Research Article

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Effect of Finish Lines Types (Shoulder & Chamfer) on Marginal Adaptation of Provisional Crowns

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ABSTRACT

Background: Biologically acceptable fixed prosthodontics treatment demands that prepared teeth be protected and stabilized with provisional restoration that resembles the form and function of planned definitive treatment.

Aims and objective: The aim of study was to evaluate the effect of two different types of finish lines on marginal accuracy of provisional crowns made from bis-acryl composite resin provisional restorative materials using direct technique of fabrication.

Material and method: A total of 48 provisional restorations were made using bis-acryl composite resin provisional restorative materials, 24 specimens for each type of finish lines (shoulder and chamfer) using direct technique. Two artificial maxillary right first molar ivorine tooth were prepared for complete crown restoration, one with a 1 mm chamfer finish line and other with 1 mm shoulder finish lines and a taper of approximately 5 degrees and then casted in non precious Ni-Cr alloy and 1 vertical reference line was marked at the midpoint of metal die finish line, each on mesial, distal, buccal and palatal sides. The provisional restorations were fabricated using bis-acryl composite resin on this metal die with a vinyl polysiloxane impression as matrix. The marginal discrepancies were measured using stereomicroscope at 30X magnification using Image J software.

Results: No statistically significant difference was found between the adaptation of the temporary of the chamfer and shoulder type finish lines, although the marginal gap of the chamfer type finish lines increased from day 1 to day 7, this increase was not statistically significant. No statistically significant difference was found between the specimens of the shoulder type finish lines evaluated immediately after seating and those evaluated, after 1 or 7 days storage in a water bath. However, a significantly higher degree of marginal discrepancy was observed in the specimen stored 7 days as compared to those stored 1 day.

Conclusion: The type of finish lines may have a period influence on the marginal adaptation of temporary crowns.

Keywords: Temporary crowns, Marginal accuracy, Finish line, Stereomicroscopy.

INTRODUCTION

The requirements of satisfactory provisional restoration should be same as definitive prosthesis in all aspects except for the materials from which they are fabricated.[1] A well made provisional fixed partial denture should provide a preview of future prosthesis and enhance the health of the abutment and periodontium. Interim treatment promotes numerous adjunct benefits to the definitive prosthodontic treatment. The marginal fit of temporary crown should be just as precise as that of the final restoration.[2,3,4] Poor marginal fit allows passage of fluids and bacteria into the gap and may predispose the tooth to caries or pulpitis. In

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addition, poorly adapted interim restorations cause mechanical irritation to surrounding tissues and enhance plaque accumulation with subsequent periodontal problems.

Provisional restorations can be done either using prefabricated shells or it can be custom made (direct, indirect, indirect-direct technique). Amongst these techniques the direct technique is preferred by most of the clinicians because of ease of fabrication and shortened chairside time despite of superior performance of indirect technique.[5,6]

Even though there is no ideal provisional material and technique that meets all the clinical requirements. Most of the studies have been done to compare the marginal accuracy of auto polymerising acrylic resin with that of bis-acryl composites resins and found that the bis-acryl materials were significantly superior to polymethylmethacrylate.[5] Studies evaluating the effect of finish lines on marginal adaptations of provisional crowns are scarce in the available dental literature. So an invitro study was planned to evaluate the effect of two different types of finish lines on marginal adaption of provisional crowns made of bis-acryl composite resin provisional restorative materials fabricated by direct technique.

MATRIALS AND METHODS

Two artificial maxillary right first molar ivorine tooth were prepared for complete crown restoration, one with a 1 mm chamfer finish line and other with 1 mm shoulder finish line and a taper of approximately 5 degrees(photo 1&2). An impression of the prepared tooth was made using a light-bodied vinyl polysiloxane impression material (Aquasil LV, DENTSPLY Caulk, USA) which acted as mold, into which melted Type II inlay wax, (MDM. Corp.) was poured. Casting was done using non precious alloy with composition Ni 65.2%, Cr 22.5% and Mo 9.5% (Bellabond Plus, BEGO, Germany). One vertical reference line was scored on the finished metal die to act as a reference point for measurement of mesial, distal, buccal, and palatal sides using a diamond point so that the measurements made were consistent for each of the specimens.

