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Comparison of fit accuracy of pressed lithium disilicate inlays fabricated from wax or resin patterns with conventional and CAD-CAM technologies

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Abstract: STATEMENT OF PROBLEM The use of resin patterns to produce partial coverage restorations is poorly documented. PURPOSE The purpose of this in vitro study was to compare the marginal and internal fit accuracy of lithium disilicate glass-ceramic inlays obtained from wax or resin patterns and fabricated with digital and conventional techniques. MATERIAL AND METHODS A dentoform mandibular first molar was prepared for a mesio-occlusal ceramic inlay. Six groups of 15 inlays were obtained by conventional impression and manual wax (group CICW) or resin patterns (group CICR); conventional impression, laboratory scanning of the stone die, CAD-CAM milled wax (group CIDW), or polymethylmethacrylate (PMMA) blocks (group CIDR); and scanning of the master preparation with an intraoral scanner, CAD-CAM milled wax (group DSDW), or PMMA blocks (DSDR). The same design was applied to produce the wax and PMMA patterns in the last 4 groups. The replica technique was used to measure marginal and internal fit under stereomicroscopy. Mixed-model ANOVA was applied to assess differences according to the techniques, materials, and discrepancy location (=.05). RESULTS The results demonstrated significant effects of the technique (P<.001), material (P=.009), and discrepancy location (P<.001) on fit measurements. Marginal discrepancy was only affected by the technique (P<.001), with the digital approaches yielding the smallest marginal discrepancy (23.5 ±3.6 m), followed by the conventional digital techniques (31.1 ±5.6 m) and finally by the conventional (42.8 ±7.2 m) techniques. Internal fit was significantly influenced only by the material with lower discrepancy in wax (75.2 ±9.0 m) than in resin patterns (84.7 ±15.1 m). The internal discrepancy was significantly larger than the marginal discrepancy in all groups (P<.001). CONCLUSIONS Inlays generated from conventional wax and resin patterns tend to show higher marginal discrepancies than conventional digital and full digital patterns. Wax and resin materials yield similar marginal fit accuracies irrespective of the impression/manufacturing technique. Better internal fit was shown in wax than in resin patterns, regardless of the technique.

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Comparison of fit accuracy of pressed lithium disilicate inlays fabricated from wax or resin patterns with conventional and CAD-CAM technologies

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ABSTRACT

Statement of problem. The use of resin patterns to produce partial coverage restorations is poorly documented.

Purpose. The purpose of this in vitro study was to compare the marginal and internal fit accuracy of lithium disilicate glass-ceramic inlays obtained from wax or resin patterns fabricated with digital and conventional techniques.

Material and methods. A dentoform mandibular first molar was prepared for a mesio-occlusal ceramic inlay. Six groups of 15 inlays were obtained by conventional impression and manual wax (Group CICW) or resin patterns (Group CICR); conventional impression, laboratory scanning of the stone die, CAD-CAM milled wax (Group CIDW) or polymethylmethacrylate (PMMA) blocks (Group CIDR); and scanning of the master preparation with an intraoral scanner, CAD-CAM milled wax (Group DIDW) or PMMA blocks (DIDR). The same design was used to produce the wax and PMMA patterns in the last 4 groups. The replica technique was used to measure marginal and internal fit under stereomicroscopy. Mixed-model ANOVA was applied to assess differences according to the techniques, materials, and discrepancy location (α=.05).

Results. The results demonstrated significant effects of the technique (*P*<.001), material (*P*=.009), and discrepancy location (*P*<.001) on fit measurements. Marginal discrepancy was only affected by the technique (*P*<.001), with the digital approaches yielding the smallest marginal discrepancy (23.5 ±3.6 µm) followed by the conventional-digital (31.1 ±5.6 µm) and finally by the conventional (42.8 ±7.2 µm) techniques. Internal fit was significantly influenced only by the material with lower discrepancy in wax (75.2 ±9.0 µm) than in resin patterns (84.7

±15.1 μm). The internal discrepancy was significantly larger than the marginal discrepancy in all groups (*P*<.001).

