

Evaluation and Comparison of Marginal Fit between Complete and Partial Provisional Crowns- In Vitro Study

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Abstract

Introduction: A study was conducted to measure and compare the marginal accuracy of provisional crowns (partial and full coverage crown) fabricated by direct technique.

Materials and Methods: A direct technique was used in which temporary crowns were made on prepared typodont teeth by using an impression as a matrix. Fifteen complete crown for molar and fifteen partial crown for canine were made. The marginal discrepancy was determined by stereomicroscope which measures the space between the margin of the crown and the finish line of the preparation .The crowns which showed least marginal discrepancy were decided to have good marginal fit.

Results: Student's t tests were applied and mean value was calculated. A t- value of 8.126 was obtained for both the means. Statistically significant difference was found between the means of both the crowns ($p<0.001$). Thus, it was found that marginal fit discrepancy was less in complete provisional crowns (95.664) than the partial coverage provisional crowns (124.577).

Conclusion: Marginal fit of complete provisional crowns is better than partial provisional crowns.

Key Words: Marginal accuracy, Provisional crowns, scanning electron microscopy.

Introduction

Provisional Restoration plays a vital role in the long term success of fixed partial restorations. These interim restorations are used individually on single or multiple prepared teeth or they may provide coverage for abutment teeth as part of a splint or fixed partial denture prior to placement of permanent prosthesis.[1] Provisional restorations are essential to cover freshly cut dentine and prevent tooth movement.[2] According to glossary of prosthodontic terms, provisional restorations are defined as removable/fixed prosthesis designed to enhance esthetics, stabilization and /or function for a limited period of time after which it has to be replaced by a definitive prosthesis.[3]

The provisional restoration is currently recognized to have a fundamental role in the determination of success or failure of permanent restorations. Marginal accuracy is of paramount importance because an acceptable fit at the margins is essential in maintaining gingival health and protecting the tooth from physical, chemical, bacterial and thermal injuries. The marginal fit or accuracy of a restoration can be defined best in terms of the "misfit" or the gap measured at various points between the restoration and the tooth.[4]

Provisional restorations are designed in order to protect oral structures and promote function and esthetics for a limited period of time, after which

they are to be replaced by a definite prosthesis. They play a particular role in diagnostic procedures and continued evaluation of the treatment plan, as they should resemble the form and function of the definite rehabilitation that they precede. Therefore, interim treatment should satisfy the criteria of marginal adaptation, strength, and longevity.[5]

Provisional restorations that are placed after tooth preparation protect the pulp from thermal changes; maintain proper contacts; restores occlusion, esthetics and function. The most important factors that determine the success of a provisional restoration is adequate vertical marginal fit. Obtaining the best possible marginal adaptation of provisional restoration effectively prevents plaque accumulation thereby maintaining gingival health and protects the pulp from thermal, bacterial and chemical insults.[3]

Pronounced marginal discrepancy can result in development of pulpal sensitivity, gingival recession and tissue inflammation [3]. Provisional crown should also be easy to clean and not impinge on the tissues. Most importantly maintains interocclusal and intra-arch tooth relationships. They should exhibit a good shade match and have a highly polished surface so that they are esthetically pleasing to the patient.[6]

Provisional material selection should be based on how their mechanical, physical, and handling properties fulfill specific requirements for any

clinical case. Other factors to be considered are biocompatibility and complications from intraoral use, such as chemical injury from the presence of monomer residue and thermal injury from an exothermic polymerization reaction. The most common materials used for custom interim-fixed restorations are several types of acrylic resins such as polymethyl methacrylate (PMMA) resin, polyethyl methacrylate (PEMA) resin, polyvinyl methacrylate resin, bis-acryl composite resin, and visible light-cured urethane dimethacrylates.[7]

The theories and techniques of fabrication for numerous types of provisional restorations abound in the dental literature. Provisional restorations may be made directly on prepared teeth with the use of a matrix or indirectly by making an impression of the prepared teeth. A combination indirect-direct technique is also possible which has evolved as a sequential application of these that involves fabrication of a preformed shell that is relined intraorally.[7]

Perhaps the most empirical treatment restoration for full coverage is the prefabricated aluminum or celluloid crown form.“-Talkov” and Adams” described a technique for attaching individual celluloid crown forms together to obtain a splinting effect.[8] Fritts and Thayer’ suggested that preformed crowns are seldom morphologically correct and usually require alteration to make them esthetically acceptable and protective.[9]

Several types of partial veneers exist for posterior teeth, three-quarter, modified three-quarter, and seven-eighths crowns and for anterior teeth, three-quarter crowns and pin ledges.[10]

Materials and Methods

Materials used in the study are given in Table 1.

