ECRONICON OPEN ACCESS

EC DENTAL SCIENCE
Research Article

To Evaluate Maxillary Permanent Denture Base Retention with Two Step and Single Step Impression Technique Using Polyether Impression Material: An *In Vivo* Study

Anshu Garg[1]*, Shashikala Jain[2], Himanshu Gupta[3], Srividhya S[4], Balamurugan A[5] and Naveen AC[5]

[1]*Final Year PG Student, Department of Prosthodontics, Maharaja Ganga Singh Dental College and Research Centre, Sriganganagar, Rajasthan, India*

[2]*Head of Department, Department of Prosthodontics, Maharaja Ganga Singh Dental College and Research Centre, Sriganganagar, Rajasthan, India*

[3]*Reader, Department of Prosthodontics, Maharaja Ganga Singh Dental College and Research Centre, Sriganganagar, Rajasthan, India*

[4]*Second Year PG Student, Department of Prosthodontics, Maharaja Ganga Singh Dental College and Research Centre, Sriganganagar, Rajasthan, India*

[5]*First Year PG Student, Department of Prosthodontics, Maharaja Ganga Singh Dental College and Research Centre, Sriganganagar, Rajasthan, India*

***Corresponding Author:** Anshu Garg, Final Year PG Student, Department of Prosthodontics, Maharaja Ganga Singh Dental College and Research Centre, Sriganganagar, Rajasthan, India.

Received: February 18, 2020; **Published:** March 20, 2020

Abstract

Aim of the Study: The aim of study is to compare maxillary denture base retention with two step and single step impression technique using medium body polyether as wash impression material.

Materials and Methods: 15 healthy completely edentulous patients were included in this study. For each patient, three special trays were constructed, thus, having total 45 samples further sub divided into three subgroups of 15 each. In Group 1 and Group 2 patients, border molding was carried out with green stick and putty addition silicone respectively. In group 3 patient, no border molding was carried out. In all 3 groups, definitive impression with medium body polyether was made. Final analysis was carried out with Turkey HSD post hoc test in which significant difference was found in retention values of denture bases made for group 1, 2 and group 3 patients.

Results: Insignificant difference in retention between group 1 and group 2 ($p = 0.7185$) and significant difference in retention values of group 1and group 3 ($p = 0.0005$) and group 2 and group 3 (0.0062).

Conclusion: Two step impression technique is more retentive as compared to one step impression technique.

Keywords: *Border Molding; Green Stick; Addition Silicone; Polyether; Retention; Single Step Impression Technique*

Introduction

Contemporary complete denture therapy is undoubtedly transpired in a rich tradition of innovative techniques, unique materials, clinical precision and scientific implementation. Most important aspects of high-quality complete denture therapy starts from impression making stage. The degree to which the impression accurately represents oral contours and conditions, both anatomically and functionally determines in large part the quality of therapeutic outcome. The final impression procedure for a conventional complete denture is a two -step procedure capturing the width and depth of vestibule through border molding procedures of specially fabricated custom tray and then making an impression of edentulous arch [1].

The original material used for border molding was low fusing modelling compound introduced by Greene brothers in 1907. Accurate impressions were achieved but border molding with impression compound was time consuming and tedious. Woelfel and associates determined that dentists required an average of 17 insertions when utilizing low fusing impression compound for border molding in same patients [1]. In the last two decades, several investigators have recommended using newer elastomeric materials like silicone and polyether impression materials for border molding offering advantage of single step molding of all borders of either maxillary and mandibular impressions. Accurate reproduction of details as well as consistency sufficient enough to do border molding with polyether advocates its use in single step impression technique. Recent randomized controlled trials have presented results demonstrating that use of one step impression procedure with alginate material in custom tray for denture fabrication has influenced positively function, retention and stability of dentures [9].

Amount of force required to dislodge denture from foundation has been used as an indirect measure of retention. Digital force gauge offers advantages of being portable, accurate and convenient to patient.

