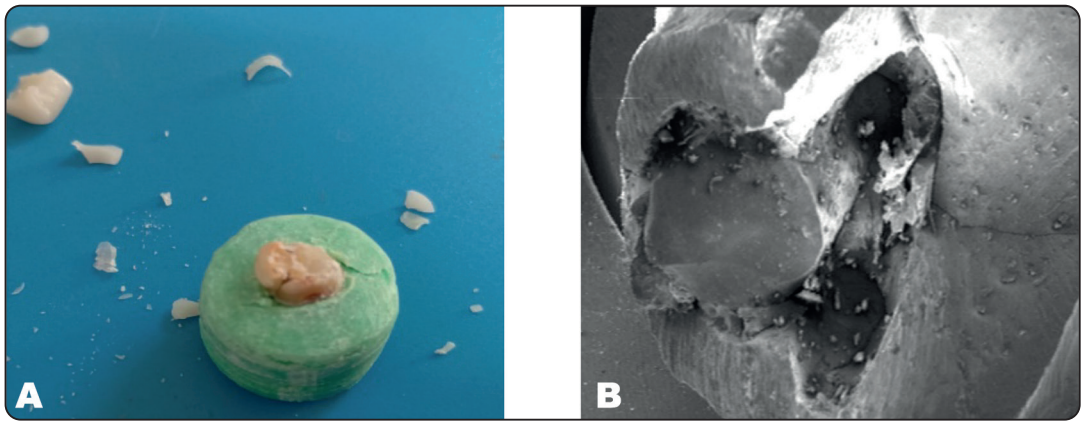

Fig. (8) A Failure mode of Endocrown, and B Post crown

DISCUSSION

The null hypothesis that the difference in fracture resistance of hybrid ceramics and lithium disilicate is insignificant was rejected as the findings of this study indicated that the average fracture resistance of IPS e.max CAD restorations is greater than that of hybrid ceramic restorations. The result of this study was in accordance with **Kalyoncuoğlu et al** [19] as they found that compared to nano-hybrid endocrowns (1406.56 ± 369.49 N), lithium disilicate ceramic endocrowns shown greater fracture strength (1913.84 ±501.18 N).

The null hypothesis that there is no significant difference between the anterior endocrown and Monoblock post crown on the fracture resistance of the endodontically treated teeth was accepted. Additionally, this result was consistent with Amira A. Abozaid's study That stated that the fracture strength of the anterior tooth that has undergone endodontic treatment will not be affected by the extension of the endocrown into the root canal.[20]

To ensure standardization in the preparation process, the same operator prepared all the teeth specimens. Additionally, they measured and checked the depth of the pulp chamber cavity, the width and height of the cavity walls using a digital caliper and a graduated periodontal probe with a rubber stopper. This allowed them to confirm that the depth of the central pulpal cavity in both groups was within the range of (3±0.5) mm, and that the axial walls' width were also within the range of (2±0.5) mm in both groups, additionally the silicon

index was used to measure the extent of the occlusal reduction, also digital designing of restoration aimed more standardized milled restorations.

The term "Monoblock post crown" has become widely adopted in the dental field in recent years, reflecting a shift toward minimally invasive dentistry, especially with notable advancements in adhesive systems and restorative material techniques.

It has been demonstrated that the use of endocrowns and post crowns in anterior teeth increases the fracture strength and helps in distributing the functional stresses to the remaining tooth structure, post and endocrown materials should be of high rigidity to obtain restoration of high fracture resistance.[21]

Endocrowns are monolithic ceramic overlays that reach within the pulp chamber and preserve the greatest amount of enamel to promote adhesion. They are used to reconstruct the coronal portion of endodontically treated teeth that have a supra-cervical butt joint. An alternative to conventional endodontically treated tooth restorations was the use of endocrowns. The challenges happen in anterior endocrowns because of the bending movements on the anterior region are much greater than those acting on the posterior area. Furthermore, the anterior endocrowns bonding surface is twice lesser than in the posterior region which decrease the retention of the endocrown.[22]

It should be emphasized that in the rehabilitation of non-vital teeth, to preserve the radicular dentin, decreasing the post space preparation can greatly increase the fracture resistance of the post with a ferrule of at least 2 mm of sound tooth structure. **Zicari et al. (2013)**[23] stated that, while it was proven to be beneficial in teeth without any ferrule, inserting a fiber post appears not to be required to increase the fracture resistance of endodontically treated teeth in which a ferrule is intact.