Conclusions. Inlays generated from conventional wax and resin patterns tend to show higher marginal discrepancies than conventional-digital and full digital patterns. Wax and resin materials yield similar marginal fit accuracies irrespective of the impression/manufacturing technique. Better internal fit was shown in wax than in resin patterns regardless of the technique.

CLINICAL IMPLICATIONS

In-office and laboratory digital technologies are likely to improve marginal fit accuracy of heat-pressed inlays when compared with the conventional workflow.

INTRODUCTION

Synthetic lithium disilicate glass-matrix ceramics have gained popularity because of their excellent esthetic and mechanical properties.[1,2] IPS e.max lithium disilicate (Ivoclar Vivadent AG) restorations can be fabricated by using either computer-aided design and computer-aided manufacture (CAD-CAM) procedures (IPS e.max CAD) or the lost-wax techniques (IPS e.max Press).[3] The overall consensus is that pressed restorations tend to have significantly better marginal fit accuracy that those milled from lithium disilicate blocks.[3]

The patterns used to generate pressed restorations are conventionally fabricated with wax shaped by laboratory technicians. This technique offers the advantages of convenient and precise laboratory handling.[4] However, it is time-consuming, technique-sensitive and has several drawbacks related to wax thermal sensitivity, high coefficient of thermal expansion,[4,5] and distortion during removal from the stone die.[6,7] CAD-CAM systems allow the fabrication of wax patterns by milling solid blanks through direct or indirect scanning of the preparation.[8] When e.max Press partial coverage restorations are considered,[9-17] only 1 investigation[16] has compared the adaptation of inlays produced from wax patterns fabricated by conventional waxing or CAD-CAM systems. The authors concluded that the subtractive waxing technique resulted in improved marginal and internal fit accuracy compared with conventional wax pattern fabrication.

Resinous materials have been proposed as an alternative to wax in conventionally or digitally produced patterns for e.max Press onlays.[17] The authors are unaware of current ~~information~~ studies ~~relative to~~ evaluating pressed inlays obtained from resin patterns or ~~by~~ comparingwax versus resin materials in conventional or subtractive manufacturing.

Kommentiert [A1]: The sentence should read: The authors are unaware of current studies evaluating pressed inlays obtained from resin patterns or comparing wax versus resin materials in conventional or subtractive manufacturing.

The purpose of this in vitro study was to compare the marginal and internal fit of pressed inlays obtained from patterns fabricated by using 6 combinations of techniques and materials: conventional impression and laboratory wax (CICW) or resin patterns (CICR); conventional impression, laboratory scanning of the stone die and milling of wax blanks (Group CIDW) or polymethylmethacrylate (PMMA) blocks (Group CIDR); digital intraoral impression and milling of wax blanks (Group DIDW) or PMMA blocks (DIDR). The null hypothesis was that marginal and internal fits would be similar among techniques and materials.

MATERIAL AND METHODS

A typodont (Dentoform M-860; Columbia Dentoform mandibular right first molar was prepared for a ceramic class II mesio-occlusal inlay with diamond rotary instruments (Experten-Set 4562S Keramik-Inlays; Brasseler, GmbH). The preparation design included a 2.5-mm-deep occlusal box, an isthmus width of 3 mm, and a convergence angle of approximately 8 degrees. The proximal gingival margin was located 1.5 mm above the cemento-enamel junction. The

Kommentiert [A2]: The sentence should read: 3 mm, and a convergence angle of approximately …….

occlusogingival dimension of the proximal box was 4 mm. All internal angles were slightly rounded (Fig. 1). The preparation was done freehand, and the vertical walls were adjusted with a surveyor (Kavo EWL, Type 990; Kavo).

