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Marginal accuracy of zirconium reinforced lithium silicate (Vita Suprinity) crowns with two marginal designs before and after cementation under thermo mechanical cycling *In vitro* study

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Abstract
The aim of the present study is to evaluate the marginal accuracy of zirconia reinforced lithium silicate (VITA SUPRINITY) single crowns with two margin designs. Conservative dentistry is a treatment procedure by which a minimum of healthy tooth structure is removed during the restoration process; it is inherently a desirable dental goal. Feather edge (knife edge) or shoulderless margin design is considered a conservative tooth preparation. With the production of recent adhesive technologies and high strength ceramic materials that can be constructed in the form of monolithic restoration, tooth structure can be preserved by prepless preparation design. Newly introduced material in dental field should pass through several in-vitro tests before any clinical application.

Keywords: Glass ceramics, marginal fit, feather edge finish line, chamfer finish line

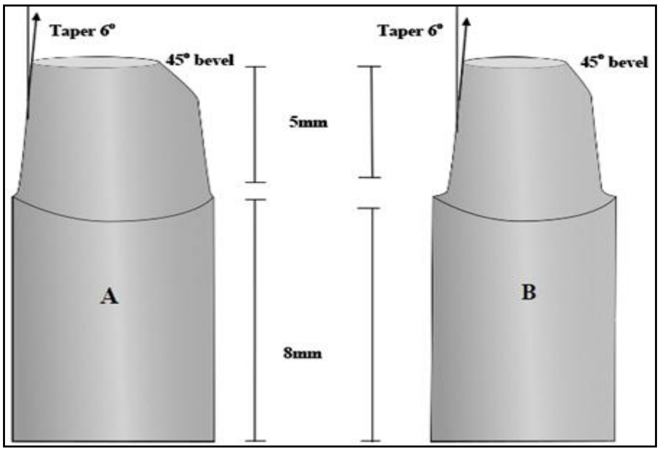
Introduction
Conservatism is a desirable procedure in which natural enamel and natural dentin are still preserved [1]. Feather edge (knife edge) or shoulder-less margin design is considered a conservative tooth preparation [1]. One drawback of the conventional FPD is that a large amount of tooth tissue from the abutment teeth must be removed to provide the appropriate retention and resistance shape. The modern era of dentistry has witnessed the development of new materials, new techniques, and new instruments that make conservative dentistry and ultraconservative dentistry possible [1]. Recently there were several CAD/CAM machinable all ceramic material blocks have been introduced to obtain restorations with proper esthetics, mechanical properties and biocompatibility [2, 3]. Zirconia reinforced lithium silicate (VITA SUPRINITY) was introduced to provide a material with improved mechanical properties. This was attributed by the addition of zirconia particles (8-10%) to its composition [4]. Marginal accuracy is a very important property for the prolonged success of the restoration from the biological and mechanical points of view [5]. Poor marginal accuracy or too large opening will affect the restoration's strength, decrease its longevity and lead to higher risk of recurrent caries and periodontal disease [2, 5]. Throughout dental literature, the effect of marginal design on the marginal accuracy is controversial. Some studies performed revealed that the finish line design may affect the marginal accuracy of all ceramic restoration [6, 7]. The authors conducted this in- vitro study, to evaluate the marginal accuracy of zirconia reinforced lithium silicate (Vita Suprinity) single crowns with two margin designs (feather edge and deep chamfer). The hyposthesis proposed was Null: There will be no difference in the marginal accuracy of single Vita Suprinity ceramic crowns with two different margin designs (feather edge and deep chamfer) before and after cementation under thermo-mechanical cycling.

Materials and Methods
Sample grouping
A total of twenty samples (ten in each group) were used in the present study
Group 1: included ten crowns (n=10) fabricated with deep chamfer finish line (control).
Group 2: included ten crowns (n=10) fabricated with feather edge finish line.

Master dies construction and duplication

Two stainless steel dies were constructed using a lathe cutting machine Figure (1) to simulate tooth preparation to receive an all ceramic crown for a mandibular second molar. Each die was prepared to have 5mm occluso-cervical height, 8mm for the root unprepared portion of the die and a total convergence of 12° (6° axial taper) [1]. One die was prepared according to standard preparation with deep chamfer finish line (0.7mm) [8] and the other with feather edge (0.25mm) [9, 10].

