

## Comparison of the effect of sectional border molding using different molding and final impression materials on the retention of maxillary complete denture bases

Prof. Dr. Hikmat J. Al-Judy

B.D.S., M.Sc., Ph.D in Prosthodontic, College of Dentistry/ Baghdad University/ Baghdad, Iraq.

---

### **Abstract:**

**Background:** Restoration of dentition lead to an improvement in the oral health related quality of life. Complete dentures are used to restore this oral cavity disability to an acceptable condition.

**Aim of the study:** was to compare the retention of complete denture bases made by sectional border molding using the low fusing compound and putty type condensation silicone for border molding material and metallic oxide and light body condensation silicone as a final impression materials.

**Materials and Method:** Fifteen completely maxillary edentulous patients were selected. Eight close fitted custom trays were constructed for each patient; the first two trays were fully border molded using green stick compound. The third and fourth trays were fully border molded using the putty type silicone. The fifth and sixth trays, the labial flanges were molded using green stick compound while the buccal and posterior palatal seal area were molded using the putty type silicone. The seventh and eighth the labial flanges were molded using putty type silicone compound while the buccal and posterior palatal seal area were molded using the green stick. In each group, the final impressions were made using metallic oxide in the first tray and light body silicon in the second try. After pouring of impressions and producing master casts, fabrication of heat cured denture bases were made on each cast. The retention forces were examined and compared using strain measuring device.

**Results:** there was a statistically highly significant difference in retention forces between denture bases obtained from full and posterior putty silicone border molding combined with the light body silicone and metallic oxide final impression materials compared to denture bases obtained from other tracing procedure, materials and final impression materials, Significance was set at  $P \leq 0.05$ .

**Conclusion:** Denture bases produced by full putty silicone and posterior putty silicone tracing material and light body silicone final impression materials showed the highest mean values of retention forces.

**Key words:** Border molding, retention, maxillary complete denture.

---

### I. Introduction

One of the important parts of dental education and practice is the complete denture prosthodontic<sup>(1)</sup>, since the teeth loss leads to disability & impairment, and teeth restoration lead to improvement in the life quality throughout the oral health improvement<sup>(2)</sup>. The acceptable function of a complete denture on great extent depends on impression technique which includes the maximum coverage of denture supporting areas and making a combination of managing movable soft tissues along with different kinds of impression materials and techniques for accurate reproduction of oral foundation<sup>(2,3)</sup>.

The finished and polished denture base borders should simulate the final impression denture borders, and one of the important factors in complete denture retention is the border seal, which is the biological factor that involves contact of the denture borders with the surrounding oral soft tissues<sup>(4)</sup>. Border molding considered to be as an important step in the in complete denture fabrication, since the retention of complete dentures depend on several factors, as the biological, physical and mechanical, these factors could be achieved by mean of an accurate border molding followed by an accurate final impression<sup>(5)</sup>.

The border molding technique is the shaping of the border areas of a custom impression tray by manual or functional manipulation of the tissue adjacent to the borders in order to duplicate the size and contour of the vestibule resulting in maintains of the peripheral seal during function<sup>(5,6)</sup>. Metallic oxide (zinc oxide eugenol) final impression material following border molding with low fusing compound was the most commonly used final impression in complete denture because its fast setting, capable of details reproduction, easily handled with no significant dimensional changes subsequent to hardening, although some limitation is being present as heat irritation to the oral tissues and presence of undercut areas make the introduction of another material as polyvinylsiloxaine to be use in undercut areas as the putty silicone material since it had the ability to be correctly accommodated in the peripheral sulcus for proper retention of the dentures resulting in comfort of the patient<sup>(7)</sup>.

The raised purpose of this study was to compare the retention of complete denture bases made by sectional border molding using the low fusing compound and putty type condensation silicone for border molding material and metallic oxide and light body condensation silicone as a final impression materials.

## II. Materials And Methods

Fifteen completely maxillary edentulous patients (ten male patients and five female patients) were selected from the prosthodontic clinic of college of dentistry / Baghdad University, with age ranging from 50-60 years.

The patients were selected according to the inclusion criteria like well formed maxillary edentulous arch, well rounded, adequate width and height of the residual ridges, no severe undercuts or bony exostosis, firm mucosa of moderate thickness all over the denture bearing area and with no signs of inflammation, hyperplasia or ulceration were selected to contribute in the present study.

All patients were informed about the study through patient information sheet and informed consent was sought.

