

CLINICAL OUTCOME OF WEARING IMPLANT RETAINED OVER DENTURE IN PATIENTS WITH ATROPHIC ANTERIOR MAXILLA RECONSTRUCTED BY SUB NASAL LIFTING (CLINICAL STUDY)

Yassmin A. Tahamawy¹BDS, Faten S. Abbas² PhD, Nevien S. Abdallah³ PhD

ABSTRACT

INTRODUCTION: Maxillary implant overdenture has improved the quality of life for edentulous patients especially patients with atrophic maxilla. Sub-nasal lifting was introduced to solve the problem of severely atrophic anterior edentulous maxilla to allow insertion of dental implants. The type of attachment may influence the retention and stability of the prosthesis and thus, masticatory efficiency. Especially locator attachment is used with great success for improvement of implant-assisted over denture

OBJECTIVES: To evaluate clinically and radiographically the effect of wearing implant- retained over denture in patients with atrophic anterior maxilla which was reconstructed by nasal lifting. Patient satisfaction was also evaluated.

MATERIALS AND METHODS: This clinical trial was conducted on seven patients with edentulous atrophic anterior maxilla rehabilitated by Sub-Nasal Lifting, restored with bilateral two implants and grafted with Platelet-Rich Fibrin. For each patient an implant- retained over denture with locator attachments was constructed. Patient assessment was done using different three method including clinical, radiographic evaluation and patient satisfaction at three intervals: at time of over denture insertion, 3months and 6 months of denture use.

RESULTS: All patients showed increased bone density around dental implants with slight decrease in marginal bone height, no mobility of each implant was detected .All patient showed increased well satisfaction throughout the follow up periods.

CONCLUSIONS Two implant-assisted maxillary over denture is an acceptable treatment for patients with atrophic anterior maxilla and it showed increased patient satisfaction and favorable clinical and radiographic findings.

KEYWORDS: Maxillary over denture, two implants, nasal lifting, patient satisfaction, peri-implant tissue.

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1. Instructor at Department of Removable Prosthodontic, faculty of Dentistry, Alexandria University, Alexandria, Egypt.
 2. Professor of Prosthodontic, faculty of Dentistry, Alexandria University, Alexandria, Egypt.
 3. Professor of oral&maxilla facial surgery, faculty of Dentistry, Alexandria University, Alexandria, Egypt.

INTRODUCTION

Edentulism is associated with several deleterious effects on oral health including degenerative changes of the alveolar bone, reduction of height and width of available bone for dental prosthesis (1). In addition to its negative impact on oral health, edentulism has also detrimental effects on general health (2).

Following tooth loss, lack of alveolar bone stimulation leads to decrease in trabeculae and bone density in the area with loss in external width then height of the bone volume (3,4). Reduction of anterior maxillary bone dimension, both width and height, can reach up to 70%, especially if multiple extractions were performed and followed by alveoloplasty before delivery of a maxillary denture (5).

Treatments for edentulous maxilla patients specifically with severe degree of resorption can be performed through several techniques-bone augmentation or grafting; using angled implants in parasinus region; placing implant in the pterygoid apophysis; using short and wide implants; or using zygomatic implants (6).

Bone augmentation has been regarded as the gold standard procedure to treat atrophic maxilla. Le Fort I osteotomy with interpositional grafting and distraction osteogenesis are among augmentation procedures performed to restore the lost bone (7).

Restorative implant solutions for the edentulous maxilla include: removable overdenture therapy and fixed restoration (8). Zygomatic, small diameter implant and

tilted implants all are used to restore maxilla when insufficient bone height was available (9,10).

Reports of treatments involving two- implants maxillary over dentures with partial palatal coverage are limited but not entirely unfavorable (11). Providing only two implants in the maxilla does not compromise the longevity of the prostheses or patient satisfaction compared with 4-implant overdentures (12).

The newly developed locator attachment system has become widely applied. Recently, the locator attachment system being characterized by a low profile design, ease of seating in the oral cavity by the patient, self-locating feature to fit non-parallel implants up to 40° divergence (13). Other studies have reported that locator attachment system possessed the highest retentive force and maintained that force up to 30° tilting when compared to ball system (14).

Placement of dental implants in a severely resorbed anterior maxillary alveolar ridge is limited by the fact that implants may penetrate the nasal cavity. Recently, Mazor (15), investigated the use of bovine bone material for augmentation of the nasal floor and simultaneous insertion of dental implants during the same procedure. No implant failure was reported in this study.