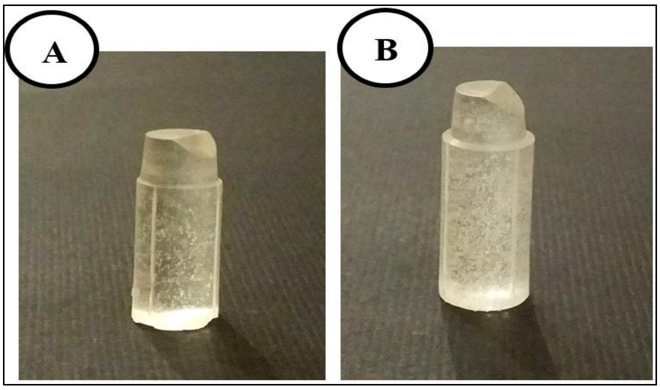
Each die was prepared with a non-anatomical occlusal table and an anti-rotational occluso-axial bevel (1 mm thick, 45° angle) was made on the dies to prevent rotation of the crown copings on the dies, as well as assuring the exact reproducibility of placement of the crown copings [11] figure (1).



A: Feather edge finish line **B:** Chamfer finish line

Fig 1: Diagrams of the stainless steel dies

Each stainless steel die was duplicated to form 10 replicas fabricated from Epoxy resin material (10 dies for each finish line design) using silicon molds that were made from duplicating addition silicon material Figure (2).



A: Feather edge finish line **B:** Deep chamfer finish line

Fig 2: Epoxy resin dies

Optical impression, designing the restoration and milling procedure

Before scanning of stainless steel dies, they were sprayed with Okklu-exact spray to overcome the highlights from the dies surfaces and ensure an accurate scanning. After that, scanning of dies was carried out by Activity 885 scanning machine that gives highly accurate results by automated 3D calibration. The scanned data were then saved in open STL format that allowed to be processed by CAD software (Zirconzahn software). Then the completed data set were reloaded into the 3D viewer for designing the restoration for lower second molar using both margin geometries. Occlusal thickness of designed restoration was 1.5mm, axial wall thickness was 0.8mm [12] and cement thickness was 50 µm [13]. Also checking the thickness of both finish line designs was carried out with a measuring tool Figure (3).

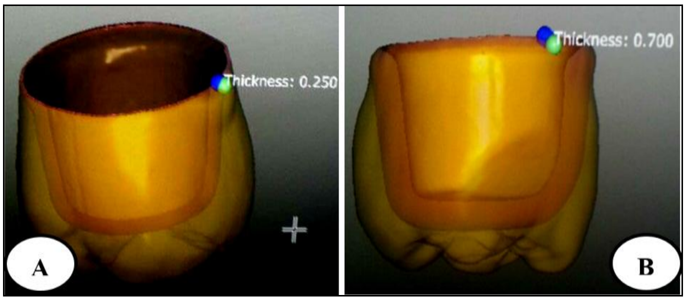


Fig 3: A: Measured thickness of feather edge finish line
B: Measured thickness of chamfer finish line

Data of 3D models were sent to imes-icore 250i milling machine
(a compact 5-axis dry and wet milling machine). After that each block was inserted in the work piece spindle and tightened then wet milling was carried out. Then each restoration was fitted on the corresponding die
for checking of margin accuracy using UNIVET magnifying loupe (3.5 X 400).

Removal of the sprue and finishing

After milling, the precrystalized VITA SUPRINITY ceramic crowns had their transparent honey color with a projected sprue (at the region where the crown is separated from the block after milling). Finishing of the sprue area was carried out using a fine grit red coded diamond stone followed by a green diamond finishing stone.

Crystallization and glazing cycle

Each crown was supported over a piece of thermal cotton and the glazing material was applied over each crown (VITA Azent plus), then held in the tray of the Ivoclar Vivadent furnace for crystallization and glazing cycle according to the manufacturer instructions at 840 °C for 8 minutes followed by slow cooling [14, 15]. Rechecking the margin of each crown was carried out. Any roughness was finished then samples were ready for cementation.

Testing procedures before cementation

Marginal accuracy was assessed by measuring the marginal opening (MO) which is the gap between the crown margin and the preparation external surface figure (4) [8] by using scanning electron microscope (SEM) with magnification of 200X [16, 17].