Post, core and crown restorations can be made as one unit and called Monoblock or Hybrid post crown and they have similar design as endocrown with root canal extension, and all components made from one the same material.[24]

The homogeneous load distribution led to optimization of the stresses transferred to the tooth parts and making equal distribution of the force between the restoration and tooth structure so that decrease the catastrophic effect of the weakened root.[20]

In the present study, LDS (E-Max IPS e.max CAD, Ivoclar-Vivadent, Liechtenstein) and Nanoceramic hybrid Grandio blocs (Voco-Germany) as we compared the fracture resistance of the two materials and the fracture strength of the two designs (Endocrown vs Monoblock post crown).

The Nanoceramic hybrid Grandio blocs used in this study characterized to have the highest filler content (86%), so have excellent physical values for flexural strength and perfectly resembles the natural teeth. They require no firing and highly aesthetic due to the multicolor shades that can be ideal for anterior teeth, as well as it can be processed by any conventional milling units. Additional advantages related to the Grandio blocs are: Can be finished, polished and repaired perfectly, High radiopacity, Ability to be fabricated in thin edges[25]

It is claimed that the material's ability to withstand fracture and abrasion is made possible by a high percentage of nanoparticles contained in the resin matrix. The ceramics' nanostructure additionally fortifies the chemical linkages that are generated between the inorganic ceramics and the organic resin matrix. Nanoparticles have sizes that vary from 0.6 to 1 micrometer.[26] in addition to integrate the advantageous qualities of ceramics and composites, nanoceramics and hybrid ceramics were developed.

The upper central incisors were chosen for this study because they are the teeth in the aesthetic zone, which is the area of interest for us. Placing

endocrown or aesthetic posts in this way appears to be the best way to mimic a clinical setting for anterior teeth that have had endodontic treatment.

In general, it seems that maintaining a ferrule helps make teeth that have had endodontic treatment more resistant to breakage.[10] This outcome supports the earlier research that found a ferrule of at least 1.5 mm to be beneficial for the long-term success rate of endodontically treated tooth restorations, Other researchers suggested that amount of axial sound tooth structure surrounded by the crown is more significant than post length considering that these posts have the same bonding modalities and can apply the Monoblock concept as resin nanoceramic endocrowns used in the present study.[27]

The fracture resistance test was carried out using compressive load applied at a degree 45 from the tooth's long axis using a metallic rod with a round tip (5 mm diameter) attached to the upper movable part of the testing apparatus in order to achieve a uniform stress distribution and reduce the transmission of local force peaks. With a sheet of tin foil between, the rod moved at a cross-head speed of 1 mm/min. The load at failure was detected by an audible fracture, which was confirmed by a sharp decline in the load-deflection curve recorded by computer software (Bluehill Lite Software Instron® Instruments). The load required to fracture was measured using Newton.[28]

To assess the fracture pattern in each group, the failure mode was analyzed. It was classified as either repairable (fracture in the cervical portion of the root above bone level) or catastrophic (fracture in the root beyond fixing). This was significant since the failure pattern revealed whether or not the various designs and materials employed permit repairable fractures. In addition to the adhesive interfaces' strength, the endocrown's ability to replicate tooth structure and material composition was also correlated with its load-bearing capability.[29]

Manar Al-Fadhli, et al. (2021) [30] studied the difference between anterior endocrown and post crown restoration and the findings of this study indicated that there is no statistically significant difference in the fracture resistance test results between both types of restorations also found that the resistance to fracture was better in endocrowns (10 mm) than in endocrowns (6 mm) as there is increase in the surface area.

The result of this study was in disagreement with **Abdulghafor M. Naji et al (2021)**[31] as they came to the conclusion that hybrid ceramic endocrowns had higher fracture strength(3558.33±995.92 N) than LDS e-max endocrowns(2873.10±983.95 N), however this may be due to the difference in the type of hybrid ceramic used in the study as they utilized (Cerasmart 270, GC, Japan), also they used posterior teeth in the study. Furthermore, the result of this study disagreed with **El-Damanhoury et al** (32) and **Elguindy**[33]. The variations in each study's methodology might be the cause of these disparities in the outcomes, because it is difficult to restore natural teeth with the same homogenous thickness due to their uneven anatomy.

CONCLUSIONS

1. There is no statistically significant difference in the fracture resistance between anterior Endocrown and Monoblock post crown made from E-max.
2. There is no statistically significant difference in the fracture resistance between anterior Endocrown and Monoblock post crown made from Grandioblocs.
3. Restorations fabricated from E-max cad showed higher fracture resistance than that made from Grandioblocs in both types of restorations.