The principles of sterilization were followed during all steps of study. Preliminary impression were made for each patient using irreversible hydrocolloid impression material (alginate, hydrogum, Zhermack, Italy) and poured in dental stone (elite stone, Zhermack, Italy) to produce a study model. Eight custom trays of self curing acrylic resin were constructed on each cast for each patient. The custom trays were fully checked in the mouth to ascertain that the borders were to be approximately 2mm short of the vestibular reflections.

### • First group:

For the first tray, border molding was done section wise using low fusing tracing compound (Hoffmanns, Germany) were applied to the tuberosity region of the tray, glazed over flame and tampered in hot water, then inserted inside the patients mouth with protrusion and lateral movements were done by the patient till the tracing compound were showed a mat rolled edge, as shown in (Figure 1A).

The posterior palatal seal was functionally performed by application of green stick compound at the posterior border of tray from one hamular notch to other hamular, and the patient was asked to swallow. For buccal and labial tracing, the same procedure were followed by adding the soft glazed tracing compound then tempered and inserted inside the patient mouth and functional movements were done by moving the cheeks and lips upward, forward and downward. After accomplishing of tracing procedure and checking the final tracing, dryness was done to the tray and patient mouth and metallic oxide final impression paste (SS white, England) were mixed and applied over the whole tray which was inserted inside the patient mouth, gentle pressure with correct centralization and good support were applied with proper border molding till the material was set, the impression was removed from the patient mouth, inspected. This impression was the control to be compared with other impressions, as shown in (Figure 1B).

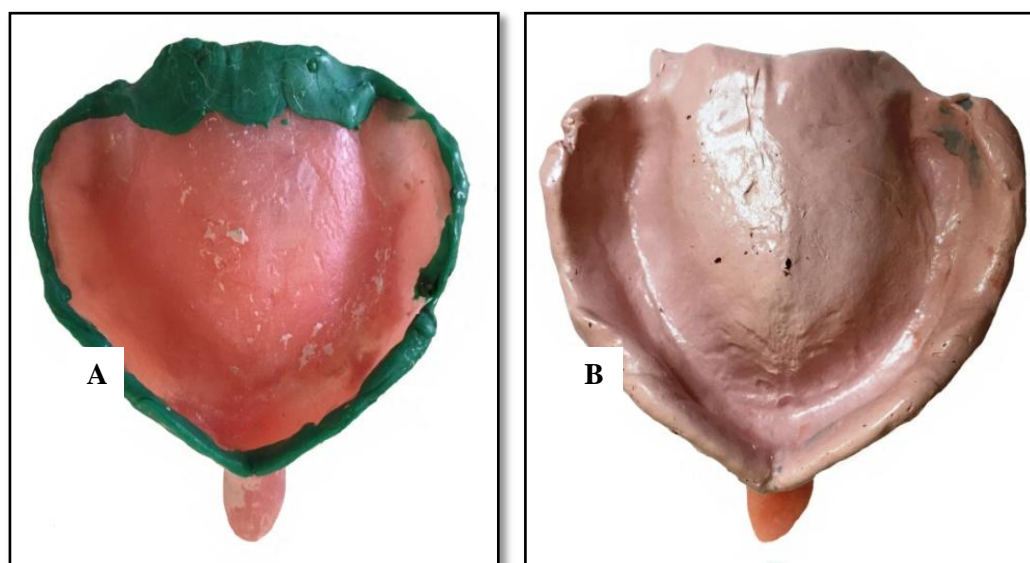
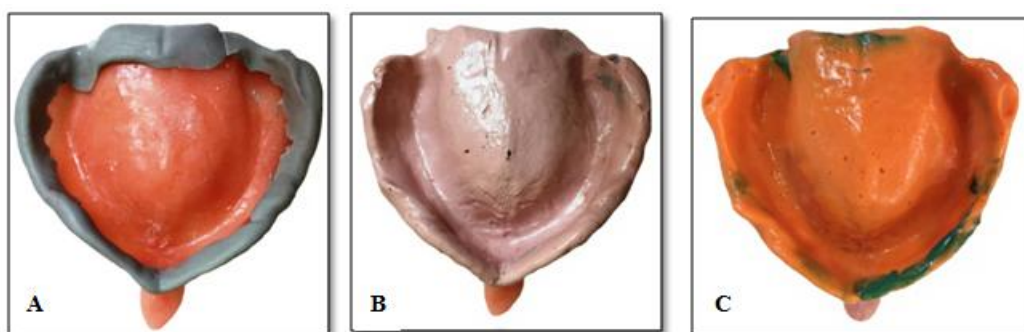


Figure (1): A. Custom tray molded with green stick, B. Metallic oxide final impression wash.

