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Research Article

INFLUENCE OF VARIOUS LOCATOR ABUTMENTS HEIGHT ON PERI-IMPLANT OUTCOMES IN MANDIBULAR IMPLANT OVERDENTURES

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A B S T R A C T

Purpose: to compare the effect of different locator abutments height on peri-implant tissue health in retained mandibular overdenture.
Material and method: Twelve completely edentulous patient were selected to this study. Each patient will received two implant in the canine area of the mandibular arch using early loading protocol. patients were grouped as follow: ***Group I***: the locator abutment height is 1mm. ***Group II***: the locator abutment height is 2mm. ***Group III***: the locator abutment height is 3mm.clinical evaluation were carried out at the time of insertion(T0),3 months(T3),6 monthes (T6) after insertion.
Results: there was statistically significant increase in plaque index and probing depth between group 1mm, 2 mm and 3 mm in different period 3and 6 monhts except mesial side after 3months.there was statistically insignificant decrease in bleeding on probing.
Conclusion: locator abutment showed favorable peri-implant tissue health especially group I better than group II and group II is better than group III.

INTRODUCTION

UN data revealed that number of elderly individuals is increased in the world population. [(1)]This especial age group seeks specific attention in health care as they manifest anatomic and physiological restrictions accompanying with their age. Particularly; in the dentistry field, usually these age group individuals suffering from edentulism, thus ordinarily these patients have remarkable problems in using the traditional complete denture due to lack of stability, support, and, retention leading to reducing of chewing efficiency.[(2)] The mandibular complete dentures predominately display very problematic condition for patients. Various treatment options were tried to resolve these aforementioned problems such as the utilization of dental implants for anchorage. [(3,4)]

Implant over dentures become a routine treatment modalities in recent years, to improve the retention and stability of conventional dentures as they are minimally invasive and offer lower costs. [(4,5)] In accordance to the York and McGill consensus, the rehabilitation of the edentulous mandible with a traditionally denture is not the ideal prosthodontic treatment, the denture retained by two implants is considered now as the least standard of care for edentulous patients.[(6,7)] Admittedly, two-implant-retained overdentures offers clinical advantages in terms of stability, retention, and patient satisfaction, preferable oral hygiene procedures due to easy removal of the prostheses.[(8)]

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These implants are installed in or somewhat medial to the canine area, utilizing various obtainable attachments for retention.[(9)]

Numbers of implants attachment systems often have been utilized to hang the overdentures to the implants, these attachments grouped to splinted and unsplinted. [(10)] Various factors act as corner stone in the selection of the implants attachment and, the design planning of the implants overdentures, like the interimplant distance which is a key factor in the designing of the overdentures as it may cause restriction of dental implant placement [(11, 12)] and the available vertical and horizontal prosthetic space that are an important factor to be first assessed after implant placement. [(13)]Attachment height is a key factor that has a considerable part in the biomechanics due to lever arm mechanics. It determines the overlying denture base thickness that indirectly influences the tendency of the denture base to deform and break. Nevertheless, a thicker mucosal lining demand the use of high collar attachment. Attachment available heights in different implant systems range from 0 to 6 mm.[(14)]

The Locator attachment has low profile design which is in charge of its popularity in limited interarch space patients, in addition to reduce denture base deformation and fracture. [(15)] It has highly retention value when compared to the telescopic and ball attachments, due to their dual mode of retention, result from the increased surface area of retentive contact. [(16)]It has some built-in angulation compensation. The Locator abutments present in different heights (1-6 mm) to be harmonized with the peri-implant tissue. [(17)]

The periimplant tissue is necessary for the long-term success of implant overdentures, it performances as a transmucosal seal, avoids recession. The first function of the tissue around implants is to play role in protection and has effect barrier that protects the underlying bone and prevents access for microorganisms and/or their products. A soft tissue seal, with structures similar to teeth with a true connective tissue attachment to the implant may improve this protective function, and provides a prosthetic-friendly environment to withstand the mechanical challenge and appropriate contours for a self-cleansing environment. [18]

Notwithstanding that researches have studied the increasing of restorative space effect on stress distribution, but few researches have evaluated the impact of the attachment systems collar height on peri-implant outcomes tissue health in mandibular implant overdentures.