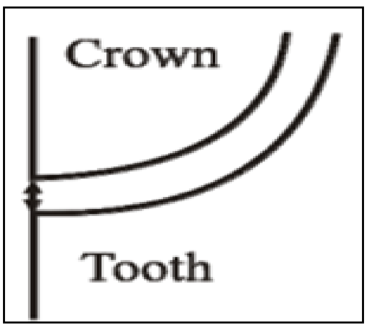
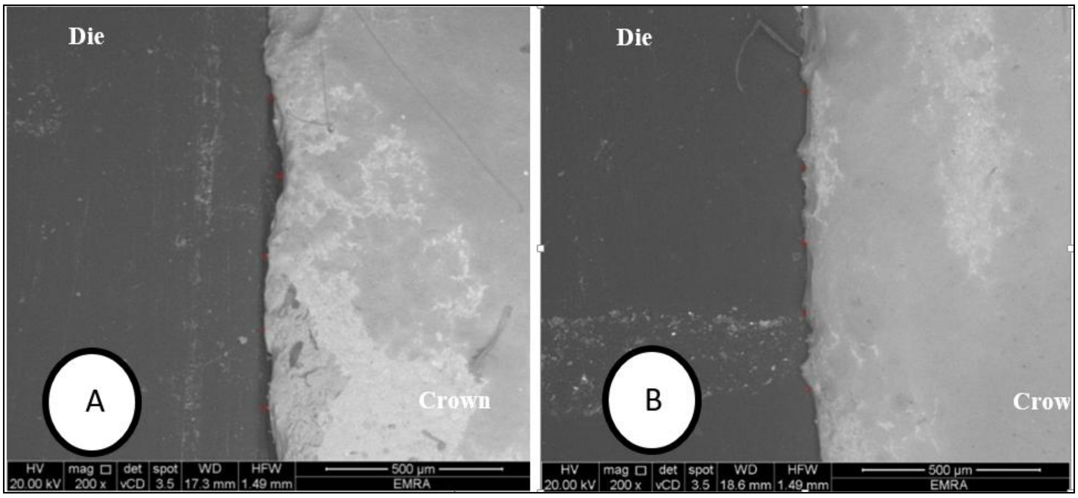


Fig 4: Marginal opening

Crowns were seated on its epoxy dies and held in its place using orthodontic elastics [5]. The marginal accuracy measurements were made on each of the four axial surfaces of the tooth at five equidistant points for a total of twenty marginal accuracy evaluation sites for each die figure (5) [16, 18]



A: deep chamfer marginal design, **B:** feather edge margin design

Fig 5: SEM photo showing the marginal gap measured at five equidistance points before cementation with

Cementation procedure

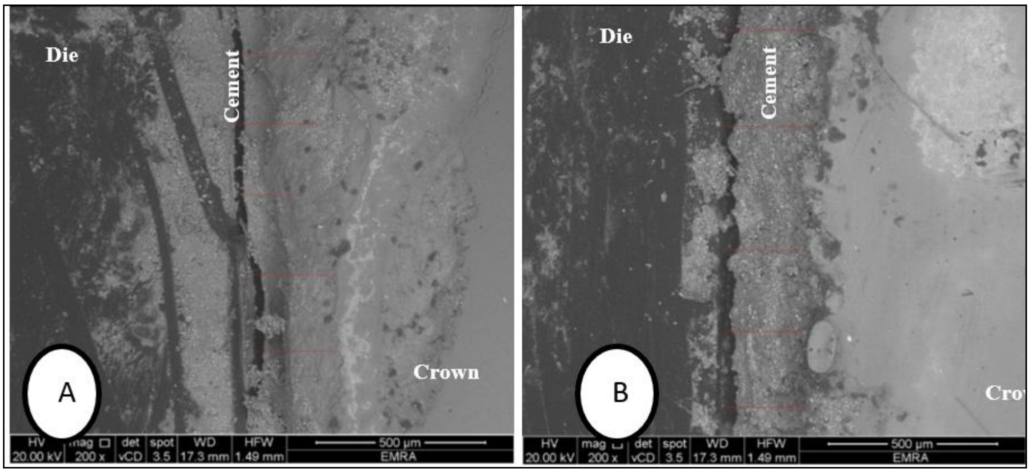
In an ultrasonic path Crowns were cleaned with ethanol and air dried then Ultradent ceramic etchant was applied into the fitting surface of each crown for 20 seconds according to the manufacturer's instructions**.** Each etched surface was then rinsed properly for 60 seconds with water spray then dried by air for 20 seconds. After that, the etched surface was then silanated by a layer of Ultradent silane coupling agent for 60 seconds followed by air thinning of the silane layer. After surface treatment of each crown (acid etching and silane application) Rely X automix resin cement was applied**.** After that, every crown was placed on its epoxy resin die. A device which was specially designed was constructed to standardize load application during cementation procedure. Each crown with its corresponding die was fixed to the cementation device. Cementation procedure started with sliding of the vertical bar in a downward direction till it touched the restoration and a 2Kg static load was applied on the upper disc shaped portion of the device for 5 minutes [19]. During chemical and light curing cementing device still applied a static load over the sample.

Thermo-mechanical aging

Mechanical aging via cyclic loading was performed using a programmable logic controlled equipment; the newly developed four stations multimodal ROBOTA chewing simulator integrated with thermo-cyclic protocol operated on servo-motor with special parameters. Samples were exposed to thermo-mechanical aging that was repeated for 37,500 cycles which simulate 3months [20]. 5Kg weight was exerted which is comparable to 49 N of chewing force with thermal aging between 5 °C and 55 °C.

Measuring the marginal accuracy after cementation and thermo mechnical aging

After cementation of crowns on dies and under thermo-mechanical cycling the marginal accuracy measurement was repeated using SEM figure (6), the obtained data were then collected, tabulated and statistically analyzed.



