INTERNAL FIT EVALUATION FOR HEAT-PRESSED ZIRCONIA REINFORCED LITHIUM SILICATE AND LITHIUM DISILICATE CROWNS IN ESTHETIC ZONE (RANDOMIZED CLINICAL TRIAL)

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ABSTRACT

Statement of the problem:

Internal fit of all ceramic crowns is one of the most important criteria for clinical success of the restorations and inadequate internal gab measure`s may increase the risk of short-term success and poor prognosis. The internal-fit of zirconia reinforced lithium-silicate (ZLS) glass ceramic is still under research to be considered a reliable alternative treatment to lithium-disilicate glass ceramic.

The Purpose:

To evaluate the internal-fit of heat-pressed zirconia reinforced-lithium-silicate and lithium-disilicate ceramic crowns in esthetic zone.

Methodology:

For teeth in the esthetic zone, fabrication of twenty six all-ceramic full coverage crowns using two different ceramic materials: According to the crown used, the patients were separated into two groups. Group 1: Lithium-disilicate ceramic material (e.max press). Group 2: Lithium-silicate ceramic material (Celtra press). Before final cementation replica technique was used to measure the internal fit between each abutment and its corresponding crown of all tested samples. Data were tested for normality using Shapiro Wilk test and Kolmogrov – Smirnov test. Mann – Whitney U test was used between – groups comparison. P values ≤0.05 are considered to be statistically significant.

Results:

The results of this study showed that there was no-significant difference in the values of internal gap width between the two groups. ($p = 0.221$).

Conclusions:

Zirconia reinforced lithium-silicate crowns fabricated with the heat press technique have measurably smaller internal fit compared with those fabricated with lithium-disilicate crowns fabricated with the heat press technique, yet it was statistically insignificant difference and clinically acceptable to be used in the esthetic zone.

Keywords:

zirconia-reinforced lithium silicate, lithium disilicate, heat-pressed technique, silicone replica technique, internal fit, internal gab.

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INTRODUCTION:

Dental ceramic crowns have proven to be predictable long-term treatment options for optimizing optical characteristics, color stability, biocompatibility, wear resistance and superior esthetics. In today`s growing field of esthetic ceramic restoration and the increasing awareness among patients of dental esthetics led to dissatisfaction with artificial appearance of porcelain fused to metal crown due to the graying effect of the metal at the gingival margin and the increased light reflectivity by the opaque porcelain used to mask the metal core[(1),] So, the clinician is facing the dilemma: which material should be used and how to fabricate the restoration to achieve the most esthetic and strength results for the dental prothesis. The introduction of IPS e.max material was in 2005 with improved chemical and physical properties (flexure strength 400 MPa) [(2).] It is composed of lithium-disilicate crystals, these crystals in the glassy matrix show enhanced physical properties and translucency generated by the use of a different firing technique. Despite its high crystalline content, this material presents high translucency due to the relatively low refractive index of the lithium-disilicate [(3).] A new zirconia reinforced lithium-silicate (ZLS) material has been launched to the dental market; celtra press by Dentsply Sirona, available for pressing using lost wax technique [(4).] This unique material was claimed to provide high aesthetics and adequate strength. This newly developed multiphase ceramic consists of zirconia (10% by weight) and lithium-silicate crystals (1.5 µm in length) additionally, lithium-phosphate at nanoscale in glass matrix. The zirconia particles are entirely dissolved in the glass phase as opposed to being in crystalline form, which reinforce the ceramic structure by preventing cracks and so increases fracture resistance [5]. Celtra Press has an excellent flow velocity during pressing and superior strength of around 500 MPa [6]. Internal fit is the width of the cement space between the fitting surface of restoration and the surface of the prepared tooth. Inadequate fit will negatively affect the restoration 's strength, reduce its longevity and lead to higher risk of recurrent caries and periodontal disease [7]. In literature, several ways used for evaluating the internal fit of restorations such as direct measurement, sectioning method, profilometry, micro-CT technique and silicone replica technique [8]. Silicone replica technique is widely used as it is noninvasive, inexpensive technique that acquires the same protocol as cementation of a restoration but utilizing light-body polyvinyl siloxane material impression material measuring the gap between the interior surface of the restoration and the prosthetic preparation. The silicone film may then be measured at various internal and external reference locations. This technique obtains two-dimensional data and can be used both in vivo and in vitro [9].