Purpose of the Study

The purpose of this study was to compare retention of maxillary denture bases with two step and one step impression technique using medium body polyether as wash impression material measured with help of digital force gauge.

Materials

Source of data

This study was conducted in the Department of Prosthodontics including Crown and Bridge and implantology in Maharaja Ganga Singh Dental College and Research Centre, Sriganganagar. Fifteen completely edentulous patients seeking prosthodontic rehabilitation were randomly selected as test subjects in age group of 45 - 70 years. Patients with- excessive ridge resorption, fibrous anterior ridge, poor neuromuscular control, rigid musculature and any other gross anomaly related to maxillofacial structure were excluded from study.

Methodology

For each patient, primary impression of the maxillary arch was made in a suitable sized stock tray (impression compound DPI) and poured in Dental plaster (Kaladent dental plaster) to obtain the primary cast. The cast was properly outlined and relieved in region of incisive papilla and midpalatine raphe for fabrication of resin custom impression trays (DPI RR coldcure). Baseplate wax of 1.5 mm thickness (rolex) was adapted on cast 4 mm short from sulcus as a spacer excluding posterior palatal seal area. In the region of cuspids and first molars, 2 x 2 mm tissue stops in resin tray were provided for proper orientation of tray in mouth. Thus, three identical trays were made for each patient (Figure 1) and divided into three groups according to materials used for border molding (Figure 2):

Figure 1: *Three custom trays fabricated for each patient.*

Figure 2: *Materials used in study.*

- **Group 1:** Border molding was done using green stick compound (DPI).
- **Group 2:** Border molding was done using putty addition silicone (Dentsply). Definitive impression was made with medium body polyether (3M impregum) in both groups.
- **Group 3:** Impression was made using polyether impression material in single step.

Group 1

Border molding was carried out in conventional method using green stick. Posterior palatal seal was recorded by applying the softened compound from one hamular notch to other and locating anterior and posterior vibrating line. Any excess material flowing onto ridge area was scrapped using a Bard Parker blade. After removal of wax spacer, equidistant holes were made in midpalatine raphe, incisive papilla region, for adequate relief. Green stick was scrapped about 0.5 mm from borders. A tray adhesive (3M polyether adhesive) was applied to inner surface of tray as well as borders. This was followed by making definitive impression using medium body polyether (Figure 3).

Figure 3: *Final impression made with polyether for group 1.*

Group 2

PVS adhesive (Coltene) was applied on borders as well as 3 mm inside and outside of tray. One scoop of putty rubber base after hand mixing with its catalyst for 30 - 45 seconds was rolled and applied to all borders of tray including posterior palatal seal area and molded in a manner similar to sectional border molding technique. The tray was removed after impression material completely polymerized and borders were examined for its extensions. Excess material was trimmed off using Bard Parker blade. Equidistant holes were made following removal of wax spacer. After polyether adhesive application on borders and inner surface of tray, the tray was loaded with medium body polyether to complete the definitive impression (Figure 4).

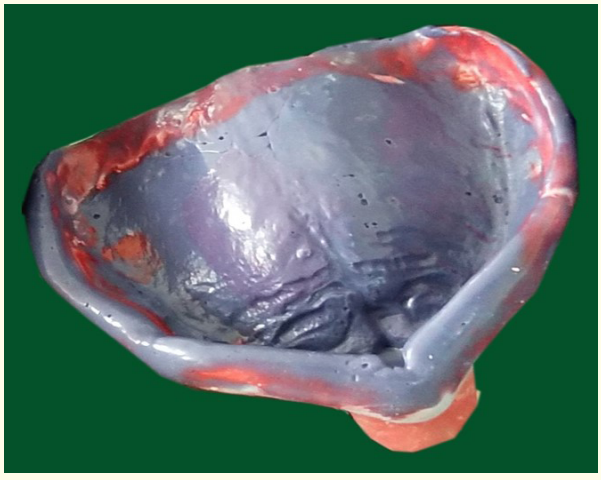


Figure 4: *Final impression with polyether for group 2.*

Group 3

Wax spacer was removed and relief holes made in tray. Polyether adhesive was applied on the inner surface of tray and 2 - 3 mm outside the borders of tray. After adhesive had dried up, the base and catalyst pastes of polyether impression material were mixed and loaded in the tray including posterior palatal seal area and all borders. Patient asked to perform movements as described earlier. The trays were removed after impression material had completely polymerized (Figure 5).