**Second group:**

Full putty polyvinylsiloxane border molding -an adhesive for silicone (Promedica,Germany) impressions was applied on the outside borders of the tray . One scoop of putty type rubber base (Zhermack, Italy) was mixed thoroughly by hand with catalyst for 30-45 seconds then rolled and applied to all the borders of the tray crossing the posterior palatal seal area, then inserted inside the patient mouth with correct centralization and border molding movements were done as in the first group. Then the tray was removed after silicone material setting and examined for accurate details for border limiting structures, as shown in (Figure 2A).

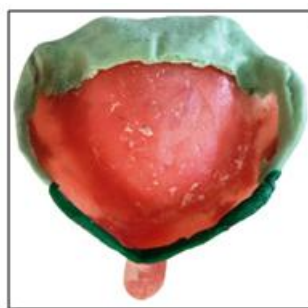
Final impression was made using metallic oxide as in the first group. The same procedure and material of border molding was done and final impression was made using the light body silicone, as shown in (Figure 2B and C



**Figure (2):** A. Custom tray molded with putty silicon, B. Metallic oxide final impression wash, and C. Light body silicon final impression wash.

• **Third group:**

The custom tray was border molded sectionally; the labial flanges were molded using the green stick compound follow the same procedure as in first group, while the buccal flanges and posterior palatal seal area were border molded using putty polyvinylsiloxane impression material following the same procedure in second group. The finished border molding was checked and final impression was made using metallic oxide impression paste, as shown in (Figure 3). The same procedure and material for border molding was used and final impression was made using light body silicone.



**Figure (3):** Custom tray molded labially with green stick while buccally and palataly molded with putty silicon.

• **Fourth group:**

The labial flanges were molded using the putty type polyvinylsiloxane impression material with the buccal and posterior palatal seal area were molded using the low fusing compound, following the same procedure in the first and second groups (Figure 4). The finished border molding was checked and final impression was made using the metallic oxide impression paste. The same procedure and material for border molding was used and final impression was made using light body silicone.

All impression trays were beaded and boxed, then pouring the impression in dental stone to produce the master casts.



**Figure (4):** Custom tray molded labially with putty silicon while buccally and palatally molded with green stick.

### Denture Base Preparations

Each patient received eight heat cured acrylic resin denture bases which was of thickness 2mm, that had been constructed on the master casts for each patient. All mixing and curing was done according to manufacturer recommendation. After flasking, the cured denture bases were finished and polished. For measurement of retention, a wire loop of 0.9mm in diameter was constructed to be attached to the center of the polished palatal surface by using autopolymerized acrylic resin, this wire loop would be used for hook attachment of the force meter, the hook used being light in weight and its easily sterilized using 70% solution of isopropyl alcohol.

A vertical downward force was applied to dislodge each denture base as the patient was set in an upright position with the occlusal plane is being parallel to the floor, and the patient's head was held firmly on the head rest. The force values at which the denture bases were dislodged completely from the palate was displayed on a strain measuring device represented by (mv) and by referring to the calibrated data, the force values in grams could be calculated. The results were collected and statistically analyzed to evaluate the difference in retention of the denture bases.

### III. Results

The statistical analysis of the data obtained indicated that the higher mean of retention forces were found in the denture bases were fabricated by using the full putty silicone border molding accombined with light body silicone final impression, then follow by the denture bases were fabricated from anterior green stick tracing and posterior putty silicone border molding with light body silicone and metallic oxide final impression material (Table 1), while the least retention forces of denture bases was indicated in the denture bases were fabricated from full green stick tracing and metallic oxide impression materials and in posterior tracing using green stick material a combined to metallic oxide and light body silicone final impression material. (Table 1), (Figure 5).

The analysis of variance (ANOVA) test showed that there was a statistically highly significant difference in retention force between denture bases obtained from full and posterior putty silicone border molding combined with the light body silicone and metallic oxide final impression materials compared to denture bases obtained from other tracing procedure, materials and final impression materials as shown in (Table 2, 3). For the comparison between group, (Table 4), a highly significant differences between the denture bases obtained by light body silicone final impression material as compared to denture bases obtained by metallic oxide final impression material when the same tracing procedure and material were used.

