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Evaluation Of The Fracture Resistance And Marginal Gap Of Endocrowns Retained Bridges With Two Different Designs

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ABSTRACT

Objective: The purpose of this in vitro study will evaluate marginal gap of endocrowns retained bridges replacing missing lower second molar will done by two different designs from monolithic zirconia.

Material and method: twenty bridges designed from monolithic zirconia. Specimens will be divided into two groups, each of these groups contains 10 samples, the first group represents endocrown endocrown retained, and second group endocrown retained bridges. The marginal gap for the buccal, lingual, proximal and connector area were measured .scan electron microscope were used. Universal testing machine was used to detect fracture resistance for all samples.

Results: Data analysis was performed by student t-tests to detect significance between groups. One way analysis of variance ANOVA test followed by pair-wise Newman-Keuls was used to detect significance between sites. Statistical analysis was performed using Graph pad Prism-4 statistics software for Windows. P values < 0.05 are considered to be statistically significant in all tests. Marginal gap results measured in micron (µm) for both designs at different sites. It was found that endocrown endocrown retained recorded higher marginal gap mean value than endocrown retained bridges and this was statistically non-significant ($p > 0.05$).

Conclusions: Fracture resistance and marginal gap of endocrowns retained bridges with two different designs were be accepted.

Keywords: endocrown ,marginal gap, fracture resistance ,and monolithic zirconia.

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INTRODUCTION

With the increasing popularity of adhesive dentistry, a shift in treatment decisions toward more conservative modalities has been observed, and the need for conventional post and cores has become less clear. Endocrowns have been introduced as alternative restorations for endodontically treated molars, depending on the availability of remaining tooth structure. endocrowns are type of restoration consisting of the entire core and crown as a single unit (ie, monoblock). Endocrowns use the available surface of the pulp chamber axial walls as macro retentive resources and adhesive resin cement as a means of micromechanical retention. This type of restoration is made available through computer-aided design/computer aided manufacturing (CAD/CAM) technology[(1)]. The marginal adaptation of bridges important for clinical success of restorations. Improper marginal fit in the restoration exposes the luting agent to the oral environment. The ceramic crowns with smaller marginal discrepancy demonstrated the best compressive strengths when loaded on die[(2)].

MATERIAL AND METHOD

On Ramses cast endocrown retained bridges were constructed on lower first molars and third molars bilaterally. On right side endocrown retained bridge was constructed, on left side endocrown endocrown retained bridge was constructed.Before started indexes for both sides were obtained using (zeta plus)rubber base condensation silicone .Putty and catalyst according to manufacture instruction was mixed to do Four index The shape of access cavity was detected by endodontist, black pencil with diameter 0.7 mm was used to draw shape of access cavity on both right and left side. Low speed motor (strong) with round bur and tapered stone number (13) latch type was used to prepare access cavity of right first molar, and also The access was prepared for both left first molar, and third molar .The depth of all cavities were 6mm, measured by periodontal probe. 2mm flat occlusal reduction of all teeth that received endocrown restoration were done, and measured by periodontal probe was done by tapered stone with rounded end.Third molar on right side received full contoured zirconia crown preparation, occlusal reduction was 1.5mm, and mesial, distal, buccal, and lingual reduction were 1mm. low speed round end tapered stone latch type number (13) was used to prepare all this surfaces. All surfaces had 1mm deep chamfer finish line all around was done by the low speed round end tapered stone latch type number . . Yellow code low speed Fine tapered stone was used to do smoothing to all surfaces. Fig(1)

Figure 1: preparation on cast.