Also, El-Ghareeb (16) reconstructed atrophic maxilla cases by performing nasal floor augmentation. The implant survival rate in his study was 100%. He concluded that "The use of osteoconductive bone substitutes for nasal floor augmentation, as shown in this small case series, is a

reliable method for reconstruction of the anterior atrophic maxilla for implant-supported over dentures".

Finally, a straight forward, minimal invasive and cost effective treatment option for atrophic edentulous anterior maxilla could be the placement of two implants at the canine area bilaterally following nasal lifting. Supporting this treatment approach using clinical, radiographic and patient satisfaction questionnaire is our aim.

MATERIALS AND METHODS

The clinical part of the study was performed after the approval of research ethics committee, Faculty of Dentistry, Alexandria University. Official consent was obtained from the patients. The patients received both oral and written information about the study protocol and signed an informed consent to participate in the study.

Patient rehabilitation

This study was conducted on seven completely edentulous patients having atrophic edentulous anterior maxilla and who found difficulty to be restored by conventional complete denture or insertion of implant at anterior atrophic maxilla. Those patients were previously rehabilitated using sub nasal lifting, and restored with bilateral two implants at canine area and grafted with platelet-rich fibrin (PRF). For each patient an implant retained over denture with locator attachment was constructed.

Prior to sub nasal surgical phase, a set of complete maxillary and mandibular dentures was fabricated for every patient according to standardized conventional technique.

Nasal lifting procedure with two implant placement (Dentium Co.Ltd, Korea) and platelet rich fibrin (PRF) grafting at the atrophic anterior maxillary edentulous area was done at the department of oral & maxillo facial surgery. The implants were inserted at the canine area bilaterally. The maxillary complete denture was relined with soft liner for the following six months (osseointegration phase).

Following the six months of osseointegration phase, new conventional complete denture set was constructed for each patient. The implants were uncovered by small crestal incisions at the location of the implants (Figure 1);

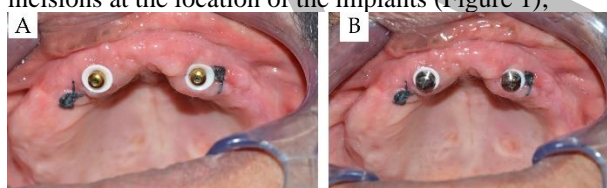
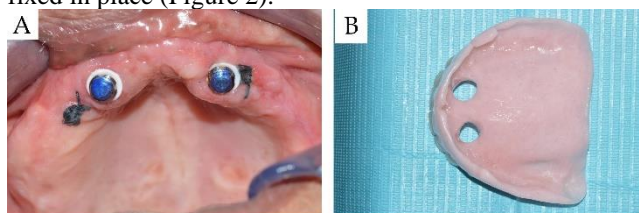


Figure (1):Showing crestal incision at the location of implant.

the exact location was determined using the previously used surgical template. The cover screws were removed and the healing caps were placed and left for one week allowing the gingiva to heal.

Healing abutments have been removed and abutments with Locator Positioner attachment and 2 mm collar height were fixed in place (Figure 2).



Figure(2):Showing Abutments with Locator (Positioner) attachment

The locator Positioner abutment (L13D102811, DentiumCo.Ltd, Korea) selected for this study was low profile (2mm) collar height with 3.5mm diameter with a socket set (Positioner socket set FSMHS, DentiumCo.Ltd, Korea.)

White block-out spacers were placed over the head of each Locator abutment (Figure 3(a)). The spacers were used to block out the area surrounding the abutment, a metal socket with white processing cap was inserted into each Positioner implant abutment, leaving the white block-out spacer beneath it (Figure 3 (b)).

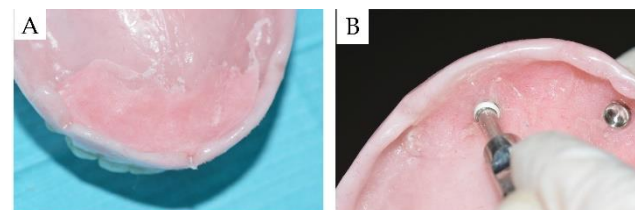
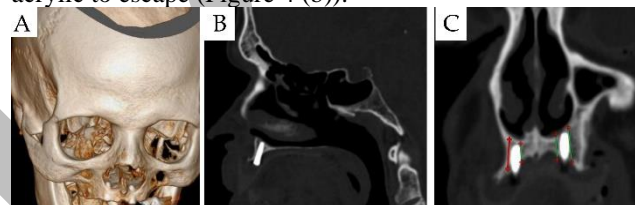


Figure (3):Showing a) White block-out spacers were placed. b) A metal socket with (white processing cap)

The maxillary denture was seated into the patient's mouth to determine the locations of the metal housings relative to the tissue-bearing surface of the prosthesis by marking the metal housings with indelible pencil (Figure 4 (a)). Recesses were prepared in the fitting surface of the maxillary denture to accommodate the protruding Positioner metal socket. Small relief holes were drilled through the top of the recesses palatally, to allow excess acrylic to escape (Figure 4 (b)).



