Bone Height Changes in Implant Supported Overdenture with Ball Attachments

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ABSTRACT

Aim: This clinical study was conducted to evaluate the bone height changes around implant in implant supported complete mandibular overdenture. **Subjects and methods:** Twelve completely edentulous patients were selected for this study controlled from any systemic or local disease that may contraindicate implant placement. History taking, extra and intraoral examination, and radiographic evaluation were done for each patient. Preoperative cone beam computerized tomography (CBCT) was done for each to determine bone height and width. Each patient received two implants in the interforaminal area of mandible, three months later lower denture was converted into mandibular overdenture by picking up the metal house into the denture. The Radiographic evaluation for the marginal bone loss was done using Digital panoramic X-ray film from the apex of the implant to most coronal points of bone attachment mesially and distally. The bone height was calculated by subtraction of it from original bone length, and the average length of both mesial and distal sites was calculated. All evaluations were done at the time of implant placement, three months, six months, twelve, eighteen and twenty-four months of implant placement. One-way ANOVA with post hoc turkey test was used for multiple time comparison. **Results:** Significant bone height occur for comparisons between any follow up times more than 6 months, except between 3 and 12 months follow up. **Conclusion:** Significant peri-implant bone height changes occur in mandibular implant supported overdentures that increases with time.

INTRODUCTION

Despite recent advances in preventive dentistry that helps in protecting the natural teeth, Edentulism has been still and remain the main problem facing developing countries that result in a rapid increase in their elderly population[1]. Tooth loss has a profound impact effect on the lives of people. Emotionally tooth loss effect can range from bereavement, lowered self-confidence, altered self-image, dislike of appearance[2]. Both maxilla and mandible undergo a life-long catabolic remodeling and rate of reduction in size of the residual ridge is maximum

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in the first three months and then gradually decrease. However, bone resorption activity continues throughout life at a slower rate, resulting in loss of varying amount of jaw structure, ultimately leaving the patient a 'dental cripple'.[3] Numerous investigators made different attempts to analyze the changes in the form of the residual alveolar ridge using lateral cephalographs, panoramic radiographs, or diagnostic casts as standardized measurements to determine the exact cause of bone resorption. They postulated that the four main factors responsible for bone resorption are namely anatomic, prosthetic, metabolic, and functional factors but it still pending till date.[4]

Overdentures are considered a simple, cost-effective, viable, less invasive and successful treatment option for edentulous patients.[5] It is a mandatory treatment option instead of extensive surgical procedure such as vestibuloplasty, ridge augmentation[6,7]. For several years ago implant retained mandibular overdenture has been investigated with longitudinal studies via placement of only two implants in the edentulous mandible and their success rates were 98.[8] Currently, the most used attachments are Ball attachment which is considered the simplest type of attachment for clinical application with tooth or implant supported overdentures. These attachments do not need a great prosthetic space and they allow hinge and rotation dislodgements[9]. Overdentures play a significant role in ridge preservation. It was found that mandibular bone loss was 2.5 times significantly less in patients with mandibular two implant supported overdenture than the complete denture group, the measurement was carried out by panoramic x-ray in midline, canine, first , and second molar areas [10].Marginal bone levels around oral implants plays a key role in the success of dental implants. This criterion is generally accepted as a reliable indicator of bone response to the surgical procedure and subsequent occlusal loading [11].

AIM OF THE STUDY

The aim of this study was to changes bone height changes around implant in implant supported complete mandibular overdenture with ball attachments

MATERIALS AND METHODS

A: Patient selection

Twelve completely edentulous patients were selected from the clinic of removable prosthodontic department, Faculty of Dental Medicine Al Azhar University. All patients were free from any systemic disease as confirmed by history taking and laboratory examinations. All patients were without any noticeable signs and symptoms of local and system disorder. All selected patients had no abnormal habits such as bruxism, clenching, tongue thrusting, did not take drugs that affect bone quality or quantity, and had adequate mandibular bone for implants insertion. Each patient received a written consent explaining the study description. Cone beam computed tomography (CBCT) was made for each patient guided by radiographic stent before implant insertion for accurate determination of height and width of bone and size of the proposed implant at specific site or sites.