MATERIALS AND METHODS:

- **Sample Size**

Power analysis was created to achieve enough power in order to perform a two statistical test for the null–hypothesis that there is no-significant statistically difference in internal fit between; zirconia reinforced lithium-silicate and lithium-disilicate crowns fabricated in esthetic zone. According **M.Saleh** [10] results of **s**ample size predicted for the study was 21 cases. The total number will be raised to; (26) restorations to compensate the dropout rate of 25%. By using G Power version 3.1.9.4 sample size calculation was performed.

- **Research Ethical Approval**

This study and the template informed consent form were reviewed by the Ethics Committee of Scientific Research - Faculty of oral and dental medicine – Cairo University and approved in September 2019. This study was performed in Fixed Prosthodontics Department clinics of Faculty of Dentistry, Cairo University, Egypt.

- **Case selection**

Selection of cases for this clinical study was based on cases need a complete crown restoration on esthetic tooth in the esthetic zone. Each patient received full-coverage anterior cosmetic crowns Their main complaint was to protect the teeth or to restore proper function and esthetic. Each patient was informed with his treatment plan. Before starting the clinical work, they accepted to sign the informed consent. They have the ability and want to keep up good dental hygienic conditions.

- **Selection criteria**

- **Inclusion criteria**: All patients were required to have no active periodontal diseases, be physically and psychologically capable of withstanding standard dental treatments, be indicated for all ceramic crowns in maxillary esthetic zone as: badly decayed teeth, teeth restored with large filling restorations, endodontically treated teeth, malformed teeth, malposed teeth and spacing between maxillary teeth in esthetic zone.
- **Exclusion criteria**: Patient with active periodontal diseases failing to maintain good oral hygiene measure, pregnant women, patients with incompletely erupted teeth and patients with malocclusion or parafunctional habits

- **Allocation concealment**

Sequence generation

After enrolling the patients by the main researcher in this randomized clinical trial, the participants were randomized by dental assistant to ensure allocation concealment, each patient was given numbered in opaque, sealed envelope that contain the patient's name from inside and nothing is coded from outside the envelope. These envelopes were released to the main supervisors in the 2nd visit after teeth preparation.

Envelops were allocated randomly in two different groups, group (I): IPS e.max press ceramic crowns (as control group) and group (II): Celtra press ceramic crowns (as intervention group) by the main supervisors.

- **Allocation**

In the present study four patients were enrolled and were described as the following:

- 1st.

Patient:
received nine crowns and was participated in Group one.
- 2nd Patient: received four crowns and was participated in Group one.
- 3rd Patient: received six crowns and was participated in Group two.
- 4th Patient: received seven crowns and was participated in Group two.

- **Blinding:**

Two examiners - from the Fixed Prosthodontics Department Staffs, faculty of Dentistry, Cairo University - (who went through profound assessment training program including assessment chart with different techniques for measurement of outcomes) were responsible for the assessment of clinical outcomes. Any conflict in assessment between the examiners, was solved by the main investigators.

1- Diagnostic-Phase:

Extra-oral and Intra-oral examination, Radiographic examination and pre-operative photos were carried out for all patients.

Figure (1): Intra-oral photo for patient#1

Figure (2): Intra-oral photo for patient#3

2- Pre – Prosthetic Phase:

One week before any tooth preparation; Scaling and Polishing for all- patients were performed. Then, all teeth were evaluated clinically and some of the cases as patient#1 required anterior crown lengthening, composite restorations and root canal treatments. Endodontically treated teeth were restored with peek custom-made posts and cores. **Figure (3)** Patient#3 required removal of the defected anterior crowns and a broken custom-made metal post. Composite restorations were done for decayed anterior teeth and root canal retreatment for the upper right central was performed. Fabrication of PEEK custom- made post and core before prosthetic phase. Teeth shades were recorded by VITA 3D-Master shade-guide system.