Six groups of 15 inlays each were produced according to the experimental design shown in Figure 2. Thirty partial custom trays (Schellack Basisplaten; Cavex) with occlusal rests were fabricated on the cast obtained from an irreversible hydrocolloid impression of the right quadrant of the typodont. Thirty master impressions were made with light- and heavy-body polyvinyl siloxane (PVS) (Hydrorise; Zhermach) at a room temperature ranging between 20°C and 22°C[18] by the same prosthodontist (F.H.). The casts were poured in Type IV stone (Resinrock; Whip Mix Corp) under standardized conditions. Die spacer was not used.[19] Two layers of hardener (Die:master duo; Renfert GmbH) were applied on all dies,[16,20] and 2 to 4 layers of liquid separator (Kefoil; Keystone Industries) were added on the resin-dedicated dies. Fifteen wax and 15 resin (Pattern Resin LS; GC) patterns were fabricated. The resin patterns were made by using the bead-brush technique and were removed from the dies 20 minutes after the last bead addition.[21] When fracture of the resin pattern occurred during removal from the die, a new impression was made and a new die with a new pattern prepared. All patterns were invested in a phosphate-bonded investment (Xpand; Dentify GmbH) immediately after removal from the dies[22] and pressed according to the manufacturer's recommendations (groups CICW and CICR). The intaglios were airborne-particle abraded with 100-µm aluminum oxide particles at 0.5 MPa.[12]

One conventional PVS impression of the prepared tooth was made and poured with Type IV gypsum. The stone die was scanned with a laboratory scanner (Ceramill Map400; Amann Girrbach GmbH). The inlay was designed with the Ceramill software (Ceramill Mind v2.7.05;

Amann Girrbach GmbH). The marginal discrepancy was set at 0 µm and the margin thickness at 0.2 mm. The simulated die spacer was programmed at 30 µm,[23] starting 1 mm away from the margin. This same design was used to mill 15 wax blocks (Ceramill Wax; Amann Girrbach) and 15 PMMA blanks (Ceramill PMMA; Amann Girrbach) with a 5-axis milling machine (Ceramill Motion 2; Amann Girrbach). Fifteen e.max Press inlays were obtained from the wax patterns (group CIDW) and 15 from the PMMA patterns (group CIDR).

The master tooth was scanned with an intraoral scanner (Trios; 3shape), and the standard tessellation language (STL) file produced was exported to the laboratory. The inlay was designed with Ceramill software by using the same settings. The same design was applied to produce 15 wax and 15 PMMA patterns with the Ceramill 5-axis milling machine and subsequently the corresponding 15 pressed inlays of the group DIDW (wax) and 15 of the group DIDR (PMMA).

Tungsten carbide rotary instruments of 1.4-, 1.8-, and 2.5-mm diameter (Amann Girrbach) were used for the 4 groups CIDW, CIDR, DIDW, and DIDR. One set of rotary instruments was used for the 30 wax patterns and 2 sets for the 30 PMMA patterns. Wax patterns were dry milled while PMMA patterns were wet milled.

All patterns obtained with CAD-CAM were invested and finished in the same way as the hand-formed specimens. All inlays in the 6 groups were transferred to the master preparation, and their intaglios slightly adjusted with water-cooled diamond rotary instruments (Set 4562; Brasseler GmbH) after locating the points of contact with an elastomeric paste (Fit Checker II; GC).[24] These adjustments were required for accurate seating of most inlays due to the complex geometry and the large number of angles inherent in this type of restoration.[24] The adjustments were limited to the occlusal axial walls.

Replicas of the space between the inner surface of the inlay and the cavity surfaces were made[25-28] by coating the cavity walls with a thin layer of light-body silicone material (Hydrorise; Zhermach), after which the inlay was placed in the preparation. A metal weight of 39.2 N[29] was placed on the upper surface of a vertically sliding platform positioned on top of the master tooth until the impression material had fully polymerized. After excess removal, the inlay was removed, and the thin film of light-body material adhering to the master tooth was stabilized by injecting a medium-body material (Elite HD; Zhermach) onto it. If defects or tears in the silicone film occurred, the replica was discarded, and the procedure repeated.

The replicas were sectioned with a scalpel in 2 directions, buccolingually (5 sections) and mesiodistally (3 sections) according to a previously described technique to ensure accurate and reproducible sectioning of the replicas.[16] The middle sections passed through the center of the restorations while the adjacent cuts were made at 1-mm intervals. Each of the 5 buccolingual (BL) sections enabled 7 measurements (Fig. 3A), whereas each of the 3 mesiodistal (MD) sections allowed 10 measurements (Fig. 3B). In each specimen, 65 measurements were evaluated,[30] totaling 975 per group and 5850 for the entire study sample. The marginal and internal fits were assessed under stereomicroscopy (Amscope 3.5) at ×40 magnification (Fig. 4).

