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BIOLOGICAL RESPONSE OF DIFFERENT LOCATOR HEIGHTS IN MANDIBULAR OVERDENTURE WEARERS

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ABSTRACT

Introduction: The locator attachment has been widely and successfully used to support dentures has dual retention and is available in different heights with different retention values; in addition, their repair and replacement are quick and straight forward. **Aim:** The aim of this study was to compare clinically and radio graphically the biological effect of two different locator heights on peri-implant bone width and probing depth in mandibular implant overdenture wearers**. Materials and methods:** Conventional complete dentures were constructed for twelve completely edentulous male patients, chosen from Out-clinic of faculty of dentistry Suez Canal University. Two implant were inserted in the lower cusped region then the patients divided randomly into two groups Group A(GA): Six patients received implant retained over denture with 1mm locator height. Group B (GB): Six patients received implant retained over denture with 3mm locator height, the follow up both clinically and radiography were taken at 0, 6, 12 and 18 months starting from the first day of over denture attachment pick up. Peri-implant bone width and probing depth were estimated through the evaluation periods. **Results:** It was found that the reduction in the peri-implant alveolar buccolingual width and probing depth around the implants were higher in **GA** than **GB** at all follow up periods, except for the last follow up period. **Conclusion:** The locator height has a biological effect on bone width and probing depth as the higher locator height the more preservation of peri-implant bone.

INTRODUCTION

Rate of mandibular alveolar bone resorption was proven to be four times more than that of maxilla; this would in turn cause further diminish in the retention quality of the lower denture which might increase patient discomfort and results in impaired speech and mastication as well as compromising the patient's facial appearance [1,2].

An endosteal implant may be considered to replace missing teeth for a primary reason of maintaining alveolar bone and guard against its resorption, maintain bone quantity, and helps to preserve the underlying soft and hard tissues [3, 4].

Implant overdentures might help in improving the nutritional state, which will impact on general health of the edentulous patients.

Particularly for senior adults who are vulnerable to malnutrition [5].

In a flapless procedure, a dental implant is installed through the mucosal tissues without reflecting a flap; flapless surgery has numerous advantages, including preservation of the vessels around the implants, maintenance of the original mucosal form around the implants. This method also improves patient comfort, and accelerates recovery [6-8].

A resilient stud attachment that successfully used with overdentures is the Locator system, this attachment is self-aligning and has a characteristic feature of dual retention with combined internal and external retentive features [9, 10].

Locator attachment female parts are available in different vertical heights from 1mm. to 5 mm. They are resilient, retentive and durable. In addition, their repair and replacement are easy and fast [11].

The purpose of this study was to estimate the changes in peri-implant bone width and probing depth whenever using implant locators of different heights to retain implant supported mandibular overdentures.

MATERIALS AND METHODS

Patient selection criteria

Twelve completely edentulous male patients with age range 50-70 years were selected from the out-clinic of removable Prosthodontics Department, Faculty of Dentistry, Suez Canal University. All patients were selected with skeletal Angles class I maxillary-mandibular relation, with well formed upper and lower ridge forms, available inter arch space suitable for over-denture prosthetic treatment and patients were free from any systemic and tempromandibular joint disorders. The patients who were smoking, with history of poor oral hygiene, bad habits e.g. severe clenching, bruxism, alcohol or drug abuse were excluded.

The selected patients were informed with detailed consent the nature of the research work.

Conventional complete upper and lower dentures were constructed for all the selected patients. Scan appliance was constructed by duplication of the patient's complete mandibular denture in radiopaque resin material mixed with barium sulphate. Preoperative Cone Beam Computerized Tomography (CBCT) scan was taken for the patient's maxillary and mandibular arches with the scan appliance and interocclusal bite index in their position in the patient's mouth with CBCT machine. Optical scanning of the cast was done producing a stereolithography (STL) file which can be easily merged into the planning software, then the models with the attached scan appliance were scanned again using the same optical scanner. The STL of the second optical scan used in planning and fabricating a more accurate fitting surgical guide. Both scans were imported to the blue sky plane 3 software and were used together with the preoperative CBCT to plan the optimal implant position. Two virtual implants were placed in a parallel locations bilaterally at the lower cusped areas guided by the radiolucent channels in the scan appliance. The final virtual surgical guide was then exported as STL file [12,13] ,and then was processed from poly-amide material with special software at the rapid prototyping unit of the "Central Metallurgical Research and Developing Institute" (CMRDI) unit. Metallic sleeves were then fitted into the planned holes of the fabricated stent.

Two root form Implants (Dentis Co South Korea) guided by the computerized CAD/CAM surgical guide stent were placed in sufficient bone locations at the lower cusped area of the patients guided by the surgical guide stent.