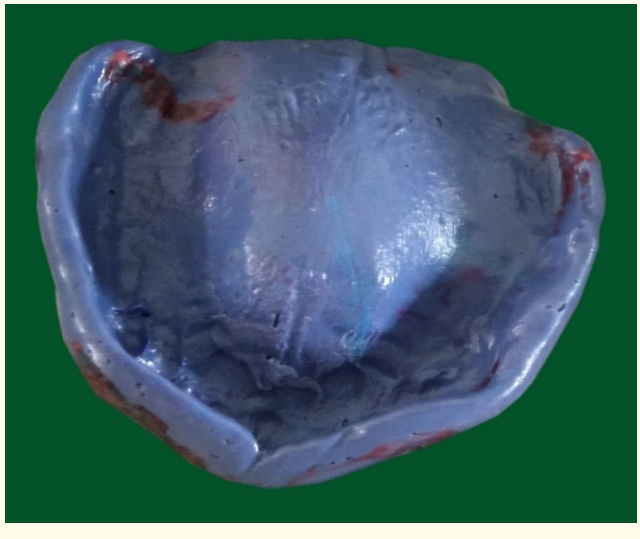


Figure 5: *Final impression with polyether in single step for group 3.*

Preparation of the cast

After making 3 impressions for each patient, beading and boxing was done and impressions were poured using type III dental stone (Kalstone, Kalabhai Pvt. Ltd.) to obtain definitive casts. Denture bases were waxed on each cast and coded. A loop made out of 19 gauge stainless steel wire was attached to anterior palatal region of waxed up bases approximately corresponding to line joining the distal surfaces of cuspids. The casts with waxed up bases were flasked and processed in curing unit. After processing (Figure 6), the bases were removed from the casts and finished keeping thickness of denture bases 2 mm all around (Figure 7). The finished bases were inserted, checked in mouth with pressure indicating paste and adjusted as necessary.

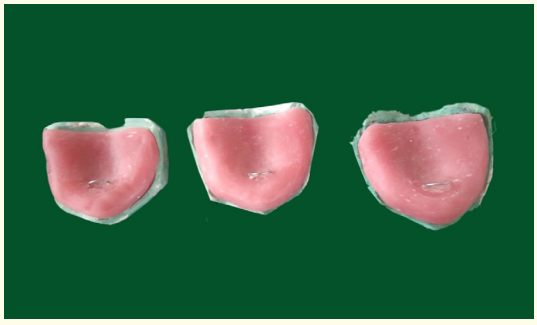


Figure 6: *Three denture bases fabricated for each patient.*

Figure 7: *Finished denture bases.*

Measuring the retention of denture bases

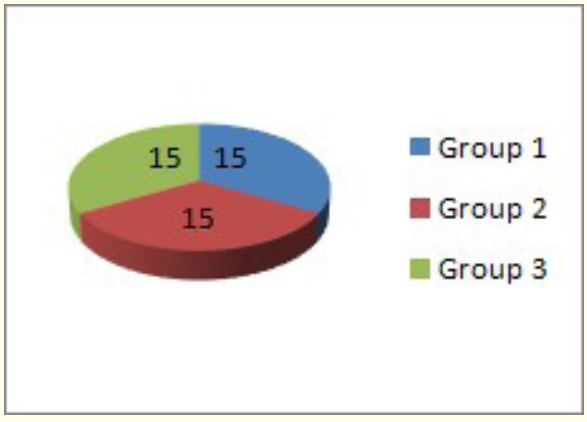
A digital force gauge (Precise Model SF 500) (Figure 8) was used to record retention of denture base, adjusted to display readings in newton. The patient stood upright with head position stabilised by help of cephalostat keeping maxilla parallel to floor. Force gauge was engaged into hook of heat polymerized denture base and downward force was applied (Figure 9). Amount of force required to dislodge from foundation on force gauge screen, moment denture base got dislodged was noted. Three readings were taken for each sample and an average was calculated.

