MJMR, Vol. 34, No. 3, 2023, pages (25 - 35).

Open Access
ISSN:2682-4558

Research Article

Evaluation of the amount of bone loss on CAD/CAM (milled framework) support two implant Telescopic mandibular overdenture attachments by splinting and Nonsplinting of two different impression materials (Vinyl Polyether Silicone and additional silicone)

Marco Fouad Khalil[1], Amr Mohamed Ismail Badr[1] and Gehan Fekry Mohamed[1]
Department of Prosthodontic, Faculty of Dentistry, Minia University

DOI: 10.21608/MJMR.2023.219198.1429

Abstract

Background: Utilizing to different impression materials in implant supported overdenture is the critical point on the effect on the amount of bone loss in definitive prosthesis especially if this stage of impression making splinted or not, effect of splinting of two implant will affect passivity of final prosthesis also effect of amount of marginal bone loss, new impression material of Vinyl polyether silicone can solve this problem due to its stiffness enough to support. **Objective:** The aim of this study was to evaluate the amount of bone loss on CAD/CAM (milled) two implant supported Telescopic mandibular overdenture attachments by splinting and Non splinting of two different impression materials (Vinyl Polyether Silicone and additional silicone). **Materials and Methods:** 4 groups of this study prepared on two different impression material, each impression material divided into two group splinting and non-splinting: **Group (I):** Divided into two subgroups **Group (I.A):** 5 patients receive two implants with CAD/CAM (milled) two implant supported Telescopic mandibular overdenture attachments opposing maxillary complete denture with final impression technique made by Vinyl Polyether Silioxaine (VPES) with splinting technique. **Group (I.B):** 5 patient receive two implants with CAD/CAM (milled) two implant supported Telescopic mandibular overdenture attachments opposing maxillary complete denture with final impression technique made by polyvinyl silicone with splinting technique. **Group (II):** Divided into two subgroups **Group (II.A):** 5 patient receive two implants with on CAD/CAM (milled) two implant supported Telescopic mandibular overdenture attachments opposing maxillary complete denture with final impression technique made by Vinyl Polyether Silioxaine (VPES) without splinting. **Group (II.B):** 5 patients receive two implants with CAD/CAM (milled framework) support two implant Telescopic mandibular overdenture attachments opposing maxillary complete dentures with final impression technique made by polyvinyl silicone without splinting. **Follow up:** Bone loss evaluation around two implants with CAD/CAM (milled framework) support two implant Telescopic mandibular overdenture attachments was done using measurements on digital periapical radiograph with long cone paralleling technique for one year following interval time (at loading, 0 to 3 months, 0 to 6 months, 0 two 9 months, 0 to 12 months). **Results:** After mean percentage change calculation, independent t-test was performed to Determine the significance between the four groups which concluded that there was significant difference between all groups as (P-value < 0.05). **Conclusion:** The marginal bone loss in the group of Vinyl Polyether Silioxaine (VPES) with splinting was the least amount of bone loss compared to the other three groups (Vinyl Polyether Silioxaine (VPES) without splinting, polyvinyl silioxane with splinting Group) while the marginal bone loss in the group of polyvinyl silioxane without splinting was the greatest.

Keywords: Implant, splinting, framework, millied, resorption

Introduction

Edentulism has a very detrimental effect on individuals . It has been observed to result in functional, psychological, and social limitations and affects the quality of life and general health.(1)

Edentulism is a challenging problem for the healthcare providers, for going of this problem as a literature review, main responsible factors for teeth loss Dental caries and periodontal diseases. (2)
Negative impact of teeth loss will affect esthetics also functional activity, prosthetic rehabilitation is the best choice to solve this problems for restoring vertical dimension also esthetics and function, either treating traditionally by conventional complete dentures or by implant supported prostheses. (3)

Retention, stability and support, improved by implant supported -overdentures which have many functions as two implant overdentures have been agreed to be the basic standard restorative solution for the edentulous mandible overcoming the problems associated with conventional dentures. (4)

Implant overdentures can be divided according to the type of retention systems to bar splinting or solitary attachments(5) Also the number, distribution, of implants and placement sits depending on many factors, which include the anatomical condition and the economic status of patients.

