

Comparative Effect of Various Border Molding and Final Impression Materials of Altered Cast Impression Technique on Tissue Displacement of Mandibular Distal Extension Cases

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Abstract: ***Background:** The functional impressions for tissue supported partial dentures require recording the functional form of the residual ridge under occlusal loading. **Aim of study:** is to measure the amount of vertical tissue displacement by using different impression and border molding materials used in altered cast impression technique. **Materials and method:** Ten patients were selected with unilateral edentulous span in mandibular arch with at least first premolar and all anterior teeth were remain. Patient was subjected to three different altered cast impression procedures using the low fusing compound as border molding and zinc oxide eugenol as final impression material which is considered as a control for comparison with other groups that border molded with putty type silicone and final impression made with light and very light silicone impression material. Standardized acrylic occlusal platform was constructed and at three points of the edentulous span the vertical tissue displacement occurring due to different impression procedure was measured. **Results:** indicated that when an altered cast impression technique using light body silicone final impression material with putty type silicone border molding material resulting in higher amount of tissue displacement when compared to zinc oxide eugenol impression material and very light body silicone final impression material in all examined points. **Conclusion:** An altered cast impression technique using the putty type silicone as border modeling and very light body silicone as a final impression material producing a little amount of tissue displacement as compared to other groups and A greatest displacement was produced at the point C which represent the center of retromolar pad area.*

Keywords: altered cast, final impression materials, tissue displacement, modeling materials

1. Introduction

In mandibular distal extension partially edentulous cases, the support against the vertical forces of mastication is obtained from the rigid teeth, resilient mucosa and the underlying bone, an exact impression technique would provide the best support to be gained from distal extension ridge and giving the required stability for prosthesis⁽¹⁾ and since in the procedure of prosthesis production, the clinical situation to the cast which must reproduce exactly the oral structures and simulate the occlusion with its antagonist.⁽²⁾

The functional impressions for tissue supported partial dentures require recording the anatomic form of the teeth and the functional form of the residual ridge under occlusal loading the key point is to capture the surface morphology and location of the saddle which produced from deformation under loading; therefore, the functional selective pressure impression could overlap the distal extension ridge is much highly required than the rest of mucostatic anatomic impression in free-end saddle patient dentures^(3, 4).

The altered cast impressions can simultaneously capture the surface contour location of the ridge under occlusal function and most effectively the requirement of relating the anatomic form of the tooth to the functional form of the ridge^(10, 11).

Authors have suggested various functional impression produces^(5, 6), and most of them favoring altered cast procedure as the best possible way to obtain the cast by

combining anatomic and functional impression^(7, 8) in order to produce the accurate dental stone cast, the correct selection and use of impression materials. The silicones for oral impressions are most widely used in prosthodontics related to its accuracy and dimensional stability⁽⁹⁾.

The reaction of distal extension ridge tissue to the impression produces material could be reflected by the amount of vertical displacement so this study was designated to measure the amount of vertical tissue displacement occurring in the distal extension tissue under different impression materials and border molding materials used in altered cast impression technique.

2. Materials and Methods

Ten patients with age range (45-58) years were selected from the post-graduation prosthodontics clinic, college of dentistry, Baghdad University, their main chief complaint is the substitution of their missing lower molars. The inclusion criteria including mandibular unilateral distal extension with at least first premolar and all anterior teeth were remain, with healthy gingival tissue and no symptoms of inflammation of the denture foundation area and free from periodontal involvement of abutment teeth. Preliminary impression was made for each patient using rim lock stock tray with irreversible hydrocolloid impression material (Zhermack, Italy).

Surveying, designing and custom tray fabrication with wax spacer and stopper over the anterior teeth and residual ridge

for proper seating of the tray and to the pressure during impression. After mouth preparation was done, final impression was made with alginate impression material (Zhermack, Italy) to gain the cast where the investing and casting was completed and the finished frame work was examined to ensure the fitness orally, Duplication of the master model to produce three models to be used in the study using putty type silicone duplicating materials (Elite Zhermack-Italy), in order to be serve the original master model. An acrylic resin custom tray was attached to the metal frame work, border molding was done using low fusing compound stick (Hoveman, Germany) and final impression was made with Zinc oxide eugenol impression (SS White England) with finger pressure was applied only to the parts of the framework that comes in contact with teeth (Figure 1).



Figure 1: Border molding was done using low fusing compound stick

The first model was altered by cutting the residual ridge at 0.5-1.0 mm distal to the last remaining tooth the cut surface of the cast was then grooved inattentions to provide retention of newly poured stone as shown in Figure (2). Beading and boxing was done and pouring the impression using dental stone to produce the first altered cast which is considered to be control cast of this study.



Figure 2: The cast is altered after final impression

The second altered cast was produced by making the final impression using light body silicone (Zhermack-Italy)(Figure 3) as an impression material and with putty type silicone as border modeling material and the third altered cast was produced by making the final impression with very light body silicone (Zermack-Italy) (Figure 4) as an impression material with putty type silicone as border modeling material.