Discrepancy measurements according to Holmes et al[31] were recorded in 9 locations (Fig. 4). Marginal fit was calculated as the average of the discrepancy measurements in locations A1 and A2, and internal fit was expressed as the mean of locations A3 to A9. All measurements were performed by 1 calibrated prosthodontist blinded to the study objectives. Intraobserver reliability was calculated by measuring the discrepancy at 17 points on 3 inlays at 10 different instances with an interval of 3 days between assessments. High intraobserver agreement (.987) was calculated by using the intraclass correlation coefficient test.

Kommentiert [A3]: Add initials if an author
The calibrated prosthodontist is not an author.

Descriptive statistics were obtained for the outcome measurements (marginal and internal fit) in the 6 groups. Mixed-model ANOVA was used for multiple comparisons and interaction among the explanatory variables with the impression/manufacturing technique (conventional versus conventional-digital versus digital) and material used (wax versus resin) as the between-subject effect and discrepancy location (marginal versus internal) as the within-subject effect. Effect size (partial eta square) and observed power were estimated for each effect, where the minimal partial eta square observed was .022 and the largest .936, with an observed power of .210 to .999. Two additional mixed ANOVA analyses were run separately for internal and marginal discrepancies. The Mauchly test indicated that the assumption of sphericity had been violated (X2=2951.6; df=1175; *P*<.001) for the internal and (X2=353.5; df=119; *P*<.001) for the marginal; therefore, degrees of freedom were corrected by using the Greenhouse-Geisser estimates of sphericity. Statistical significance was set at α=.05. The data were analyzed with statistical software (IBM SPSS Statistics v20; IBM Corp).

RESULTS

A summary of marginal and internal fit measurements per group are presented in Table 1. The mixed-model ANOVA showed significant effects of technique (*P*<.001), material (*P*=.009), and discrepancy location (*P*<.001) on discrepancy measurements (Table 2). The interaction technique/material was not significant (*P*=.389), indicating independent effects of technique and material on discrepancy measurements. Significant interactions were observed between technique and discrepancy location, F (2,84)=9.205 (*P*<.001) and between material and discrepancy location, F(1,84)=16.342 (*P*<.001) (Table 2).

When marginal and internal discrepancies were considered separately (Table 3), mixed model ANOVA showed that the marginal discrepancy was only affected by the technique (*P*<.001) and not by the material (*P*=.223). The digital approaches yielded the smallest marginal discrepancy (23.5 ±3.6 µm), followed by the conventional-digital (31.1 ±5.6 µm) and finally by the conventional (42.8 ±7.2 µm) techniques. Conversely, the internal fit was only influenced by the material (*P*<.001) with lower discrepancy in wax (75.2 ±9.0 µm) when compared with resin (84.7 ±15.1 µm).

Significant differences were found between marginal and internal fit in all 6 groups (Table 4), with the marginal discrepancy being smaller than the internal discrepancy (*P*<.001).

DISCUSSION

The purpose of the present study was to compare the marginal and internal fit of e.max Press inlays from conventionally fabricated and machine-milled wax and resin patterns. The results supported rejection of the null hypothesis that no differences would be found in marginal and internal fits among the inlays fabricated by using different techniques and materials.

The impression/manufacturing technique of the inlay patterns had a significant impact on the overall discrepancy and more specifically on the marginal fit. The greatest marginal discrepancies were observed in the conventional groups (CICW and CICR) while the fully digital inlay groups (DIDW and DIDR) showed the lowest discrepancies regardless of the material. Only 2 studies have reported similar comparisons for e.max Press single crowns[32] and inlays[16] and concluded that the CAD-CAM waxing technique improved the marginal fit of pressed restorations compared with that of conventional wax pattern fabrication.