From the biomechanical view, overdenture prosthetic option considering the best restorative option as they allow for a proper physiological force distribution and gentle impact on the mucosa also residual ridge preservation. (6)

Excessive functional loads on implants, leads to crestal bone loss leading to implant faliure This may result from biomechanical response of implant to stress.(7)

Impressions is a critical part of the process of constructing a well-fitting prosthesis; it is imperative that it copies the exact topography of the recorded site and translates it accurately to its cast. To achieve this, the impression material must be both accurate and stable (8,9)
Accuracy of impression plays an essential role in prosthesis-implant fit.(9) Although there are many studies comparing different impression materials and techniques, but there is still no consensus (10-14).

Materials and methods

Twenty completely edentulous patients were selected from the outpatient clinic of the Prosthodontic department, Faculty of dentistry, Minia University according to the following inclusion criteria:
1. Highly motivated completely edentulous patient with aged range from 50 to 60 years old.
2. According to American Society of Anesthesiologists (ASA) Classifications which illustrate the types of patients free from any systemic diseases that will hinder or affect the survival rate of the implant. or affect implant surgery: patients Selected were (ASA. type. 1) and (ASA. type. 2),
3. Well-developed ridge with adequate amount of keratinized mucosa.
4. patients with adequate inter arch space.
5. patients with normal facial symmetry and normal muscle tone.
6. Angle's Class I skeletal relationship

<u>The following patients were excluded from the study:</u>
1. severly atrophied ridges
2. Young aged patients
3. (ASA. type. 3) & (ASA. type. 4) having a systematic disease that may affect the survival rate of the implant.
4. Angle's Class II and III skeletal relationship
5. Irradiated patient or patient undergoing chemotherapy
6. D1&D4 bone densities

Upper and lower Complete dentures were constructed for all patients, the lower denture was duplicated, radiographic

markers inserted into canine region to be used as a radiographic stent and later as a surgical stent.

Each patient received two mandibular root form implants with standardized diameter of 3.5 mm. and 13mm length, placed at the canine region. then they were divided randomly into two main groups (I & II) and two subgroups (A & B):

Group (I): Divided into two subgroups

Group (I.A): 5 patient receive two implants with on CAD/CAM (milled) two implant supported Telescopic mandibular overdenture attachments opposing maxillary complete denture with final impression technique made by Vinyl Polyether Silioxaine (VPES) with splinting technique.

Group (I.B): 5 patient receive two implants with on CAD/CAM (milled) two implant supported Telescopic mandibular overdenture attachments opposing maxillary complete denture with final impression technique made by polyvinyl silicone with splinting technique.

Group (II): Divided into two subgroups

Group (II.A): 5 patient receive two implants with on CAD/CAM (milled) two implant supported Telescopic mandibular overdenture attachments opposing maxillary complete denture with final impression technique made by Vinyl Polyether Silioxaine (VPES) without splinting.

Group (II.B): 5 patient receive two implants with on CAD/CAM (milled) two implant supported Telescopic mandibular overdenture attachments opposing maxillary complete denture with final impression technique made by polyvinyl silicone without splinting.

After ensuring Osseointegration the implants, its uncovered, multi-unit abutments heights 1.2 were screwed in the implants hex (fig. 1) all patients recalled after seven days for primary impression making which poured to making a study model upon which a customized open tray technique.