Figure (3): PEEK custom-made Posts and core

Functional and esthetic 3D-printed model was designed using Smile design pro. Software and Exocad software then fabricated by 3D-printer machine for each investigated group. Condensation putty silicon impression material was applied on the 3D-printed model to fabricate silicon mock-up. **Figure (4)**

Figure (4): Functional and esthetic 3D-design using Intra-oral photo with Retracted view patient#3

3.1.2 Orientation grooves:

Orientation grooves were done on the incisal edge by using round ball-tip diamond stone (head Ø =1.7 mm). Buccal surface was prepared first by orientation grooves using three-wheel stone (depth maker) (head Ø =2.6 mm) then the lingual surface of the tooth, to prevent penetration more than the stone diameter which will standardize the preparation.

3- Prosthetic Phase

3.1 Teeth Preparation

3.1.1. Fabrication of silicon guide index:

The appropriate amount of condensation silicon impression material was mixed and adapted to the designed model in a “horseshoe” shape. The index had a minimum 2mm thickness. The silicone extended 3-4 mm into the vestibular areas. The palatal extension also had 3-4 mm of extension.

3.1.4 Proximal Reduction:

Preparation performed using a fine-tapered diamond stone to open the inter-proximal contact. Then a tapered diamond stone with a

3.1.3. Incisal Preparation:

After making incisal orientation grooves, tapered-stone with round end diamond stone (end Ø =1.1 mm) was placed parallel to the incisal surface with 45^{o} lingually nclination to remove the projections between grooves to achieve 1.5-2 mm .

round end was used to form a deep chamfer finish line with 0.8-1mm thickness.

3.1.5 The buccal and lingual preparation:

After buccal and lingual orientation grooves, the remaining island was reduced till the full depth of pre-marked grooves using round-end tapered diamond stone (end Ø =1.1 mm), to evenly reduction of the labial and lingual surface creating amount of reduction 1mm. Direction of cutting was mesio-distally on 3 plans. Then the preparation was assessed by using the silicon guide index.

3.1.6 Cervical finish line:

The preparations were ended by an equi-gingival deep Chamfer finish-line 0.8-1.0mm thickness by round-end tapered diamond stone. Then ultrasonic scaler tip was used to eliminate enamel lip.

3.1.7 Finishing the Preparation:

All-sharp line angles were rounded using finishing stone to remove points induce stress concentration. Preparation of all teeth was done with same operator for standardization and before proceeding with the following steps checking with silicon guide index to standardize the amount of preparation. Figure (5) & (6)

Figure (5): Finished preparation for patient#1

Figure (6): Finished preparation for patient#3

3.2. Impression:

Retraction cord (size 0, single technique) was used to allow accurate impressions.

Intra oral scanning was used for the final impression for both investigated groups. Insert the scanner into the patient's mouth and gently

move it over the surface area of the teeth. A light source from the scanner is projected onto the dental arch to capture the size and shape of each tooth. and a 3D model created by the software is then shown on the screen. **Figure (7)**

Figure (7): Intra-oral scanning for patient #3

3.3 Temporization:

Silicon mock-up was used to construct provisional restoration. The mock-up was filled with bis-acrylate Resin Composite material and placed on the lubricated teeth of the patients intra-orally. After complete setting of temporary material, the silicon mock-up was removed. Then the temporary restoration was removed for proper finishing and polishing, followed by temporary cementation using non-eugenol, acrylic-urethane polymer based temporary cement

3.4. Designing phase:

3.4.1. 3D-Printed master cast fabrication

Once dental lab. received STL file for the intra-oral digital impression, fabrication of 3D-printed resin master cast was done by using 3d-printer machine.

3.4.2. Crown design:

By using Exocad software, margination was done by automatic margination finder used for detection of the margin then designing the crowns. In accordance with manufacturer's recommendations, the axial wall and incisal thickness was adjusted at 1.5–2 mm, whereas the marginal thickness was adjusted at 0.8–1 mm. The software adjusted the cement gap for both materials to be 60 microns [11].

3.5. Manufacture phase:

3.5.1. Milling machine:

For each investigated group a 5-axis milling machine was used for milling the wax crowns. The wax disc was inserted and fixed into the milling machine; the milling process terminated after 3 minutes for each crown. At the end of milling procedures, crowns were removed from block-holder using diamond - cutting stone. The milled crowns were checked for try-in on the corresponding 3D-printed cast then were checked intra-orally.

