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Original Research

Assessment of marginal fit and axial wall adaptability of copings fabricated by lost-wax technique and metal laser sintering technique

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ABSTRACT

Background: The marginal fit is required for a successful fixed dental prosthesis. The present study compared marginal fit and axial wall adaptability of copings fabricated by lost-wax technique and metal laser sintering technique.

Materials & Methods: 60 replicas of master die were fabricated in gypsum type IV and were divided in two groups. Group I coping was fabrication by lost-wax (LW) technique and the group II coping fabrication by metal laser sintering (MLS) technique. The marginal fit and axial wall adaptability was calculated.

Results: The mean marginal fit in group I was 37.2 µm and in group II was 23.5 µm. The difference was significant (P< 0.05). The mean axial wall adaptability in group I was 56.2 µm and in group II was 32.7 µm. The difference was significant (P< 0.05).

Conclusion: The metal laser sintering technique could be an alternative for conventional lost-wax technique.

Key words:metal laser sintering, lost-wax technique, Marginal fit.

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Introduction

The marginal fit is required for a successful fixed dental prosthesis. It is mentioned in literature that the axial wall adaptation affects the seating of a prosthesis therefore affecting the marginal fit, making it equally important. Incomplete marginal fit lead to dissolution of luting cement, secondary caries formation, adverse pulpal reactions and periodontal inflammation.[1] The marginal fit of castings relies on perceptive tooth preparation, accurate impressions, precision castings with careful finishing, and cementation procedures. The clinically acceptable marginal discrepancy for a cast restoration varies from 10 to 160 µm.[2]

Various computer-aided designing/computer-aided manufacturing (CAD/CAM)based systems are available for rapid production of fixed dental prosthesis(FDP). One such technology is the metal laser sintering (MLS).[3]

The MLS is an additive technique, based on the 3-dimensional information received from the CAD and the prosthesis is fabricated in CAM machine. The main advantage of MLS technique is that it eliminates the drawbacks of the lost-wax (LW) technique.[4] In addition, the MLS technique allows easy fabrication of prosthesis with complex design. The technology is automated and has shorter working time due to elimination of procedures involved in the LW technique, i.e., wax pattern, investment, wax burnout, and casting works.[5]The present study comparedmarginal fit and axial wall adaptability of copings fabricated by lost-wax technique and metal laser sintering technique.

Materials & Methods

The present study comprised of a stainless- steel master die assembly fabricated simulating a prepared crown; 60 replicas of master die were fabricated in gypsum type IV and divided in two groups. Group I coping was fabrication by lost-wax (LW) technique and the group II coping fabrication by metal laser sintering (MLS) technique. The copings were seated on their respective gypsum dies and marginal fit was

measured using stereomicroscope and image analysis software. For evaluation of axial wall adaptability, the coping and die assembly were embedded in auto-polymerizing acrylic resin and sectioned vertically. The discrepancies between the dies and copings were measured along the axial wall on each halves.Data thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

Results

Table I Comparison of marginal fit between both groups

Groups	Mean	P value
Group I	37.2	0.04
Group II	23.5	

Table I, graph I shows that the mean marginal fit in group I was 37.2 µm and in group II was 23.5 µm. The difference was significant (P< 0.05).