Fig. (1) Multi unit Abutments screwed to the two implants

For group (I.A) five patient receive The final impression of implants retained mandibular overdenture by Vinyl Polyether Silioxaine (VPES) without splinting of transfer copings, impression transfers attached, then Vinyl Polyether Silioxaine (VPES) prepared and injected around transfres and loaded into the tray, after complete setting, transfer copings unscrewed and impression removed then analogues attached (Fig. 2)

Fig. (2) Nonsplinted Vinyl Polyether Silioxaine (VPES) impression

For group (I.B): impression transfers attached, tray checked, then elastic power chin attached between transfer copings to act as a scaffold for flowable composite jpg, then polyvinyl silioxane impression materials prepared and injected around the transfers and loaded into the tray, after complete setting, transfer copings were unscrewed and impression was removed then implant analogues were attached and screwed. (Fig 3)

Fig. (3): Splinted polyvinyl silioxane impression

For group (II.A) 5 patient receive two implants with bar retained mandibular overdenture opposing maxillary complete denture with final impression technique made by Vinyl Polyether Silioxaine (VPES) without splinting (Fig. 4)

(Fig. (4): Non-Splinted Vinyl Polyether Silioxaine impression

For Group (II.B) 5 patient receive two implants with bar retained mandibular overdenture opposing maxillary complete denture with final impression technique made by polyvinyl silicone without splinting (Fig. 5)

Fig. (5): Non Splinted polyvinyl silicone impression

Two castable plastic abutments were then attached to the analogues then cut and Adjusted on the articulator resembling the normal future height of the Bar owing to the inter-arch space.

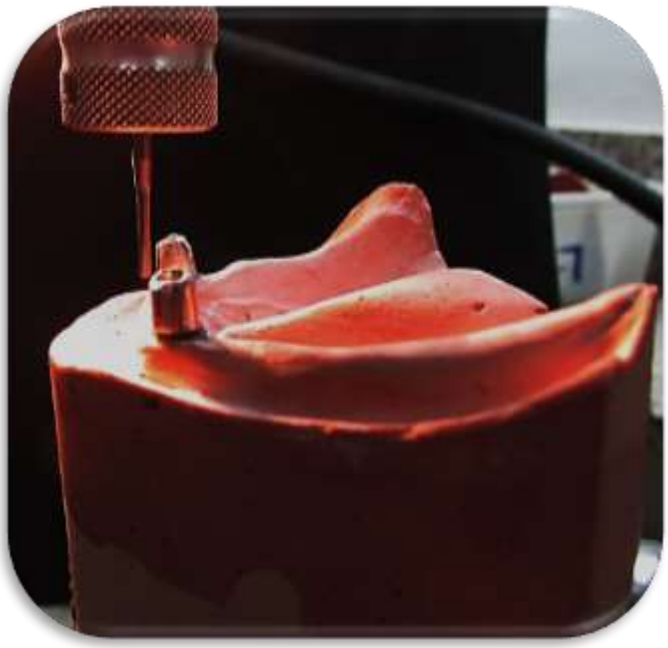
Milling wax[1] was then sprinkled on these plastic inserts using special instruments for wax dipping producing two wax copings**.** The wax pattern of the primary coping was milled using a straight wax trimmer (side cutting) then refined by an angulated wax trimmer (end cutting) so that the axial walls had a taper of 6 degrees The lower casts were then placed on the table of a Milling machine[2] according to the right insertion axis. The two wax copings were then milled using a stone on the milling machine ensuring proper wall parallism all around the copings **(Fig 6)**

Fig. (6): Milling the wax pattern on the milling machine

[1]Fraswäches, Milling wax, BEGO, Germany.

[2]Xp dent Corp.12145 SW 131 AvenueMiami, Florida 33186

The two milled wax copings were then casted The wax pattern was then sprued, invested, burnt out and finally casted into cobalt-chromium alloy The cast with the metal coping was replaced on the milling machine and the primary coping was finished using a finishing bur on a straight hand piece attached to the spindle of the milling machine[3] to achieve a smooth and even tapered coping. (Fig 7)



e metal primary coping on the milling machine using a

ıe with round end. Degree of taper was 6º.