A: deep chamfer marginal design **B:** feather edge marginal design.

Fig 6: SEM photo showing the marginal gap measured at five equidistance points after cementation and thermo-mechanical aging with:

Statistical analysis

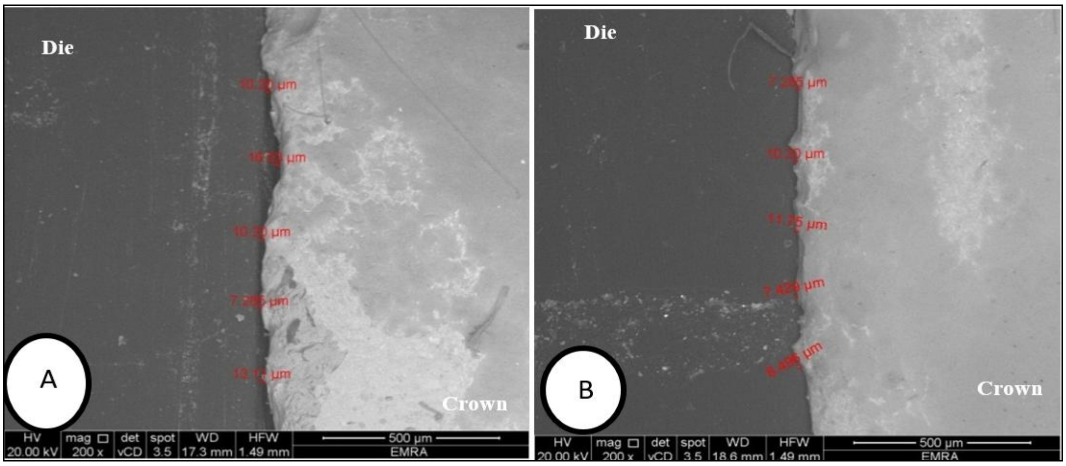
The results were analyzed using Graph Pad Instat (Graph Pad, Inc.) windows software. A value of $P \leq 0.05$ was considered statistically significant. The mean and standard deviation were expressed as continuous variables. Paired t-test was used within each margin design preparation to show effect of cementation under thermo-mechanical aging. A two -way analysis of variance was performed to detect significance between variables (margin design and cementation under thermo-mechanical aging). One-way ANOVA was done for compared surfaces followed by Tukey's pair-wise if showed significant. Sample size (n=10) was large enough to detect large effect sizes for main effects and pair-wise comparisons, with the satisfactory level of power set at 80% and a 95% confidence level.

Results

Results of the marginal accuracy testing:

Results of the effect of margin design on the marginal accuracy

With regard to the effect of margin design, It was found that deep chamfer margin design recorded statistically non-significant higher marginal gap mean value (27.20 ± 3.52 µm) than feather edge design (26.21 ± 1.49 µm) figure (7) as demonstrated by two way ANOVA test (p=0.7671 > 0.05) as shown in table (1) and figure (8).



A: chamfer marginal design **B:** feather edge marginal design.

Fig 7: SEM measurements of marginal accuracy at five equidistance pints before cementation to

Table 1: Results of the effect of two marginal designs (Mean values ± SDs) on marginal accuracy in microns.

Variables		Mean± SD	Statistics P value
Margin design	Feather edge	26.21 ± 1.49	0.7671 ns
	Deep chamfer	27.20 ± 3.52	