The spaces provided in the fitting surface of the maxillary denture over the metal housings were wetted with auto-polymerized acrylic resin monomer. A mix of auto-polymerized acrylic resin "pick-up material" was prepared, and the spaces were filled using a plastic filling instrument (Figure 5(a)). The denture was inserted into position in the oral cavity. The patient gently guided into centric occlusion to maintain proper relationship with the opposing arch, direct pick up (17).

The locator core tool (Positioner Core Tool XPCT, DentiumCo.Ltd, Korea) was used for the procedure of removing the white processing cap from the socket and replacing it with the final nylon cap replacement, Ivory colored (Figure 5 (b)). Then the occlusion was readjusted intra-orally. The nylon caps were changed from ivory (least retention) to orange (medium retention) to blue (highest retention) within one month.

Patient evaluation

Radiographic evaluation

Radiographic evaluation of the bone around the implants for this study included:

Assessment of peri-implant marginal bone height changes.

Assessment of peri-implant bone density

Computerized tomography was used to evaluate the peri-implant tissue according to bone density as well as ridge height values using computer software radiat DICOM

viewer (RadiAnt DICOM viewer, Medixant, Poland) the assessment was done at time of implant assisted over denture insertion and after 6 months of over denture use (Figure (a-c)).

Patient satisfaction evaluation

Patient satisfaction was evaluated according to different parameters at time of over denture insertion, 3 months and 6 months after over denture use (18).

Clinical evaluation

Mobility

Mobility of the implants was assessed by placing each abutment between the ends of two blunt instruments and applying alternate pressure. A two point scale was used, namely mobile or non-mobile as recommended by Smith and Zarb (19).

Statistical analysis:

Data were fed to the computer and analyzed using IBM SPSS software package version 20.0. (Armonk, NY: IBM Corp) Qualitative data were described using number and percent. The Kolmogorov-Smirnov test was used to verify the normality of distribution Quantitative data were described using range (minimum and maximum), mean, standard deviation and median. Significance of the obtained results was judged at the 5% level.

The used tests were

McNemar-Bowker and Marginal Homogeneity Test

Used to analyse the significance between the different stages

Paired t-test

For normally quantitative variables, to compare between two periods

RESULTS

Radiographic evaluation:

Assessment of peri-implant marginal bone height changes: (Table 1) showed slight decrease in the mean marginal bone height throughout the period of follow up, but with non-significant statistical values, with (P=0.083) at right side, (P=0.127) at left side and (P=0.059) at both of them.

Assessment of peri-implant bone density: (Table 2) showed a statistical increase in the mean peri-implant bone density (HU) throughout the follow-up period especially at the right side with (P=0.049) which was statistically significant increase and also the same statistical significant increase recorded at the average of both right and left implants with (P=0.028).

Patient satisfaction evaluation

Table 3 showed a gradual increase in patient satisfaction parameters throughout the different periods of follow up especially at the end of 6 months period

Regarding the chewing efficiency: 71.4% of the patients presented well satisfaction with their stable dentures till the end of 6 months follow up period and 28.6% were satisfied. At the same time, tasting parameter was improved with well satisfaction for 42.9% and satisfaction of 57.1% of the patients.

For Speech parameter, also 71.4% of the patient showed well improvement at the end of 6 months follow up period.

As regard to Pain, no one of the patients showed satisfaction at time of insertion, but at the intervals of 3-months and 6-months, 57.1% of the patients reported good satisfaction without any pain complain.

-It was found that 71.4% of the patients were satisfied with their esthetics and 28.6% were well satisfied.

Denture retention and stability parameters, showed that all the patients (100%) reported significant improvement specially at the end of 6 months follow up period.

As regard to comfort no one of the patients showed any discomfort with their dentures at both the three and six months follow up periods.

Clinical evaluation

Mobility

None of the implants showed any signs of mobility throughout the evaluation period, so mobility scores were zero.

Table (1): Distribution of the studied cases according to marginal bone height.

