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Influence of Preparation Design on Fracture Resistance of Occlusal Veneers Constructed from Gradient Zirconia Compared to Zirconia Reinforced Lithium Silicate - In-Vitro Study

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Abstract

Background: Posterior occlusal veneers provide a conservative option compared to standard full coverage restorations. The influence of the correct material and preparation design on fracture resistance, which affects the longevity of the restoration, is still unknown.

Aim: To evaluate fracture resistance of occlusal veneers constructed from Gradient Zirconia as compared to Zirconia Reinforced lithium silicate using two preparation designs.

Materials and methods: Twenty-eight epoxy resin dies were created using 3D printing following the scanning of a typodont first molar tooth. The dies were divided into two main groups (n=14) based on the material used, with each group further subdivided into two subgroups (n=7) according to the preparation design**,** group (GZ) Gradient zirconia (IPS e.max ZirCAD Prime), group(ZLS) Zirconia reinforced lithium silicate (Vita Suprinity® PC), subgroup A: represents the preparation design involving an occlusal reduction of 1.5 mm and a rounded shoulder finish line of 1mm, subgroup OB: represents the preparation design featuring a 1.5 mm occlusal reduction with a 1mm deep occlusal box with a divergence wall with a 10oangle and a rounded shoulder finish line of 1mm width. Occlusal veneer restorations were constructed using Cerec in-Lab. All restorations CAD/CAM system. Each occlusal veneer cemented to the corresponding die were subjected to thermo mechanical fatigue loading in a masticatory simulator, undergoing 1.2 million cycles at 98 N. Universal testing machine was used to measure fracture resistance values. Load to fracture for all samples was recorded in Newton. The mode of failure was determined as well. Data were analyzed using Shapiro-Wilk tests data showed parametric distribution and were analyzed using two-way ANOVA followed by adjustment using Bonferroni correction, the significance level was set at $p<0.05$.

Results: Regardless of preparation design, CAD/CAM restorative materials had a statistically significant effect on mean fracture resistance of the occlusal veneers with IPS e.max Zir CAD Prime showing the highest mean value (3724.89±666.29 N) compared to Vita Suprinity® PC(1462.70±183.24N) whereas, regardless of material type, the preparation design had no significant effect on fracture resistance of occlusal veneers.

Conclusion: Both tested materials had fracture resistance value that are clinically accepted and safely used for molar region. Occlusal veneers fabricated from gradient zirconia yielded promising fracture resistance compared tozirconia reinforced lithium silicate. Gradient zirconia can be considered suitable material for minimally invasive posterior restoration. Both preparation design considered reliable and conservative that can be used in minimally invasive restoration in molar region.

Keywords: Gradient Zirconia, Occlusal Veneers, Fracture Resistance, Preparation Design, Mode of Failure.

Introduction

Preserving tooth structure is a fundamental principle in restorativedentistry[1]. Preserving tooth structure is essential in maintaining the subtle equilibrium between biological, mechanical, functional, and aesthetic aspects from a biomimetic perspective. Moreover, conservative restorative modalities are advantageous as they avoid the risk of loss of pulp vitality, endodontic treatment, and subsequent post and core constructions. These more invasive methods can disrupt the biomechanical equilibrium and compromise the long-term performance of restored teeth[2].

Dental restorations, particularly occlusal veneers, are crucial for restoring both the structure and function of teeth. Over the years, there has been a remarkable advancement in materials and techniques used in restorative dentistry, aimed at enhancing the longevity and esthetic outcomes of dental restorations. Recent ceramic materials and adhesive technologies together with advances in (CAD/CAM) technologies allowed the introduction of novel treatment concepts for modern fixed prosthodontics with an increase in interest in minimally invasive dentistry[3]. One such an interest is the development of occlusal veneers constructed from novel materials, including gradient zirconia and zirconia reinforced lithium silicate.

The fracture resistance of occlusal veneers is a crucial factor determining their clinical success and durability. Numerous factors influence the resistance of these restorations to fracture, with preparation design being one of the key considerations. Preparation design encompasses various aspects, such as the amount of tooth reduction, the inclusion of features to enhance retention, and the preservation of tooth structure[4].

Understanding the influence of preparation design on the fracture resistance of occlusal veneers constructed from gradient zirconia compared to zirconia reinforced lithium disilicate is essential for achieving favorable clinical outcomes. Gradient zirconia is a material that offers a unique combination of high translucency and strength due to controlled variations in its composition from the core to the surface[5]. On the other hand, zirconia reinforced lithium silicate is known for its remarkable esthetics coupled with good mechanical strength[6].