LIMITATION OF THE STUDY

The size of the sample, the manufacturing mechanism, the luting protocols and the final preparation design all can affect the fracture strength of the ceramic materials. Also, invitro studies may show different results than that made in vivo.

CLINICAL RECOMMENDATIONS

1) E-max restorations assess more resistance to fracture
2) Endocrowns with 2 mm ferrule is recommended for restoring anterior endodontically treated teeth.
3) Endocrowns and Monoblock post crowns made from Grandioblocs have Favorable failure modes.
4) To establish criteria for the anterior endocrowns, further studies including many variables should be conducted.

ETHICAL APPROVAL

This research protocol was approved by Minia university, The committee of Research Ethics of the Faculty of Dentistry at meeting number (98), item number (772) for 2023.

REFERENCES

1. Zhu Z, Dong XY, He S, Pan X, Tang L. Effect of Post Placement on the Restoration of Endodontically Treated Teeth: A Systematic Review. Int J Prosthodont. 2015 Sep;28(5):475–83.
2. Bankoğlu Güngör M, Turhan Bal B, Yilmaz H, Aydin C, Karakoca Nemli S. Fracture strength of CAD/CAM fabricated lithium disilicate and resin nano ceramic restorations used for endodontically treated teeth. Dent Mater J. 2017;36(2):135–41.
3. Homaei E, Farhangdoost K, Tsoi JKH, Matinlinna JP, Pow EHN. Static and fatigue mechanical behavior of three dental CAD/CAM ceramics. J Mech Behav Biomed Mater. 2016 Jun 1;59:304–13.
4. Stawarczyk B, Liebermann A, Eichberger M, Güth JF. Evaluation of mechanical and optical behavior of current esthetic dental restorative CAD/CAM composites. J Mech Behav Biomed Mater. 2016 Mar 1;55:1–11.
5. Acar O, Yilmaz B, Altintas SH, Chandrasekaran I, Johnston WM. Color stainability of CAD/CAM and nanocomposite resin materials. Journal of Prosthetic Dentistry. 2016 Jan 1;115(1):71–5.
6. Morimoto S, Rebello De Sampaio FBW, Braga MM, Sesma N, Özcan M. Survival Rate of Resin and Ceramic Inlays, Onlays, and Overlays: A Systematic Review and Meta-analysis. Vol. 95, Journal of Dental Research. SAGE Publications Inc.; 2016. p. 985–94.
7. Fasbinder DJ, Neiva GF, Heys D, Heys R. Clinical evaluation of chairside Computer Assisted Design/ Computer Assisted Machining nano-ceramic restorations: Five-year status. Journal of Esthetic and Restorative Dentistry. 2020 Mar 1;32(2):193–203.
8. Badr A, Abozaid AA, Wahsh MM, Morsy TS. Fracture resistance of anterior CAD/CAM nanoceramic resin endocrowns with different preparation designs. Braz Dent Sci. 2021;24(3).
9. Garg N, Jaiswal J, Samadi F, Chowdhary S, Samadi F, Tripathi VP. A Comparative Evaluation of Efficacy of Different Obturation Techniques used in Root Canal Treatment of Anterior Teeth: An in vitro Study. Int J Clin Pediatr Dent. 2014 Apr;7(1):1–5.
10. Tan PLB, Aquilino SA, Gratton DG, Stanford CM, Chian Tan S, Johnson WT, et al. In vitro fracture resistance of endodontically treated central incisors with varying ferrule heights and configurations.
11. Silva-Sousa AC, Moris ICM, Barbosa AFS, Silva-Sousa YTC, Sousa-Neto MD, Pires CRF, et al. Effect of restorative treatment with endocrown and ferrule on the mechanical behavior of anterior endodontically treated teeth: An in vitro analysis. J Mech Behav Biomed Mater. 2020 Dec 1;112.
12. Falcão Spina DR, da Costa RG, Correr GM, Rached RN. Scanning of root canal impression for the fabrication of a resin CAD-CAM-customized post-and-core. Journal of Prosthetic Dentistry. 2018 Aug 1;120(2):242–5.
13. Badr A, Abozaid AA, Wahsh MM, Morsy TS. Fracture resistance of anterior CAD/CAM nanoceramic resin endocrowns with different preparation designs. Braz Dent Sci. 2021;24(3).
14. Charasseangpaisarn T, Krassanairawiwong P, Sangkan-chanavanich C, Kurjirattikan A, Kunyawatyuwapong K, Tantivasin N. The Influence of Different Surface Cleansing Agents on Shear Bond Strength of Contaminated Lithium Disilicate Ceramic: An in Vitro Study. Int J Dent. 2021;2021.
15. Grandio blocs-Surface conditioning [Internet]. Available from: www.voco.dental

16. Xiaoping L, Dongfeng R, Silikas N. Effect of etching time and resin bond on the flexural strength of IPS e.max Press glass ceramic. Dental Materials. 2014 Dec 1;30(12): e330–6.