The cast was sprayed by scan sprayed powder (occluatec no 1935000) according to manufacture instruction.the cast had green color. The lower cast was fixed to metal base.to fix cast in scanner. The lower cast and metal base attached to movable part of scanner fig (2). In EOS X5 dental supply sirona in lab scanner was used to scan the cast fig (3). After scanning the model was added to software. The restoration were designed. The connector size (4×4) was selected according manufacture instruction fig (4). The prettau zirconia was plugged into the milling machine the start button was pushed to start milling. All the bridges were enter cleansing firing cycle to clean the crowns from the lubricant after the milling process. The bridges were carefully placed in same order in the special crucible. The tray was then placed in the sintering furnace and a preinstalled sintering program for the pretteau disc was selected and start button was pushed to start the sintering cycle. Apply Colouring Liquids to all bridges fig (5). Marginal measurements marginal gap distances measurements were done directly to ensure complete seating of the bridge over cast use temporary cement (calcium hydroxide). scan electron microscope Microscope connected to computer software, at 767 magnification and measurements fisixteen different points on each surface and average were evaluated. Means were calculated and statistical analysis was made fig(6)

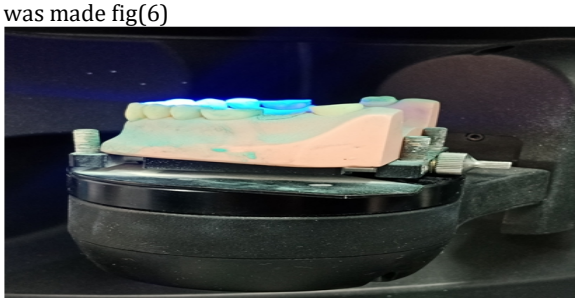


Figure2: scanned cast

Figure (3):In EOS X5 sirona lab scanner.

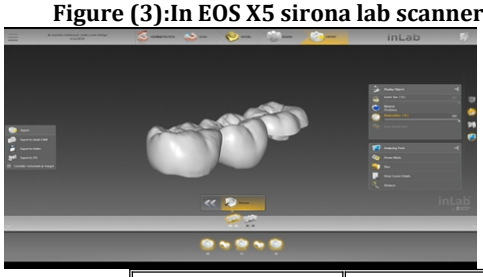
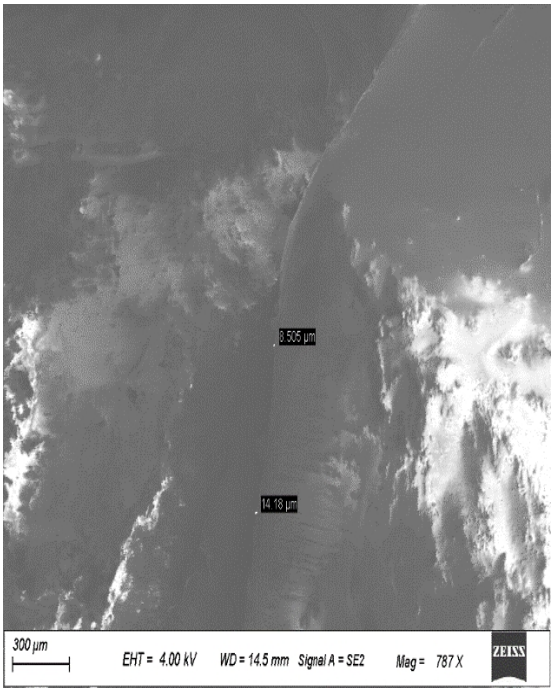


Figure (4): Preview the restoration

Figure(5): final design of two bridges



Figure(6): measurements use scan electron microscope.

Statistical analysis

Data analysis was performed by student t-tests to detect significance between groups. One way analysis of variance ANOVA test followed by pair-wise Newman-Keuls was used to detect significance between sites. Statistical analysis was performed using Graph pad Prism-4 statistics software for Windows. P values < 0.05 are considered to be statistically significant in all tests..

RESULTS

Marginal gap results measured in micron (µm) for both designs at different sites are summarized in Table (1)

Designs	Region Site	Mesial abutment Mean ± SD	Distal abutment Mean ± SD
Endocrown retained bridges	Buccal	38 ± 6	49±10
	Lingual	40±8	44±12

	Proximal	44±9	46±10
	Connector area	40±7	47±13
Endocrown endocrown retained bridges	Buccal	39±6	43±5
	Lingual	40±7	40±9
	Proximal	45±8	43±8
	Connector area	40±7	41±7

Table (1): Marginal gap results (Mean ± SD's) for both designs at different sites.