**Table (1): Descriptive statistics for retention force values in gm of all groups**

Groups	N	Mean	S.D.	S.E.	Min.	Max.
1	15	1303.32	9.57	2.47	1288.90	1317.90
2	15	2908.39	7.89	2.04	2900.20	2924.30
3	15	3406.55	6.78	1.75	3400.60	3420.10
4	15	2895.06	8.29	2.14	2876.10	2908.90
5	15	3002.94	7.36	1.90	2992.90	3017.00
6	15	1330.30	2.05	0.53	1329.10	1337.20
7	15	1341.93	0.14	0.04	1341.70	1342.10

**Table (2): ANOVA test for retention forces between and within groups**

ANOVA	Sum of Squares	d.f.	Mean Square	F-test	p-value
Between Groups	79399480.12	6	13233246.69	283349.09	0.000 (HS)
Within Groups	4576.89	98	46.70		
Total	79404057.02	104			

Significant (S):  $P \leq 0.05$

Highly Significant (HS):  $P \leq 0.001$

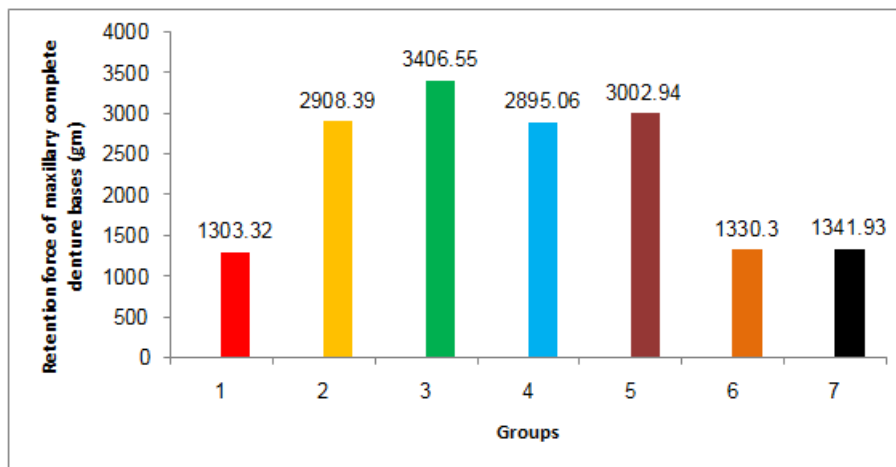
**Table (3): LSD test for retention forces between and within groups.**

Groups	Mean Difference	p-value
1	2	-1605.07
	3	-2103.23
	4	-1591.74
	5	-1699.62
	6	-26.98
	7	-38.61
2	3	-498.16
	4	13.33
	5	-94.55
	6	1578.09
	7	1566.47
3	4	511.49
	5	403.61
	6	2076.25
	7	2064.63
4	5	-107.88
	6	1564.76
	7	1553.13
5	6	1672.64
	7	1661.01
6	7	-11.63

S.E. = 2.50

**Table (4): Comparison of the retention forces of complete denture bases between groups**

Groups	Mean Difference	t-test	d.f.	p-value
2 vs. 3	-498.16	-185.48	28	0.000 (HS)
4 vs. 5	-107.88	-37.69	28	0.000 (HS)
6 vs. 7	-11.63	-21.86	28	0.000 (HS)



**Figure (5):** The retention forces mean of maxillary complete denture bases (gm) produced by different sectional border molding and different final impression materials.

#### IV. Discussion

One of the main goals of successful complete denture treatment is the construction of a retentive denture, since the irretentive dentures disturb all other goals as mastication, speech and in turn affected patient's psychology<sup>(7)</sup>. One of the greatest important factors to obtain such required retention is the peripheral seal, and to gain this peripheral seal, border molding must be done<sup>(8)</sup>.

This study deals with four different sectioning of border molding using two different materials and two final impression materials to compare the maxillary denture base retention obtained from these border molding and final impression materials. In the present study, patients with well formed residual ridges were selected without undercuts to eliminate the effect of mechanical factors on dentures retention which is an important variable during the research. The age of the patient participated in the study were selected with the age ranged from 50-60 years, since patients over 60 were excluded as they are more susceptible to trauma of oral mucosa, increased mitosis with slow turnover of tissue, and overall increase in the elastic fiber number.