For the try-in stage, interm restorations removal was done manually by using excavator then cleaning the all-prepared teeth surfaces was done. Milled wax was initially tried to check marginal adaptation using a sharp-explorer; (from the tooth to the restoration), then checking the shape, contacts, contour and occlusion. Finally, orofacial and dentofacial integration with the lips, cheeks and face were examined.

Since the milled wax can accept modification, any anatomical adjustments were carried out to achieve best functional and esthetic results to be ready for the pressing technique.

To guarantee the ideal wax adaption at the margin, the wax crowns were reflowed entirely through the marginal wax over a band of 1 mm width using a well-heated tool. [12]

3.5.2. Heat-press technique:

a- Spruing:

For both materials spruing was done for each crown as per manufacture's specifications then placed in IPS e.max investment ring system.

b- Investing:

For e.max group, investing using the IPS Press VEST investment material was performed. For Celtra press group, investing carried out using Celtra vest investment material. Powder to liquid ratio was adjusted according manufacture's instructions for each investment material using the supplied measures and handmixed for 15 seconds then the mix was completed under vacuum for 60 sec in Vacuum mixer.

c- Preheating

The ring was left for 30 min to set following the manufacturer instructions. After investment setting, the ring gauge was removed by turning movement from ring base then investment was carefully pushed-out from silicone ring. On the bottom surface of the investment ring rough spots were removed with plaster knife.

The ring was placed with the opening facing downwards in the burnout furnace at the holding temperature of 250° C with a holding time of 45 minutes, the temperature was then increased gradually by 5°C / minute till reaching the final temperature of 850°C for 45 minutes.

d- Pressing:

After complete burn out, investment ring was removed from the burnout furnace then IPS e.max press ingot and Celtra press ingot were immediately inserted into the hot investment ring followed by the Alox plunger. At the center of the hot Programat P3010 furnace the ring was placed. This step took maximum (30seconds) to prevent cooling down of the investment ring. Press program was selected for e.max press and for celtra press.

For both materials the furnace was heated automatically starting from the stand by tempratute to the final programmed press temprature. After holding time, the pressing prcedure was activated following the firing and pressing prameters for IPS e,max Press and Celtra press as supplied by manfacturer.

e- Divesting

For both materials, after cooling of the investment ring to room temperature (60 minute),the length of the plunger was marked on investment ring, seprating disc was utilized to split the investment ring at the pre- determined breaking point.

Regarding IPS e.max crowns, an extra step was done before fine sandblasting to remove the reaction layer by immersing the crowns in Invex liquid and cleaning in ultrasonic cleaner for 10 min. Following complete divesting, sprues were cut off by fine-diamond rotary disc then the attached point of the sprue was removed.

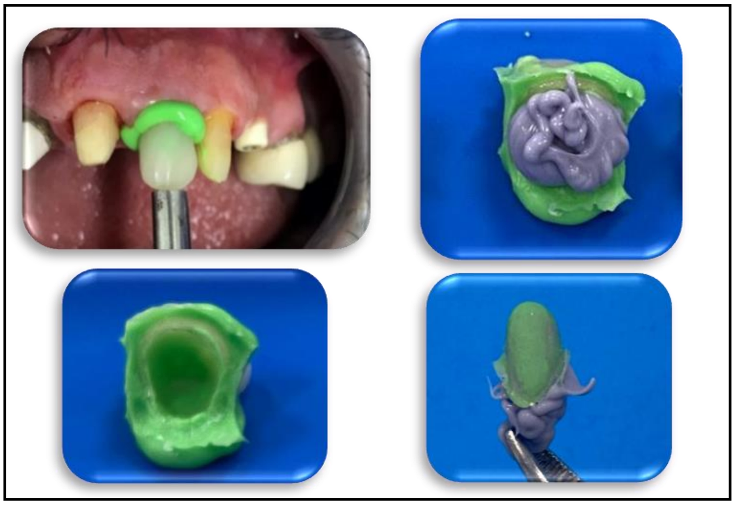
f- Finishing and Polishing:

For both materials, shape and surface texture of the crowns were finished with ceramic diamond polishing kit with low speed and low pressure to avoid overheating then cleaned in ultrasonic cleaner to remove any contaminations.

g- Staining and Glaze:

Staining and Glazing was done until the desired consistency is achieved and then applied on the desired area, then firing was done in the Programat P3010 furnace.