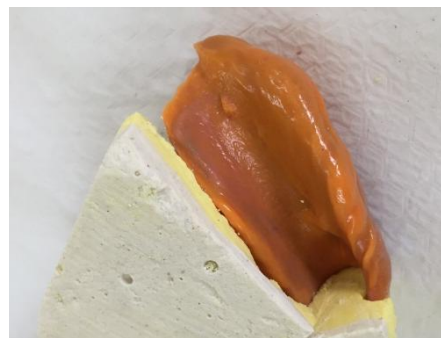


Figure 3: Altered cast impression technique using light body silicone final impression



Figure 4: Altered cast impression technique using very light body silicone final impression

The same procedure of cast alteration and pouring were followed as in the first altered cast.

3. Measurement and Data Collection

In order to measure and compare the amount of vertical tissue displacement of three altered casts for each patient, an auto polymerizing acrylic resin plate form was constructed to the height of the occlusal surfaces and the incisal edges of the remaining teeth on the control model. These platforms were extended up to retro molar pads and were approximately 0.5 inch higher than the crest of the ridges. Three measuring points were selected on the crest of the ridges of the control model on edentulous side.

The reference points were located at the center of the retromolar pad, 5mm posterior to the last standing abutment and the midway between two pervious points.

The cast and standardized occlusal platform were stabilized using a surveyor. An endodontic file with a stopper was passed from the top of the acrylic platform till it contacted the crest of ridge. The distance between the stoppers and the tip of the file was measured using a digital vernier caliper. The single custom platform constructed was resealed on the all altered casts obtained from various impression and modeling materials, and measurements were done as in control cast.

4. Results

The mean values indicated that when an altered cast impression technique using light body silicone final impression material with putty type silicone border molding material resulting in higher amount of tissue displacement

when compared to zinc oxide eugenol impression material and very light body silicone final impression material in all examined points, and the altered cast impression technique using very light body silicone final impression with putty type silicone as a modeling material revealed the least amount of tissue displacement table (1), figure (5).

The inferential statistic using ANOVA test revealed a highly significant differences in tissue displacement between the control and the first and second experimental groups at the points near the abutment teeth and at the retromolar pad areas while the middle point showing only significant amount of tissue displacement. Table (2)

The LSD test between groups showing highly significant differences in tissue displacement at examined points except the area near abutment tooth, there was no significant difference between the control group and second experimental group (Table 3).

Table 1: Descriptive statistic of tissue displacement of various impression and molding materials

		A	B	C
Control	Mean	10.054	10.133	10.505
	SD	0.014	0.302	0.025
	SE	0.0045	0.096	0.0079
Group1	Mean	10.186	10.356	10.559
	SD	0.0142	0.0164	0.0144
	SE	0.0045	0.0052	0.0046
Group2	Mean	10.054	10.086	10.262
	SD	0.0343	0.0566	0.0078
	SE	0.0109	0.0180	0.0025

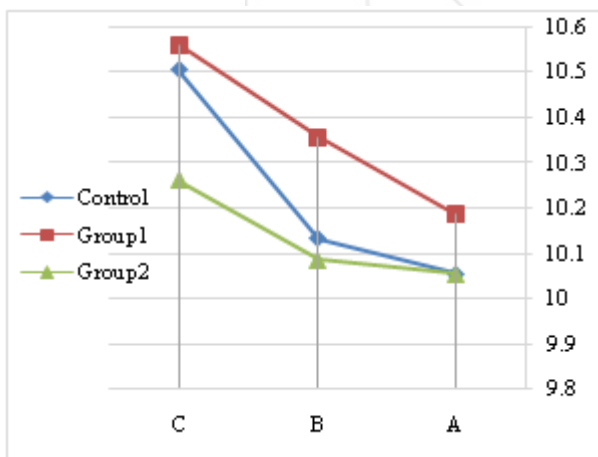


Figure 5: Showing tissue displacement using various impression and molding material in altered cast technique

Table 2: ANOVA of tissue displacement between groups

	A		B		C	
	F-test	P-value	F-test	P-value	F-test	P-value
Between groups Control & Group1 & Group2	109.5	P<0.01 HS	6.591	0.005 S	83.4	P<0.001 HS

*P<0.001 High significant
 **P<0.05 Significant
 ***P>0.05 Non significant

Table 3: LSD of tissue displacement between groups

	A		B		C	
	P-value	Sig	P-value	Sig	P-value	Sig
Control & Group1	P<0.001	HS	0.009	S	P<0.001	HS
Control & Group2	1.000	NS	0.559	NS	P<0.001	HS
Group1 & Group2	P<0.001	HS	0.002	S	P<0.001	HS

*P<0.001 High significant
 **P<0.05 Significant
 ***P>0.05 Non significant

5. Discussion

Altered cast technique is typically used as a special procedure for removable partial denture in distal extension situations to equate the pressure between the teeth and the edentulous space. In addition, favorably extended base will provide stimulation to the underlying bone and distribute forces uniformly and once the altered cast technique allows the ridge recorded in functional form to be related to the abutment teeth as the prosthesis is seated, resulting in prosthesis derives support simultaneously from the teeth and the denture base.