Figure 8: *Digital force gauge.*

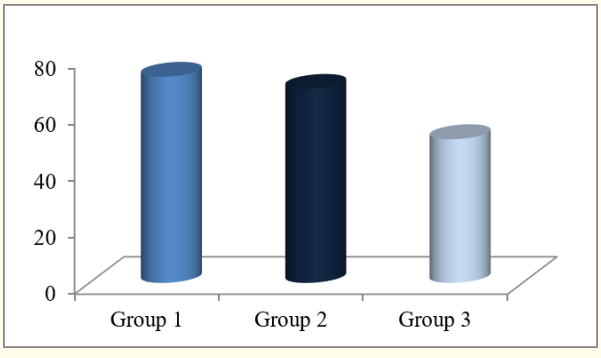
Figure 9: *Retention measurement with help of force gauge.*

Observations and Results

Statistical analysis: Data so collected was tabulated in an excel sheet, under guidance of statistician. There is uniform distribution of samples in three groups (Graph 1). Assessment of level of significance was made for mean of minimum and maximum readings for each patient in respective groups 1, 2, 3 (Table 1-3). Mean values for each group was compared (Graph 2) and data was statistically analysed using Turkey HSD Post-hoc Test.



Graph 1: *Distribution of samples.*



Graph 2: *Comparison of retention among three groups.*

	N	Minimum	Maximum	Mean	SD
First Value in N	15	50.10	102.50	71.41	15.83
Second Value in N	15	50.20	98.60	72.59	15.16
Third Value in N	15	49.80	110.80	75.11	17.45

Table 1: *Assessment of level of significance for average values of measured forces (for group 1).*

	N	Minimum	Maximum	Mean	SD
First Value in N	15	45.10	89.60	67.73	16.66
Second Value in N	15	40.20	113.60	70.10	21.49
Third Value in N	15	44.80	102.40	68.48	17.16

Table 2: *Assessment of level of significance for average values of measured forces (for group 2).*

	N	Minimum	Maximum	Mean	SD
First Value in N	15	40.10	72.50	51.19	10.07
Second Value in N	15	39.00	78.60	50.94	10.57
Third Value in N	15	35.40	70.80	50.57	9.21

Table 3: *Assessment of level of significance for average values of measured forces (for group 3).*

It was observed that there was a significant difference among the three group mean values between Group 1 and group 3 ($p < 0.05$) and Group 2 and Group 3 ($p < 0.05$) (Table 4).

Group	Mean	SD	Anova test	p value
Group 1	73.09	15.86		
Group 2	68.82	18.21		
Group 3	50.96	9.74	9.15	0.0005*
Turkey HSD Post-hoc Test...				
Group 1 vs Group 2: Diff = -4.2700, 95%CI = -17.6065 to 9.0665, p = 0.7185				
Group 1 vs Group 3: Diff = -22.1300, 95%CI = -35.4665 to -8.7935, p = 0.0007*				
Group 2 vs Group 3: Diff = -17.8600, 95%CI = -31.1965 to -4.5235, p = 0.0062*				

Table 4: *Comparison of retention among the study groups.*

**: Statistically significant.*

Discussion

Advanced techniques for optimal complete denture treatment have come into use today because of thorough knowledge of oral tissues, their behaviour and reaction to manipulation for making impressions. Traditional technique comprises of two steps in which wash impression is made in border molded special tray whereas simplified technique eliminates border molding and advises one step impression to reduce time required to make impression. Study by Regis., *et al.* [2] observed that no significant difference exist between two dentures for oral health related quality of life as well as masticatory performance received by a group of patients fabricated using simplified and traditional procedure**.** In this study, we compared retention of denture bases made with two step and single step impression technique using polyether as wash impression material.

