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Research Article

Comparing Pressable Versus CAD/CAM Endocrown Restorations for Cervical Marginal Gap

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Abstract

Statement of Purpose: Ceramic Endocrown is considered a recent approach to treating endodontically treated teeth with the benefit of reducing the amount of tooth structure loss compared to a classic crown with post and core that requires macro retentive reduction. Therefore, we need to evaluate the fabrication method and the remaining walls of this ceramic endocrown restoration with their effects on the marginal gap.

Purpose: The study aimed to evaluate the cervical marginal gap of pressable versus computer-aided design/manufacturing (CAD / CAM) endocrown restoration.

Materials and Methods: Twenty human intact caries-free mandibular first premolars were collected from orthodontic clinic, The teeth were selected with approximate anatomic crown length, mesiodistal width, and facio-lingual thickness with complete root growth. The buccolingual and mesiodistal dimensions were measured millimeters at the cement-enamel junction level using a digital metal gauge that was accurate to within 0.01 millimeters**.** A total of twenty endocrowns were fabricated for this study. The endocrowns were divided into two main groups (N and O), with ten endocrowns for each group according to the type of preparation design (no wall or one wall). Then each group is divided into two subgroups (C and P), five endocrowns for each subgroup according to the ceramic type (C subgroup = IPS e-max CAD endocrowns and P subgroup = IPS e-max press endocrowns).

Results: One-way ANOVA test results followed by pair-wise Tukey's post-hoc tests revealed that O group C subgroup had the highest marginal gap mean value (54.85 2.5 m), O group P subgroup came in second (52.00 4.3 m), N group P subgroup came in third (49.47 1.3 m), and N group C subgroup had the lowest marginal gap mean value (49.31 5.4 m), both of which were statistically significant.

Clinical Recommendation: The use of endocrown restoration can be recommended in a clinical situation on whether constructed from pressing or CAD/CAM, as both can give comparative results.

Conclusion: We draw the following conclusion, keeping in mind the limitations of this study:

1. The construction technique of endocrown restoration does not affect the marginal adaptation.
2. The remaining tooth structure of endocrown preparation affects the marginal adaptation.

Keywords: *Comparing Pressable; CAD/CAM Endocrown Restorations; Cervical Marginal Gap*

Introduction

Reconstruction of endodontically treated teeth is a significant challenge in reconstructive dentistry because they are more susceptible to biomechanical failure than healthy teeth. The removal of tooth structure during mechanical instrumentation of the root canal preparation, mechanical pressures during obturation, a lack of cuspal protection, and substantial restorations can all result in total or incomplete tooth fractures. When the remaining tooth structures don't provide enough retention for conventional restorations, many treatment options are available [1-3].

To rebuild teeth that have undergone endodontic treatment, posts might be prefabricated, cast, or made of ceramic. A few issues have come to light, including tooth fractures with metallic and ceramic posts and a high incidence of debonding with fiber-reinforced composite posts. Sometimes endodontically treated teeth cannot be restored because there is insufficient interocclusal space [4,5].

Long ago, the Richmond crown was developed to address the issue of inadequate interocclusal space. Due to difficulties, this project was abandoned fast. Although it was preserved, the single-unit repair method is now known as an all-ceramic endocrown [6,7].

Instead of using intra-canalicular posts, the endocrown preparation creates a circular equigingival butt-joint margin and central retention cavity within the whole pulp chamber. The fracture load values of bonded endocrown are comparable to those of traditional crowns. Even with the decreased dental integrity of non-vital teeth, this restorative technique has the ability to deliver enough function and aesthetics that meet clinical standards [8,9].

A study was conducted to assess the therapeutic benefits and development of ceramic endocrowns made with the Cerec 3D technology (Sirona) [10]. Endocrowns were created in a hospital setting and assessed on the day of installation and six months later using the FDI criteria. Each item was given a grade between 1 (good) and 5 (bad). For each review, a total score and scores for appearance, usability, and biological integration were calculated. Except for a single endocrown restoration, the scores throughout the 6-month evaluation were consistently associated with good clinical quality [11].