Prior to intra-oral checking, the pressed crowns of both groups were checked on their corresponding casts then all prepared teeth surfaces were cleaned and washed with water. The finished pressed crowns were checked to be ready for measuring internal fit before final cementation.



3.6. Internal fit measurements:

Internal fit between each abutment and its corresponding superstructure of all tested samples were examined using the replica technique. A light body addition silicon was auto-mixed by a gun and applied inside the fitting walls of the crown. Then, it was seated on the abutment for two minutes. till complete setting of light body. After complete setting of light body addition silicon, the crown was removed from the abutment carefully. Then heavy body addition silicon was auto-mixed and injected to fill the inside of the superstructure to support the light body addition silicon replica.

Figure (8) : Silicone replica technique

After setting of the heavy body addition silicone, the silicon assembly was retrieved from each crown and sectioned into two halves bucco-lingually then mesio-distally using blade no 15 to get four sections of replica. Attention was paid so as to achieve equal parts with perpendicular direction to the surface.

From each replica, four sections were taken, two-opposite parts were selected then at 7 regions, internal fit were evaluated on each region (finish line, axial wall and occlusal), yielding 14 internal measurements for each coping. [13]

Using USB digital microscopy with built in camera at ×25 magnification the light-body silicone thickness for all replicas was measured, representing the distance between the internal surface of the coping and the external surface of the preparation.

The gap width was measured and qualitatively evaluated using a digital image analysis system. All limitations, sizes, frames, and measurable parameters are represented in pixels inside the Image J software. In order to transform the pixels into absolute real-international units, system calibration was carried out (i.e., um). In order to calibrate, a known-size object (in this instance, a ruler) was compared to a scale produced by the Image J software.

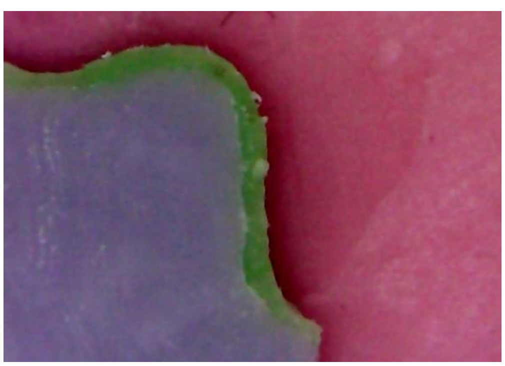


Figure (9) : Mesio-distally sectioned replica for upper left 4 groupI patient #1

Figure (10) : Mesio-distally sectioned replica for upper left 2 groupII patient #3

3.7. Cementation:

All crowns were ultrasonically cleaned for 10 minutes before cementation. A dual cured resin cement with translucent shade was used.

Preparing the crowns for bonding.

- All crowns (e.max press and Celtra press) were prepared following the same protocol as their manufacturer's recommendations:
- The fitting surface of the crowns was etched with a 10% hydrofluoric acid gel for 20 seconds, rinsed with water spray for 60 seconds and thoroughly dried with oil-free air, then cleaned with 37% phosphoric acid for 60 seconds.
- Silane coupling agent was applied to the pre-treated surfaces with a micro-brush and was left 60 seconds to react then, excess was blown with a stream of oil - free air spray.

a. Preparing the teeth for bonding:

- Prepared teeth were conditioned with 37 % phosphoric acid for 30 seconds, then rinsed and dried.
- Bonding agent was applied to the prepared surfaces and was thinned out with gentle air then light cured with 3M light curing unit.

b. Cement phase:

- Self -Etch / Self-adhesive dual cured resin cement with translucent shade was applied following manufacturer's instructions.
- The cement was applied evenly to the surface of the prepared teeth and to the fitting surface of the crowns.

Figure (11): Final e.max crowns after cementation

Figure (12): Final Celtra crowns after cementation

3.8. Postoperative instructions and follow up sessions:

- The patients were instructed to practice good dental hygiene by frequently brushing and flossing with a soft brush and non-abrasive fluoride toothpaste.