Similar marginal fit accuracies were demonstrated between wax and resin patterns for any given technique. Inlay wax and autopolymerized resin patterns have been compared in 2 studies.[23,33] Both investigations concluded that inlay wax showed significantly greater marginal discrepancy than resin at 1 hour and 24 hours after fabrication. Such discrepancies can be attributed to differences in pattern morphology and dimensions, resin type, time elapsed between fabrication and assessment, storage time and conditions, comparison of raw patterns versus cast/pressed restorations, and fabrication technique of the pattern (bulk versus incremental).

When internal discrepancy was considered, the different impression/manufacturing techniques yielded similar results. The internal fit was however significantly affected by the material with the inlays generated from resin patterns showing greater discrepancies (84.7 ±15.1 µm) than wax patterns (75.2 ±9.6 µm). In the conventional approach, this difference can be attributed to the use of separating medium on the stone dies to facilitate removal of the resin patterns. Such separator was not used for the wax where only a die hardener was applied. It is possible that the separating liquid tended to accumulate in the internal angles of the inlays, resulting in layers of unequal thickness and therefore greater internal discrepancies. In the conventional-digital and fully digital techniques, the internal discrepancies were still larger with resin than with wax. Milling accuracy might have been affected by material hardness with chipping of the inner surface of the harder resin patterns during cutting.[34] It is also possible that the wet milling of resin resulted in an undesired residue and subsequently poorer internal fit.[35]

The marginal discrepancy was significantly lower than the internal discrepancy for all techniques and materials. One single study[16] reported similar findings. A possible explanation for this difference in the digital and conventional-digital groups is the geometrical complexity of the inlay preparation resulting in reduced scanning efficiency.[36] In addition, the relatively large diameter of the smallest tungsten carbide rotary instrument (1.4 mm) might have resulted in unwanted removal of material during milling of the restricted proximal box. In the conventional workflow, lower wax wettability in multi-angled surfaces and distortion of the wax patterns during removal from the die might have led to larger internal discrepancies.

Different methods for measuring fit accuracy have been reported including the direct view technique, 3D laser scanner, cross-sectioning, profilometry, weight technique, replica and microcomputed tomography (micro-CT). There is no consensus on which is the best nondestructive method for fit assessment of indirect restorations. The replica is one of the most commonly used methods to assess both marginal and internal discrepancies[25] and has been shown to yield fit accuracy values that strongly correlate with those of micro-CT.[37]

In the present study, care was taken to optimize the replicas quality and to use a large number of measuring points (65) exceeding that recommended by Groten et al[30] (50) to produce clinically relevant discrepancy measurements. In addition, the implemented experimental design limited the assessment of fit differences between groups to the material and fabrication technique by eliminating potential errors associated with repeated conventional impressions or digital scans.[16]

A limitation of this study is impression polymerization at room temperature.[18] The shrinkage of impression materials caused by cooling from mouth temperature (37°C) to room temperature (23°C) averaged 40 µm in a simplified experimental model[18] where teeth were represented as cylinders and with trays allowing a uniform thickness of the impression materials. The inlay preparations in the present study have a more complex geometry and the custom trays used had different thicknesses of the impression material across the restoration. Therefore, the amount and direction of shrinkage in the present study are difficult to assess based on the figures reported by Kim et al[18] and the fit accuracy values were therefore not adjusted accordingly.

The results of the present study demonstrate that wax is preferable overall to resin in the fabrication of inlay patterns. Despite the internal strains that develop within wax,[22] distortion of the wax patterns was minimal under the study conditions resulting in low discrepancies. It should be emphasized that although the internal discrepancies associated with resin were statistically greater than wax, the differences can be considered negligible at the clinical level. Other considerations may orient laboratory technicians to choose wax rather than resin to generate inlay patterns. Wax is more economical, easier to manipulate in the conventional approach, and requires less frequent replacement of the cutting rotary instruments in the subtractive techniques.

CONCLUSIONS

Within the limitations of this in vitro study, the following conclusions were drawn:

1. Fit accuracy of e.max Press inlays fabricated with conventional, conventional-digital and full digital approaches with wax or resin materials had clinically acceptable ranges;
2. The best fit accuracy was demonstrated with the digital approaches followed by the conventional-digital and conventional methods;
3. Marginal discrepancies were significantly affected by the impression/manufacturing technique but not by the material;
4. The internal fit was significantly greater with resin regardless of the technique.