Since a large marginal aperture encourages increased plaque accumulation, gingival sulcular fluid flow, and bone loss, which in turn results in microleakage, recurrent caries, and periodontal disease, Regarding fixed repairs. marginal adaptation is essential. The imbalance between the cement's polymerization shrinkage stress and its connection to the tooth structure commonly results in marginal gaps

between the tooth structure and luting cement forms. Therefore, a crucial element in attaining clinical success when luting restorative materials is the adaptation and adhesion of the luting cement to the dentin [12,13].

Aim of the Study

This study hypothesized that the instruction technique and remaining tooth structure would mold the marginal gap. Therefore, in this study we aimed to evaluate the cervical marginal gap computer-aided design/manufacturing (CAD /CAM) endocrown restoration.

Materials and Methods

Twenty human intact caries-free mandibular first premolars were collected from the orthodontic clinic. Teeth were selected with approximate anatomic crown length, mesiodistal width, and faciolingual thickness with complete root growth.

Using a digital metal gauge with an accuracy of 0.01 millimeters and a 10% maximum variation from the established mean, the buccolingual and mesiodistal dimensions were measured in millimeters at the level of the cement-enamel junction [8,9].

Before the test, the teeth were washed and kept in distilled water at room temperature from the day after the extraction.

Twenty endocrowns in all were created for this study. The endocrowns were split into two major groups, N (no wall) and O (one wall), with ten endocrowns in each group, depending on the preparation design.

Then, five endocrowns were assigned to each of the two subgroups, C (IPS e-max CAD) and P (IPS e-max press endocrowns), according to the type of ceramic used.

Instrumentation was done using K-files. For each specimen, the working length was established as 1 mm below the apical foramen, using the root surface as the reference point.

After the apical parts of the root canals were extended to a size 40 master file, the canals were flared to size 80 using the step-back technique. A size 10 K-file was inserted into the apical foramen to test the patency of each canal both before and after the root canal preparation was complete.

A 2.5 percent sodium hypochlorite solution was used to irrigate all instrumentation canals. Five canals were first prepared to replace each file with a new one. The root canals were dried with paper points and gutta-percha obdurate before being sealed with eugenol-free sealer and gutta-percha obdurate. A master size 40 gutta percha point that had been softly sealed with the sealer filled the entire working length of the canal (15mm). Each canal was filled with lateral condensation using six sizes of S 25 supplementary gutta-percha cones and an endodontic finger spreader.

A heated tool was used to remove extra gutta-percha, and a size 50 plugger and vertical force were used to compact the gutta-percha in the coronal section of the canal.

To avoid dehydration, teeth were handled with gauze during the treatment and kept in a saline solution between phases.

The acrylic blocks were made using a machine-milled split brass mold that was particularly created. Each mold features a cylindrical chamber with a depth of 30 mm and an interior diameter of 18 mm. With the aid of an external Teflon ring, the broken mold's two parts were put back together. The top of the mold was covered. A rounded 8 mm diameter hole is located in the middle of this cover to guarantee that the root will be centered within the acrylic block.

The long axis of each tooth specimen was vertically mounted in blocks of self-curing polymethylmethacrylate (PMMA) resin. Each tooth specimen was mounted using a paralleling device surveyor, ensuring the specimen was centered and lined up with the mold.

Screws were used to attach the mold to the surveyor's base. A separating agent was used to release the acrylic specimen from the mold. The mold was filled with a fluid mixture of polymethylmethacrylate resin that self-cure. Each tooth sample was secured to the tool's lower tip using an adhesive waxy substance. The tip was lowered to the predetermined depth after that. The Teflon ring and mold pieces were separated following the acrylic block's hardening.

Endocrown preparation

All acrylic blocks were seated in the base of the hard stone to prevent rotation and vibration during preparation.

All teeth are prepared by transverse section, using a disc attached to the milling machine, 3 mm above the highest point of the cemento-enamel junction.

The preparation using a milling machine is done to make endocrown by cylindrical diamond stone[1] to prepare the entire external surface with a finish line 1 mm and make preparation of the retention cavity with a depth of 5 mm.