MATERIAL AND METHOD

This observational study methodology and protocol were revised for the approval of the Dental Research Ethical Committee of faculty of dentistry, Mansoura University.

This study was performed in the clinics of removable prosthodontics in Mansooura University. All the study participants were randomly selected and informed of the study procedures, its purpose, the benefits of the interventions and the minimal risk that might be inquired during the study. In addition to that, they were acquainted that they have the right to withdraw at any time from the research, to ask questions about the research procedures and they have the freedom of participation without coercion. The consent form was discussed and declared prior to their signatures.

Twelve participants were examined and employed according to the following implication: Totally edentulous healthy patients with Age ranged between 50 and 60 years; Angle class I maxillo-mandibular relationship; The mandibular canine areas bone width at least was 5.6 mm to allow installation of standard implant diameter of 3.6mm with at least 1 mm lingual and buccalsurrounding bone. Furthermore, the bone height allowed placement of a 12.6 mm implant length with at least 2mm of bone was existed beneath the fixture apex. Participants were prevented from the study recruited if: they refuse to sign the consent form, have uncontrolled diabetes mellitus, osteoporosis, alcoholism, smokers, or have chemotherapy, radiotherapy,Type III and IV bone and, need for major bone augmentation procedures.

Surgical and Prosthetic Procedures

For each Participant; to assure ideal implant overdentures that was in harmonious with osseous anatomy, complete maxillary and mandibular dentures were fabricated prior to implant surgery. A radiographic stents were fabricated from clear acrylic to confirm the selected implant site, by duplication of the mandibular denture. A mucosal supported Sterolithographic surgical guide from 3d printer was constructed and used for implant placement.

Stereolithographic stent was fixed in its accurate position by anchor pins and utilizing the maxillary denture as an indicator. Tissue punch was used through the metal sleeve of the stent to locate the exact position for drilling. The drilling was started by Using the (2.0 mm) drill as initial drill followed by (2.5 mm,2.8 mm, and finally 3.0 mm) diameter drills. The implants were placed into position by using manual torque wrench the implant insertion torque was measured to be at least 45 Ncm. The smart peg transducer was directly mounted onto the fixture to assess initial implant stability using the resonance frequency analysis (RFA) (Osstell ISQ, Gothenburg, Sweden).

The Locator abutment (Kerator attachment system, New York, USA) was secured on the implant (Super Line Dentium, Korea.) Using hand torque controller at 20 Ncm, as follow: Group I: Locator abutment height 1mm, Group II: locator abutment height 2 mm, Group Ⅲ: locator abutment height 3 mm (fig. 1). In the same visit; relieve the denture base over the implants area to allow about 2 mm space for the denture relining by using tissue soft liner to avoid damage effect of early loading on the dental implant. Accurate implant position was verified by panoramic x-ray. All Participant were instructed to soft diet for 10 days. Moreover; instructed to protocol of plaque control.