B: Surgical phase:

Construction of maxillary and mandibular conventional heat cured acrylic resin complete dentures was done by usual protocol. Final adjustments were made; the dentures were checked for retention and occlusion. The surgical procedures of implant insertion were done by two-stage technique to minimize the risk of infection. A mucoperiosteal flap was reflected exposing the mandibular inter-foraminal region for optimal implant insertion. The implants (Dentist, South Korea. 14 mm x Ø 3.7 mm) were derived in position. The surgical stent was placed to drill the implant site using the pilot drill, then the subsequent drills were used to widen the implant site at 800 RPM under copious irrigation. The implant

was screwed in place using hand torque controller at 20 Ncm^2. All patients received screw shaped, root form implant to permit primary fixation between implant and the bone during initial healing period, also, increasing area of contact between implant surface and surrounding bone, the implants were inserted at the canine regions. Antibiotic (amoxicillin 875mg with clavulanic acid 125mg, and metronidazole 500mg) were taken twice daily for at least 7 days and analgesic (diclofenac sodium 75mg) were prescribed for all patients after surgery.The patients were not allowed wearing their dentures for two weeks after surgery then the dentures were relieved at the implant areas to be seated properly in the patient's mouth.

C: Prosthetic phase:

Healing period of three months to assure complete implant bone osseointegration. Second stage surgery was carried out after three months. The attachment (bollard or locator) was screwed on the implant using hand torque controller at 20 Ncm. and then the flap edges were repositioned and sutured all attachment installation and pick up technique was done by auto-polymerized acrylic resin. The finished mandibular implant supported over dentures were inserted into patient's mouth and checked for retention and occlusion, final adjustments were made, and the patients were instructed to care and use his or her maxillary complete denture and implant supported mandibular prosthesis for 3 months.

D: Marginal bone loss measurement

Marginal bone loss was measured by digital panoramic X-ray film. The marginal bone loss was measured from the apex of the implant and most coronal points of bone attachment. The amount of bone loss was calculated by subtraction from original bone length that was calculated before implant placement. This procedure was done mesially and distally for each implant, and the amount of bone loss for each implant was calculated by the average bone height of both mesial and distal sites. The radiographic evaluation was done after three months, six months, twelve, fifteen, eighteen, and twenty-four months of implants placement.[12]

Statistical Analysis

The results were analyzed for normality using Kolmogorov Smirnov test. Data showed normal (parametric) distribution. The data presented as mean and standard deviation (SD) values. One-way ANOVA followed by post-hoc turkey test was used to compare the bone height change between attachments. The significance level was set at P ≤ 0.05. Statistical analysis was performed with IBM SPSS© Statistics Version 20 for Windows.

RESULTS

The Mean and SD of bone loss data is represented in **Table (1)** and **Figure (1).** Data show increase bone loss over all the observation periods especially after 12 months. One-way ANOVA post-hoc turkey test between insertion and the remaining follow up period showed statistically significant difference except with 3- and 6-months follow-up time. In between the remaining follow up times, there was non-significant difference when the readings were less than 6 months interval. For 3 months follow-up time, the interval of insignificance was 9 months **Table (2)**.