Fig. (8): Primary casted copings tried intraorally

The primary coping was tried in the patient's mouth and checked for complete seating, proper fit and adaptation (Fig 8)

Bredent milling machine,Germany[3]

The coping then removed from the patient's mouth and was replaced on its cast then cast scanned after masking of the metal of primary copings , the framework designed directly of the copings with relief 1mm beneath the fitting surface of framework then framework milled into titanium frame from titanium blocks (figure 9)

Fig. (9): milled framework tried intraorally

Then Complete processing of the maxillary and mandibular dentures was done. The mandibular denture was processed on a duplicate of the master cast, followed by finishing and polishing of denture.

Dentures were inserted and fitted on their perspective telescopic attachments and occlusal adjustments were made

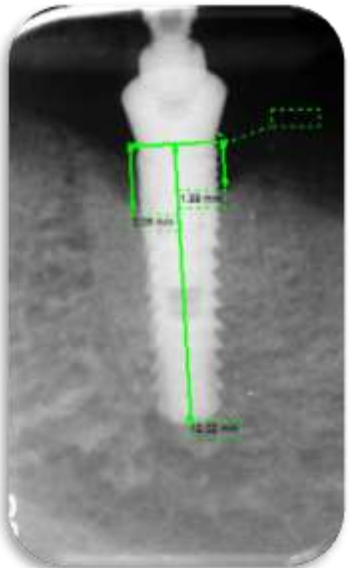


Fig. (10). Periapical radiograph showing the bone height measurements

The follow up started, using a film holder and long cone paralleling technique **(Fig. 10)** sequential digital x-rays were taken at loading, 3, 6 , 9 and 12 months.

The digital images were analyzed to evaluate the level of marginal bone height mesial and distal to the implant. To obtain an actual measurement the option calibration was used. The screen length of the implant was measured and calibrated to

the actual length of the implant. The contact between the implant platform and the abutment base was selected as reference point.

Bone height was measured as a distance between the reference point and the highest point of bone crest in contact with the implant.

Measurments of marginal bone loss were divided into four intervals (1st interval 0-3 months, 2nd interval 0-6, 3rd interval 0-9 &4th interval 0-12).

Marginal bone loss at 1st interval was measured by subtracting the bone height after one month from bone height at loading time.

Results

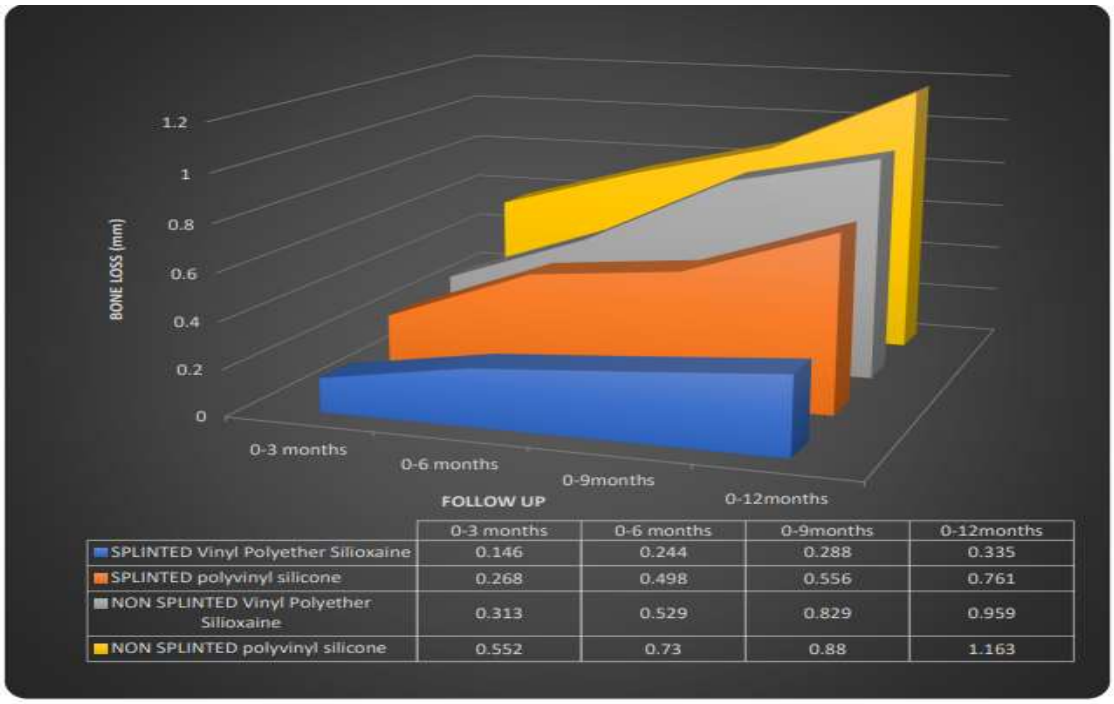
Data were presented as means and standard deviation (SD) values. One Way-ANOVA was used to study the bone loss after different follow up intervals, different splinting techniques and the effect of different impression materials used within each group. Tukey's post-hoc test was used for pair-wise comparison between the means when ANOVA test was significant. Statistical analysis was performed with IBM® SPSS® (SPSS Inc., IBM Corporation, NY, USA) Statistics Version 23 for Windows.

