

COMPARISON OF THE MARGINAL FIT OF CONVENTIONAL METAL CERAMIC CROWNS WITH THAT OF HEAT PRESSED ALL CERAMIC CROWNS: AN INVITRO STUDY

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ABSTRACT:

The smile is one of the most appealing aspects of the human face and is considered to be the very image of the soul. Dr. Charles Land introduced one of the earliest forms of ceramic crowns in 1903. Then the first metal-ceramic crown was described by Brecker in 1956.

From its introduction till date, the porcelain fused metal restorations have a long proven record of success because of their good compressive strength, marginal fit, fracture resistance and the versatility to be used for both single crowns and fixed partial dentures. But the esthetic limitations like lack of metal translucency, exposure of metal collar in the anterior region, paved way for all ceramic metal free restorations. This study was performed to compare the ultimate marginal fit of conventional metal ceramic crowns with that of heat pressed all ceramic crowns.

Keyword: Marginal Fit, Casting, Ceramic Veneer

INTRODUCTION:

Full veneer ceramic crowns are very successful in covering the entire tooth they can totally mask the previous condition to create a new appearance. The absence of metal layer in all ceramic restorations helps in transmission of light through the full depth of the restoration there by enhancing the translucency creating a life like appearance. Depending upon the clinical demand, both all ceramic and porcelain fused to metal can be used for full veneer crowns.^[1]

The clinical success of a complete crown depends on many factors. It must seat accurately on the tooth, exhibit a minimum cement margin, be adequately retained and restore function and esthetics. Of all these marginal fit is considered to be a primary and significant factor in the prevention of secondary caries, and is an important indicator of the overall acceptability and longevity of the restoration. Clinically distortion of the margins creates a potential space between the crown and the tooth preparation. This space promotes leakage

and dissolution of cement, encourages plaque deposition, initiates secondary caries, leads to gingival inflammation, periodontal disease & finally results in deterioration of the restoration and the supporting tooth. So, the intimacy of fit of the crown margins is critical to ensure a smooth surface that will not promote accumulation of plaque.

MATERIALS AND METHODS:

This invitro study was performed to compare the marginal fit of the metal ceramic and pressed ceramic jacket crowns over the prepared tooth.

A Typhodont maxillary right central incisor was prepared for a jacket crown. A uniform labial and axial reduction of 1.5 mm was made along with a 2 mm incisal reduction and an uniform shoulder of 1.5mm. The height of the preparation was 7mm with a convergence angle of 6°. Twenty Impression of the prepared tooth were made in light body impression material, cast made with die stone.

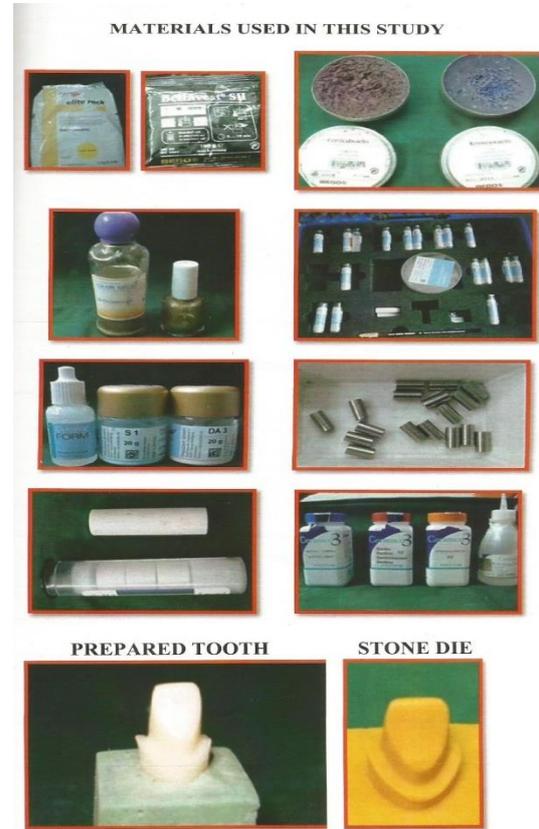
The 20 stone dies were then divided into 2 groups as group I and group II.

Group I -consists of 10 stone dies for the fabrication of metal ceramic crowns.

Group II-consists of 10 stone dies for the fabrication of heat pressed all ceramic crowns.