To date, there are limited study's available in investigating the impact of preparation design on the fracture resistance of occlusal veneers constructed from gradient zirconia. Therefore, this thesis aims to enhance the current knowledge in restorative dentistry and offer valuable insights to dental professionals, ultimately leading to improved patient satisfaction.

Two null hypotheses were suggested for this study, the first one was that there will be no significant difference in fracture resistance between occlusal veneers constructed from Gradient Zirconia and Zirconia Reinforced lithium silicate and the second one was that there will be no significant difference in fracture resistance of occlusal veneers using anatomical occlusal reduction design and anatomical occlusal reduction with occlusal box design.

Materials and methods

Construction of epoxy resin dies: A total of twenty-eight epoxy resin dies were constructed via 3D printing technique using software(in-Lab 19 software) connected to 3Dprinter (Halot- Mage Pro Creality)following scanning of mandibular first molar typodont tooth(Columbia Dentoform by Dentalez USA) by an extraoral scanner (Cerec inEos X5 Sirona Dental Systems Gmbh), The initial scan was then imported into software(Blend for dental v 3.6) to facilitate the design of the occlusal veneers' preparations. This scan was saved to be used later during designing of the occlusal veneer restorations to mimic the occlusal morphology of the unprepared typodont tooth and to achieve standardization for the occlusal morphology in the final restoration.

Sample grouping: A total of twenty-eight resin epoxy dies were constructed and divided into two main groups according to the material used**:** Group (GZ):(Gradient zirconia n=14), and Group (ZLS): Zirconia reinforced lithium disilicate control group (n=14).Each group was further subdivided into two subgroups based on the preparation design (n=7). Subgroup. A :(anatomical occlusal reduction) (n=7) (**Figure1)**, and Subgroup. OB: (Anatomical occlusal reduction with occlusal box) (n=7) **(Figure 2)**.

Fabrication of the occlusal veneers: CEREC in-Lab 19 CAD/CAM system was utilized to fabricate all occlusal veneers. A bio-generic copy mode was used so that all occlusal veneers would have the same anatomy dimensions. Dies were scanned using Cerec in Eos X5. Twenty-eight occlusal veneers were milled from an equal number of IPS e.max ZirCAD Prime (n=14) and Vita Suprinity® PC (n=14).following the same principles already described by Magne et al[7]. After milling all restoration was carefully examined for any cracks, ZLS occlusal veneers went through Crystallization phase using program at CS3 furnace according to the manufacturer's instruction, The stand-by temperature was set at 400 °C for 4 minutes. The temperature was then increased at a rate of 55 °C/minute until reaching 840 °C, where it was held for 8 minutes. Finally, the temperature was gradually decreased to 680 °C during the program's long-term cooling period. Whereas GZ occlusal veneers after milling went through sintering according manufacturer's recommendations using the in Lab profile furnace, temperature increase from 25°C to 1200°C at a rate of 15°C/minute, with the temperature held constant for 60 minutes. After that, the temperature was further raised to 1300°C at a rate of 2°C/minute, and then to 1530°C at a rate of 10°C/minute, where it remained constant for 150 minutes. To cool the specimens, a long cooling cycle was implemented, gradually reducing the temperature from 1530°C to 155°C at a rate of 15°C/minute. Both material than polished and glazed according to manufacturer's instruction.

Surface treatment: For (GZ) occlusal veneers the internal surface of the restoration was sandblasted using 50μm aluminum oxide particles using micro etcher and each sample were sandblasted at a pressure of 1.8 bar for 10 seconds. While the internal surface of (ZLS) samples was etched with Bisco porcelain etch 9.5% hydrofluoric acid for 20 seconds, then the etched samples were rinsed with water and dried with oil free moisture free air until the internal surface of the restoration has showed frosted white appearance, then the silane coupling agent(Bisco porcelain primer)was applied using a brush on the etched ceramic surface and dried well after one minute with moisture free oil free compressed air according to the manufacture instruction.