Table 1: *Mean and SD values of bone loss*

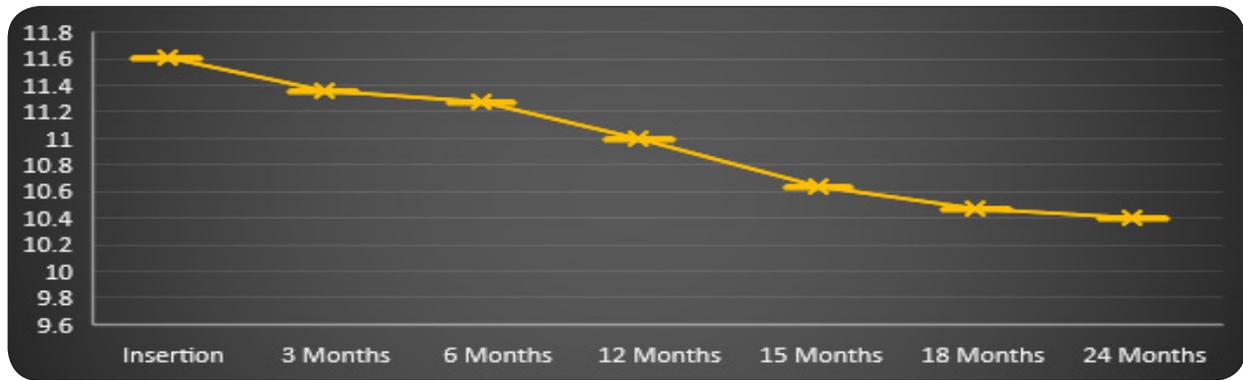|	Insertion	3 Months	6 Months	12 Months	15 Months	18 Months	24 Months
Mean	11.60938	11.3525	11.27641	11.00444	10.64219	10.47688	10.39625
SD	0.270891	0.274421	0.27079	0.406327	0.482083	0.460726	0.43403

Fig. (1) Mean and SD values of bone loss

Table 2: *Post-hoc Turkey test for multiple time comparison*

(I) VAR00002	(J) VAR00002	Mean Difference (I-J)	p value.	Significance
Insertion Vs	3 Months	.25687	.827	Non-Significant
	6 Months	.33297	.591	Non-Significant
	12 Months	.60494*	.039	Significant
	15 Months	.96719*	.000	Significant
	18 Months	1.13250*	.000	Significant
	24 Months	1.21312*	.000	Significant
3 Months Vs	6 Months	.07609	1.000	Non-Significant
	12 Months	.34806	.539	Non-Significant
	15 Months	.71031*	.009	Significant
	18 Months	.87563*	.001	Significant
	24 Months	.95625*	.000	Significant
6 Months Vs	12 Months	.27197	.786	Non-Significant
	15 Months	.63422*	.026	Significant
	18 Months	.79953*	.002	Significant
	24 Months	.88016*	.001	Significant
12 Months Vs	15 Months	.36225	.491	Non-Significant
	18 Months	.52756	.104	Non-Significant
	24 Months	.60819*	.038	Significant
15 Months Vs	18 Months	.16531	.976	Non-Significant
	24 Months	.24594	.854	Non-Significant
18 Months Vs	24 Months	.08062	1.000	Non-Significant

DISCUSSION

Residual ridge resorption can be described as major oral disease that affect size, shape and tolerance of residual ridges that provides basis of stability, retention, support of complete denture[13]. Unfortunately, bone resorption under conventional complete denture regardless type of prosthesis used as well as atrophy of the denture supporting areas leading to ill-fitting denture, lack of stability, and impaired masticatory efficiency. Another alternative treatment plans are vestibuloplasty, ridge augmentation, and finally implantation such problems are more common with mandibular arch .[14]

The mandibular overdenture retained by implants in the inter-foraminal region appears to maintain bone in the anterior mandible. In addition, it exhibit higher patient satisfaction scores than complete dentures, even with patients who have undergone pre-prosthetic surgery [15]. The success rate of implantation in the anterior mandible is now very high, use of only two or three implants for overdenture retention has proved successful[16].A two-implant overdenture provides an excellent alternative to a conventional complete denture. This recommendation supported by comparative prospective studies of patients with two or four implants in the edentulous mandible. These studies concluded that there were no significant differences in survival rates, clinical outcomes, masticatory performance and patient satisfaction for mandibular overdentures supported by two or four implants in the inter-foraminal region[17].

When considering prosthetic rehabilitation of the edentulous mandible with implant-supported or retained overdenture, various parameters may affect the chosen treatment plan, such as residual ridge resorption, the patient's expectations, medical condition, skills, and financial capabilities all of these should be considered for success of treatment regardless number of implant or abutment type[18]. Before surgical procedure the selected patients had a CBCT scan for evaluation of bone width and length at the canine area to select suitable width and length of the implants to achieve primary stability and to minimize implant failure rates [19].