RESULTS

Statistical analysis:

Data analysis is presented in terms of mean, standard deviation (SD), median, minimum (min) and maximum (max) values. Data were tested for normality using Shapiro Wilk test and Kolmogrov – Smirnov test. Mann – Whitney U test was used for between – groups comparison. P values ≤ 0.05 are considered to be statistically significant.

Results of Internal Fit:

Regarding the results of internal fit for both groups I (e.max crowns) and II (Celtra crowns), the values of the internal gap width were presented numerically in **Table (1)**

The mean and standard deviation values of the internal gap width were 74.1 (5.4) µm in the Celtra crowns group and 85.3 (21.3) µm in the e.max crowns group. The median and range values of the internal gap width were 73.9 (67.1 – 81.5) µm in the celtra group and 80.6 (64.2 – 138.2) µm in the e.max group.

There was no-significant difference in the values of internal gap width between the two groups. (p = 0.221).

Table (1): Descriptive statistics and the results of Mann – Whitney U test for comparison of internal gap width in µm between the two groups:

	e.max	**Celtra**	***p*-value**
Mean	85.3	74.1	0.221
SD	21.3	5.4	
Median	80.6	73.9	
Min	64.2	67.1	
Max	138.2	81.5	

*Non- significant (p > 0.05) *significant (p < 0.05)

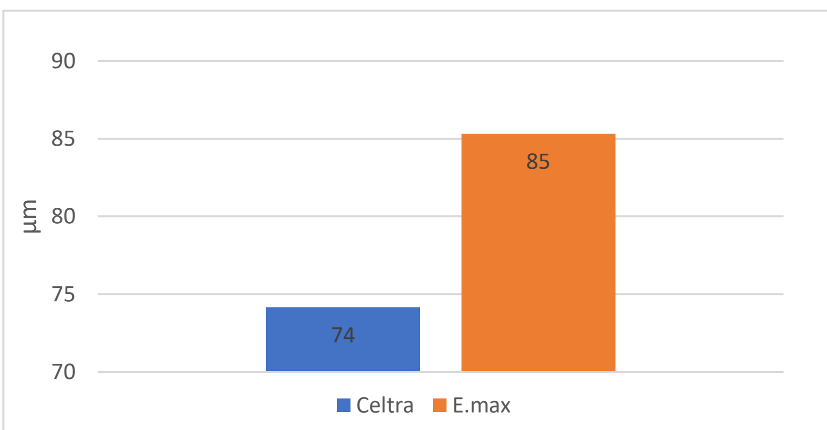


Figure (13): Bar chart representing the mean internal gap width in the two groups.

DISCUSSION

Using of all-ceramic restorations has increased in daily dental fixed treatment as a result of excellent physical and chemical properties as outstanding aesthetics, strength, color stability and biocompatibility. [(14)]

Selection of lithium-disilicate ceramic material (IPS e.max) in this study was based on the fact that, it is one of the most esthetic ceramic materials due to its special microstructure which is the needle-like lithium-disilicate crystals embedded in a glassy matrix; which resulted in reducing internal scattering of the light as it passes through the structure enhancing the optical properties of the material in addition to its chameleon effect characteristics. [(15)]

Azar et al., (2018)[(16)] compared the vertical marginal gap of heat pressed and CAD/CAM lithium- disilicate crowns using an optical microscope. Heat pressed crowns had significantly smaller marginal gaps (38 ± 12 µm) when compared to CAD/CAM crowns (45 ± 12 µm). The use of pressed ceramics has the advantage of decreasing sintering shrinkage volume during firing of ceramic and enhancing the marginal adaption as a result.

Recently, the introduction of the zirconia reinforced lithium-silicate ceramic was claimed by the manufacturer of have superior mechanical and physical properties. Zirconia reinforced lithium-silicate ceramics (Celtra) is a glass ceramic matrix enriched with 10% zirconia by weight. This resulted in a very homogenous dual microstructure that allowed a high flexural strength with proper optical properties. Moreover, excellent esthetics was achieved based on integrated translucency, opalescence and fluorescence [(17)].