Cementation of occlusal veneers: The mixing tip was attached to the Automix Total Cem resin cement syringe. And the material was dispensed directly on the fitting surface of the restoration, then the restoration was seated gently on epoxy resin dies allowing the cement to flow from all sides. A custom-made device was used to standardize the applied force during cementation by a 4Kg load (**figure 3**).After proper seating of the restoration, the material was allowed to reach the gel state by allowing it to self-cure for 30 seconds. Then tack curing for 3-4 seconds according to the manufacturer instructions. All excess cements were removed from all surfaces using a probe. After removal of excess cements, the luting material was finally cured using a light curing unit (Elipar 2500). For 100 seconds (20 seconds per surface).

Aging of the restoration: All twenty-eight restorations cemented to the epoxy resin dies were subjected to 5000 cycles in SD Mechatronik thermo cycler, each cycle includes immersion for 30 seconds into the hot path at 55 ± 1°C followed by immersion for same time into the cold path at 5 ± 1°C with 5 seconds delay between the hot and cold paths.

Fracture resistance test and mode of failure: All samples were secured to the lower fixed compartment of the testing machine using screws. The fracture test was conducted in a compressive mode. Occlusal load was applied using a metallic rod having a round tip 5mm in diameter attached to the upper movable compartment of the testing machine, at a crosshead speed of 1mm/min. with a tin foil sheet in-between to achieve uniform stress distribution and reduce transmission of local force peaks. The load required to fracture was measured in Newtons. (**Figure4**)

The fractured samples were inspected under 30x magnification (Nikon Ma 100 stereomicroscope)to detect and characterize the failure mode in each sample according to crack propagation whether through the veneer only or extending to the epoxy die and to what extent.

Statistical analysis

Evaluating the data distribution and utilizing tests of (Shapiro-Wilk tests) numerical data's normality was investigated. Data showed parametric distribution and were analyzed using two-way ANOVA. The comparisons of simple effects were made utilizing the pooled error term of the two-way model with p-values adjustment using Bonferroni correction. The significance level was set at $p<0.05$. Statistical analysis was performed with R statistical analysis software version 4.3.3 for Windows.

Results

Descriptive statistics: Table **(1).**

Effect of different variables and their interaction: The results showed that preparation design had no statistically significant effect on mean fracture resistance values. While material type and interaction between variables had a statistically significant effect on mean fracture resistance values table **(2).**

Main effects

A. Effect of material: Gradient Zirconia samples (3724.89±666.29) (N) had statistically significantly higher fracture resistance than Zirconia reinforced lithium silicate samples (1462.70±183.24) (N) ($p<0.001$).

Intergroup comparisons mean and standard deviation values of fracture resistance (N) for different materials are presented in table (**3**) and in figure (**5**).

B. Effect of preparation design: There was no statistically significant difference between occlusal veneers prepared with anatomical occlusal reduction (2692.63±1369.13) (N) and those with additional occlusal box (2494.96±1156.53) (N) ($p=0.276$).

Intergroup comparisons mean and standard deviation values of fracture resistance (N) for different materials are presented in table (**4**) and in figure (**6**).

Interactions

A. Effect of material within each preparation design: Intergroup comparisons, mean and standard deviation values of fracture resistance (N) for different materials and preparation designs are presented in table (**5**) and in figure (**7**).

- **Anatomical occlusal reduction**: Gradient zirconia samples had statistically significance higher fracture resistance than ZLS samples ($p<0.001$).
- **Anatomical occlusal reduction with occlusal box:** Gradient zirconia samples had statistically significance higher fracture resistance than ZLS samples ($p<0.001$).

B. Effect of preparation design within each material

- **Gradient zirconia:** There was no statistically significance difference in samples made with both preparation designs ($p>0.05$).Occlusal veneers constructed with anatomical preparation design had higher mean fracture resistance values (3977.11±433.87) than those with additional occlusal box (3472.68±790.70).
- **Zirconia reinforced lithium silicate:** There was no statistically significance difference in samples made with both preparation designs ($p>0.05$).Occlusal veneers constructed with anatomical occlusal reduction with additional design had higher mean fracture resistance values (1517.24±205.71) than those with anatomical occlusal reduction (1408.16±153.29).

Mode of failure analysis

All samples were examined for the evidence of cracks, adhesive failures, or cohesive failures. The fracture surfaces were examined under a stereomicroscope (Nikon Ma 100) and the failure mode of each specimen was determined according to the following classification system: Class I: crack formation within restoration without chipping. Class II: cohesive fracture within restoration without involving the tooth structure. Class III: adhesive fracture between the restoration and tooth. Class IV: longitudinal fracture of the restoration and tooth. Figure **(8).**

Comparison of the mode of failure among the four subgroups according to their preparation design class II and class III were the most common modes of failure table (**6**).