17. Huang Y, Fokkinga WA, Zhang Q, Creugers NHJ, Jiang Q. Biomechanical properties of different endocrown designs on endodontically treated teeth. J Mech Behav Biomed Mater. 2023 Apr 1;140.

18. Eliasson ST, Dahl JE. Effect of thermal cycling on temperature changes and bond strength in different test specimens. Biomater Investig Dent. 2020 Jan 1;7(1): 16–24.

19. Hazal Acar D, Kalyoncuoğlu E. The fracture strength of endocrowns manufactured from different hybrid blocks under axial and lateral forces. Available from: https://doi.org/10.1007/s00784-020-03495-y

20. Badr A, Abozaid AA, Wahsh MM, Morsy TS. Fracture resistance of anterior CAD/CAM nanoceramic resin endocrowns with different preparation designs. Braz Dent Sci. 2021;24(3).

21. Dejak B, Młotkowski A. Strength comparison of anterior teeth restored with ceramic endocrowns vs custom-made post and cores. J Prosthodont Res. 2018 Apr 1;62(2): 171–6.

22. Waaz S. Impact of Preparation Depth and Length on Fracture Resistance of Anterior Teeth Restored by Endocrowns and Post Retained Crowns. Egypt Dent J. 2020 Jan 1;66(1):507–16.

23. Zicari F, Van Meerbeek B, Scotti R, Naert I. Effect of ferrule and post placement on fracture resistance of endodontically treated teeth after fatigue loading. J Dent. 2013 Mar;41(3):207–15.

24. Elmaghraby AM, Yousreya B, Shalaby A, Alabbassy FH, Azer AS. Fracture Resistance Of One-Piece And Two-Piece Post-Core-Crown Restorations Fracture Resistance Of Cad/Cam One-Piece And Two-Piece Post-Core-Crown Restorations Using Two Different Materials (In Vitro Study).

25. Amr H, Elshaboury Elsayed E. Effect of Endodocrown Materials on fracture strength of Endodontically Treated Teeth; comparative in vitro study. Egypt Dent J. 2022 Jul 1;68(3):2933–43.

26. Ceren N, Turp V, Emir F, Akgüngör G, Ayyildiz S, Şen D. Nanoceramics And Hybrid Materials Used In Cad/Cam Systems. Vol. 2, Aydın Dental-Year. 2016.

27. Goodacre CJ, Bernal G, Rungcharassaeng K, Kan JYK. Presented at the Annual Session of the American College of Prosthodontists. THE JOURNAL OF PROSTHETIC DENTISTRY. 2000.

28. Hany C, Taymour M. Fracture Resistance And Failure Mode Of Two Restoration Designs Made Of Monolithic Hybrid And Glass Machinable Ceramics ; In Vitro Study [Internet]. Vol. 63, Dental Journal. 2771. Available from: www.eda-egypt.org

29. Badr A, Abozaid AA, Wahsh MM, Morsy TS. Fracture resistance of anterior CAD/CAM nanoceramic resin endocrowns with different preparation designs. Braz Dent Sci. 2021;24(3).

30. Al-Fadhli M, Katamich H, Mohsen C. Fracture Resistance of Anterior Endocrown Vs Post Crown Restoration: An Invitro-Study.

31. MJD_Volume 8_Issue 3_Pages 59-64.

32. El-Damanhoury HM, Haj-Ali RN, Platt JA. Fracture resistance and microleakage of endocrowns utilizing three cad-cam blocks. Oper Dent. 2015;40(2):201–10.

33. Al shibri S, Elguindy J. Fracture Resistance of Endodontically Treated Teeth Restored with Lithium Disilicate Crowns Retained with Fiber Posts Compared to Lithium Disilicate and Cerasmart Endocrowns: In Vitro Study. Dentistry. 2017;7(12).