Material Used	manufacturer
DPI tooth colored chemically polymerised PMMA resin (powder-liquid system)	Dental Product of India
Photosil Additional Silicone Putty And Light body impression material	Dental Product of India

A direct technique was used in which temporary crowns were made on prepared typhoon teeth by using an impression as a matrix. Fifteen complete crowns for molar and fifteen partial crowns for canine were made with shoulder finish lines with a taper of approximately 5 degree. Auto polymerizing

acrylic resin of the suitable shade is mixed and allowed to set to a doughy consistency (the sheen of surface-free monomer has completely disappeared). After that typhoon teeth is lightly lubricated with petrolatum, the acrylic resin record is placed over the prepared typodont teeth. The temporary crowns were removed and reseated once during the elastic phase of polymerization. The excess material was used to indicate the proper time to remove the temporary crowns. Excess flash was trimmed from the crown margins. The crowns were reheated on the preparation and allowed to set completely in the water bath at 37° C. After curing was completed the gingival margins of the temporary crowns were trimmed. Carbide burs and diamond stones are used to roughly develop contour and form of the provisional restoration. Crowns were fabricated by following manufacturer’s instructions. The crowns were cemented on the prepared teeth with zinc oxide Eugenol cement. A thin coat of cement was applied on the cleaned internal surfaces of each crown. The crowns were seated with a rocking dynamic force applied by fingers. A firm finger pressure was applied for five minutes. The excess cement was removed with an explorer.

The marginal discrepancy of the temporary crown was measured by using a stereomicroscope adjusted at the magnification level of 40 xs along with special measurement software and a digital camera was used for analyzing marginal gap. The marginal discrepancy was determined by measuring the space between the margin of the crown and the finish line of the preparation For each crown and preparation assembly, measurements were made at 4 reference points in complete provisional crowns and 3 reference points in partial coverage provisional crowns marked random around the circumference of the finish line of the preparation.

Results

Mean vertical marginal discrepancy, standard deviation, p value and inference using one way analysis of variance is given in Table 2.

S.No	Types of crown	Mean	SD	t-test	p-values
1.	Complete provisional crown	95.664	27.948		
2.	Partial coverage provisional crown	124.577	26.777	8.126	<0.001*

Discussion

Closed marginal adaptation of a provisional resin crown to the finish line of a prepared tooth protects the pulp from the thermal, bacterial and chemical insults. In order to overcome from these insults marginal accuracy of provisional restorations are important.[1-10] This study was carried out to observe the effectiveness of conventional full crown over three quarter crown.[11] The result showed a significant difference in the marginal fit of crowns .[12-21] It was found that marginal fit discrepancy was less in complete provisional crowns than the partial coverage provisional crowns. One of the major predictors of long-term success of any dental restoration is its marginal fit, which is a notion never been defined certainly. Marginal gap might be defined as the perpendicular measurement from the marginal surface of the restoration to the axial wall of the preparation. Much has been said about different variables affecting the marginal fit. [23, 25]

In a hypothetical preparation setup with clear-cut margins, at least seven types of variables might correspond to marginal accuracy. These include internal gap, marginal gap, overextended or under extended margins, and vertical/horizontal/ and absolute marginal discrepancies. However, since actual margins are usually blunt, different subtypes can also be considered for definitions of some discrepancies. Various methods have been utilized for measuring marginal adaptation, including sectioned or embedded specimens as well as direct visualization by stereo- or electron-microscopy and clinical examinations.[24]

Among the requirements of a proper provisional restoration material, marginal adaptation is the most important one, since a fine margin may provide health for the prepared tooth as well as its gingival tissues which is necessary for further cementation. Marginal failure might lead to micro leakage, postoperative sensitivity, and recurrent dental caries. This is because of numerous factors such as the gap between the tooth and the restorative material, dentinal fluids, material properties such as dissolution and coefficient of thermal expansion, polymerization shrinkage. It may cause pulpitis in vital teeth due to bacteria toxins, and may reduce restoration longevity because of bacteria colonization through the restoration tooth gap or in dentinal tubules.[25]

Robinson and Hovijittra¹² compared four brands of materials and reported that the Scultan brand has the less marginal discrepancy. It was assumed that the observed marginal openings were caused by polymerization shrinkage. Tjan et al.¹⁵ compared six provisional materials (three auto-polymerizing and three photo-polymerizing) and

reported that Interim crowns made with Splintline (a product of ethyl methacrylate) and Protemp materials had the best marginal adaptation. Ehrenberg et al [19].,compared changes in marginal gap of two materials under the effect of water absorption and thermo cycling, and observed that thermo cycling was able to change significantly marginal gaps in both Bis-acrylic resin composite, and polymethyl methacrylate (PMMA) copolymer. Nivedita and Prithviraj¹⁸ compared light-cured and self-cured provisional resins and showed that light-cured resins might have better marginal fits.[26]

Data was analysed using IBM SPSS Statistics-version 21 (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.) Descriptive statistics included calculation of means and standard deviation. Data distribution was assessed for Normality using Shapiro-Wilk test. Student's t-test was used for paired samples for intragroup comparison. Spearman's correlation coefficient was also calculated to assess the relationship between the two groups. A correlation is said to be strong or positive if the values range from 0.7 to 1. All values were considered statistically significant for a value of $p<0.05$.

The result shows that there is a significant difference between the complete provisional crown and partial provisional crown. Marginal fit of complete provisional crown is lesser than the marginal fit of partial coverage provisional crowns. Therefore complete provisional crowns are more precisely marginally adapted.[27]

Conclusion

Under the condition of this in-vitro investigation and the result observed it can be concluded

1. Marginal fit of complete provisional crowns (95.664)
2. Marginal fit of partial coverage provisional crowns (124.577).
3. Marginal fit of complete provisional crown is better than partial provisional crown.

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