A two stainless steel mold was constructed of 6 mm internal diameter to fit around the ferrule and 8 mm external diameter to accurately determine the 1 mm finish line around the tooth. After that, the excess width of the finish line was removed using a carbide fissure bur to adjust the finish line width to 1 mm all around the circumference of the tooth one of them with 3 mm height while the other 1.5 mm.

By using the prefabricated small stainless steel 1.5 mm mold to act as a ruler, make a transverse section to the height of 1.5 mm so the retention cavity will be by 3.5 mm (N group).

Then by transverse section above the finish line 1.5 mm by using the prefabricated small stainless steel (1.5 mm) to 3 walls leaving only the buccal wall (O group).

Construction of IPS e-max CAD endocrown

Scanning process

10 samples were chosen, five from each group by random selection, and sprayed with cerec optispray[2] to prepare for optical impression.

Scanning under CEREC In-Lab InEos blue scanner[3] optical camera, which terminated in 2 minutes, the scanned model appeared on the screen and was subsequently rotated on the screen via the menu item (design/insertion axis) and was ready for the design step.

Design process

The design for the restoration used CEREC in Lab machine software as following:

- By creating a new restoration by selecting the icon (new restoration), the following options were selected from the (new) dialog box: Restoration type: crown, design technique: Reduced, and the tooth to be restored was selected.
- The die spacer is selected to be 40 microns, then click ok, and the mouse goes automatically to the Acquire preparation icon.
- Entering the preparation margin is done through automatic margin founding by moving the mouse along the preparation margins.

[1]Intensiv, Grancia, Switzerland.

[2]Sirona, Germany.

[3]Sirona, Germany.

- Calculating and displaying the restoration on the screen and, trimming the preparation, determining insertion axis, scales, and position; tools should be rotated to adjust restoration dimensions by manufacturer specifications.
- Finishing the restoration by clicking the next icon to display a lay simulation of the milling.
- The restoration was checked for any corrections on the outer surface, if necessary, were made with the Drop and Shape free forming tools; any faulty was removed as the mouse takes the shape of the hand and then can be used on the smooth surface locally.

Milling process

the milling procedures started by selecting the block type from the Select box by clicking IPS Emax cad, the block type and size C14 and confirmed by ok.

The chosen ceramic block was placed in the spindle of the milling chamber of the cerec In-Lab system and secured with a set screw to the appropriate size and dimensions.

Closing the milling chamber door and selecting the Mill icon were done after attaching a 1.6 mm cylinder diamond stone to the right side of the chamber and a cone-shaped diamond stone to the left. It took around 15 minutes to finish the milling process for each restoration since the two diamond stones worked together in unison during the shaping process and were generously sprayed with water cooling from two directions. Each tooth in this research underwent the same procedure.

Crystallization process

Checking the crowns and removing the sprues, Select the furnace Programat P310[4]. Make the crystallization and glazing cycle, and it is ready to be tested.

The crystallization firing cycle transforms the microstructure of blue partially crystallized e-max crowns into fully crystallized tooth-colored lithium disilicate crystals at the completion of the fabrication process.

Construction of IPS Emax press endocrown

Fabrication of Emax press is done to the other five prepared teeth from (O group) and five prepared teeth from (N group). Making duplication to the Emax CAD crown ten times by dupliflex[5] duplicating material to standardize the external surface of mandibular first premolar.

Taking impression to the 10 prepared teeth and pouring by dental stone. Pico fit[6] die spacer is done by applying two brushes from the gold and silver to compensate for the 40 microns of e-max CAD crowns.

Heating the wax and pouring it in the duplicated Emax CAD, which previously had to separate the medium. Putting the die inside to the end of the finish line and allowed to set. Then separate the duplicating material into two halves. Check it and make a fine adjustment, especially at the margin.

[4]Ivoclar vivadent, Leichstenstein.

[5]Protechno, spain.

[6]Picofit, Renfert, Germany.

The sprues were inserted in the ceramic flow direction and at the thickest area of the wax-up to aid in the smooth flow of the viscous ceramic during pressing. The investment ring system made of 100g IPS was chosen. When investing, IPS press VEST speed is employed (speed investment), and the appropriate IPS Silicone Ring with the appropriate ring gauge is used.