The success rate of the placed implants during the follow up was 100% (i.e. No implant was lost or showed signs of failure). The two bone height readings recorded for each implant (Mesial and distal aspects) were pooled for further statistical analysis as the statistical analysis for all the implants in all groups showed no significant difference. the readings were pooled for further statistical analysis. The mean bone loss values recorded for different study groups are shown in (Table 1)

Table (1): Mean and SD and results of comparison of bone loss (mm) for the different treatment options in the current study.

Variables		Follow UP intervals					P-value
Splinting	**Material**	**Baseline**	**0-3 months**	**0-6 months**	**0-9months**	**0-12months**	
SPLINTED	Vinyl Polyether Silioxaine	0 ± 0^{Aa}	0.146 ± 0.05^{Ba}	0.244 ± 0.07^{Ca}	0.288 ± 0.07^{Da}	0.335 ± 0.06^{Ea}	< **0.001***
	polyvinyl silicone	0 ± 0^{Aa}	0.268 ± 0.12^{Bb}	0.498 ± 0.19^{Cb}	0.55 ± 0.12^{Db}	0.761 ± 0.193^{Eb}	< **0.001***
NON SPLINTED	Vinyl Polyether Silioxaine	0 ± 0^{Aa}	0.313 ± 0.16^{Bc}	0.53 ± 0.18^{Cc}	0.829 ± 0.1^{Dc}	0.959 ± 0.32^{Ec}	<**0.001***
	polyvinyl silicone	0 ± 0^{Aa}	0.55 ± 0.128^{Bd}	0.73 ± 0.16^{Cd}	0.88 ± 0.14^{Dd}	1.16 ± 0.17^{Ed}	< **0.001***
	P-value		< **0.001***	< **0.001***	< **0.001***	< **0.001***	

Where *: significant at P<0.05; P>0.05(non-significant), P<0.05(significant), and P<0.01 (highly significant). and the letters denotes Tukey HSD all-pairwise comparisons test report where means that are not sharing similar letter are significantly different. capital letters detonated comparison between different follow up intervals while small letters detonated comparison between different treatment options for the same follow interval



	0-3 months	0-6 months	0-9months	0-12months
SPLINTED Vinyl Polyether Silioxaine	0.146	0.244	0.288	0.335
SPLINTED polyvinyl silicone	0.268	0.498	0.556	0.761
NON SPLINTED Vinyl Polyether Silioxaine	0.313	0.529	0.829	0.959
NON SPLINTED polyvinyl silicone	0.552	0.73	0.88	1.163

Graph (1) Mean values of bone loss (mm) for the different treatment options in the current study

Discussion

The original implant position must be reproduced in an accurate working cast by means of an impression technique which differ from splinting and non-splinting techniques This plays an essential role in the prosthesis implant adaptation conse-quent of crestal bone loss[9,10]. Several authors have reported that addition silicones are very accurate impression materials and should be used for implant-level impressions [10,11].