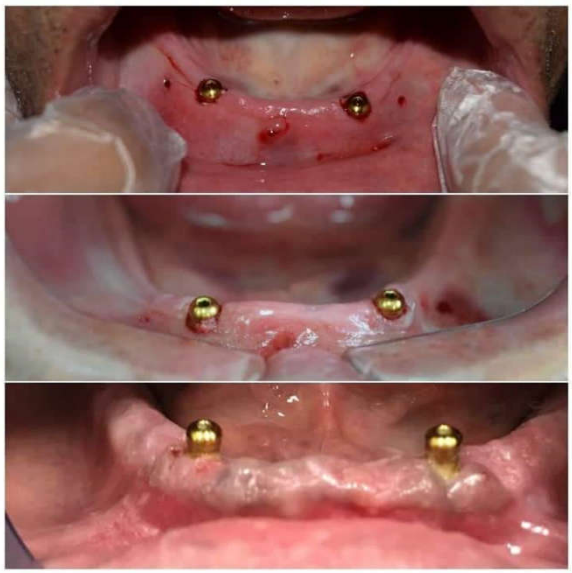

Fig 1 different locator abutment height in patient oral cavity

The Participant was left for 2 weeks according to early-loading protocol. Every participant was instructed to make regular visit to follow occlusal refinement and denture adjustment. To pick up of locator female housing with the retentive insert, soft liner was removed from intaglio surface of the denture base, to avoid acrylic resin ingress under the denture, a clear protective disk was inserted, The locator female housing (cap) with processing insert was placed on locator abutment. The processing insert is slightly larger than the standard retention inserts. Two small vents were made on the lingual surface of the denture, mixed autopolymerized acrylic resin was positioned in the relieved intaglio denture surface, the denture was placed in the patient mouth under finger pressure, and then; the Participant was asked to occlude in centric relation until complete polymerization. The processing insert was replaced by the corresponding retentive inserts, Evaluation of peri-implant tissue health parameter in terms of bleeding on probing, plaque index, and probing depth were done for two implant retained mandibular overdenture (fig. 2) with locator attachment after insertion (T0), three months (T1) and six months (T2) after overdenture insertion.

Statistical analysis

Data were analyzed using the Statistical Package of Social Science (SPSS) program for Windows (Standard version 21). The normality of data was first tested with Shapiro test.

Variables were presented as median (min-max) for non-parametric data and Wilcoxon signed rank test was used to compare paired data while kruskilwallis test was used to compare more than two medians. The threshold of significance is fixed at 5% level (p-value).The results was considered

Fig 2 Evaluation of peri-implant tissue health parameter

RESULT

Table (1) revealed Kruskilwallis test that was used for comparing the probing depth of different height of locator abutment 1 mm, 2 mm and 3 mm at two weeks after locator insertion (T0), three months postoperative (T3) and, six months (T6) postoperative at buccal, mesial, lingual and, distal of each implant. Comparing the probing depth between 1mm, 2mm and, 3mm at T0 there was statically insignificant increase in probing depth around locator abutment for all implants sides. Comparing the probing depth between 1mm, 2mm and, 3mm at T3 there was statically significant increase in probing depth around locator abutment for all implants sides except mesial side. Comparing the probing depth between 1mm, 2mm and, 3mm in T6 there was statically significant (p =0.019) increase in probing depth around locator abutment for all implants sides.

Table 1 Comparison probing depth of two implant supported overdenture with different locator height in T0, T3 & T6

Probing depth	Height	T0	T3	T6	P0	P3	P6
	1mm	2 (1-2)	0.75 (0.5-1)	0.25 (0-0.5)			
Buccal	2mm	2 (0-2)	0.75 (0.5-1)	0.5 (0-1)	0.128	0.016*	0.019*
	3mm	2.25 (2-2.5)	2 (2-2)	2.25 (2-2.5)			
	1mm	2 (2-2)	1 (0.5-1.5)	0.5 (0.5-0.5)			
Lingual	2mm	1.75 (0.5-3)	0.5 (0.5-0.5)	0.5 (0.5-0.5)	0.920	0.01*	0.005*
	3mm	2 (1-3)	2.5 (2-3)	2.75 (2.5-3)			
	1mm	1.5 (1-2)	1.25 (0.5-2)	0.25 (0-0.5)			
Mesial	2mm	2 (2-2)	0.75 (0.5-1)	0.25 (0-0.5)	0.064	0.058	0.018*
	3mm	2.25 (2-2.5)	2 (2-2)	2.25 (2-2.5)			
	1mm	2.5 (2-3)	1.25 (1-1.5)	0.5 (0-1)			
Distal	2mm	2 (1-2)	0.5 (0.5-0.5)	0.25 (0-0.5)	0.079	0.006*	0.019*
	3mm	3 (2-3)	2.75 (2.5-3)	2.75 (2.5-3)			

T0: two weeks after implant insertion.
T3: three months postoperative.
T6: six months postoperative.
P0: comparison between 1mm, 2mm and 3mmm in T0.
P3:comparison between 1mm, 2mm and 3mmm in T3.
P6: comparison between 1mm, 2mm and 3mmm in T6.
Data were expressed as Median (Min-Max)
Kruskilwallis test was used for comparison,*significant p <0.05

Table 2 illustrated Kruskilwallis test that was used for comparing Bleeding on probing of different height of locator abutment 1mm, 2 mm and,3 mm at two weeks after locator insertion (T0), three months postoperative (T3) and six months postoperative (T6) at buccal, mesial, lingual and distal of each implant. Comparing bleeding on probing between 1mm, 2 mm and, 3 mm at T0, T3 and T6 there was statically insignificant increase in bleeding on probing around locator abutment for all implants sides, except lingual side at T3 and T6.