Once the investment material has been thoroughly mixed, the ring gauge indication on the investment ring is reached, and the investment ring is filled with the investment material, and the ring base is then removed.

The cold IPS Alox Plunger is kept ready for use by being dipped into the plunger separator's aperture. In the furnace, the press is promptly turned on. It is decided to use the IPS e-max press program. Immediately following the preheating cycle, the investment ring is removed from the preheating furnace.

The cold IPS e-max press ingot is inserted into the hot investment ring. The cold IPS Alox plunger side coated with the IPS Alox plunger separator is inserted into the heated investment ring.

The entire investment ring is put into the hot press furnace at EP 3000's program center. Pressing START launches the selected press program. Use the ring holder to remove the investment ring from the press furnace as soon as the press cycle is complete (optical and acoustic signal).

A cooling grid was used to cool the investment ring. The cooled investment ring has a mark indicating the length of the Alox plunger. A separation saw was used to cut the investment ring apart. A plaster knife cut the investment ring at the chosen breaking point.

The white reaction layer can be removed using type 100 AL_2O_3 at a pressure of no more than 1 - 2 bar (15 - 30 psi). Staining and characterization were completed by applying IPS e-max Ceram Glaze and Stain Liquids to the repair surface while using the furnace P 300's fire parameter (Table 1).

Staining technique	B C°/F°	S Min.	T C°/F°/Min	T C°/F°	H Min	V_1 C°/F°	V_2 C°/F°
Stain and characterization firing	403/757	6:00	60/108	770/1418	1:00	450/842	769/1416

Table 1: *Stain and characterization firing.*

As indicated in, glazing is done by mixing IPS Ceram Glaze and Stain Liquids with glazing material (IPS Ceram Glaze Paste or Powder) (Table 2).

Staining technique	B C°/F°	S Min	T C°/F°/Min	T C°/F°	H min	V_1 C°/F°	V_2 C°/F°
Glaze Firing	403/757	6:00	60/108	770/1418	1:00 - 2:00	450/842	769/1416

Table 2: *Glaze firing.*

Without applying any conditioning, all preparations were cleansed with pumice and water. All ceramic restorations had their fitting surfaces etched for a minute with hydrofluoric acid porcelain etch. The restorations were completely cleaned with water for 15 seconds,

followed by an oil and water drying process. After applying the silane coupling agent for one minute, the area was air-dried to allow the solvent to evaporate completely. All endocrown was cemented with Rely X Unicem Aplicap (Self-Adhesive Universal Resin Cement). To ensure that the cement's qualities can be controlled, it is given in a capsule with uniform doses.

Rely X Unicem Aplicap capsule was inserted in the activator[7] and the lever pressed down and held for two seconds. The capsule was mixed in the ProMix[8], at high frequency for 10 seconds. Then inserted in the applier[9] and the nozzle was opened as far as possible. A thin even layer of cement was applied to all internal aspects of the prepared surfaces. The endocrowns were seated with finger pressure, and then a 4 kg weight was applied onto the endocrowns using a specially designed loading device.

The margins were cured for 20 seconds per surface. The endocrowns were left under the loader for 12 minutes (according to manufacturer instructions). The cemented endocrowns were finished with 15 µm diamond burs and polished with a composite finishing and polishing kit[10] in a slow-speed handpiece.

Before testing, the cemented endocrowns were kept in water at 37°C for 24 hours.

Testing procedures

Marginal fit

To help with specimen holding during gap examination, each sample in the two groups had a hole drilled in a specially made device made of wood.

The holding device consists of two components (A-B):

1. A: Rectangular base part that is fixed (10 cm length of 1.2 cm height and 2.3 cm width). On this part, the acrylic resin block will rest.
2. B: Rectangular in design, the upper moving portion (10 cm length of 1.2 cm height and 2.3 cm width). To control the upper portion's ability to compress, this portion is fastened by tightening plastic caps and connected to the base portion by two metallic rods. Additionally, it has a rubber sheet interior to reduce friction that could harm the specimen.

All samples were placed perpendicularly onto a digital microscope at a magnification of X 50 using a costume-made holding mechanism. The photographs were then taken and uploaded to an IBM personal computer outfitted with the Image-tool program.