Bone height	At time of over denture insertion	6 months of over denture use	P
Right implant			
Min. – Max.	13.28 – 13.32	13.20 – 13.32	0.083
Mean ± SD.	13.31 ± 0.02	13.27 ± 0.06	
Median	13.32	13.30	
Left implant			
Min. – Max.	13.30 – 13.35	13.25 – 13.35	0.127
Mean ± SD.	13.32 ± 0.01	13.30 ± 0.04	
Median	13.33	13.30	
Average (RT, LT)			
Min. – Max.	13.30 – 13.33	13.23 – 13.33	0.059
Mean ± SD.	13.32 ± 0.01	13.28 ± 0.04	
Median	13.32	13.30	

p: p value for Paired t-test for comparing between Pre-operative and Post-operative.

Table (2): Distribution of the studied cases according to bone density.

Bone Density	Pre-operative	Post-operative	p
Right			
Min. – Max.	308.58 – 761.58	538.63 – 874.57	0.049*
Mean ± SD.	519.67 ± 170.03	714.59 ± 127.04	
Median	496.88	727.5	
Left			
Min. – Max.	376.19 – 1052.93	541.17 – 784.86	0.112
Mean ± SD.	531.72 ± 239.4	671.45 ± 87.8	
Median	428.73	678.54	
Average			
Min. – Max.	362.65 – 842.17	559.0 – 829.72	0.028*
Mean ± SD.	525.7 ± 172.64	693.02 ± 105.45	
Median	450.94	691.29	

p: p value for Paired t-test for comparing between Pre-operative and Post-operative

*: Statistically significant at $p \leq 0.05$

Table (3):Distribution of the studied cases according to different parameters of patient satisfaction.

	At time of denture insertion		Post-operative			
			3 months		6 months	
	No.	%	No.	%	No.	%
Chewing						
Dissatisfied	1	14.3	0	0.0	0	0.0
Satisfied	3	42.9	2	28.6	2	28.6
Well satisfied	3	42.9	5	71.4	5	71.4
Sig. bet. periods	p ₁ = 0.083,p ₂ = 0.083,p ₃ = 1.000					
Tasting						
Satisfied	5	71.4	4	57.1	4	57.1
Well satisfied	2	28.6	3	42.9	3	42.9
Sig. bet. periods	p ₁ = 1.000,p ₂ = 1.000,p ₃ = 1.000					
Speech						
Satisfied	5	71.4	3	42.9	2	28.6
Well satisfied	2	28.6	4	57.1	5	71.4
Sig. bet. periods	p ₁ = 0.500,p ₂ = 0.250,p ₃ = 1.000					
Pain						
Dissatisfied	2	28.6	0	0.0	0	0.0
Satisfied	5	71.4	3	42.9	3	42.9
Well satisfied	0	0.0	4	57.1	4	57.1
Sig. bet. periods	p ₁ = 0.014*,p ₂ = 0.034*,p ₃ = 1.000					
Esthetics						
Dissatisfied	1	14.3	0	0.0	0	0.0
Satisfied	4	57.1	5	71.4	5	71.4
Well satisfied	2	28.6	2	28.6	2	28.6
Sig. bet. periods	p ₁ = 0.317,p ₂ = 0.317,p ₃ = 1.000					
Retention						
Satisfied	6	85.7	1	14.3	0	0.0
Well satisfied	1	14.3	6	85.7	7	100.0
Sig. bet. periods	p ₁ = 0.063,p ₂ = 0.031*,p ₃ = 1.000					
Comfort						
Dissatisfied	2	28.6	0	0.0	0	0.0
Satisfied	5	71.4	3	42.9	3	42.9
Well satisfied	0	0.0	4	57.1	4	57.1
Sig. bet. periods	p ₁ = 0.014*,p ₂ = 0.034*,p ₃ = 1.000					
Stability						
Satisfied	3	42.9	1	14.3	0	0.0
Well satisfied	4	57.1	6	85.7	7	100.0
Sig. bet. periods	p ₁ = 0.500,p ₂ = 0.250,p ₃ = 1.000					

Sig. bet. Periods was done by using Marginal Homogeneity Testor McNemar test.

p₁: p value for comparing between at time of denture insertion and after 3 months

p₂: p value for comparing between at time of denture insertion and after 6 months

p₃: p value for comparing between after 3 months and after 6 months

*: Statistically significant at $p \leq 0.05$

DISCUSSION

The prosthodontic literatures regarding maxillary implant assisted over denture lacks established scientific evidence that clinicians may use to guide clinical procedures and concepts.