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

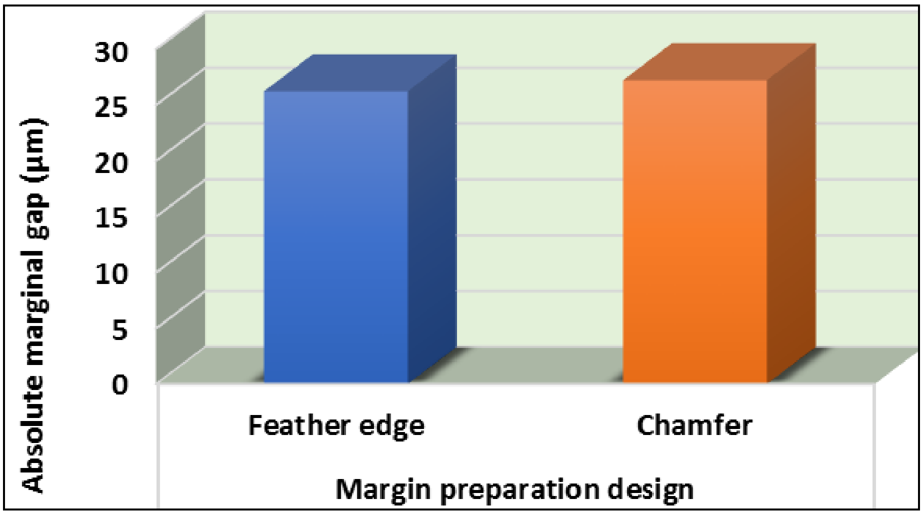
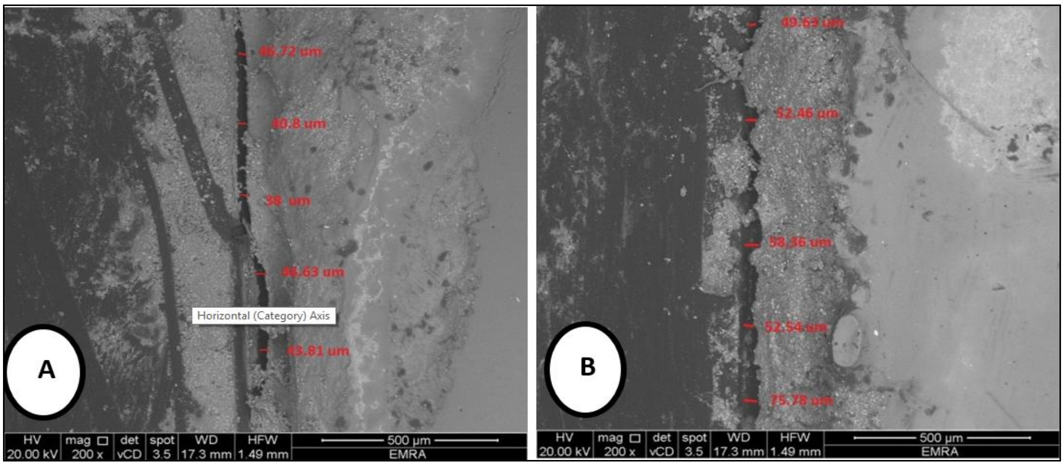


Fig 8: Column chart of results of the effect of two marginal designs (Mean values ±SDs) on marginal accuracy in microns.

Results of the effect of cementation under thermo mechanical aging on the marginal accuracy

Irrespective of the margin of preparation design, Marginal gap before cementation recorded lower mean value (11.89±2.13 µm) than after cementation under thermo mechanical aging (41.97 ± 3.68 µm) figure (9) and this was statistically significant as verified by two way ANOVA test (p = <0.0001< 0.05) as shown in table (2) and figure (10)



A: deep chamfer marginal design, **B:** feather edge marginal design at five equidistance points after cementation under thermo-mechanical aging.

Fig 9: SEM measurements of the marginal gap with

Table 2: Results of the effect of cementation under thermo mechanical cycling on the marginal accuracy.

Variables		Mean± SD	Statistics P value
Cementation	Before	11.45 ± 1.37	<0.0001*
	After cementation under thermo mechanical cycling	41.97 ± 3.68	

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

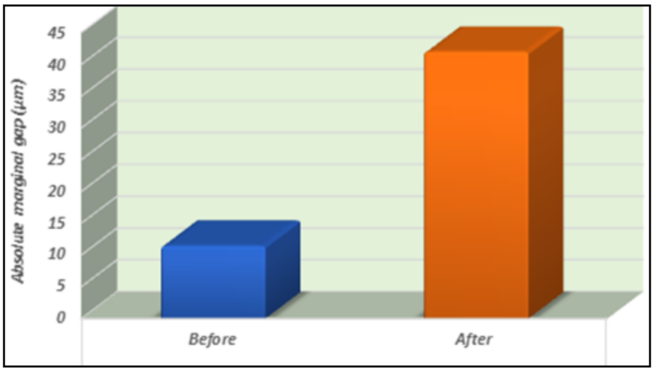


Fig 10: Column chart of results of the effect of cementation under thermo mechanical cycling on the marginal accuracy

Results of the effect of variables interaction on marginal accuracy of the tested crowns

Descriptive statistics of marginal gap (µm) showing mean, standard deviation (SD), minimum, maximum and 95% confidence intervals (low and high) values for both margin preparation designs before and after cementation under thermo-mechanical aging are summarized in table (3) and graphically drawn in figure (11).

With feather edge margin design; it was found that marginal gap before cementation recorded lower mean value (11.00±2.28 µm) than after cementation under thermo-mechanical aging (41.42±2.12 µm) and this was statistically significant as indicated by paired t-test (p=<0.0001< 0.05) as shown in table (3) and figure (11)

With chamfer margin design; it was found that marginal gap before cementation recorded lower mean value (11.89±2.13 µm) than after cementation under thermo-mechanical aging (42.52±6.09 µm) and this was statistically significant as proven by paired t-test (p=<0.0001< 0.05) as shown in table (3) and figure (11)

Feather edge vs. chamfer margin design

Before cementation; it was found that deep chamfer margin design recorded statistically non-significant higher marginal gap mean value (11.89±2.13 µm) than feather edge design (11.00±2.28 µm) as confirmed by student t-test (p=0.063 > 0.05) as shown in table (3) and figure (11).