All restrictions, boundaries, frames, and measurable parameters are expressed in pixels within the Image J software. System calibration was therefore performed to translate the pixels into precise real-world units. To calibrate, a known-size object (in this instance, a ruler) was compared to a scale produced by the Image J program. Then, using Image J software, in order to calculate the gap, which was quantified in the photos of the traced marginal route (um).

Results

Marginal gap

Data analysis was carried out in stages; first, findings of descriptive statistics for each group; analysis of variance using three factors Comparing factors influencing gap mean values was done using the ANOVA test of significance (processing technique, remaining walls,

[7]3M ESPE AG, Dental products D-82229 Seefeld- Germany.

[8]Dentsply Caulk Milford, DE 19963-0359 U.S.A.

[9]3M ESPE AG, Dental products D-82229 Seefeld- Germany.

[10]Soflex pop-on; 3M Dental Products, St. Paul, MN55144-1000. U.S.A.

and cementation). One one-way ANOVA was used to find significance between subgroups, followed by pair-wise Tukey's post-hoc testing. The Windows statistics program Assistant 7.6 was used to conduct the statistical study. In all tests, P values 0.05 are regarded as statistically significant.

Table 3 and 4 summarize the mean values and standard deviation of the marginal gap (m) as a function of the processing method and the remaining walls (Figure 1).

Variable		e-max processing technique	
		CAD	Press
Remaining walls	No wall	49.31 ± 5.4	49.47 ± 1.3
	One wall	54.85 ± 2.5	52.00 ± 4.3

***Table 3**: Results of the marginal gap (Mean values SDs) depending on the processing method, and the remaining walls.*

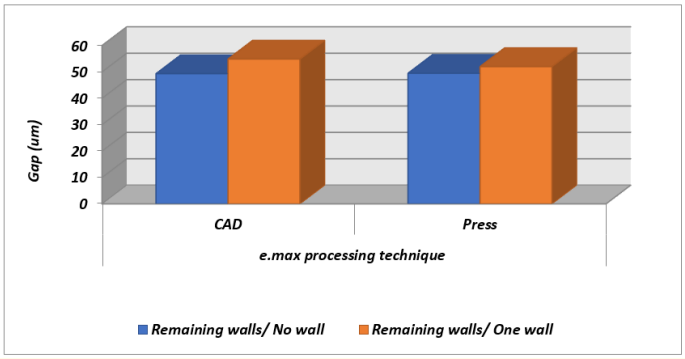

***Figure 1:** Histogram of marginal gap means values as function of processing technique, remaining walls.*

Source of Variation	Df	SS	MS	F	P value
Processing technique	1	9.045125	9.045125	1.041353	0.3227[1]
Remaining walls	1	81.40613	81.40613	9.372175	0.007[2]
Interaction	1	11.32513	11.32513	1.303846	0.2703[3]

***Table 4:** Variance analysis using two factors ANOVA test of significance comparing factors impacting the mean values of the marginal gaps.*

[1]Non-significant (p > 0.05)

[2]Significant (p < 0.05)

[3]Non-significant (p > 0.05).

It was found that O group C subgroup recorded statistically significant (P < 0.05) highest marginal gap mean value (54.85 ± 2.5 µm) followed by O group P subgroup (52.00 ± 4.3 µm) then N group P subgroup (49.47 ± 1.3 µm) while N group C subgroup recorded statistically significant (P < 0.05) lowest marginal gap mean value (49.31 ± 5.4 µm) as indicated by one way ANOVA test.

Pair-wise Tukey's post-hoc test showed that there was no-significant (P > 0.05) difference between (O group C subgroup and O group P subgroup), and (O group P subgroup and N group P subgroup) and (N group C subgroup wall and N group P subgroup) that summarized in table 5 and graphically drawn in figure 2.

Remaining walls	Processing technique	Mean± SDs	Tukey's rank	ANOVA test
One wall	CAD	54.85 ± 2.5	A	P value
	Press	52.00 ± 4.3	AB	0.0002[1]
No wall	Press	49.47 ± 1.3	B	
	CAD	49.31 ± 5.4	B	

Table 5: *Results of the marginal gap as a function of processing method, residual walls, and cementation were graded from higher to lower.*
[1]Significant (p < 0.05).