It was found that endocrown endocrown retained recorded higher marginal gap mean value than endocrown retained bridges and this was statistically non-significant ($p > 0.05$). Total region (mesial vs. distal)Regardless to designs or measurement site it was found that distal abutment of endocrown retained bridges higher marginal gap mean value than endocrown - endocrown retained bridges was statistically significant ($p < 0.05$) table (2).

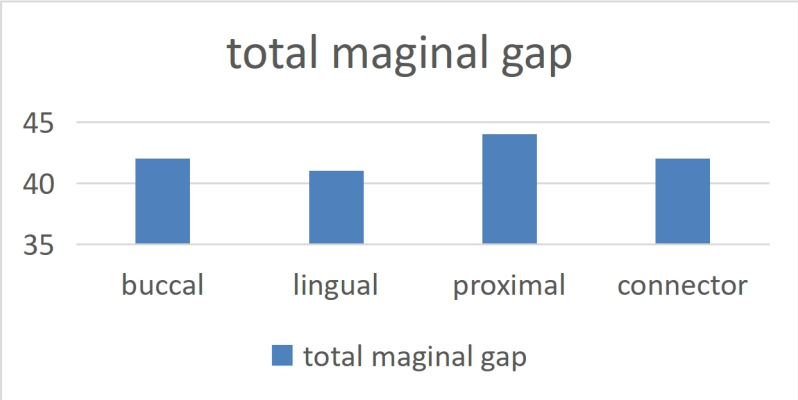
Region	Mean ± SD	Means difference	t-test
Mesial abutment	40.75 ±7.25	1.75	P value
Distal abutment	43.5 ± 9.249		0.0304*

Table (2): Comparison of marginal gap results (Mean ± SD's) between total mesial and distal abutment

Total measurement site regardless to designs or regions it was found that proximal site recorded the highest marginal gap mean value followed by buccal site then connector site while lingual site recorded the lowest marginal gap mean value and the difference between sites was statistically significant ($p < 0.05$)table(3),and figure(7).

	Buccal	Lingual	Proximal	Connector	ANOVA
Mean	42.61^{A}	41.33^{A}	44.29^{B}	42.2	*P* value
Std. Deviation	6.75	9	8.75	8.5	<0.0001*

Table (3): Marginal gap results (Mean ± SD's) for both designs at different sites



Figure(7) :marginal gap at different area.

Total designs(endocrown retained vs. endocrown - endocrown)regardless to region or measurement site it was found that endocrown- endocrown retained bridges higher marginal gap mean value than endocrown retained bridges and this was statistically non-significant ($p > 0.05$) table (4).

designs	Mean ± SD	Means difference	t-test
Endocrown retained	43.79 ±9.375	3.891	*P* value
Endocrown - endocrown	41.68 ± 7.125		0.2962*

Table (4): Comparison of marginal gap results (Mean ± SD's) between two designs.

DISCUSSION

One of the most significant advances in the field of restorative dentistry has been the introduction of zirconia-based ceramic materials. The benefits of these materials include a substantial improvement in strength and longevity. These new core materials can withstand high levels of stress without failure Currently used fixed restorations suffered from some drawbacks that were reported in some studies. Among these, are the non-conservative abutment preparations, too poor esthetics if metal coping were used and veneer chipping that may occur with bi- layered zirconia restorations[3].

The monolithic zirconia was chosen to construct the endocrown retained bridge. It has the advantage of being translucent, monolithic and no veneering porcelain is added where porcelain chipping was a common problem reported in previous studies [4].

In the present study, the endocrown retained bridges was selected for its conservative preparation compared with full coverage restorations where approximately 63—73% of the coronal tooth structure is removed when teeth are prepared [8].