After cementation under thermo-mechanical aging; it was found that **deep chamfer** margin design recorded statistically non-significant higher marginal gap mean value (42.52±6.09 µm) than feather edge design (41.42±2.12 µm) as verified by student t-test (p=0.5969 > 0.05) as shown in table (3) and figure (11).

Table 3: Descriptive statistics of results of the effect of variables interaction on marginal accuracy of the tested crowns

Margin design	cementation	Mean± SD	Min.	Max.	95% CI Low	95% CI High	Statistics P value
Feather edge	Before	11.00±2.28	8.96	17.04	9.37	12.64	<0.0001*
	After cementation under thermo- mechanical cycling	41.42±2.12	38.04	45.36	39.9	42.94	
Deep Chamfer	Before	11.89±2.13	7.78	15.85	10.36	13.42	<0.0001*
	After cementation under thermo- mechanical cycling	42.52±6.09	34.55	49.72	38.16	46.88	

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

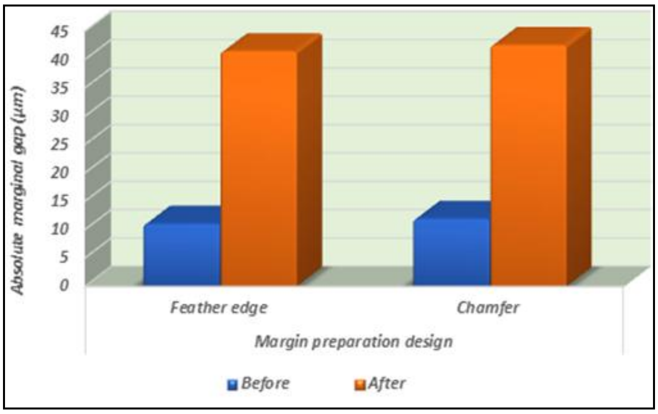


Fig 11: Column chart showing: results of the effect of variables interaction on marginal accuracy of the tested crowns

Discussion

Minimum invasive dentistry is the concept of obtaining excellent esthetic results without letting down the preservation of the biological structures especially in the cervical area where as the distance of the pulp preparation is of prime importance to preserve the strength of the tooth and the vitality of the pulp and it is one of the main objectives of recent restorative dentistry. Vertical preparations could be a more conservative alternative to a horizontal preparation design (shoulder or chamfer) [21].

Continuous progress in all ceramic restorations has been made to ensure better esthetics, biocompatibility and good resistance to chewing powers [22].

Marginal fit is one of the most important criterions for the long term success of all-ceramic crowns. The luting agent dissolution and micro leakage lead to increased marginal crown discrepancies.

The use of all-ceramic restorations and adhesive systems of the new generation can lead to better preservation of the remaining tooth structures [21].

The null hypothesis of the present study was accepted as there was no significant difference in the marginal accuracy of single crowns constructed from Vita Suprinity ceramics with two different marginal designs (feather edge or deep chamfer) before and after cementation under thermo-mechanical aging.

Zirconia reinforced lithium silicate (Vita Suprinity) was selected in the present study as it combines the advantages of glass ceramics as esthetics and bonding protocol with a relatively high ceramic strength from zirconia particles addition (8-12%). The zirconia particles added to reinforce the ceramic by crack interruption (flexural strength is approx. 420 MPa) [4].

A feather edge marginal design was chosen as a test group because it was proposed that such vertical margins would offer the procedural advantages of easier impression making, even for multiple abutments, and enhanced marginal adaptation after cementation [23]. Furthermore a smaller gap will cause less extrusion of cement that would be in direct contact with highly sensitive gingival sulcus environment as proposed by Fabio scutellà *et al*. [24]

Although the manufacturer does not specify feather-edge preparations for use with this material, the manufacturer claims that it can be milled to form thin, preparation-less veneers with a minimum thickness of 0.25 mm which is compatible with the crown thickness at the margin of the current study [14, 9, 10].

A deep chamfer finish line design 0.7mm was selected as a control group as Jalalian [25] suggested that chamfer finish line design aid in increased fracture resistance of ceramic restoration than shoulder one as the deep chamfer finish line produces an angled enamel cut that increases the enamel's susceptibility to etching and bonding, so we have a good bond between the restoration and the teeth which improves the resistance to fracture compared to the shoulder finish line [25].

Since the deep chamfer marginal design provides more round angle between the axial and gingival seat which will enable a more precise crown seat than with shoulder finish line (90°). Shoulder marginal design results in incomplete crown seat and raises the vertical marginal gap. Also it may be due to the accuracy of digital scanner detection that is being affected by differences in depth of the preparation which could be easily detected in deep chamfer marginal design as suggested by ZAK Al-Zubaidi and AMW Al-Shamma [26].