Table 2 Comparison Bleeding on probing of two implant supported overdenture with different locator height in T0, T3 & T6

Bleeding on probing	Height	T0	T3	T6	P0	P3	P6
	1mm	0.5 (0-1)	0.5 (0-1)	0 (0-0)			
Buccal	2mm	0 (0-0)	0 (0-0)	0 (0-0)	0.253	0.253	0.111
	3mm	0.5 (0-1)	0.5 (0-1)	0.5 (0-1)			
	1mm	0 (0-0)	0.5 (0-1	0 (0-0)			
Lingual	2mm	0 (0-0)	0 (0-0)	0 (0-0)	0.111	0.253	0.004*
	3mm	0.5 (0-1)	0.5 (0-1)	1 (1-1)			
	1mm	0.5 (0-1)	0 (0-0)	0 (0-0)			
Mesial	2mm	0 (0-0)	0 (0-0)	0 (0-0)	0.111	1.0	1.0
	3mm	0 (0-0)	0 (0-0)	0 (0-0)			
	1mm	0 (0-0)	0.5 (0-1)	0 (0-0)			
Distal	2mm	0 (0-0)	0 (0-0)	0 (0-0)	1.0	0.111	1.0
	3mm	0 (0-0)	0 (0-0)	0 (0-0)			

T0: two weeks after implant insertion.
T3: three months postoperative.
T6: six months postoperative.
P0: comparison between 1mm, 2mm and 3mmm in T0.
P3: comparison between 1mm, 2mm and 3mmm in T3.
P6: comparison between 1mm, 2mm and 3mmm in T6.
Kruskilwallis test was used for comparison,*significant p <0.05

Table (3) showed Kruskilwallis test that was used for comparing plaque index of different height of locator abutment 1mm 2 mm and, 3 mm at two weeks after locator insertion (T0), three months postoperative (T3) and six monthes postoperative (T6) at buccal, mesial, lingual and distal of each implant. Comparing plaque index between 1mm, 2mm and 3mmm at T0 there was statically insignificant increase in plaque index around locator abutment for all implants sides. Comparing plaque index between 1mm, 2 mm and 3 mm at T3 and T6 there was statically significant increase in plaque index (P=0.019, P= 0.013, P= 0.004, P= 0.026) respectivelly around locator abutment for all implants sides.

Table 3 Comparison of plaque index of two implant supported overdenture with different locator height in T0, T3, T6

plaque index	Height	T0	T3	T6	P0	P3	P6
	1mm	0 (0-0)	1 (0-2)	1 (0-2)			
Buccal	2mm	0 (0-0)	1.5 (1-2	1 (1-2)	1.0	0.05*	0.019*
	3mm	0 (0-0)	2.5 (2-3)	3 (3-3)			
	1mm	0 (0-0)	1 (1-1)	2 (0-2)			
Lingual	2mm	0 (0-0)	2 (1-3)	1 (1-1)	1.0	0.026*	0.013*
	3mm	0 (0-0)	3 (3-3)	3 (3-3)			
	1mm	0 (0-0)	0 (0-0)	0 (0-0)			
Mesial	2mm	0 (0-0)	0 (0-0)	0 (0-0)	1.0	0.004*	0.004*
	3mm	0 (0-0)	2 (2-2)	2 (2-2)			
	1mm	0 (0-0)	0 (0-0)	0 (0-0)			
Distal	2mm	0 (0-0)	0 (0-0)	0 (0-0)	1.0	0.026*	0.026*
	3mm	0 (0-0)	2 (0-2)	2 (0-2)			

