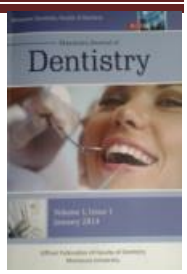

Two different designs of the 4-implants used for assisting mandibular complete overdentures: peri-implant metabolic activity.

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Abstract:

Objectives: The aim of this study was to compare the metabolic activity around implants between four axially placed implants and "all-on-four" designs used for assisting mandibular complete overdentures.

Methods:Ten healthy male completely edentulous patients of age ranging from 50 to 60 years were selected for this study. All patients received 4 implants used for assisting mandibular complete overdentures opposed by maxillary single denture. Each patient received four implants using one-stage flapless surgical technique. The patients were divided randomly into two equal groups, Group A: Patients received four axially parallel placed implants in canine and second premolar regions and Group B: Patients received four implants (two parallel implants in canine regions and two 300 distally inclined implants in the 1st molar regions).All implants were attached to the mandibular overdentures through ball and socket attachments. Biochemical evaluation of peri-implant tissue was done immediately, 3 months and 6 months after insertion of definitive overdenture. This is done by measuring glycosaminoglycans (GAGs) and chondroitin-4-sulphate (C4S) levels in the peri-implant sulcular fluid.

Results:When comparing metabolic activities of anterior (or posterior) implants within each group in all intervals of study, there was a significant decrease in total values of glycosaminoglycans and chondroitin 4 sulfate. When comparing between the two groups regarding the total means of GAGs and C4S around all implants along the T3 and T6 intervals, there was an insignificant difference.

Conclusions:Although the insignificant difference between the two groups, the four parallel axially placed implants can be considered more favorable design than the "all-on-four" design regarding the peri-implant metabolic activity for assisting the mandibular complete overdentures

Keywords:Implants, Complete Overdenture, Distal inclined implants, Metabolic Activity.

Introduction

Complete denture is the main treatment for completely edentulous patients despite its complications and problems like lack of retention, stability and persistent pain.(1)There are several ways that can be used to overcome the problems of the conventional complete denture. Some of these solutions are prosthetic approaches such as denture adhesives(2), soft liners, tissue conditioners(3), different impression techniques (neutral zone) and flexible dentures. Other solutions that can be used are surgical approaches as vestibuloplasty, ridge augmentation and dental implants.(4)(5)

For the rehabilitation of completely edentulous arch, multiple designs of implant prosthesis have been used. These designs are classified into implant supported fixed prosthesis and implant assisted removable overdentures. Although the need for more post insertion adjustment, implant overdenture shows less complications in comparison with conventional complete denture.(6)

The early loss of teeth especially the posterior ones leads to bone resorption and loss of alveolar bone above the inferior alveolar nerve decreasing the bone suitable for implant placement. The inter foraminal region is the only suitable area for implant placement. increasing the number of implants could be achieved by the use of angled implants that allows maximum use of existing alveolar bone and placement of posterior teeth with cantilever. This treatment option can be used in cases with posterior bone resorption and nerve approximation preventing the use of axial implants.(7) This concept has many advantages like avoiding the use of complex treatment options as nerve repositioning or bone graft. Also achieving a full arch prosthesis based on four implants with two tooth distal cantilever. Providing a good inter implant distance.(8), has a high success rate up to 10 years with low rate of marginal bone loss. This demonstrates the long term viability of the design of a mandibular fixed prosthesis on four immediately loaded implants with low rate of bone resorption.(9)

one of the new attachment designs for inclined implants is angulated multi-unit abutment.This perfect solution can be used in cases that angulation correction is required. The multi-unit abutment can correct angulations up to 30°. This abutment can be used in all on four concept as the distal implants are inclined about 30° and this will correct the angulation of the implant to be parallel to the other axially placed implants facilitating the placement and removal of the prosthesis.(10)

The aim of this study was to evaluate the metabolic activity around implants of two different designs of implant assisted mandibular complete overdentures.