Effect of border molding materials on tissue displacement

The tissue displacement resulting from an altered cast impression technique using the putty type silicone as border molding material with very light body silicone as a final impression material producing a little amount of tissue displacement as compared to other groups this may be attributed to the putty silicone tracing characterized by an excitement manipulative consistencies, dimensional stability and being molding by fingers prior to be inserted intra orally with an adequate working times which resulting in uniform border thickness and smooth continuity helping in an accurate adaptation of the tissue borders with simultaneous muscle movement while, the green stick material need to be softened using the dry heat flame, which may affect the flow and texture properties of green stick material since the flow will be retained for short period of time as the materials being in contact with oral tissues resulting in an inaccurate adaptation to the surrounding oral tissues^(2,9,11).

Effect of impression material on tissue displacement.

Its seem that the factors that affect the reproduction of and accuracy of molded structure are associated more with the impression materials⁽⁹⁾ and once the most desirable impression would attempt to provide mild displacement of the more resilient tissues which are capable of providing denture support⁽¹²⁾ these facts might explain the result of present study in that the third experimental group using the very light final impression material producing significant decrease in tissue displacement as compared to other experimental group as revealed in table 2. Since the very light body silicone final impression would flow properly all over the peripheral surfaces area in addition to the chemical bonding between the molding material and the impression material which produce a rhythmic displacement of blood fluids from the super facial vessels during function this vascular displacement concedes with more elastic phase of impression^(2,9,12)

Response of reference points on tissue displacement.

The result indicated a greatest displacement at the point C which represent the center of retromolar pad area, this displacement could be explained on bases of that the area covered with mucosa and containing submucosa associated with muscle tendineous attachments of buccinators, superior constrictor and temporal muscle making the area as a stress bearing area following by reference point B which covered by mucosa with an intervening submucosa layer containing connective tissues and muscle fibers of buccinators muscle while the reference point A gave the least amount of displacement due to the histological nature of the area⁽¹³⁾.

6. Conclusion

With the limitation of present study, we can conclude:

- 1) An altered cast impression technique using the putty type silicone as border modeling and very light body silicone as a final impression material producing a little amount of tissue displacement as compared to other groups.
- 2) A greatest displacement was produced at the point C which represents the center of retromolar pad area.

References

- [1] Suresh V, Nadiger R, Philip JM, Jain AR. Comparison of different impression procedures on tissue displacement. *Int. J of recent Advances in multidisciplinary Research* 2015; 2(3): 340-344.
- [2] Leao MP, Pinto CP, Sponchiado AP, Ornaghi BP. Dimensional stability of a novel polyvinylsiloxane impression technique. *Braz J Oral Sci.* 2014;13(2):118-123.
- [3] LiQL, Cao Y. Anovel Functional impression procedure to distal – extension removable partial dentures. *Int J Dentistry Oral Sci*, 2015; 2(11):168-172.
- [4] Al-dafii RN, Khamas AM. The effect of using different impression techniques and materials on vertical tissue displacement in free end extension ridges. (Dental Survey and clinical study). *J Bagh college Dentistry* 2009; 21(1):9-14.
- [5] Vonkramer R. A two stage impression technique for distal extension removable partial dentures. *J Prosthet Dent* 1988; 60(2): 199-201.
- [6] Diwan RR, Fahmi F. Comparison of two functional impression techniques for distal extension removable partial dentures. *J Prosthet Dent* 1988;60(4): 470-3.
- [7] Dumbrigue HB, Esquivel JF. Selective pressure single impression procedure for tooth mucosa supported removable partial dentures. *J Prosthet Dent* 1998;80(2): 259-61.
- [8] Leupold RJ, Flinton RJ, Pfeifer DL. Comparison of vertical movement occurring during loading of distal extension removable partial denture bases made by three impression techniques. *J Prosthet dent* 1992;68:290-3.
- [9] Vitti RP, Desilva MAB, Consani RLX, Sinhoreti MAC. Dimensional accuracy of stone casts made by silicone based impression materials and three impression techniques. *Baz Dent J* 2013; 24(5):498-502.
- [10] Holmes JB. Influence of impression procedures and occlusal loading on partial denture movement. *J Posthet Dent* 2001;86(4):335-341.

- [11] Daou E, Boulos P. A simplified impression technique for distal extension removable partial dentures. *IAJD* 2013;3(2):108-111.
- [12] Wyatt CL. The effect of prosthodontics treatment on alveolar bone loss. A review of literatures. *J Prosthet Dent* 1998;80:362.
- [13] Farhad V. Vertical displacement of distal extension ridges by different impression techniques. *J Prosthet Dent* 1978;40:374.