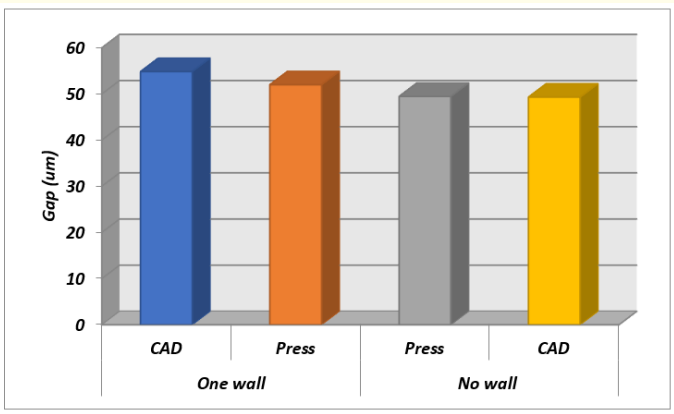

Figure 2: A column chart comparing marginal gap mean values as a function of processing technique and remaining walls ranked from higher to lower.

Effect of processing technique

The results of the two-way ANOVA followed by the pair-wise Tukey's post-hoc test are summarized in table 6 and graphically represented in, which demonstrate that the C subgroup recorded a statistically non-significantly (P > 0.05) higher marginal gap mean value (52.08 2.77 m) than the p subgroup (50.735 1.265 m), despite the presence of other walls (Figure 3).

Variable		Mean	SD	Tukey's rank	Statistics (P value)
Processing technique	CAD	52.08	2.77	A	0.32271[1]
	Press	50.735	1.265	A	

Table 6: *Comparison of the total marginal gap results as a function of processing method (Mean values and SDs).*
[1]Non-significant (p > 0.05).

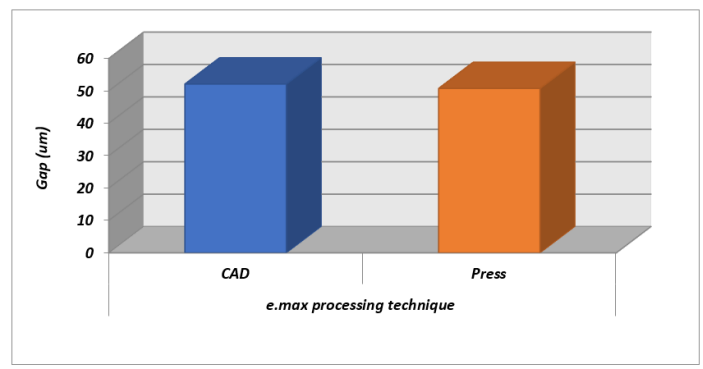

Figure 3: *A column chart of total marginal gap means values as function of processing technique.*

Effect of remaining walls

Regardless of processing method or cementation, two-way ANOVA followed by pair-wise Tukey's post-hoc tests revealed that O group recorded statistically bigger marginal gap mean value (53.425 2.36 m) than N group (49.39 2.026 m) (Table 7 and figure 4).

Variables		Mean	SD	Tukey's rank	Statistics (p value)
Remaining walls	No wall	49.39	2.026	B	< 0.0001[1]
	One wall	53.425	2.36	A	

Table 7: *Comparison between total marginal gap results (Mean values ± SDs) as function of remaining walls.*
[1]Significant (p < 0.05).