The materials used are Diestone, Bellavest, Addition silicone, Inlay wax, ceramic ingots, and ceramic veneering. Equipments used are casting machine,

ceramic furnace, vaccum mixer and sectioning machine



10 STONE DIES FOR ONE GROUP



Fabrication Of Metal Copings:In this procedure application of die spacer by 3 layer of paint on the die of 33-40µm was applied 1mm short of the margins. Preparation of wax pattern of uniform thickness of .5mm. The dimensions were confirmed by measuring at multiple points

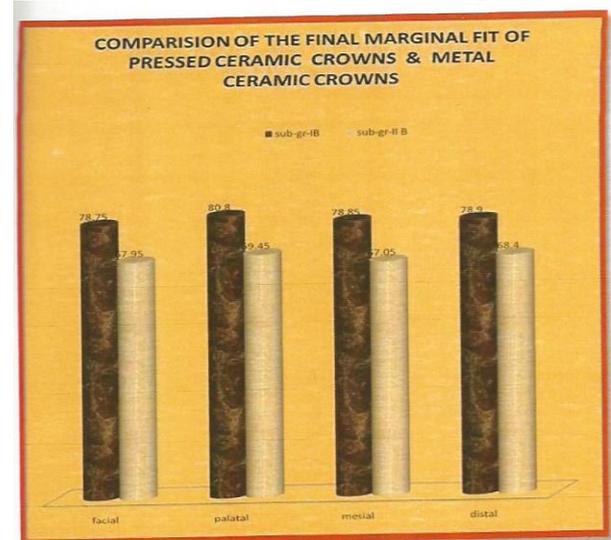
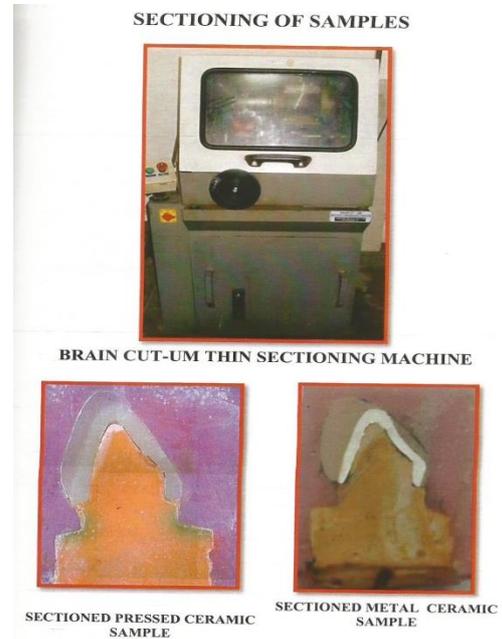
with a wax thickness caliper [2,3]. Investing and burnout and casting was done.

Fabrication Of Pressable Ceramic Copings: In this die spacer applied and thickness of 30-40 μm. Wax pattern of .7mm thickness and the patterns were immediately invested in phosphate bonded investment. The mould is heated from the room temperature to 800 degree centigrade. It is taken from the furnace and a pellet of presable ceramic is placed in the mould. The aluminium oxide plunger is placed over the ceramic pellet. Using the multimat touch and press furnace programmed is started. The ingot pressed into the mould at 960 degree temperature with the holding time of 20 minutes.

Measuring of the initial marginal fit of the copings is made at the 6 points around the circumference of the crowns. 1 point- mid facially, 1 point- mid palatally, 2-points on the mesial side, 2 points on the distal side. The mean of all the six values measured is the initial marginal fit of the coping. The measurement sites were marked for reproducible identification by scoring the die with sharp blade. Care was taken not to contact the marginal areas [4].

Sectioning Of The Final Samples: The crowns were cemented to the dies with Zn PO₄ cement using finger pressure. The crown die complexes were then embedded in rectangular acrylic block. The samples were then sectioned faciolingually and mesiodistally using diamond sectioning saw, following the guide marks on the dies. There are 2

interfaces for each point if sectioning so measurement can be made at 8 points around the crown. Mean vertical and horizontal marginal discrepancies were calculated from the values obtained.



RESULTS:

The test samples were divided into 2 major groups-

Group-I-Metal ceramic crowns

Group-II Heat pressed all ceramic crowns.

Marginal fit of these copings were verified by measuring 6 points as discussed before. The mean of all the 6 points were taken as the initial reading of marginal fit before veneering of porcelain. The completed crowns were cemented on their respective dies using ZnPO₄. The marginal fit of the samples were assessed by the cross sectional method.

The samples were mounted in acrylic blocks and then sectioned faciolingually and mesiodistally following the markings on the dies. The mean value and standard deviations were calculated and the results of one way ANOVA among the groups:

Metal Ceramic crown (subgroup I)	Pressed ceramic crown (subgroup II A)	P-value
MEAN±S.D	MEAN±S.D	0.00002***
79.15±3.07	67.97±3.34	0.00002***

***denotes significant at 1% level

Interpretation of results:

The values indicates that the samples of subgroup II had lower values (68.21µm) of marginal fit than the samples of subgroup I (79.32 µm) .The difference is significant by 1 % level. This implies that the pressed ceramic crowns had a better marginal fir than metal ceramic crowns.