Medium body polyether is monophasic impression material and has desirable thixotropic property thereby causing desirable flow under pressure. Its flowability allows to capture fine details. The making of wash with medium viscosity is in accordance with Troendle and Troendle [6] and Pai UY., *et al* [10].

Khajuria RR., *et al.* [12] in a study comparing three subgroups of final impressions made from polyether, addition silicone and ZOE, confirmed that final impression with polyether developed least bubbles.

Polyether has also been material of border molding in a study done by Smith., *et al.* [3] and Tan HK, Hooper PM [5]. Pachar RB., *et al.* [14] have obtained satisfactory results by using polyether in a single step in their study. So, in group 3, single step impression with polyether was carried out whereas in group 1 and 2, definitive impression was made with it after border molding. Measurements were made for all 45 samples. The mean retentive value for group 1 was 73.09 ± 15.86N, for group 2 was 68.82 ± 18.21N and for group 3, it was 50.96 ± 9.74N respectively. These values are in range with as found by AlHelal A., *et al*. [12] who found average retention for conventional denture bases in range of 54.23 ± 27.36N. Retention value has a spread of varying sizes for each sample because all retention factors namely viscosity, salivary volume and jaw size could not be controlled in this study. This is also supported by previous retention measurement study by Aayogi., *et al*. [16] on some salivary viscosities who got lowest scores of 0.92N and highest values of 17.78N.

The difference in results between group 1and group 2 was statistically insignificant (p = .7185). However, high values of retention with sectional border molding were in accordance with Quango A., *et al.* [1] who found mean retentive values for impressions with sectional border molding in range of 9.06 kgf whereas for putty molded impressions values were in range of 8.26 kgf. The slightly lower retention values in their study can be explained on basis of different wash impression material. Also, among other studies comparing the retention of sectional and single step border molding techniques common choice had been ZOE for wash impression with sectional border molded tray whereas for putty molded tray, it has been light body addition silicone.

In this study, we used same wash impression material in three samples to maintain standardization and to eliminate effect of different wash impression material on retention values obtained by two techniques.

The observational results of our study were also supported by K Kumar V [15] who found mean retentive forces in range of 7.93 kgf with sectional border molding technique. Whereas, with single step border molding retentive forces were in range of 6.58 kgf. Similarly, Rameshbabu Y., *et al.* [8] in their study found mean retentive forces in range of 3835.14 ± 3038.07 grams for sectional border molding and 4025.14 ± 2685.96 grams. (p = 0.1239, not significant) for single step border molding.

The results were, however, contrary to Rizk FN [9] who found statistically significant difference in retention value of impressions with single step border molding as compared to sectional technique. The difference may be due to operator skill as putty being technique sensitive material.

A study by Gupta R, Luthra RP [11] also found mean retentive force for single step border molding with putty better as compared to sectional border molded impressions. The basis of difference in the methodologies could be reason as denture bases made up of autopolymerizing resin were used in their study.

Much larger borders with putty addition silicone as compared to border molding by low fusing impression compound and tissue conditioner has been found by Patel JR., *et al*. [7] in a research study. They discarded putty as a suitable material for border molding.

This study also compared the results of group 1 samples with group 3 and group 2 samples with group 3. The results found showed statistically significant difference. Higher values for group 1 and group 2 patients (with border molding) and lower values for group 3 patients which are without border molding support observations made by Skinner., *et al*. [4] who found highest retentive force was required to dislodge denture plates having both peripheral seal and postdam as compared to denture plates only with post dam, only with peripheral seal and those with direct contact. The mechanism for improvement in retention with postdam and peripheral seal was described as a seal against ingress of air which might unseat the denture. Similar results were observed by Kaur S., *et al*. [17] who found that dentures made with border molding provided higher retention values (2765g) compared to dentures made without border molding (1805g).