As the design and shape of endocrown cavity preparation and dimensions can affect the outcome and fracture resistance designs, every effort was made to standardized the cavity preparation [5].

Preparations was measured by the CAD software to reassure the accurate dimensions. The recommended connector size is between 16 mm^2 when using monolithic zirconia. In this study, the minimum connector size recommended was used for minimal tooth preparation [6].

Marginal fit plays an indisputable role in the clinical success of restorations. On this score, many studies have focused on investigating the fit of zirconia restoration fabricated with different CAD/CAM systems currently available in the market [7]. The overall fit of CAD/CAM fabricated restorations by taking into consideration the marginal gaps of both pontic and non-pontic sides.From the types of zirconia blocks available for the CAD/CAM systems, monolithic pretteau® zirconia block used in this study.Milling an enlarged framework using rotary cutting tool was performed as usual and then the framework was sintered in the sintering furnace and shrunk to the desired dimensions [8]. After milling, the framework was shrunk by 25- 30% to the desired dimension through dense sintering. Balance between the enlarged machining of the pre-sintered ceramic block and the shrinkage occurring during the sintering process is mandatory to create framework with an overall improved internal and marginal fit [9].

The present study showed under scan electron microscope the grains of material appeared fine and smooth and that may be due the particles used in translucent zirconia smallest.The micrographs showed that the grains of translucent zirconia appeared slightly finer than those of the conventionally sintered zirconia [10].

Each specimen was photographed using a scan electron microscope with a magnification of 787X, then digital image analysis was performed to measure and qualitatively evaluate the marginal gap. Measurements of gap distance were done along three equidistant landmarks along the cervical circumference for each site (Buccal, Lingual, Proximal and connector) of each region

Cementation of bridges were done by temporary cement to stably the bridges on scan electron microscope bridge ,and also to stimulate clinical situation.The results of marginal gap distance testing obtained in this study showed that regardless to measurement region or measurement site (Buccal, Lingual, proximal or connector surface) endocrown endocrown retained bridges were more accurate (41.368±7.125µm) than endocrown retained bridges (43.79±9.375µm).

Larger gaps which occurred with the endocrown retained bridge in this study was believed to be attributed to the small thickness finish lines of distal abutments of endocrown retained bridges compared to thick finish line of endocrown.Measuring the marginal gaps at different regions of the frameworks (mesial and distal abutments) revealed that mesial abutment (40.75±7.25µm) was significantly more accurate than distal abutment (43.52±9.249 µm) leading to statistically significant less accurate marginal adaptation of crown than the endocrown.Upon comparing the four different sites regardless to the region a significant finding was observed; the proximal (non-pontic) site recorded the highest marginal gap mean value (44.29 µm) followed by the buccal site (42.61 µm) ,then the connector (Pontic) (42.2 µm), while the lingual site recorded the lowest marginal gap mean value (41.33µm).

This results may due to improper scanning of proximal , improper positioning of cast on scan table ,or due to in accurate pressure during cementation of samples but the results with accepted clinical range.**Yavuz Burgaz,** found Cementation causes a significant increase in the vertical marginal discrepancies of the test specimen [11]. The results were in agreement with **Beuer et al** who stated that scanning CAD/CAM construction, milling and sintering can cause inaccuracies during the fabrication of zirconia substructures and that these inaccuracies vary according to the differences in the density of the used semi-sintered blanks [12].

In spite all of the previous findings, all the marginal gap measurements in this study was in concurrent with **Francesco Riccitiello et al,**who stated that the marginal opening of 120 µm should be the limit of clinical acceptability[13]. They also evaluated the marginal opening of clinically well-fitting copings microscopically and they reported marginal discrepancies values of 7-65µm[14].

CONCLUSION

are,and provide agood substitute for replacing posterior teeth.

Within the limitation of this study,the following conclusions were found:

endocrown endocrown retained bridges were found to be a successful mean of restoring posterior teeth.

All tested endocrown endocrown retained bridges designs were conservative had good marginal fit

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Esthetical clearance: Study was done in vitro study samples.

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