While the comparison of the mode of failure among the two main groups according to the material of construction, class II was the most common mode of failure.

Discussion

This investigation was carried on evaluating the Influence of Preparation Design and material of construction on Fracture Resistance of Occlusal Veneers, with two preparation designs that were fabricated from Gradient zirconia, and Zirconia reinforced lithium silicate using CAD/CAM technology. According to the result of the study: the type of the material significantly affected values of fracture resistance of occlusal veneers, while the preparation designs docent, so the null hypothesis would be partially rejected. In the present study Epoxy resin was selected as the material of construction for the dies to which occlusal veneers were cemented. Epoxy resin is characterized by an elastic modulus of (18.6Gpa) which is close to the human dentin (15-20Gpa). In addition, the stress strain curve of epoxy resin is identical to that of human dentin. Also, epoxy resin showed bond strength to resin cement comparable to that between resin cement and human dentin[8].This subsequently allows for the simulation of the natural teeth. The irregular occlusal anatomy of natural teeth makes it challenge to be restored with occlusal veneers having the same form and thickness, so CAD/CAM technology was chosen in this study, due to its ability of providing precise control over the thickness and anatomy of the restorations. Additionally, this technology allowed for the standardized internal fit, dimensions, and mechanical properties of the restorative materials[9].

Glazing was performed on the two selected materials GZ and ZLS after polishing to correct any areas that may not have been properly polished. Also, new studies found that polishing than glazing zirconia demonstrate slightly less ceramic wear and enamel antagonist wear than glazing zirconia alone[10].

Thermo cycling was selected as an aging technique in order to simulate thermal changes in the oral cavity during eating and drinking. Thermal changes cause compressive and tensile forces in the ceramic material and induce cracks within the material. This results in a decrease in fracture resistance of restored teeth. It is assumed that dental restorations in the oral cavity are subjected to 20 changes of temperature per day. Therefore, five thousand cycles are approximately the equivalent to six month in the oral environment[11]

Occlusal veneers, known for their thin overlay design without retention, are increasingly favored as a conservative treatment for occlusal abrasion or erosion. They are being embraced as a viable alternative to on lays and traditional full coverage crowns. Two preparation designs were selected in the present study namely; a minimally invasive design where only the occlusal surface was included in the preparation and round shoulder finish line, whereas the second design had the same designs adding 1mm depth of an occlusal box. For standardization the preparation was carried out by software a Blend for dental v 3.6, so all preparations are identically the same.

The success of ceramic restorations in clinical settings appears to be influenced not only by the method of cavity preparation but also by the specific ceramic material chosen. Ceramic materials with enhanced mechanical properties may exhibit superior performance in clinical situations[12].IPS e.max ZirCAD Prime and Vita Suprinity® PC blocks were for construction of restorations in this study.

Using gradient zirconia (IPS e.max ZirCAD Prime) in the current study because of its combining different generations of zirconia in a single blank. This innovative approach enhances both esthetics and mechanical strength. The dentin/body area of the restoration is made with 3Y-TZP, a three-mole percent yttria-stabilized zirconia, which provides excellent stability and durability. Meanwhile, the incisal/occlusal area is fabricated using 5Y-TZP, a five-mole percent yttria-stabilized zirconia, which offers superior translucency and esthetics for a natural, lifelike appearance. This overall enhances restoration durability[13].

On the other hand, using zirconia reinforced lithium silicate (Vita Suprinity pc) in this study is due to its consistent of glass ceramic enriched with zirconia (10% by weight) and polymer materials have a low wear and abrasive potential, strong adhesive bonding resulting in a restoration that is both strong and durable. This makes it well-suited for occlusal veneer restorations, which require resistance to occlusal forces and biting pressure[14].

In the present study, the mean fracture loads for occlusal veneers in all study groups were beyond the range of realistic occlusal forces in the posterior region. Therefore, it can be assumed that all the tested specimens can withstand the maximum intraoral posterior masticatory forces. This agreed with **Z. badr et al. in 2022**[15] who found that the mean values of fracture load of Gradient zirconia samples were 2461.3 ± 332.1 N.