The surgical steps For all the selected patients , the surgical guide was firmly attached to the lower jaw and underlying mucosa by bite index and three fixation screws in a tripod position. The implant site was prepared using sequential drills 2.2-2.8from simple guide, and final drill3,5 from universal guide (Dentis Co South Korea). The implant was then carried by its fixture mount and inserted manually in the prepared osteotomy site, further tightening using a ratchet was continued until reaching the required depth.

Patient grouping: After implant Osseo-integration confirmation for all the patients according to implant locator heights the twelve patients were divided into two equal groups n=6

Group A: the patients of this group were received locator abutment with 1mm height.

Group B: the patients were received locator abutment with 3mm height.

Locator attachments pick up: Direct pick up method was used to incorporate the locator to the fitting surface of the lower denture. The locator male abutments were screwed to the implant fixures using implant screw driver and torque ratchet (Dentis Co South Korea) and metal housing cap was fitted to the locator abutment inside the patient's mouth.

The fitting surface of the lower denture was relieved and tried to obtain available space for metal housing cap. Two vents were made on the lingual surface of the lower denture to allow escapements of excess self-cure acrylic resin during direct pick-up method after the patient has been closed lightly in centric occluding relation.

Radiographic Evaluation:

A series of cone beam radiography were taken at 0, 6, 12 and 18 months intervals, starting from the day of over denture locator installation. Using the on demand 3D software.

Peri-implant bucco-lingual bone width changes measurements:

(M,M1,M2) fig (1) representing 3 horizontal lines in the axial plane cross section at (crest of alveolar bone level, mid-implant level measured at 5mm from implant apex and at the implant apex level) respectively.

Average peri-implant bucco-lingual width changes for each implant in each group calculated by the following equation:

Average buccolingual bone width = (M+M1+M2) /3.

These results were calculated, tabulated and statistically analyzed.

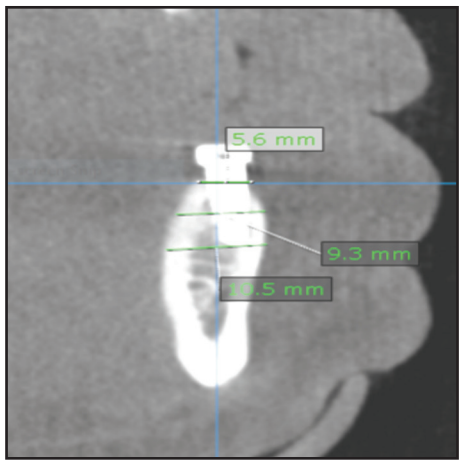

Fig (1) Measuring bone width

Clinical evaluation

Pocket depth: Measuring the attachment level were done at 0, 6, 12 and 18 months starting at the day of over denture Locator installation at mid (mesial, distal, buccal and lingual) sites using Williams periodontal probe [14] fig (2).

Fig (2) Probing depth

Statistical analysis

The obtained data at different observation periods were collected, tabulated and statistically analyzed using independent t-test) as means, ± standard deviation (SD), P-value which is considered significant at P ≤ 0.05 level and highly significant at ≤ 0.01 level.

Eta-square (η^2) estimates are used for overall comparison among studied groups, while **Cohen's d** estimates represent the effect size estimates between any two groups (repeated measurements).

For any PQAS item, effect size estimate (η^2 or d) close to 0.80 suggest *a large effect*, η^2 or d close to 0.50 suggest *a medium effect*, and η^2 or d of values ≤ 0.20 suggest *a small effect*. Moreover, effect size estimates (η^2 or d) greater than one suggests *a very large effect*.

RESULTS

Differences in buccolingual width between the two groups at observation periods:

As shown from table 1 the reduction in alveolar buccolingual width around the implants is relatively higher regarding **GA** with non statistical significant difference between the two test groups at all observation periods (p >0.05), the Cohen's effect size estimates that the reduction in alveolar buccolingual width around the implants were higher in **GA** than **GB** at all follow up periods indicates positive sign, except for12-18 months indicates negative sign, on average.