Materials and methods

Ten healthy male completely edentulous patients of age ranging from 50 to 60 years were selected for this study from the out patients' clinic, Faculty of Dentistry, Mansoura university to receive 4 implants assisted mandibular complete overdenture against maxillary single denture according to the following criteria: mandibular residual alveolar ridge was of adequate height and width (suitable for the prospective implants) with healthy firm mucosa,the quality and quantity of alveolar bone was verified by cone beam computed tomography, suitable inter arch space for insertion of implants with ball attachment and mandibular overdenture as detected by tentative jaw relation,normal

maxillomandibular relationship (Angle's class I). Exclusion criteria were patients had systemic diseases that interfere with surgical procedures like cardiac patients or hemophilia, patients had systemic diseases that affect metabolic activity of bone like uncontrolled diabetes or osteoporosis, heavy smokers, patients with history of parafunctional habits like bruxism or clenching.

For each patient, conventional complete denture was constructed, inserted and the patients were instructed to wear the dentures for one month before implantation with weekly follow up visits till no complain. The mandibular denture was duplicated to be used as a radiographic stent and the stereolithographic surgical guide was constructed to determine the exact location, parallelism and inclination of the implants. For each patient, two parallel implants were surgically inserted in canine regions (13mm length×3.75mm diameter), two parallel implants inserted in the second premolar areas (10mm length×3.75mm diameter) for group A and two 300 distally inclined implants inserted in 1st molar areas (16mm length×3.75mm diameter) for group B. The one stage surgical technique of implant placement and immediate loading protocol were followed.

Ball attachments with 2 mm gingival height were screwed in the parallel fixtures using ball driver. In group B, 300 angled ball attachments were used to be parallel with the axial attachments (composed of multiunit abutment with 300 angulation screwed firstly in the fixture with screw driver then screwing the ball over the abutment with screw driver). Indelible pencil was used to identify the location of the attachment in the fitting surface of the denture. Relief in the site of the female housing of the ball attachment till complete seating of the denture without touching the ball attachment. Indelible pencil was used to determine if there is enough space for the female housing or not. Small vents were made lingual to the prepared cavities for easy escape of the excess resin. The female housings were picked up using autopolymarized acrylic resin while the denture was seated asking the patient to close in centric occlusion. After curing of the acrylic resin the denture was removed, finished and polished. Intraoral readjustment of occlusion was done using articulating paper. The patient was instructed how to wear and remove the denture properly and about oral hygiene measures.

Evaluation of metabolic activity

Biochemical evaluation of peri-implant tissue was done immediately, 3 months and 6months after insertion of definitive overdenture. This is done by measuring glycosaminoglycan (GAG) and chondroitin-4-sulphate (C4S) levels in the peri-implant sulcular fluid as follow: Evaluating the metabolic activity around implants by collecting the crevicular fluid around implants using periopaper. The sample sites were air dried and isolated with cotton rolls to prevent contamination of the field with saliva. Air dry again then gently inserting the periopaper in the peri implant crevice until resistance. Waiting for 30 seconds then removed. Any strip was contaminated with blood or saliva were discarded. Unstable implants were excluded from the study. The samples were stored at -70 C prior to analysis. Under these conditions, there is no risk of degradation of GAGs content. Separation of glycosaminoglycan by cellulose acetate electrophoresis of the peri-implant sulcular fluid.

Results

Table (1) shows comparison of the means of total level of GAGs between all implants in group A and group B immediately after insertion of definitive prosthesis, three months and six months. There was a statistically significant difference between the two groups at T0 (T=2.573 and P=.014), there was a statistically insignificant difference between the two groups at T3 (T=-.431 and P=.669) and there was a statistically insignificant difference between the two groups at T6 (T=-1.387 and P=.174).