T0: two weeks after implant insertion.
T3: three months postoperative.
T6: six months postoperative.
P0: comparison between 1mm, 2mm and 3mmm in T0.
P3: comparison between 1mm, 2mm and 3mmm in T3.
P6: comparison between 1mm, 2mm and 3mmm in T6.
Kruskilwallis test was used for comparison,*significant p <0.05

DISCUSSION

Mandibular implant supported overdenture is an excellent treatment option for totally edentulous patients in terms of patient's satisfaction, chewing ability and, masticatory function. To improve stability and, support of a denture, various numbers of implants have been recommended for mandibular implant overdentures The McGill consensus statement indicated that mandibular two-implant overdentures are the first choice of care for edentulous patients.[7] The locator attachment system is an attachment system with self-

aligning feature and has dual retention (inner and outer), has different retentive value that can be used to correct implant angulation up to 20 degrees. Low vertical dimension and increased retention force. At the same time, it should be noted that this retention system is compatible with all the available most implant systems.[19]

Peri-implant tissue health evaluation is very important for the detection of early signs of peri-implantitis. Experimental and human studies have proved evidence that formation and development of a microbial biofilm is an important etiologic factor in the pathogenesis of peri-implantitis and subsequent marginal bone loss.[20]

The results of this study revealed a statistically significant increase in the probing depth around two implants supported overdenture using locator abutment with different height 1 mm,2 mm and, 3 mm during the first three-month period. And this value increase during the second three months this may be because oral hygiene of most patients investigated in this study appeared to be insufficient in the second three months These results were in agreement with Oetterli*et al*. [21]specially at height 3mm increased probing depth could be related to increased peri-implant vertical bone resorption with time and peri-implant soft tissue enlargement also increase surface area in height3 mm and microflora and microorganisms easy to adhere to these inaccessible sites and cause gingival hyperplasia with increased probing depth.[22]The insignificant increase of measured probing depth between different heights of locator abutments in the first three months at mesial side of all implants may be related to the better accessibility for brushing and cleaning performed by the patient. While there is difficulty in cleaning may be encountered with lingual and distal surfaces of the implants. Therefore adherence of microflora and microorganisms to these inaccessible sites may cause gingival hyperplasia accompanied with increased and probing depth. [23]The results of this study showed that the average probing depths was less than 3 mm in all periods of study. This was in agreement with Mombelli [24] who claimed that successful implants generally allow a probe penetration of approximately 3 mm. The author added that if there are pockets deeper than 3 mm, an inflammatory process may take place at the bottom of the defect.

Regarding the modified plaque index, it was slightly increased along the different time points in all observational periods, this may be due to the resiliency of the locator attachment, which allows denture movements and accumulation of food particles and plaque under the denture. Statistically differences were identified at the first three months and decrease in the second three months this can be attributed to the plaque control by the patient and the repeated reinforcements of oral hygiene measures.[25]Another observation in this study was the statistically significant decrease of plaque index during the first three-month period of study. This may indicate the improvement of oral hygiene provided by the patient. The statically significant differences between two weeks after implant placement and three months postoperative was observed at all surfaces (buccal, distal and lingual) in all implants. Then there was an increase in the plaque index during the second three months of the study, this may be attributed to the insufficient oral hygiene in this period resulting from the patient's lack of the ability to perform self-care with a relatively inaccessible cleansing of abutments. [23,26]This might be in agreement with Al-Dharrab,[27] Fayek *et al*. [28]who reported that some patients were unable to sustain the same level of oral hygiene and relapses were seen. Frequent recall visits must be scheduled to reinforce and motivate the patient's oral hygiene.

The current study had a number of limitations such as the short follow-up period and the small number of participants. In summarization of this study; it could be state that patients treated with an implantsupported overdenture need more treatment interventions, treatment time and aftercare maintenance visits than patients treated with conventional dentures.

CONCLUSION

Within the limitations of the present study, it canbe concluded that:

1. Regarding the peri-implant tissue health, Locator attachment can be used successfully.
2. Decreasing the attachment heights (distance from crestal bone to abutment) in unsplinted resilient attachmentsin a mandibular implant overdenture, the healthier of the tissue around the implant.

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