Graph I: Comparison of marginal fit between both groups

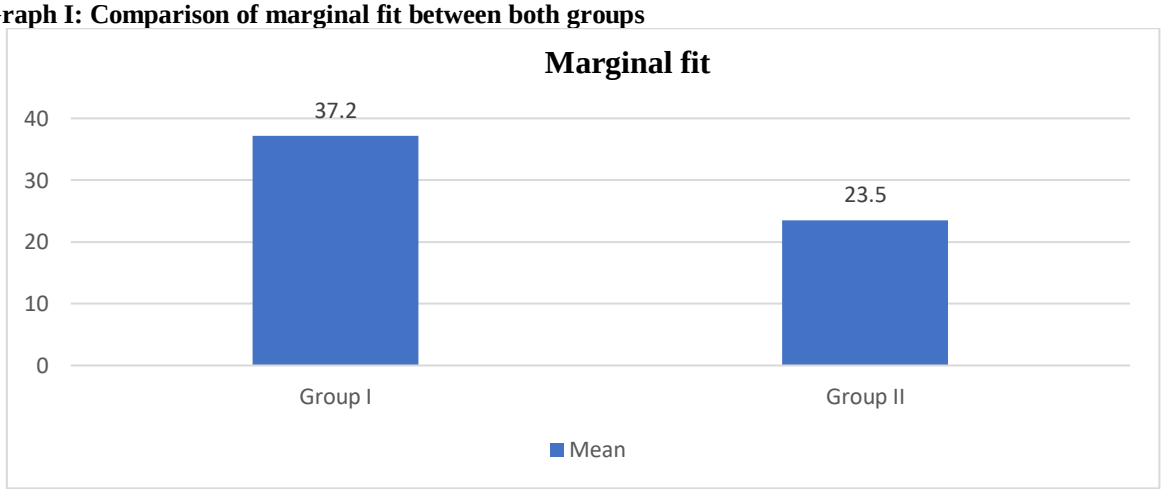
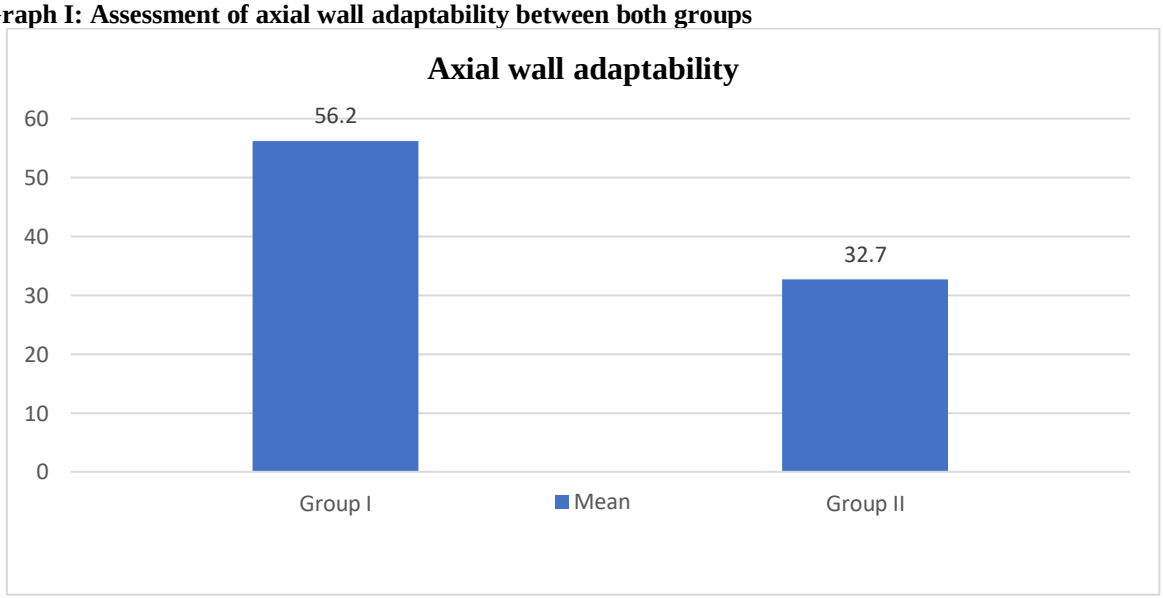


Table II Assessment of axial wall adaptabilitybetween both groups

Groups	Mean	P value
Group I	56.2	0.02
Group II	32.7	

Table II, graph I shows that mean axial wall adaptability in group I was 56.2 µm and in group II was 32.7 µm. The difference was significant (P< 0.05).

Graph I: Assessment of axial wall adaptability between both groups



Discussion

Many factors affect the overall acceptability of a cast restoration and many methods and techniques are used to improve it.[6] A cast restoration must seat accurately on the tooth, exhibit a minimum cement margin, be adequately retained, and restore or improve function and esthetics.[7,8] Marginal adaptation is considered to be a primary and significant factor in the prevention of secondary caries and is an important indicator of the overall acceptability of the cast restoration.[9]The present study comparedmarginal fit and axial wall adaptability of copings fabricated by lost-wax technique and metal laser sintering technique.

We found that the mean marginal fit in group I was 37.2 µm and in group II was 23.5 µm. Gaikwad et al[10]compared and evaluated the marginal fit and axial wall adaptability of Co-Cr copings fabricated by metal laser sintering (MLS) and lost-wax (LW) techniques using a stereomicroscope. The mean values of marginal fit for copings in Group B (MLS) were lower (24.6 µm) than the copings in Group A (LW) (39.53 µm), and the difference was statistically significant ($P < 0.05$). The mean axial wall discrepancy value was lower for Group B (31.03 µm) as compared with group A (54.49 µm) and the difference was statistically significant ($P < 0.05$).

We found that the mean axial wall adaptability in group I was 56.2 µm and in group II was 32.7 µm. HollenbackZ[11] stated that well-fitting castings, unless they were relieved an optimum 25 pm might fail to completely seat by as much as 100 pm. A casting may be acceptable before cementation but be ruined because of incomplete seating during cementation.

McLean JWet al[12]compared radiographic and clinical findings. Radiographically, margin discrepancies less than 80 pm were difficult to detect. With the use of an explorer with an average 80 pm radius in a clinical examination, a 200 pm discrepancy was barely discernible. The results revealed that castings considered clinically and radiographically acceptable had marginal discrepancies ranging from 10 to 160 pm.

Nortwick and Gettlemanlz[13] stated that internal relief has the same result as oversize castings. Several formulas have been developed to determine the occlusal offset of castings relative to film thickness of the luting agent and degree of taper of the tooth preparation.Donovan et al[14] studied the use of die spacers on preparations with grooves. With two different application techniques and two different die spacing materials, an attempt was made to determine the thickness of die spacer in retention grooves of full castings. Aerogloss and Tru-fit die spacers were evaluated. Five to six coats of Aerogloss and two to three coats of Tru-fit die spacer were applied to improved die stone blocks with grooves. Film thickness of Aerogloss die spacer was small enough that the variations in technique did not significantly affect the clinical results; however, marked variability was noted in the thickness of the Tru-fit film. A significant amount of pooling was evident at the base of the grooves. No attempt was made to determine whether die spacer applied to retention grooves of full castings improved seating of the castings.

The limitation the study is small sample size.

Conclusion

Authors found that the metal laser sintering technique could be an alternative for conventional lost-wax technique.

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