The higher retention forces were detected in the denture bases produced by putty silicone full tracing a combined by light body silicone final impression material as it was compared with other tracing procedure and

materials, these results could be explained on the bases, that the putty silicone tracing characterized by an excellent manipulative consistencies dimensional stability and being molding by fingers prior to be inserted intra orally with an adequate working times<sup>(9)</sup>, these properties of putty silicone tracing material resulted in uniform border thickness and smooth continuity, with elasticity of putty silicone which help in accurate adaptation of the tissue borders with simultaneous muscle movement resulted in a uniform recording of the periphery<sup>(3)</sup> on both sides resulting in all around peripheral seal, in addition, as the light body silicone final impression is being polymerized against the putty type silicone full tracing, so this exhibit good dimensional stability as a result of greater bone strength between the putty tracing and light body silicone final impression material<sup>(8)</sup>, all these facts explain the higher retention forces and its statistically highly significant difference as compared to retention forces of denture bases produced by full green stick tracing and metallic oxide final impression, this may be clarified by the facts that during softening procedure, green stick by dry heat flame, this may have resulting in flow and texture properties of green stick material, since the flow will be retained for a short period of time, as its in contact with hot water & oral tissues, the green stick cool and flow ceased this may be resulted in an inaccurate impression and if tissues are contacted before tray is properly seated for border molding procedure<sup>(6)</sup>. in addition, the newly added materials to a tray border with section being previously molded this contact of fresh green stick material to already set one may compromise the bonding between fresh and set green stick materials, which might be resulted in error in continuity, and the high heat required for softening of the green stick, as it being in tissue contact, this may result in a alteration of muscle tonicity as reflex to heat application and resulting in compromised border molding, and this may be associated with multiple insertion during molding procedure which may alter the orientation of the tray and may incorporating an error<sup>(3)</sup> that is why the denture bases resulting from full green stick and full metallic oxide is with least retention forces compared to the other tracing procedures, and also explain why the retention forces is decrease with use of green stick tracing for posterior palatal seal area in sectional tracing procedure, when the anterior flanges were traced with putty silicone but the retention values is improved with use of light body silicone as final impression material because of good flow property all over the peripheral surfaces, these finding are in line with the findings of Rizk<sup>(7)</sup> and Yarapatineni et al.<sup>(3)</sup> while in using the putty type silicone as a tracing materials for the posterior palatal seal areas resulting in a higher retention values than the use of green stick tracing material, this may be attributed is the better adaptability of the putty silicone and better peripheral seals were achieved due to the more accurate recording of the seal areas, this may associated with good flow of light body silicone final impression all over the peripheral surfaces of the denture bearing area and the chemical bond between the light body silicone final impression and putty silicone tracing, also the retention forces in denture bases with use of metallic oxide as a final impression is less than is with use of light body silicone, because of lacks bonding to both green stick and putty silicone tracing material.

#### IV. Conclusion

##### Within the limitation of this study, can conclude:

1. Denture bases produced by full putty silicone and posterior putty silicone tracing material and light body silicone final impression materials showed the highest mean values of retention forces.
2. The denture bases produced by full green final impression material showed the lowest mean values of retention forces
3. All the retention forces of all denture bases showed an acceptable retention forces on clinical examination.

#### References

- [1]. Jayaprakash MB., Sahu K, Khan M, Khoriya S, Jadhav S, Rendre B, Lukaram A. Management of flabby ridge cases: A challenge in clinical practice. *Int. adv health sci* 2014; 1(5): 32-7.
- [2]. Tasleem R, Bin Saeed MH, Javed MU. Comparison of complete denture fabricated by two different border molding materials, in terms of patients' satisfaction. *J Ayub Med Coll Abbottabad* 2013; 26(3-4): 78-80
- [3]. Yarapatineni R, Vilekar A, Kumar JP, Kumar GA, Aravind P, Kumar PA. Comparative evaluation of border molding, using two different techniques in maxillary edentulous arches-An in vivo study. *Int oral health* 2013; 5(6): 82-7.
- [4]. Patel JR, Sethuraman R, Chaudhari J. Comparative evaluation of border morphology produced by three different border molding materials. *Int. Journal of Contemporary Dentistry* 2010; 1(3).
- [5]. Olivieri A, Zuccari AG, Olivieri D. A technique for border molding with light – polymerized resin. *J Prosthet Dent* 2003; 90: 101.
- [6]. Smith DE, Toolson LB, Bolender CL, Lord JL. One step border molding of complete denture impression using polyether impression material. *J Prothet Dent.* 1974; 41: 347-51.
- [7]. Rizk FN. Effect of different border molding materials on complete denture retention. *C.D.J* 2008; 24; 3: 415-20.
- [8]. Nawar NH, Eid HI, Sabet ME. A study on the effect of border molding on retentive efficiency of maxillary complete denture. *C.D.J.* 2005; 21:135-40.
- [9]. Felton DA, Cooper LF, Scurria MS. Predictable impression procedure for complete dentures. *J Prosthet Dent.* 1996; 40: 39-51.