Regarding to the materials in this study it had statistically significant effect on fracture resistance, where occlusal veneers constructed using gradient zirconia had a statistically significantly higher fracture resistance than those constructed using zirconia reinforced lithium silicate. This may be with attributed to the advantage of combination of three-mole percent yttria-stabilized zirconia, and five-mole percent yttria-stabilized zirconia to gradient zirconia, where the strong 3Y-TZP phase increases the overall strength of the material, also the manufacturing process of Gradient zirconia which involves more tetragonal phase crystals. This process makes the material tougher by transforming it into a monoclinic phase, creating compressive stresses that prevent cracks from spreading. This leads to higher strength and fracture load values[16].

The results of the current study are in agreement with the results obtained by **Malallah A et al. in 2022**[17], who attributed the superior strength properties of Gradient zirconia to the contents of 3Y % of yttria and the increased amount of tetragonal phase, which lead to transformation toughening where the transition from tetragonal to monoclinic associated with 3%–4% volume expansion followed by compressive stress that opposes the crack tip and restricts it from propagating, causing fractures and flaws to be arrested. In addition, the result of the current study was in agreement with **Labeti ́c et al. in 2024**[18], who attributed the strength of Gradient zirconia to the content of zirconium dioxide and the presence of a homogeneous grain size distribution which exerts a significant positive effect on the flexural strength of multilayer Y-TZP material.

In our study, comparing two preparation design (Anatomical occlusal reduction) and (Anatomical occlusal reduction with occlusal box), our results have shown that preparation design have no significant effect on fracture resistance of occlusal veneers. This may be attributed to the minimal tooth preparation performed in both preparation designs. Tooth preparation was limited to the enamel surface only and this ensures the mechanical strength of the restoration. It also may be attributed to the circumferential finish line which equally distributes the stresses over the tooth.

The result of the present study is in agreement with the study conducted **Falahchai et al. in 2020**[19], and **Elgendy et al. in2021**[20], who found that preparation design of occlusal veneers have no significant effect on their fracture resistance. In addition, the results of the current study are in accordance with **Shaimaa. Aet al.**

in2023[21], who showed that there is no effect for the preparation design on fracture resistance of occlusal veneers. They attributed their findings to the anatomical reduction of the occlusal surface, thus converting all the occlusal stresses into compressive forces rather than lateral one. This provides more favorable stress distribution for the tooth-restoration complex.

Contrary to the results of the current study**, X. Huang et al. in2020** [22], concluded that preparation design significantly affects the fracture strength of the occlusal veneer. These finding were attributed to the number of prepared axial walls, as the number of prepared axial walls increased, the fracture strengths of the restorations decreased. Furthermore, **C. Halim et al. in2018**[23], determined that the fracture strength of the occlusal veneer is significantly influenced by the preparation design. His conclusion attributed to the benefits of the circumferential finish line that evenly distributing stresses over the tooth structure. Additionally, the inclusion of two slots proximally to the veneers at the critical contact area was noted to provide added bulk that contributed to the overall strength of the design.

Microscopic examination of Gradient zirconia samples showed that 8% of the samples showed class I mode of failure (crack formation within restoration without chipping)and this could be explained by the strong core of 3Y-TZP which involve more tetragonal phase which creates compressive stresses to prevent cracks to spreads, while 50% of Gradient zirconia samples showed class II mode of failure (cohesive failure) and this may be attributed to the use of Self-adhesive resin cement and MDP primer which they enhance the bond strength, On the other hand 22% of Gradient zirconia samples showed class III mode of failure (adhesive failure) and this may attributed to the great stress accumulation in the cement line[24], while only 22% of Gradient zirconia samples showed class III mode of failure(longitudinal fracture of the restoration and tooth).

The limitation of the present study includes that the fact of In vitro studies cannot fully replicate the oral environment, although they are considered a reliable method for comparing tested groups and assessing material behavior under various conditions. An additional limitation is that the testing was carried out on epoxy resin dies rather than natural teeth, potentially limiting the simulation of actual clinical situation.

Conclusion

Within the limitations of this study, the following could be concluded:

1- Occlusal veneers fabricated from gradient zirconia yielded promising fracture resistance compared to zirconia reinforced lithium silicate.

2- Gradient zirconia can be considered suitable material for minimally invasive posterior restoration.

3- Both gradient zirconia and zirconia reinforced lithium silicate restorations had fracture resistance value that are clinically accepted and safely used for molar region.