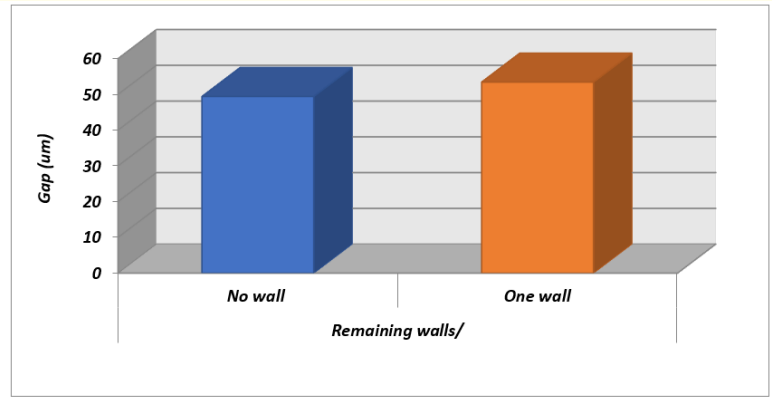

Figure 4: *A column chart of total marginal gap means values as function of remaining walls.*

In figure 5 and 6 shows the marginal adaptation between the material e-max CAD and e-max press.

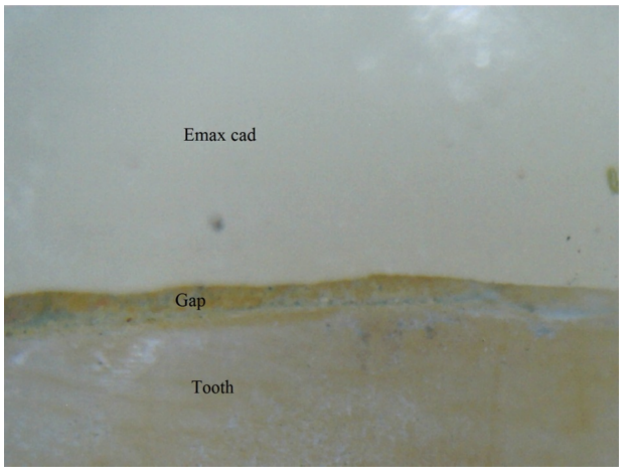

Figure 5: *e-max CAD no wall.*

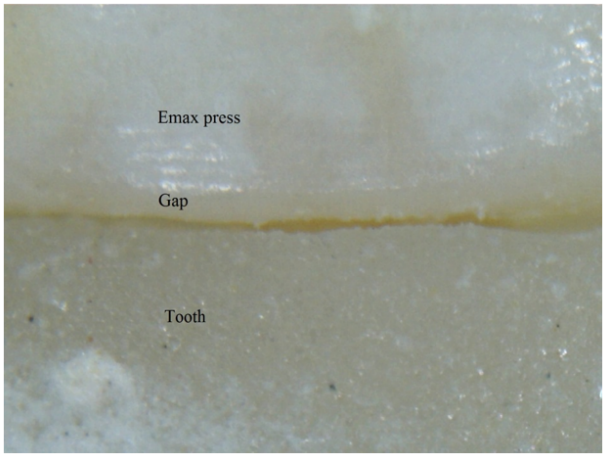

Figure 6: *e-max press no wall.*

Discussion

Repairing teeth that have undergone endodontic therapy is a common problem in reconstructive dentistry. These teeth show a higher risk of biomechanical failure than the necessary teeth [2]. The tooth may become weak and fracture completely or partially due to mechanical root canal preparation, mechanical forces during obturation, a lack of cuspal protection, and large restorations [3]. Posts used to restore teeth after endodontic therapy might be prefabricated, cast, or manufactured of ceramic [5].

Clinical experience has revealed several problems, including debonding [6]. In some instances, the absence of inter-occlusal space renders endodontically treated teeth unable of being repaired [7].

The endocrown closely follows this line of reasoning; rather than using intra-canalicular posts, the preparation consists of a circular equigingival butt-joint margin and central retention cavity spanning the whole pulp chamber [14]. Investigations conducted *in vitro* show that bonded endocrowns have fracture load values comparable to conventional crowns. Numerous clinical case studies have shown how effective this restorative approach is at restoring function and appearance, even when non-vital teeth have compromised tooth integrity [8,9,15,16].

This study's partial acceptance of the idea that building method and residual tooth structure will impact the marginal gap.

Due of their near resemblance in bond, strength, and elasticity to clinical candidates, removed human teeth were chosen over epoxy resin [8].

The decision to focus on endocrown premolars was made since there have been few investigations on premolars compared to molars and centrals [8,9].