If a larger number of implants is not associated with improved clinical results and there are economic and surgical benefits for patients with the use of a smaller number of implants, maxillary over denture treatment with two implants may warrant further consideration. And this was the hypothesis of our study.

In this study seven patients were selected with atrophic anterior maxilla which was contraindicated for implant insertion or over denture construction. All patients were previously rehabilitated by mucosal nasal lifting technique and grafting with platelet rich fibrin (PRF), then followed by two implants insertion bilaterally at the canine area.

Nasal lifting was used because it successfully creates favorable space for implant placement at the anterior maxilla (20). Platelet rich fibrin (PRF) was also selected as a grafting material because of its ability to seal biological tissue, accelerate wound healing and support osseous regeneration (21).

Locator attachment was applied in this study because of its low profile .in addition to its innovative ability to pivot, that increase resiliency and tolerance for high mastication forces (22).

The locator attachments were connected to the maxillary denture directly intra-orally under maximal biting force during polymerization of the acrylic resin to insure passivity during seating and function of the over denture after abutment connection. This used intra-oral direct technique was simple, quick, and eliminated the dimensional changes and misfit that might be occurred if extra-oral indirect technique has been used (23).

In this study a new version of multi-slices high speed three dimensional CT accompanied with (DICOM viewer) software was used It provides a high resolution image with well-defined image layer preserving soft tissue details, multi-planar 3-dimensional views, it allows simultaneous study of multiple implant sites. Furthermore, bone density can be measured on CT data, and this is important in assessing bone quality (24).

Regarding the marginal bone level changes, there was a slight insignificant decrease in the marginal bone level throughout this study.

The screw design of the implants which created more intimate contact with bone during placement might be a cause for increased percentage of bone attachment to the implant and reducing the peri-implant bone loss as reported by Sykaras N, et al (25). Moreover using resilient Locator attachment may lead to decrease in the magnitude of forces reaching to the implant abutments and hence to the crestal supporting bone (26).

Measurements of bone density around the endosteal implants where the mechanical distribution of stress occurs primarily, showed a significant increase in peri-implant bone density, throughout the whole follow up period of 6 months.

This increase in bone density can be attributed to the explanation that in function, the denture base permitted vertical movements by the virtue of the resilient attachment system, thus delivering physiological normal stimulation of the peri-implant bone. This concept of the mechanical

stimulation of bone around implants was evaluated and confirmed by a study by Rubin CT and Mcleod KJ (27).

Moreover, the self-locating design of the Locator allows patients to easily seat and remove their dentures without exertion of excessive force (passive fitting and removal of the prosthesis) which allow for more residual bone preservation with increasing peri-implant bone density (28). Improved patient satisfaction was found throughout this study following using the maxillary implant-assisted dentures regarding speech, comfort, esthetics, stability, chewing ability and retention throughout evaluation periods.

Patient satisfaction was increased gradually as a certain time of adaptation was needed with new dentures. Also with increased retention with implant which might contribute to increased ability to speak well and chew thus increasing general comfort of the patient this explanation can be related to a study Konstrom et al (29).

Retention and stability were increased which might be due to the use of locator attachment system. As recommended by Kapur et al (30), who found that stability improved significantly for implant-supported dentures compared with conventional dentures.

Reports of treatments involving two - implant maxillary over dentures with partial palatal coverage are limited but not entirely unfavorable. Providing only two implants in the maxilla does not compromise the longevity of the prostheses or patient satisfaction compared with 4-implant over denture (11,31,32).

Two implant over denture (OD) in the maxilla were also tested in a study by Bergendal and Enquist (12).they reported that cumulative implant survival rates after 7 years were 75% in the maxillae. Although the survival rate of maxillary implants was relatively low, there was no difference in the implant survival between the attachment systems. Only two implants in the anterior region of the maxilla were used in all patients.

It was clear from the previous discussion that the use of two implants at the anterior atrophic maxilla rehabilitated by mucosal nasal lifting and wearing implant assisted over denture showed successful parameters and accepted by the patients.

CONCLUSION

- 1) Radiographically, peri-implant tissue showed slight insignificant decrease in marginal bone height but significantly increased bone density under overdenture loading was recorded throughout the whole follow up periods.
- 2) The present results reported that maxillary over dentures retained by two implants provided significant improvement in oral and health-related qualities of life (patient satisfaction).
- 3) No signs of implant mobility were detected with the use of two implant assisted over denture.

CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

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