In the current study standardization of all steps was carried out, a lathe cut fabricated stainless steel dies were used instead of using natural teeth, as natural teeth represent great variations among each extracted tooth due to different individual structure, age and storage time so that standardization is too difficult [27].

Many authors have used metallic dies due to their easy reproduction, lack of abrasion during the manufacturing and measurement processes and to standardize the preparation.

Stainless steel dies were prepared according to specific parameters; the total occlusal convergence angle was 12° as it was recommended that the proper convergence angle should be in a range of 10° to 20°. In addition, it was found that preparation angle of 12° provided the best overall precision of single crowns based on zirconia. (Axial taper of 6°) is recommended with the confidence that the marginal opening will be in range of 36.6 and 45.5 µm on a consistent basis as reported by Beuer F *et al*. and Euan, R *et al*. [3, 28]

Each die has 5mm occluso-cervical height, 8mm for the root unprepared portion of the die and a non-anatomical occlusal table with an anti-rotational occluso-axial bevel (1 mm thick, 45°angle) that was done on the dies to avoid the rotation of the crowns on the dies, and also to ensure the correct reproducibility of the crowns placement [11].

The duplication of each master die was done by using REPLISIL 22 N as it has a low viscosity to record fine details, it has best mechanical characteristics with high ultimate tensile strength and offers an extremely high accuracy in dimension and design of the duplicating form and has highest tear resistance, it is very flexible and easy to deflask and It has a 100% recovery after deflasking [29].

In the present study shrink free epoxy resin material was used to construct epoxy resin dies and the dies were used as a substitution to natural teeth to allow identical crowns fabrication, which is important for a reliable comparison between different groups [30, 31].

Epoxy resin dies were used in this study because of the superiority in dimensional accuracy of this material, surface detail reproduction, transverse strength and better abrasion resistance [32]. Epoxy resin material has an elastic modulus similar to that of dentin (12.9 GPa). In addition to feature from clinical conditions is the bonding ability with luting agent which is similar to dentin [25].

In this study CAD/CAM technology was selected to support the idea of standardization in the production of all samples, as CAD/CAM technology simplifies the design of each finish line and milling procedure with the elimination of conventional restoration construction.

During scanning of stainless steel dies they were sprayed with OKKLU-EXACT to overcome any optical highlights from the dies surfaces and ensure an accurate impression [33].

Cement space was selected to be 50 µm because it was found that the marginal fit of the crowns with a cement space of 30-50 µm was found to create a better marginal fit [13].

After glazing of samples, each crown was seated on each epoxy resin die and was fixed in its place by using orthodontic elastics to provide stability during measurement [7].

Direct view technique, through a high powerful microscope was the most commonly used method to detect marginal discrepancy. This study utilized the SEM to observe marginal discrepancy, which is a high precision instrument that can accurately record the amount of discrepancy at various levels with remarkable precision. Scanning Electronic Microscopy (SEM) imaging has been stated to be better than light microscopy to determine marginal gap of class II CAD/CAM inlays. However, Groten *et al*. reported, no significant difference between the accuracy of the two methods, although according to the authors, SEM was able to provide more appropriate and realistic observations than a light microscope especially with complex margin designs [34].

Marginal accuracy was assessed by measuring the marginal opening referring to the gap from the outermost point at the crown margin to the outermost point at the preparation margin [1]. In most research, marginal opening was used as a generic term for the marginal accuracy assessment of the crown. [7, 8, 35]

Measurements were done under magnification of 200 X [16, 17] at five points on each surface at equidistance from each other [16, 18].

There were variations in the number of points measured to assess the marginal accuracy in the previous studies. While Nawafleh, N.A *et al*. recommended 50 measurements per specimen. Others suggested that 20 to 25 measurements per specimen could be used for measuring the marginal opening [34].

In the current study surface treatment of the fitting surface of each crown was carried out by the application of hydrofluoric acid etchant as it is considered as a successful chemical surface treatment for silica based ceramics. After that, application of silane coupling agent was done as it is the most broadly used coupling agents in dentistry because of their good performance and biocompatibility. In general, the coupling agents are synthetic functional compounds which wet the surfaces of the substrate, increase the free energy of the surface and the resin cements adhesive strength interfaced with ceramic crown [36, 37, 38].

Rely X Unicem cement was used to cement the crowns as it is dual-curing self-adhesive universal resin cement for adhesive cementation of indirect ceramic, composite or metal restorations. The cement is characterized by a higher moisture tolerance, as compared to multi-step composite cements. Rely X Unicem cement releases fluoride ions and is available in various shades [39].

Resin cement was supplied in the form of automix syringe as base and catalyst are easily mixed without need for hand mixing that may be inaccurate in mixing proportion and may incorporate air into the mix.