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TABLES

Table 1. Descriptive statistics of marginal and internal fit by group

	Marginal Fit				Internal Fit			
			95% CI				95% CI	
	Mean ±SD (µm)	Range (µm)	Lower Bound	Upper Bound	Mean ±SD (µm)	Range (µm)	Lower Bound	Upper Bound
Group CICW (n=15)	41.5 ±6.6	31-54	37.9	45.2	76.7 ±13.3	58-95	69.3	84.1
Group CICR (n=15)	44.0 ±7.7	29-58	39.7	48.3	87.4 ±20.8	56-127	75.9	99.0
Group CIDW (n=15)	33.7 ±5.3	26-42	30.7	36.7	75.6 ±7.4	62-87	71.5	79.7
Group CIDR (n=15)	28.6 ±4.9	19-34	25.9	31.3	88.6 ±10.0	75-104	83.1	94.2
Group DIDW (n=15)	24.3 ±2.9	21-30	22.7	25.9	73.3 ±7.2	62-89	69.3	77.3
Group DIDR (n=15)	22.7 ±4.2	16-30	20.4	25.0	77.9 ±10.5	56-98	72.1	83.7

SD, standard deviation; CI, confidence interval; CICW, conventional impression and conventional wax; CICR, conventional impression and conventional resin; CIDW, conventional impression and digital wax; CIDR, conventional impression and digital PMMA; DIDW, digital impression and digital wax; DIDR, digital impression and digital PMMA.

Table 2. Results of mixed-model ANOVA

	Type III Sum of Squares	*df*	Mean Square	F	*P*	Partial Eta Square	Observed Power
Technique (conventional versus conventional-digital versus digital)	2487.963	2	1243.981	24.251	<.001	.366	.999
Material (wax versus resin)	366.386	1	366.386	7.143	.009	.078	.752
Discrepancy location* (marginal versus internal)	101433.797	1	101433.797	1235.474	<.001	.936	.999
Interaction technique/material	97.837	2	48.919	0.954	.389	.022	.210
Interaction technique/discrepancy location*	1511.419	2	755.710	9.205	<.001	.180	.973
Interaction material/discrepancy location*	1341.681	1	1341.681	16.342	<.001	.163	.979
Interaction technique/material/discrepancy location	303.183	2	151.592	1.846	.164	.042	.375

* Greenhouse-Geisser corrected values

Table 3. Results of mixed-model ANOVA considered separately for marginal and internal discrepancies

	Type III Sum of Squares	*df*	Mean Square	F	*P*	Partial Eta Square	Observed Power
Marginal discrepancy							
Technique (conventional versus conventional-digital versus digital)	5656.998	2	2828.499	93.311	<.001	.690	.999
Material (wax versus resin)	45.689	1	45.689	1.507	.223	.018	.229
Interaction technique/material	213.453	2	106.727	3.521	.034	.077	.641
Internal discrepancy							
Technique (conventional versus conventional-digital versus digital)	734.44	2	367.22	2.365	.100	.054	.466
Material (wax versus resin)	2093.641	1	2093.641	13.485	<.001	.140	.952
Interaction technique/material	236.76	2	118.38	0.762	.470	.018	.176

Table 4. Comparison between marginal and internal discrepancies by group

Group	Mean Difference (µm)	*P* (2-tailed)	95% CI of the Difference Lower Bound	Upper Bound
CICW (n=15)	35.1	<.001	27.2	43.1
CICR (n=15)	43.4	<.001	32.7	54.2
CIDW (n=15)	41.9	<.001	37.1	46.8
CIDR (n=15)	60.1	<.001	54.2	65.9
DIDW (n=15)	49.0	<.001	44.8	53.1
DIDR (n=15)	55.2	<.001	49.3	61.1

CI, confidence interval; CICW, conventional impression and conventional wax; CICR, conventional impression and conventional resin pattern; CIDW, conventional impression and digital wax; CIDR, conventional impression and digital PMMA; DIDW, digital impression and digital wax; DIDR, digital impression and digital PMMA.

FIGURES

Figure 1. Typodont mandibular first molar with class II mesio-occlusal inlay preparation.