DISCUSSION:

Porcelain jacket crowns have historically been considered the most esthetic restorations.They are made either with or without a metal sub structure.Although the metal ceramic systems have proved to be successful,the increasing demand for esthetic materials in dentistry has resulted in the development of many new metal free ceramic systems with better physical properties.

This study analysis the marginal fit of porcelain jacket crowns with metal ceramic crowns and pressable ceramics. Siegbert Witkowshi et al 2006 used stone

dies duplicates of a human maxillary central incisor prepared for a metal ceramic crown,in his study on a marginal fit of titanium copings. James.D.Weaver et al [5] 1991,John.A.Sorensen et al [6] 1992 had also followed the same method of using stone dies of the prepared tooth for their studies on marginal fit evaluation.Shillin burg et al [7] 1973 found that shoulder finish lines with or without a bevel exhibited less marginal distortion in a porcelain fused to metal restoration.

Silver et al 1960 [3] observed that if the marginal metal was thinned beyond 0.5mm the porcelain when applied would buckle or bend in thin portions causing a change in fit.

John A.Sorensen et al [6] did a review of all the available methods of measuring the crown margin fidelity and concluded that the cross-sectional method of evaluation of the margins allows greater precision in determination of the measuring points

and also in measuring the absolute marginal fit.

The results of this present study shows that the initial marginal fit of the pressed ceramic copings were better than that of the metal copings. This is consistent with the findings of M.J Cattell et al [8] in 1999 who reported that the restorations made of pressable ceramic have a good marginal fit. He said that it is mainly because of the accuracy of the heat pressing technology. From this study it may be concluded that both the groups of crowns had marginal fit within clinically acceptable levels. But the pressed ceramic crowns had a better marginal fit than the metal ceramic crowns. Further longitudinal studies may be helpful to prove the accuracy of pressable ceramics.

CONCLUSION:

Recent days the ceramic crowns are the material of choice for esthetic restorations because of their excellent translucency and life like appearance. However just as metal ceramic crowns these crowns also can be distorted during the fabrication procedure

especially during the porcelain firing steps thus causing a negative effect on the marginal fit and hence the success of the restorations.

This invitro study was performed to evaluate the accurate marginal fit of the metal ceramic and pressed ceramic jacket crown over the prepared tooth. The marginal fit of the samples were measured after veneering the porcelain. The results obtained were statistically analyzed.

The pressed ceramic crowns have a better adaptation than the metal ceramic crowns even after exposure to multiple high temperature firing cycles.

The results of the study show that the pressed ceramic jacket crowns can be reliably used as an alternative to the traditional metal ceramic crowns because of their better marginal fit and superior esthetic value.

REFERENCES:

1. John W Mclean-The Science and Art of Dental Ceramics Vol 1 & Vol 2.
2. H.Strating, B.Ch.D, M.Sc, DC.H.Pameijer, Dmd, Msc.D, Dsc.D- Evaluation of The Marginal Integrity of Ceramometal Restorations The Journal of Prosthetic Dentistry Vol 56, Issue I, July 1981.
3. Robert R.Faucher Dds.Msd , Jack I.Nicholls, Phd-Distortion related to Margin Design in Porcelain-Fused to Metal Restorations. The Journal of Prosthetic Dentistry Vol 43, Num 2, Feb 1980.
4. Mehmet Cudi Balkaya, Dds, Phd, Aynur Cinar, Dds, Phd, Selim Pamuk, Dds, Phd- Influence of firing cycles on the

- margin distortion of 3 all ceramic crown systems-The Journal of Prosthetic Dentistry Vol 93,Num 4.
5. James D.Weaver,Dds, Glen H.Johnson Dds,Ms-Marginal adaptation of castable ceramic crowns.The Journal of Prosthetic Dentistry Vol 66,Num 6,Dec 1991.
 6. John A.Sorensen D.M.D-A Standardized Method for determination of crown margins fidelity-The Journal of Prosthetic Dentistry Vol 64,Num 1,July 1990.
 7. John W Mclean-Dental Ceramics Proceedings of the first International Symposium on Ceramic squintessence Publishing.
 8. M.J. Cattell T.C Chadwick-Flexural Strength Optimization of a Leucite Reinforced Glass Ceramics Dental Ceramics 17(2001) 21-33.