Furthermore, cementation methods such as uncontrolled finger pressure or crown overfilling with cement can cause an uneven cement flow with a thick film on one axial wall and a thin film on the opposite wall. It has also been reported that the type of the cement affects the fitness of the dental crowns

So to complete the standardized cementation protocol and to standardize the cement thickness, each sample was fixed to a specially constructed loading device with 2 Kg weight for static load application till the setting of resin cement was completed and this was done to simulate a coping cemented in the oral condition [19].

After the cementation procedure was completed, aging was carried out. Thermo-mechanical aging is one of aging procedure aiming to simulate oral cavity environment as much as possible. Each sample with its epoxy die [40, 41, 42, 43] was exposed to 37.500 cyclic loading in chewing simulator device simultaneously with thermal cycles between 5 °C and 55 °C as this condition simulates 3 months of clinical servicing [20].

As the aging procedure was completed, marginal accuracy was tested again to check the effect of cementation under thermal cycling and mechanical loading on the marginal accuracy of the tested crowns.

All the tested crowns results were within the range of the clinically accepted value. With regard to the effect of margin design, it was found that deep *chamfer* margin design recorded statistically non-significant higher marginal gap mean value (27.20 ± 3.52 µm) than *feather edge* design (26.21 ± 1.49 µm).

This could be attributed to the fact that the more the margin of the restoration ends with an acute angle, the shorter the distance between the tooth and the margin of the restoration [7].

The results of the present study were in agreement with Fuzzi, *et al*. [11] who found that the feather edge marginal design can be recommended for the teeth without sufficient dentin and remaining coronal structure to decrease the pulp inflammation risk.

Also these results are in agreement with Schmtiz *et al*. [23]. who found that for monolithic lithium disilicate, the clinical outcomes provided with the feather edge marginal design were similar to that provided with other marginal designs. In addition to Poggio, C *et al*. [21] reported that for crowns made from zirconia, knife-edge marginal design provide clinical performance similar to that provided with other marginal designs but with decreased preparation invasiveness and this is also in agreement with the present study.

The results of the effect of the marginal design on the marginal accuracy were not in agreement with Comlekuglu *et al*. [7] who found that feather-edge marginal design provided the least marginal gap but the results were with statistically significance. Feather edge marginal design (68 ± 9) was significantly lower than those of the chamfer marginal design (128 ± 10). This disagreement might be due difference in sample size, ceramic material or testing conditions.

Irrespective of margin preparation design, marginal gap before cementation recorded statistical significant lower mean value (11.89±2.13 µm) than after cementation under thermo-mechanical cycling (41.97 ± 3.68 µm).

This could be attributed to the added thickness of the cement on the marginal gap which may discontinue the full crown complete seating; resulting in an insufficiently sealed restoration margin also it may be due to hydraulic pressure of resin cement and the viscosity of resin cement [44].

These results are in agreement with Haggag *et al*. [45] who concluded that cementation and thermo-mechanical aging significantly increased the vertical Marginal gap and the deep chamfer finish line preparation is preferred for construction of monolithic zirconia crowns. Also Borges *et al*. [46] found that cementation increased the marginal discrepancy between the crown and the prepared margin. However AZAR *et al*. [47] found that the cementation process increased the marginal gap for all luting cements evaluated. Demir *et al*. [48] who concluded that the Marginal gap values of the full ceramics increased significantly after cementation.

Also these results are in disagreement with El-Dessouky *et al.* [49] who found that Cementation did not significantly increase the vertical marginal discrepancies of zirconia crowns analyzed and artificial aging significantly increased the vertical marginal discrepancy through thermo-mechanical loading.

The reduced marginal discrepancy also may be due to the hygroscopic expansion and water sorption of the resin cement during the thermal cyclic which will improve gap sealing [50].

These differences between the present and previous studies may be due to the different measurement methods and the location of the reference points used, the subjective nature of the measurements and the use of different ceramic type [26].

Despite such favorable and encouraging results, longer observation periods, assessment of the marginal accuracy of VITA SUPRINITY crowns on natural extracted teeth and randomized controlled trials are required to compare the long-term effectiveness of zirconia reinforced lithium silicate ceramic crowns made with other marginal designs.

Conclusion

Within the limitation of this *in vitro* study, the following conclusions were drawn

1. Monolithic zirconia reinforced lithium silicate (Vita Suprinity) ceramic crowns fabricated with feather edge margin design yielded comparable marginal accuracy as that obtained with deep chamfer margin design.
2. Feather edge margin design could be a promising conservative alternative to deep chamfer margin design with regard to marginal accuracy, when it is used for construction of zirconia reinforced lithium silicate (Vita Suprinity) ceramic crowns.
3. Cementation affects the marginal accuracy negatively with both tested margin designs.
4. Marginal accuracy values for both marginal designs are within the clinically accepted values.

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