Radiographic evaluation of marginal bone levels proved as one of the most valuable means to clarify implant success. To facilitate accurate reading of radiographs, it was important to establish baseline bone levels after implant placement and again after insertion of the prostheses[20].

The amount of bone resorption was significant when the interval between data was more than 6 months. This is come in agreement with Hakan et al[21]where similar significance is found in implant overdenture as well as implant supported fixed prosthesis. The data was significance at higher interval (above 9 months) for the 3 months follow up period. It may explained by high amount of bone resorption at 3 months, which makes the data close to the remaining values at the successive months. It is well known that the majority (more than half) of marginal bone loss occurs during the healing period[22] and there is high amount of bone remodeling at the first 90 days of implant placement[23]. Marzola et al has shown that 21% of implants have destructive bone resorption at the first 12 months of implant placement[24]. The results of this study shows closer results to Arora et al[25] where the bone loss of the base-line was significantly different statistically from the mean marginal bone loss at the end of 6 month, 1 year, 1.5 years, and 2 years. However, Cooper et al [26] showed no statistically significant different between base line and 1, 3, and 5 year follow-up.

CONCLUSIONS

Peri-implant bone height changes occur continuously in mandibular implant supported overdentures, which increases with time, and become significant for period more than 6 months.

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الأزهـــر
مجلة أسيوط لطب الأسنان

التغيرات فى طول العظم حول غرسات
أطقم الأسنان الكاملة المدعمة برابط كروي

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الملخص:

الهدف: أجريت هذه الدراسة سريريا لتقييم ارتفاع العظم حول الغرسة الداعمة لأطقم الأسنان السفلية الكاملة .

المواد والاساليب: ولقد اجريت الدراسة على اثنا عشر مريضا من المرضى المترددين على عيادة الاستعاضة الصناعية المتحركة بكلية طب الأسنان جامعة الأزهر بنين القاهرة. بعد التأكد من خلوهم من الأمراض العضوية او بالفم التي تعيق اجراء الدراسة. لذا قد تم أخذ التاريخ المرضي لكل مريض على حده اضافة الى الفحوصات اللازمة للفم داخليا وخارجيا سريريا واشعاعيا عن طريق الاشعة المخروطية لتقيم طول العظم قبل وضع الغرسة. تم وضع غرستين اثنتين لكل مريض في المنطقة الأمامية لثقبي الذقن ثم بعد ذلك تم تحويل الطقم السفلى الكامل العادي الى طقم فوقى مدعوما بالغرسات بعد ثلاثة شهور من وضع الغرسات. ثم بعد ذلك تم قياس التغير في ارتفاع العظم حول الغرسة اشعاعيا من نهاية الغرسة حتى الجزء العلوي لها يمينا ويسارا عن طريق اشعة البانوراما الرقمية. تم احتساب التغير في ارتفاع العظم عن طريق طرح قيمة ارتفاع العظم من القيمة الاساسية لارتفاع العظم قبل بدء تحميل الطقم على الغرسة خلال فترة ثلاثة أشهر. ستة أشهر. اثنا عشرة شهرا. خمسة عشرة شهرا. ثماني عشرة شهرا. أربع وعشرون شهرا من تحميل الطقم . تم جدولة النتائج وتحليلها احصائيا عن طريق اختبار (أنوفا) أحادي الاتجاه.

النتائج: وبناء عليه أظهرت النتائج تغيرا معنوي إحصائيا في ارتفاع العظم لفترات المقارنة فوق ستة أشهر اعتمادا باستثناء نتائج المتابعة الدورية بعد ثلاثة شهور مع نتائج اثنا عشر شهرا.

الخلاصة: هناك تغير ملحوظ فى ارتفاع العظم قبل وبدء تحميل الطقم الفوقي على الغرسات الداعمة لأطقم الاسنان السفلية الكاملة والذي بدوره يزداد بزيادة الوقت .

الكلمات المفتاحية: الغرسات الداعمة. الطقم الفوقي. نقص العظم. اشعة البانوراما. الغرسات ذات الرأس الكروية