Conclusion

Significant higher values of retention in group 1 and group 2 as compared to group 3 patients, suggests that border molding can significantly influence retention of denture bases and cannot be eliminated in secondary impression stage. The design of present study has certain limitations like retention was evaluated only for heat polymerized denture bases and not in final dentures. Also, a larger sample size could be considered for better exploration of results to a clinical scenario.

Bibliography

1. Qanungo A and Aras MA. "Comparative evaluation of border molding using two different techniques in maxillary edentulous arches: A clinical study". *Journal of Indian Prosthodontic Society* 16.4 (2016): 340-345.

2. RR Regis and CCS Alves. "The importance of two-step impression procedure for complete denture fabrication. A systematic review of literature". *Journal of Oral Rehabilitation* 43.10 (2016): 771-777.

3. Smith DE and Toolson LB. "One-step border molding of complete denture impressions using a polyether impression material". *Journal of Prosthetic Dentistry* 41.3 (1979): 347-351.

4. Skinner EW and Campbell RL. "A Clinical study of forces required to dislodge maxillary denture bases of various designs". *Journal of the American Dental Association* 47.6 (1953): 671-680.

5. Troendle GR and Troendle KB. "The Use of Injectable Polyvinylsiloxane as Medium for Border-Molding Denture Impressions". *Journal of Prosthodontics* 1.2 (1992): 121-123.

6. Tan HK and Hooper PM. "Variability in the shape of maxillary vestibular impressions recorded with modelling plastic and a polyether impression material". *International Journal of Prosthodontics* 9.3 (1996): 282-289.

7. Patel JR and Sethuraman R. "Comparative evaluation of border morphology produced by three different border molding materials". *IJCD* 1.3 (2010).

8. Rameshbabu Y., *et al*. "Comparative evaluation of border molding, using two different techniques in maxillary edentulous arches - An *in vivo* study". *Journal of International Oral Health* 5.6 (2013): 82-87.

9. Rizk FN. "Effect of different border molding materials on complete denture retention". *Cairo Dental Journal* 24 (2008): 415-420.

10. Pai UY and Reddy VS. "A single step impression technique of flabby ridges using monophase polyvinylsiloxane material: A case report". *Case Reports in Dentistry* (2014): 104541.

11. Gupta R and Luthra RP. "Comparative analysis of two border molding techniques and materials on maxillary complete denture retention- An *in-vivo* study". *Journal of Advanced Medical and Dental Sciences Research* 3.4 (2015): 109-112.

12. AlHelal AA and AlRumaih SH. "Comparison of retention between maxillary milled and conventional denture bases-A Clinical study". *Journal of Prosthetic Dentistry* 117.2 (2017): 233-238.

13. Khajuria RR and Singh R. "Better material for final impression in complete dentures-An *in vivo* study". *International Journal of Scientific Studies* 5.7 (2017): 49-52.

14. Pachar RB., *et al*. "Evaluation and Comparison of effect of different border molding materials on complete denture retention- An *in vivo* study". *Journal of Contemporary Dentistry* 19.8 (2018): 982-987.

15. K Kumar V and LN Akshatha. "Comparative analysis of two border molding techniques and materials on maxillary complete denture retention". *Journal of Advanced Medical and Dental Sciences Research* 7.6 (2019): 10-13.

16. Aayogi K and Sato Y. "Development of simple chair side evaluation for complete denture retention force and its reproducibility". *Japanese Society of Gerodontology* 29.1 (2014): 21-28.

17. Kaur S and Datta K. "Comparative analysis of the retention of maxillary denture base with and without border molding using zinc oxide eugenol impression paste". *Indian Journal of Dentistry* 7 (2016): 1-5.

Volume 19 Issue 4 April 2020