Fahmi Y. et al., (2022)[(18)] evaluated the marginal adaptation and internal fit of zirconia reinforced lithium-silicate crowns fabricated with heat pressed (Celtra Press) ingots compared to crowns fabricated with milled (Celtra Duo) blocks. Results revealed that zirconia reinforced lithium silicate crowns constructed by the heat press technique have smaller internal gaps when compared to those fabricated with CAD/CAM technique. Study concluded that heat pressing of zirconia reinforced lithium silicate crowns produced a more favorable internal fit compared to milling technique.

The present clinical study included fabrication of twenty six all-ceramic full coverage crowns using two different ceramic materials: IPS e.max Press and Celtra Press with the same fabrication techniques. All teeth reqruited in the study were in the esthetic zone (anterior teeth , fisrt and second premolars), which are the teeth more visible during smiling in the dental arch and where esthetics play an important role for patient satisfaction with successful restorations. Heat pressing technique was chosen as it has been shown to reduce porosity, greater flexural strength and improved marginal fit. This was in agreement with **El Sayed et al, (2019)** [19] who evaluated the marginal integrity and the fracture resistance of different glass ceramic material (lithium-disilicate e.max and zirconia reinforced lithium-silicate) using different techniques of pressing and CAD/CAM. It was concluded that the pressing techniques presented superior vertical marginal gap distance than CAD/CAM techniques for both ceramics.

Digital scanning was used for all cases in the present study by using MEDIT i500 intra-oral scanner to standardize impression steps and to overcome the problems related to the conventional impression technique, as intraoral scanners were proven to show higher precision and trueness values when compared with the extraoral scanner as reported by **(Sason et al. 2018)** [20]. Intra-oral digital impression for the final preparation facilitates the fabrication of 3d-printed resin master cast by 3D-printer machine then fabrication of digital wax crowns.

Using milled wax patterns enabled standardization in the spacer setting parameter to 60 μm rather than the freehand wax build up with arbitrary spacer thickness application on the die. Milled wax patterns also allowed better marginal and internal fit than conventional wax build up. This was owed to the elimination of dimensional inaccuracies resulting from the release of thermal stresses generated in the pattern during previous heating and cooling of the wax. Moreover, the act of removing a wax pattern from corresponding abutment causes an average 35 μm opening of the margin before investing. This discrepancy was eliminated when wax patterns were milled from CAD wax blanks. [21],[22]

Among the fundamental elements in the effectiveness of restorations; the marginal fit was investigated. A poor marginal fit may result in cement disintegration, marginal discoloration or staining, microleakage, and secondary caries. Additionally, the marginal opening permits more plaque to build up, which can cause gingival inflammatory responses and might result in the soft tissues deteriorating as a result of periodontal disease and bone loss. To reduce the likelihood of these difficulties, it is crucial to reduce marginal gaps. [23] Thus, the assessment of the marginal and internal fit is an important parameter that affect the long-term service of ceramic restorations.

In this study, the marginal gap and internal gap were measured using the silicone replica technique. The silicone replica technique has been widely used for its proven validity as it is a non- invasive method that replicates the complete cement space. Measurements were made without cementation of the crowns on the corresponding abutment in order to be able to solely measure the gap obtained for each ceramic crown.

Since, according to **Schönberger et al., (2017)** **[24]** who compared two measurement protocols (replica and cross section technique) of internal and marginal fit for 3 - unit zirconia FPD, they concluded that the two techniques can be used; however, the non-invasive replica technique is suitable for clinical use.

In the current study the results showed that there was no significant difference in the internal gap width between the two groups. Although zirconia reinforced lithium-silicate crowns constructed with the heat-press technique have measurably smaller internal gaps in compared to those fabricated with lithium-disilicate crowns constructed pressing technique, yet it was statistically insignificant difference.

However, due to the limited sample size and observation time in this study, future clinical studies with larger sample sizes and longer observation times are needed to provide evidence to support the clinical application of both groups.

CONCLUSIONS

1. Both materials zirconia reinforced lithium-silicate and lithium-disilicate crowns are clinically acceptable to be used in the esthetic zone.
2. Heat pressing technique provides proper internal and marginal fit.
3. Zirconia reinforced lithium-silicate crowns, fabricated by heat pressing technique have measurably smaller internal gaps in compared to lithium disilicate crowns fabricated with the heat press technique, yet there was statistically insignificant difference.

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