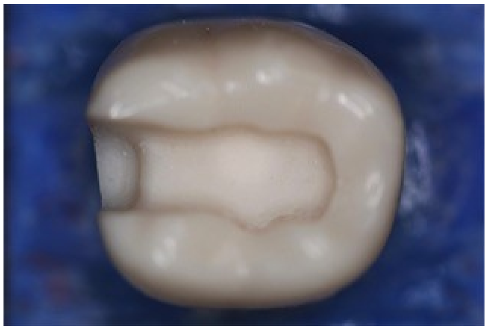
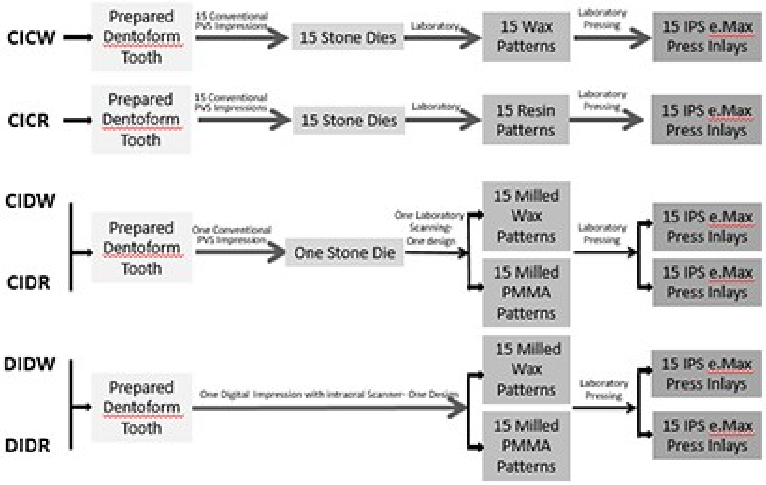


Figure 2. Experimental design.



CICW, conventional impression and conventional wax; CICR, conventional impression and resin pattern; CIDW, conventional impression and digital wax; CIDR, conventional impression and digital PMMA; DIDW, digital impression and digital wax; DIDR, digital impression and digital PMMA; PVS, polyvinyl siloxane

Figure 3. A, Typodont molar sectioned buccolingually with 7 measurement locations. B, Nine landmarks in mesiodistal sections.

A(value), measurement location.

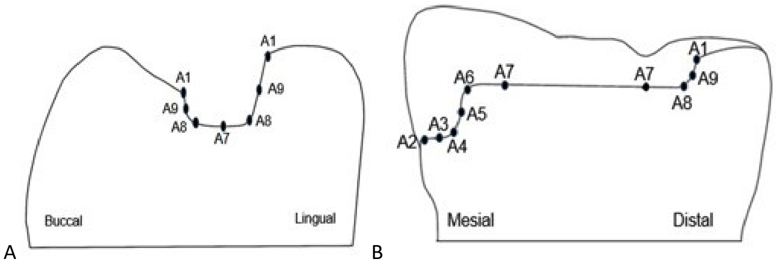
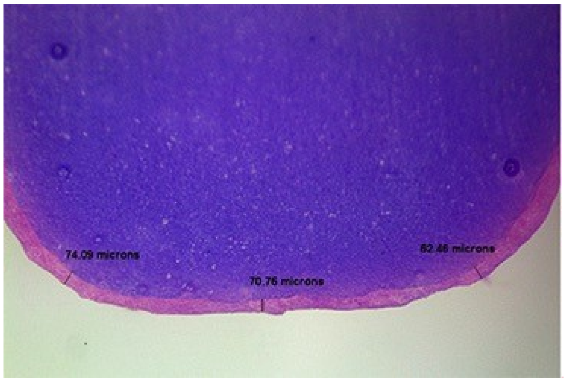


Figure 4. Stereomicroscopic view of buccolingual replica section with internal discrepancy in pink. The blue color corresponds to medium-body material used to stabilize the thin replica film. Original magnification ×???40

Kommentiert [A4]: Add magnification
Magnification x40 was added.



Kommentiert [A5]: Change microns to µm. Use one digit after decimal point
The modifications have been implemented and the revised figure uploaded.