Both the metal dies, one with chamfer finish line and other with shoulder finish lines were mounted in two separate metal boxes of dimensions 3x3x2.5 cms and acted as base box (photo 3) and another one metal box of dimensions 3.5x3.5x4.5 cms with five holes on each side acted as top box and was used as impression tray. A satisfactory seating of metal top box over smaller box without rotation was assured by indexing both boxes. The metal dies of prepared tooth were first mounted in autopolymerising clear acrylic resin [RR Cold Cure, DPI,India] in the form of cylinder and then this cylinder was mounted in base metal box using type III dental stone (Goldstone, Asian chemicals, Gujarat)

Wax pattern for crown was fabricated on metal dies with different finish lines using Dip wax technique (Type II inlay wax (ADA Sp No. 4) [MDM. Corp.]) For making of the impression of the wax pattern, a putty type vinyl polysiloxane impression material was loaded into the top box which acts as impression tray. This impression served as matrix for making provisional restorations. The matrix filled with Bis-acryl composite resin (Integrity, DENTSPLY Caulk, 38 West Clark Avenue Milford, DE 19963 USA) was then seated on metal die. Before complete polymerization, matrix was removed, excess flash was trimmed with scissors and then allowed to polymerize. The impression matrix was secured over the metal die using orthodontic elastic band (diameter 5/16 inch, Green colour) [Tru-Force Latex (T P Orthodontics, Inc, La Porte, Indiana USA)] during polymerization to exert equal force on all the specimens.

After polymerization, the gingival margins of all provisional restorations were trimmed precisely under 10X magnification using an acrylic bur and a slow speed handpiece micromotor (Marathon handy, No. 701, Korea)

For each finish line types 3 groups were made with each group having 8 eight specimens.

1. Group 1: Temporary crowns which are evaluated immediately after polymerization
2. Group 2: Temporary crowns which are evaluated after 1 day storage in a water bath at 37^0 C

3. Group 3:Temporary crowns which are evaluated after 7 days storage in a water bath at 37^0 C

All the specimens were fabricated in similar environment and by single operator to ensure consistency. A total of 48 provisional restorations were made using bis-acryl composite resin provisional restorative materials, 24 specimens for each type of finish lines (shoulder and chamfer) using direct technique

A specially designed spring loaded holding device (photo 4) was used to measure and replace the provisional crowns precisely on master die. Photograph of each side were taken after calibrating microscope(Lawerence and Mayo, India) at 30X (photo 5). A scale with millimeter calibration was photographed under same magnification to set scale (pixels/millimeter aspect ratio) into the software.

Measurements were made at vertical reference lines marked at midpoint on each side (mesial, distal, buccal and palatal) of metal die finish line and were interpreted using ImageJ software. An arithmetic mean of four measurements of all the four surfaces were calculated and noted as final marginal discrepancy value for each specimen. Statistical analysis of the data was done.

RESULTS

No statistically significant difference was found between the adaptation of the temporary of the chamfer and shoulder type finish lines.(Table 1) although the marginal gap of the chamfer type finish lines increased from day 1 to day 7, this increase was not statistically significant (Table 2).

No statistically significant difference was found between the specimens of the shoulder type finish lines evaluated immediately after seating and those evaluated, after 1 or 7 days storage in a water bath. However, a significantly higher degree of marginal discrepancy was observed in the specimen stored 7 days as compared to those stored 1 day (Table 3)

Fig 1: Prepared ivorine tooth, metal die (chamfer finish line).

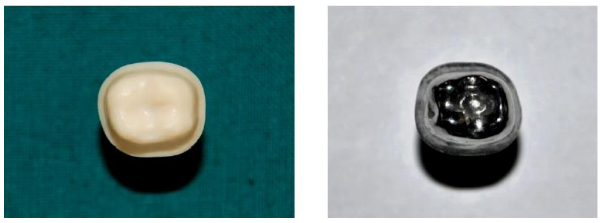

Fig 2: Occlusal view of prepared ivorine tooth, metal die (shoulder finish line).

Fig 3: Crown specimen on mounted metal die.

Fig 4: spring loading device.

Table 1: marginal discrepancy under three test conditions (mm).

	shoulder			chamfer		
	immediately	1 day	7 days	immediately	1 day	7 days
X	0.078	0.061	0.106	0.064	0.074	0.069
s.d.	0.044	0.073	0.097	0.055	0.064	0.063
s.e.	0.009	0.014	0.018	0.011	0.012	0.011

Table 2: Comparison to the marginal adaptation at each of finish line type (paired t-test).

