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EFFECT OF RECASTING CO-CR ALLOYS ON THE MARGINAL FIT OF CROWN WITH SHOULDER MARGIN - AN INVITRO STUDY

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Abstract:

Introduction: Marginal adaptation is one of the most important and weakest links in the success of cast restorations. There is some indication that the quality of marginal adaptation may be as important to gingival health as marginal location.[01]

Aims and Objectives: To evaluate the marginal integrity and occlusal discrepancy of base metal alloy copings by recasting method using conventional casting technique.

Methodology: The 30 test samples were grouped into 3groups as Group I: 10 samples will be prepared using 100% new co-cr alloy.Group II: 10 samples will be prepared using 50% new alloy and 50% reused alloy.Group III:10 samples will be prepared using 25% new alloy and 75% reused alloy. The patterns obtained were casted with an induction casting machine and Co-Cr copings, the vertical gap and internal gap/occlusal discrepancy of all the 30 Co-Cr cast copings are obtained, with the use of stereo microscope.

Results: Paired t test and tukey Kramer tests were conducted to determine p value. The p value for marginal integrity was found to be less than 0.01 which indicates that there is a significant difference between groups on buccal,lingual,mesial and distal surfaces . p value for occlusal discrepancy was found to be greater than 0.01 indicating that there is no significant difference between groups on occlusal mesial surfaces while distal side it is less than 0.01 which is significant.

Summary and Conclusion: The patterns were prepared with inlay casting wax on the custom-made stainless steel die. 30 of the patterns were invested with a metal ring during investment. The vertical marginal gaps of three groups cast copings obtained by conventional casting were statistically significant to each other with higher value in group 2 followed by group 3 and group 1.

Introduction:

Casting procedures requires use of more metal than is needed to produce a restoration. Dental laboratories often reuse the casting surplus to produce castings when high cost alloy are used. Marginal adaptation is one of the most important and weakest links in the success of cast restorations.[1] The base metal alloys were introduced in dentistry in 1930 by R.W.Eardle and C.H Prange. These alloys were so inexpensive that every time casting was performed using new alloy ingot and left over metal was either discarded or sold back.[2]Due to toxicity of nickel and beryllium, cobalt-chromium alloys for use in metal ceramic restorations were developed which are corrosive resistant and biological environments. Marginal and internal accuracy of fit is an important consideration for success of complete coverage crowns.[3] Results have shown that repeated casting could interfere with composition of alloy by reducing elements such as copper, tin, zinc, chromium, and titanium.[4] Therefore, this study was designed to evaluate the vertical marginal fitness and internal fit of metal copings of cobalt-chromium alloy produced from three different base metal alloys(100%new, 50%new+50%recasted, and 25%new+75%recasted) using shoulder finish line.[5]

Methodology:

An invitro study was conducted at the Department of Prosthodontics, G.Pulla Reddy dental college and hospital, Kurnool, to comparatively evaluate the marginal fit and occlusal discrepancy of Co-Cr copings obtained by recasting the alloy. A custom made stainless steel die was made with appropriate dimensions of maxillary first molar. 30 test samples were grouped into 3 groups of which

Group I: 10 samples will be prepared using 100% new co-cr alloy.

Group II: 10 samples will be prepared using 50% new alloy and 50% reused alloy.

Group III: 10 samples will be prepared using 25% new alloy and 75% reused alloy.

These 30 patterns were prepared using inlay casting wax patterns were prepared to obtain a uniform thickness of

0.5mm as recommended. All the patterns were subjected to casting procedures.30 castings were invested using a metal ring . The cast copings were devested, sandblasted with aluminium oxide air abrasive and steam cleaned. The patterns obtained were casted with an induction casting machine and Co-Cr copings were obtained. This study evaluated the vertical gap and internal gap/occlusal discrepancy of all the 30 Co-Cr cast copings obtained, with the use of stereo microscope and the results were tabulated for the statistical analysis.

Results:

Table 1: The mean marginal integrity and occlusal discrepancy were analysed from the three groups.

No.of samples (n=10)	Group I Mean +S.D	Group II Mean +S.D	Group III Mean +S.D	Significance (p)
Buccal	**69.53 ± 37.02756**	**132.82 ± 33.22732**	**108.39 ± 30.69779**	**0.0010468297 (S)**
Lingual	**68.03 ± 33.01367**	**117.86 ± 33.61102**	**117.58 ± 32.72212**	**0.0025606944 (S)**
Mesial	**76.14 ± 27.59948**	**142.25 ± 23.86775**	**115.58 ± 21.54251**	**0.00001 (S)**
Distal	**73.87 ± 33.18665**	**125.35 ± 20.1775**	**110.56 ± 36.93737**	**0.0084016928 (S)**

Table 2: Mean marginal integrity of group I,II,III

No.of samples (n=10)	Group I Mean +S.D	Group II Mean +S.D	Group III Mean +S.D	Significance (p)
Occlusal	**16.39 ± 5.80046933**	**18.59 ± 6.351981318**	**22.28 ± 6.9767550**	**0.13410477 (NS)**
Mesial	**28.04 ± 10.509487**	**20.13 ± 6.4591107**	**22.62 ± 9.0806020**	**0.143059976 (NS)**
Distal	**19.44 ± 10.326255**	**15.64 ± 3.582116**	**26.7 ± 9.740180**	**0.021849662 (S)**

MEAN OCCLUSAL DISCREPANCY AMONG GROUP I,II,III

Mean and standard deviation were determined for marginal gap and occlusal discrepancy from the samples for each study group. The vertical marginal gap and occlusal fit was analysed by using anova t-test and tukey-kramer. In the present study, p≤0.001 was considered as level of significance.