4- Both preparation designs considered reliable and conservative that can be used in minimally invasive restoration in molar region.

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Legend Figures and Tables

Figure 1: Preparation design subgroup A

Figure 2: Preparation design subgroup OB

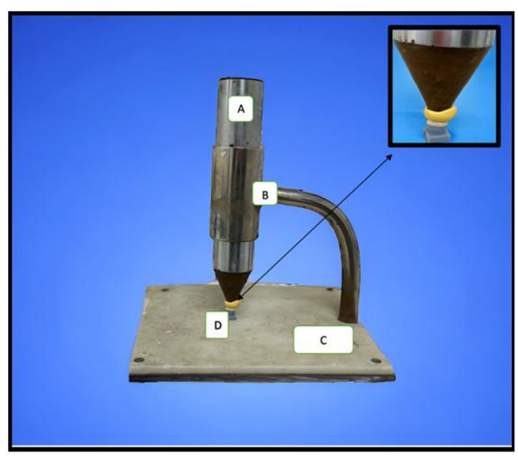

Figure 3: Cementation of the occlusal veneers under static load in a custom made device;(A) load, (B) holder, (C) base, (D) custom made rubber base jig to help fixing the position of each occlusal veneer during cementation.

Figure 4: Instron® Bluehill Lite Software equipped with a 5 KN load cell.

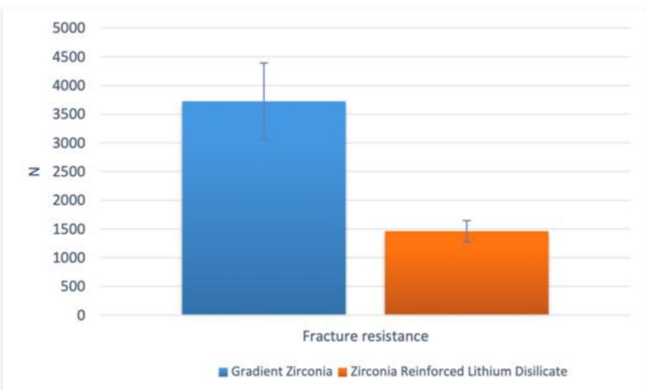

Figure 5: Bar chart showing mean and standard deviation (error bars) of fracture resistance (N) for different materials, regardless of preparation design.

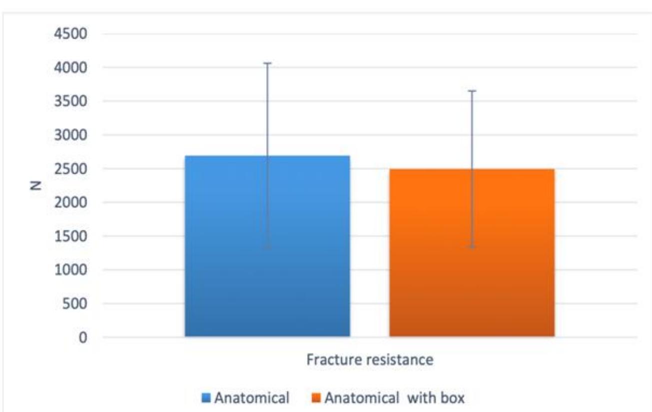

Figure 6: Bar chart showing mean and standard deviation (error bars) of fracture resistance (N) for different preparation designs, regardless of type of material.

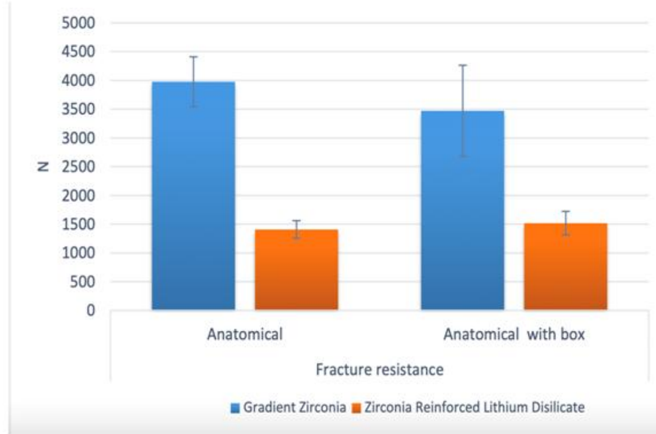

Figure 7: Bar chart showing mean and standard deviation (error bars) of fracture resistance (N) for different material within each preparation designs.