Table (1): *Means of reduction in buccolingual width between the two groups at each observation period:*

Interval Group	Estimates	0-6 month	6-12 month	12-18 month	0-18 month
Buccolingual width GA	**Mean± SD**	0.338± 0.099	0.093± 0.070	0.087± 0.052	0.518± 0.066
	SE	0.041	0.029	0.021	0.027
Buccolingual width (Group B)	**Mean± SD**	0.287±0.113	0.045±0.049	0.108±0.049	0.440±0.113
	SE	0.046	0.019	0.020	0.046
Independent t test (t)		0.840^{NS}	1.386^{NS}	-0.744^{NS}	1.462^{NS}
P value		0.421	0.196	0.474	0.174
Effect size (d) estimate		0.485	0.800	-0.430	0.844
Effect size		**Medium (~ 0.5)**	**Large (~ 0.8)**	**Medium (~ 0.5)**	**Large (~ 0.8)**

NS = Non-significant (P > 0.05)

Differences in probing depth between the two groups at observation periods:

As presented in **Table 2** there was progressive increase in the mean probing depth around the implant for both groups through follow up periods on average, which is higher in (**GA**) than(**GB**) with non-statistical significant differences (P >0.05) between the two studied groups at all observation periods .

The Cohen's effect size estimates that difference in probing depth around the implants were higher in **GA** than **GB** at all follow up periods indicates positive sign, except for12-18 months incites negative sign on average.

Table (2): *Means of Probing depth between the two groups at each observation period:*

Interval Group	Estimates	0-6 month	6-12 month	12-18 month	0-18 month
Periodontal depth (Group A)	**Mean± SD**	0.064± 0.048	0.063± 0.041	0.045± 0.033	0.172± 0.039
	SE	0.019	0.017	0.013	0.016
Periodontal depth (Group B)	**Mean± SD**	0.058± 0.053	0.047± 0.029	0.050± 0.034	0.155± 0.060
	SE	0.022	0.012	0.014	0.024
Independent t test (t)		0.170^{NS}	0.811^{NS}	-0.259^{NS}	0.568^{NS}
P value		0.868	0.436	0.801	0.583
Effect size (d) estimate		0.098	0.468	-0.150	0.328
Effect size		**Small (< 0.20)**	**Medium (~ 0.5)**	**Small (< 0.20)**	**Small to medium (~ 0.5)**

NS = Non-significant (P > 0.05)

DISCUSSION

The design of an overdenture attachment system should provide optimum force distribution around supporting implants to allow bone loading within physiological limits, transmit the occlusal forces in the direction of the long axes of the implant keeping the overdenture from dislodging for the patients to be able to enjoy a normal, comfortable chewing function [15].

Bone width and probing depth were the radiographic and clinical monitored parameters used in this study, as they considered important evaluation in determining the prognosis of any prosthetic therapy and an important parameters giving idea about the bone-load tolerance and the approximate level of tissue loading, to detect the effect of stresses transmitted by each attachment type and the subsequent bone resorption around implants [16].

The reduction in alveolar buccolingual width around the implants is higher regarding **GA** with non-statistical significant difference between the two test groups can be explained by the two crown height considerations with implant retained overdentures. The first crown height space is the crown height of the attachment system to the crest of the bone, while the second crown height space is considered to be the distance from the top of the attachment to the occlusal plane. In the current study, the first crown height space was modeled in GA 1mm above gingiva and 3mm in GB, whereas the second crown height space was decreased 1 mm in GA and 3 mm in GB, respectively (i.e second

crown height is shorter by 2mm in GB than GA), this thereby increase magnitude of prothetic force, thus increasing the lever arm, and it was concluded that the higher the crown height distance, the more the forces applied to the implants. Increasing the crown height of an implant-supported prosthesis increases the risk of excessive occlusal overload because of an increased lever arm leading to increase lateral force during overdenture movement by the lever action(second crown height space) in GA[17].

There was increase in probing depth around the implants throughout the follow-up period in both groups, increased probing depth could be related to increased peri-implant vertical bone resorption with time and peri-implant soft tissue enlargement also decrease surface area in height1 mm and microflora and microorganisms easy to adhere to these inaccessible sites and cause gingival

Hyperplasia with increased probing depth [18].

The changes that occurred in probing depth during the follow up period may may also be due to covering by the denture-base depriving it from normal salivary cleaning action which related to oral hygiene maintenance of the patient and patient satisfaction with the denture, and also this is in agreeing with another research which suggested that the movement of denture base exert pumping action on the soft tissue[19].

These results are in agreement with the findings, who found that an increase in probing depth in successful implants after 1-year follow-up period should not be more than 2 mm in good oral hygiene[5].

These changes were accepted as it could be considered as a biologic response to the insertion of overdenture in the patient's mouth with regard to microflora and the stresses transmitted to the investing structures [20].

CONCLUSION

Within the limitations of the present study, it can be concluded that:

Increasing the locator attachment heights (distance from crestal bone to abutment) decrease rate of residual alveolar bone resorption with subsequent reduction in probing depth.

Certain recommendations about the locator attachment heights in terms of their effects on peri-implant bone cannot be drawn by two-heights only for further researches of other heights.

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