The p value for marginal integrity was found to be less than 0.01 which indicates that there is a significant difference between groups on buccal, lingual, mesial and distal surfaces . p value for occlusal discrepancy was found to be greater than 0.01 indicating that there is no significant difference between groups on occlusal mesial surfaces while distal side it is less than 0.01 which is significant.

Discussion:

For a metal to be used in metal ceramic restorations ,it should be biocompatible, so that it does not cause harmful toxicological or allergic reactions in the patient or dental team members.In addition,it should have adequate physical properties, be easy to manipulate and be relatively inexpensive[6] Marginal fit is one of the most important factors for the success of any restoration.[7] Poor marginal fit leads to retention of plaque can lead to both marginal inflammation as well as gingival recession.[8]

In the present study, the marginal discrepancy was measured without cementation of the crown on die.

Soriani et al evaluated the effect of using die spacer on the marginal fit of NiCr (M1) and NiCrBe(M2)alloys and commercially pure titanium(cpTi)(M3) copings casted by the lost wax technique with No die spacer. It was concluded that there is less marginal discrepancy with two die spacer layers. In this study no die space was used.[9]

Waerhaug demonstrated inflammatory exudate in gingival tissues adjacent to margins of artificial crowns and suggested that the inflammation could be attributed to bacterial plaque in the marginal gap between the tooth and restoration[10].

In this study, a standardized custom-made stainless steel die was made with a total of 6 degree axial wall taper as recommended by Konstantoulakis et al [11] in their study with a shoulder margin which was used to obtain patterns from inlay casting wax. 6 degree taper of axial wall was used for ease of removal of the patterns. The angulation values for the preparation recommended by Schillingburg et al with a total occlusal convergence angle of between 10 and 22 degrees or the slightly narrower range of 10 to 20 degrees recommended by Goodacre et al.[12]

The basic data obtained in this study shows a mean vertical marginal gap of casting in microns on buccal side (69.53 ± 37.027), on lingual side (68.03 ± 33.0136) on mesial side (76.14 ± 27.599), on distal side (73.87 ± 33.186) obtained by conventional casting in group I (G1) ,and for castings obtained by conventional casting in group II (G2) in

microns on buccal side (132.82 ± 33.22), on lingual side (117.86 ± 33.61), on mesial side (142.25 ± 23.86), on distal side (125.35 ± 20.17),and castings obtained by conventional casting in group III(G3) in microns on buccal side(108.39 ± 30.69779),on lingual side(117.58 ± 32.72212),on mesial side(115.58 ± 21.54251), on distal side(110.56 ± 36.93737).

Farshad bajoghil et al used nickel-chrome base metal alloys was used to check the marginal integrity of castable crowns made with conventional casting process and obtained mean marginal integrity Group I (127.93±49.09) in group II (198.22±141.34) and in group III (238±160.23). In order to compare the mean vertical gap among two groups t-test was used, revealing that group A(0.069), group B(0.0116) and showed a significant difference. However group C was not like that p value(0.001).[5]

Vijayanthi Lotwani has conducted a study on recasting Ni-Cr alloy to evaluate the marginal fit of crown. In their study the castings fabricated using new alloy showed a significant difference between group I (88.43±14.11) and group II (122.66±29.80), and less difference between group II and III (146.29±36.63).[37] The mean difference between group I and group II is (34.23±15.69) shows a statistical difference between group I,II .In the present study similarly marginal difference observed between groupI and II, and less difference between group II and III .[2]

Eswaran Bhaskaran conducted a study to evaluate marginal integrity by using co-cr alloy by recasting of three groups which showed statistically significant difference. Finally they concluded that recasting the alloy increases marginal integrity of casted copings when compared to casting new alloy[13]

The basic data obtained in this study shows a mean internal/occlusal gap of casting in microns on occlusal(16.39 ± 5.80),on mesial(28.04 ± 10.509487),on distal(19.44 ± 10.326255), obtained by conventional casting in group I.,and for castings obtained by conventional casting in group II on occlusal(18.59 ± 6.351981318),on mesial(20.13 ± 6.4591107),and on distal(15.64 ± 3.582116),finally castings obtained by conventional casting in group III,on occlusal(22.28 ± 6.9767550), on mesial(22.62 ± 9.0806020) and on distal(26.7 ± 9.740180).

Lisa M. Kane, conducted study on marginal and internal adaptation of milled co-cr copings. In their study the occlusal gap was (61±41µm) mesial (52±27µm) which was not significant. Similarly in the current study the mean values on occlusal (57.26±19.12µm) and mesial (70.79±26.03µm) indicating not significant. Hence the current study supports the study of Lisa M. Kane.[14]The amount of marginal and internal gap in clinically acceptable range was 100µm.[15]

In spite of several limitations mentioned above, this in vitro study suggested that the marginal fit and occlusal fit of cast copings with single pattern forming methods were within the range of clinically acceptable values for longevity of restorations

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