In addition, condensation silicone had been described as the worst material for implant transfer impressions and may be considered contraindicated [12].

The objective of this study was to compare two different impression materials (Vinyl Polyether Silicone and additional silicone) by splinting and non-splinting grouping on amount of marginal bone loss of two implant-retained Bar mandibular overdenture

Polyvinyl siloxane produced accurate casts in this study in less chair time, as a dimensionally stable material, character-ized by its rigidity for proper splinting of transfer copings without micromovment, in agreement with other studies [13].

One of the drawbacks when the impression copings are rigidly splinted with autopolymerizing acrylic resin and making impression with additional silicone they seem to be susceptible to shrinkage lead to difficulty in determining the passive fit. However, if polymerization shrinkage occurs, it will be noticeable and the resin should be sectioned and joined again with small amounts of acrylic resin, all of that's process surely affect passive fit of jeg than affect passive fit of prosthesis and affect amount of bone loss if prosthesis non passive [12].

Conclusion

The marginal bone loss in the group of Vinyl Polyether Silioxaine (VPES) with splinting

was the least compared to the other three groups (Vinyl Polyether Silioxaine (VPES) without splinting, polyvinyl silioxane with splinting Group) while the marginal bone loss in the group of polyvinyl silioxane without splinting was the greatest.

References

1. Rajaraman, Vaishnav & Ariga, Padma & Dhanraj, M. & Jain, Ashish. Effect of edentulism on general health and quality of life. Drug Invention Today (2018). 10. 549-553.
2. Al-Rafee MA. The epidemiology of edentulism and the associated factors: A literature Review. J Family Med Prim Care. (2020); 9:1841-1843.
3. Gupta, A., Felton, D.A., Jemt, T. and Koka, S. Rehabilitation of Edentulism and Mortality: A Systematic Review. J of Prosth (2019), 28: 526-535.
4. Alqutaibi AY, Esposito M, Algabri R, et al., single vs two implant retained overdentures for edentulous mandible: a systemic review. Eur j Oral implantology (2017): 10:243-261 .
5. Cicciù, M.; Tallarico, M. Dental implant materials: Current state and future perspectives. Materials (2021), 14, 371.
6. Sadowsky, S.J. Occlusal overload with dental implants: A review. Int. J. Implant. Dent. (2019), 5, 29–34.
7. Kitamura E, Stegaroiu R, Nomura S, et al., Biomechanical aspects of marginal bone resorption around osseointegrated implants: Considerations based on a three-dimensional finite element analysis. Clin Oral Implants Res. 2004; 15:401–412.
8. Vigolo P, Majzoub Z, Cordioli G. Evaluation of the accuracy of three techniques used for multiple implant abutment impressions. J Prosthet Dent. 2003;89: 186–192.
9. Kotsiomiti E, Tzialla A and Hatjivasiliou K, Accuracy and stability of impression materials subjected to chemical disinfection - a literature review. Journal of Oral Rehabilitation. 2008- 35: 291-299.
10. Filho HG, Mazaro JV, Vedovatto E, et al., Accuracy of impression techniques for implants. Part 2: Comparison of splinting techni--ques. J Prosthodont. 2009; 18: 172–176.
11. Lee H, So JS, Hochstedler JL, et al., The accuracy of implant impressions: A systematic review. J. Prosthet Dent. 2008;100:285–291.
12. Assuncao WG, Filho HG, Zaniquelli O. Evaluation of transfer impressions for osseointegrated implants at various angulations. Implant Dent. 2004;13: 358–366.
13. Vigolo P, Fonzi F, Majzoub Z, et al., An evaluation of impression techniques for multiple internal connection implant prostheses. J Prosthet Dent. 2004; 92: 470– 476.
14. Wee AG. Comparison of impression materials for direct multi-implant impressions. J Prosthet Dent. 2000; 83: 323–331.