Dental prosthetic treatments currently follow principles based on preserving sound tissue that require removal of a minimal amount of tooth structure. Modern adhesive technologies and high strength ceramic materials with enhanced fracture toughness may facilitate development of minimally invasive preparation techniques. The choice of remaining one wall and no wall design is considered a novel approach to endocrown and an interest research point to be investigated [10,11,17-22].

The decision to use a 1.5 mm ferrule length was made in accordance with the findings that teeth with 1.5 and 2 mm ferrules were shown to be much more resistant to preliminary failure than teeth with 0.5 and 1 mm ferrules. The authors came to the conclusion that a post and core retained crown Sorenson and Engelmann should have a minimum ferrule length of 1.5 mm [23,27].

For the press and CAD/CAM technology, IPS e-max uses materials with a high degree of aesthetic appeal and strength. Innovative lithium disilicate glass-ceramic materials with high stability and suitability for single restorations are included in the system [28].

In numerous investigations, the single-visit IPS e-max CAD of CEREC 3D CAD/CAM technology and the multiple visit IPS e-max press of pressed ceramic technique were both used to produce ceramic endodontic crowns [28-31].

In order to provide a more consistent preparation and eliminate human errors and faults as much as possible, the milling machine was employed in this investigation.

In order to increase standardization, the external shape of the e-max press ceramic was made to match anatomically the external surface of the e-max CAD ceramic produced by CAD/CAM.

In this investigation, two die spacer brushes were applied to the press subgroups' dies to make up for the CAD/CAM machine's lack of a die spacer, which is forty microns in diameter compared to the single brush's twenty microns.

To prevent dislodgment as a result of interfacial or cohesive failures, the luting cement must offer a strong binding between the tooth and restoration surfaces, enough elastic modulus, and fracture toughness. To guarantee full seating, be resistant to disintegration in the oral cavity, be tissue-compatible, and exhibit suitable working and setting times, it must have an acceptable film thickness and viscosity [12,13].

Rely X Unicem, a brand-new self-adhesive universal resin cement, was employed in this trial without any conditioning or pre-treatment [12,13]. Self-etching is used when there is more dentin available for bonding, but total etching is used when there is more enamel present because the endocrown has more dentine exposed [32,33].

However, since eugenol has been found to hinder the polymerization of resins, many sealer cements used in endodontic procedures do not contain it. This inhibition can be avoided by using sealers without eugenol [34].

Within the constraints of this investigation, it was discovered that the Press subgroups recorded a statistically non-significant marginal gap mean value with the CAD subgroups, and that this statistically non-significant marginal gap followed the consensus that the margins were acceptable. Marginal fit was unaffected by either the heat press techniques or the CAD cam procedures, according to Guess, Neves, and Vanlioglu, among others [12,13,35].

Additionally, it was discovered that, regardless of processing method, one wall group recorded statistically higher marginal gap mean values than no wall group.

The procedures for pressing in order to give the operator more control during shaping, cutting, and sealing the margins, wax designs are built directly onto the No wall group. In order to ensure perfect replication of minute details, particularly at the margins, the lithium disilicate was further pressed under controlled pressure, temperature, and vacuum.

Contrarily, with computer-milled ceramic restorations, the cutting tool may have a wider diameter than other tooth preparation components, emphasizing the noteworthy distinction between the groups [36].

According to the majority of studies, all ceramic crowns with marginal deviations within the range of 120 um are clinically acceptable in terms of crown longevity. However, portions of the luting agent would be exposed to the effects of the oral environment due to marginal discrepancies or poor marginal adaptation, resulting in a high plaque index [37,38].

Although *in vitro* studies cannot accurately simulate the clinical environment of the oral cavity, they are nonetheless regarded as a suitable tool for group comparisons given the limitations of this study. We advise looking at the ceramic endocrown restoration's fatigue resistance in further research.

Clinical Recommendation

Endocrown restoration can be recommended in clinical situation, whether constructed from pressing or CAD/CAM as both can give comparative results.

Conclusion

Within the limitation of this study, we come to the following conclusion:

1. The construction technique of endocrown restoration does not affect the marginal adaptation.
2. The remaining tooth structure of endocrown preparation affects the marginal adaptation.

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