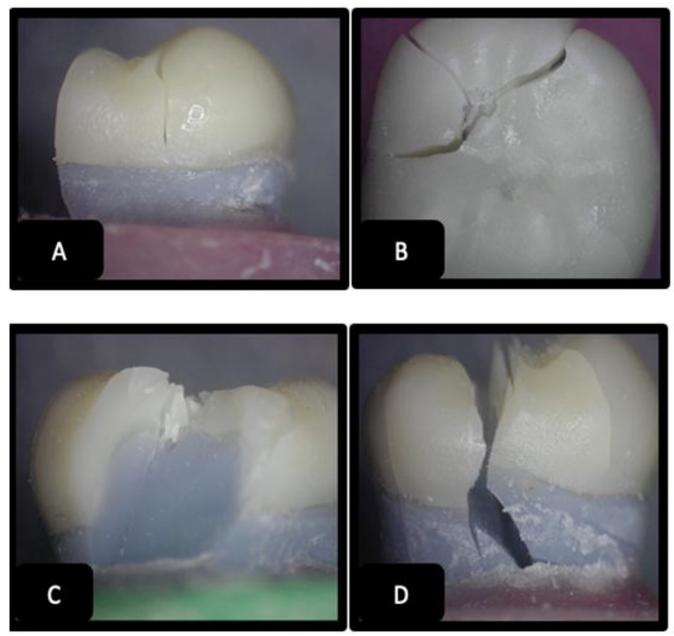

Figure 8: (A) Class I: crack formation within restoration without chipping. (B)Class II: cohesive fracture within restoration without involving the tooth structure. (C) Class III: adhesive fracture between the restoration and tooth. (D) Class IV: longitudinal fracture of the restoration and tooth.

Table 1: Descriptive statistics

Material	Preparation	Mean	95% Confidence interval		SD	Min.	Max.
			Lower	Upper			
GZ	Anatomical	3977.11	3655.70	4298.52	433.87	3481.41	4490.99
	Anatomical with box	3472.68	2886.93	4058.43	790.70	2220.05	4456.93
ZLS	Anatomical	1408.16	1294.60	1521.72	153.29	1113.98	1581.38
	Anatomical with box	1517.24	1364.85	1669.62	205.71	1231.66	1898.13

Table 2: Effect of different variables and their interactions on fracture resistance (N)

Source	Sum of Squares (II)	df	Mean Square	f-value	p-value
Material	35822674.93	1	35822674.93	162.97	<0.001*
Preparation design	273535.82	1	273535.82	1.24	0.276ns
Material * preparation	658685.97	1	658685.97	3.00	0.096ns

df =degree of freedom*; significant (*p*<0.05) ns; non-significant (p>0.05).

Table 3: Inter group comparison, mean and standard deviation values of fracture resistance (N) for different materials, regardless of preparation design.

Fracture resistance (N) (Mean ± SD)		p-value
Zir CAD Prime	Vita Suprinity	
3724.89±666.29	1462.70±183.24	<0.001*

*significant (p<0.05) ns; non-significant (p>0.05)

Table 4: Intergroup comparisons mean and standard deviation values of fracture resistance (N) for different preparation designs, regardless of type of material.

Fracture resistance (N) (Mean±SD)		p-value
Anatomical	Anatomical with box	
2692.63±1369.13	2494.96±1156.53	0.276ns

*significant (*p*<0.05) ns; non-significant (p>0.05)

Table 5: Intergroup comparisons mean and standard deviation values of fracture resistance (N) for different materials and preparation designs.

Material	Fracture resistance (N) (Mean±SD)		p-value
Preparation	Zir CAD Prime	Vita Suprinity	
Anatomical	3977.11±433.87	1408.16±153.29	<0.001*
Anatomical with box	3472.68±790.70	1517.24±205.71	<0.001*
p-value	0.055ns	0.667ns	

*significant (p<0.05) ns; non-significant (p>0.05)

Table 6: failure patterns of the four different occlusal veneer groups

Failure pattern / Groups	Class I	Class II	Class III	Class IV	Total
Group GZ subgroup A	2	4	1	-	7
subgroup OB	2	3	2	-	7
Group ZLS Subgroup A	-	2	4	1	7
Subgroup OB	-	1	3	3	7
Total	4	10	10	4	28
Percentage %	14%	36%	36%	14%	100%

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