	Immediately-1 day	Immediately-7 days	1-7 days
shoulder	t=0.994 p>0.05**	t=1.463 p>0.05	t=2.387 p<0.05*
chamfer	t=0.775 p>0.05	t=0.478 p>0.05	t=0.328 p>0.05

*p<0.05, significant **>0.05 nonsignificant

Table 3: Comparision to the marginal adaptation between shoulder and chamfer (unpaired t-test).

Immediately-immidiately	1-1 day	7-7 day
t= 1.285 p>0.05	t=0.674 p>0.05	t=1.807 p>0.05

Fig 5: specimen under stereomicroscope.

DISCUSSION

Provisional restoration is an indispensible and demanding intrim solution for a successful fixed prosthoddontic treatment. A healthy coexistence between provisional restorations and the abutment tooth along with the surrounding periodontal structures is an obvious goal of tooth reconstruction, which calls for high quality materials and ultimate care on the part of dentist.

Wang R L[7] , advocates that the selection of material should be based on the strength and weakness of a given material relative to the clinical mandates for specific treatment. Henry M. Young[5] , in an invitro study compared the polymethylmethacrylate resin with bis-acryl composite resin for marginal accuracy and found that bis-acryl composite resin is significantly superior to polymethylmethacrylate resin. Tjan et al[8], compared marginal accuracy of provisional crowns and they confirmed lower values of marginal discrepancy for bis-acryl resin than epimine resins.

Various studies have compared the techniques for better marginal adaptation. B J Crispin[9] , concluded that treatment restorations made by indirect technique is significantly better than direct technique. Gerard Chiche[6], put forward a direct method of fabrication where laboratory made shell was relined intraorally. Though marginal accuracy is shown better by indirect technique the, direct technique is considered the method of choice because of ease of fabrication, shortened chairside time and elimination of laboratory procedures.

The major concern for this technique is exothermic heat that is generated during polymerisation. The poly-vinyl siloxane impression matrix is associated with lower values of temperature rise because of bulk of material acts as heat sink and have cooling effect.[10]

The advantage of using metal die of prepared tooth for fabrication of specimens and measurements was to prevent damage of margins of master die by repeated seating of specimens and to standardize the tooth size. Similar metal die was used in the study conducted by Jerald Blum et al[11] , and Piemjai M. [12]

In this study the residual polymerization of the specimens were carried out at 37^0 C in water bath in an incubator. Polymerisation in water at 37^0 was done to simulate the clinical condition more closely. Takahiro Ogawa et al[13] , have shown that polymerisation in water at 20^0 C to 30^0 C of temperature produced the best fit at margins of provisional restoration.

A custom made spring loaded holding device was fabricated to measure the marginal discrepancy under uniform load. Such a device was used in earlier studies made by several authors.[8,14]

According to Lepe et al[15], the polymerisation shrinkage of the resin plays an important role in marginal accuracy of provisional restorations. The magnitude of polymerization shrinkage depends on a number of factors, such as the type of monomer, the volume and size of filler, degree of conversion, the nature of the resin, flow of resin, rate of polymerization, and water sorption. Bis-acryl composites consists of a base paste and two catalyst patse. Base pastes of bi-acryl composite consist of bi-functional acrylates which provide cross-linkage of high density during setting reaction and increased mechanical strength. They also contain inorganic fillers to increase their resistance to abrasion and decrease in polymerisation shrinkage.[3] The findings of this study are in agreement with the Koumjian & Holmes with regard to the shoulder type finish line. The results of the study indicate not only water absorption, but type of finish lines, may have period influence on the marginal adaptation of temporary crowns.

The limitations of this study were that the measurements obtained in vitro may not reflect the conditions found in an oral environment and the errors in fabrication and handling of the material assumed to be minimal. Considering all these factors further extensive study is required in the field.

CONCLUSION

In this study, the effect of two finish line types and the period of their remaining in the mouth on marginal adaptation of temporary crowns examined. Although no statistically significant difference was found between the marginal adaptation of the crowns of the chamfer and shoulder types, after 7 days a discrepancy of an important degree was observed in shoulder type crown ($t= 2.279$, $p<0.05$).

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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