Table (2) shows comparison of the means of total level of C4S between all implants in group A and group B immediately after insertion of definitive prosthesis, three months and six months. There was a statistically insignificant difference between the two groups at T0 (T= -.719 and P=.477), there was a statistically insignificant difference between the two groups at T3 (T= -1.394 and P=.171) and there was a statistically insignificant difference between the two groups at T6 (T=-1.338 and P=.189).

Table 1: Comparison between the means of total GAGs level around all implants in group (A) and group (B) in all intervals of study.

Intervals	Group (A)	Group (B)	T	P
T_0	215.95±13.972	207.10±6.431	2.573	.014
T_3	127.35±14.623	129.55±17.560	-.431	.669
T_6	58.85±8.203	62.95±10.369	-1.387	.174

Table 2: Comparison between the means of total C4S level around all implants in group (A) and group (B) in all intervals of study

Intervals	Group (A)	Group (B)	T	P
T_0	126.75±10.592	129.55±13.824	-.719	.477
T_3	94.30±8.086	98.70±11.572	-1.394	.171
T_6	42.05±4.774	44.00±4.437	-1.338	.189

Discussion:

When comparing between metabolic activities of anterior (or posterior) implants in each group in all intervals of study (from table 1 to table 16), there was a significant decrease in total values of glycosaminoglycans (GAGs) and chondroitin 4 sulfate(C4S). This may be because of the inflammation during the interval after implant insertion and early mechanical environment in bone around the immediately loaded implants that elevate the enzymes activity. This inflammation may be due to micro movements on the implant-bone interface or post-surgical infection. This is in agreement with Sorsa et al who supposed that the inflammation around implants is associated with elevation of matrix metalloproteinases (enzymes) levels and increasing the volume of peri-implant sulcular fluid.(11) In agreement with Akca et al who stated that the early mechanical environment in peri-implant alveolar bone could delay the initial healing especially with non-splinted immediately loaded implants.(12) Also Ormianer et al reported that immediate placement of gold metal sockets with high retention forces after implant insertion could produce great tensile forces on the implants that increase the inflammation around implants and delay the healing.(13)Astrand et al reported that most of the marginal bone resorption happens during the healing period.(14)

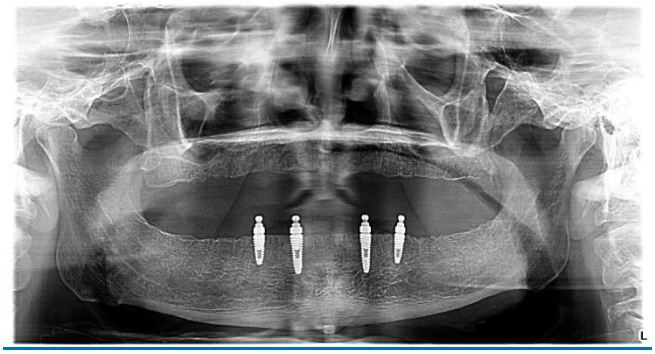
The significant decrease in the levels of GAGs and C4S may be also due to functional occlusal loading on the implants that leads to remodeling of the alveolar bone around the fixtures. In agreement with the operation Wolff`s of law, full functional occlusal loading by prosthesis on implants can cause localized remodeling and resorption of the alveolar bone around the fixtures and realignment of bone trabeculae.(15)

When comparing between the two groups regarding the metabolic activity around anterior implants at the end of 6th month of study, the mean values of GAGs and C4S of group A was found to be insignificantly less than that of group B. This may be attributed to the posterior location of ball attachments of the inclined implants in group B. This in accordance with P Malo who reported that tilting the posterior implants made the position of the implant head in the second premolar/first molar area.(7) This location may adversely affect the canine implants due to increasing the distance between anterior and posterior ball attachments which may increase stresses on the two implants in each side in group B. In agreement with C. Report who reported that increasing the distance between the implants as in long span bar between two implants may submit the implants and the prosthesis to excessive loads.(16)

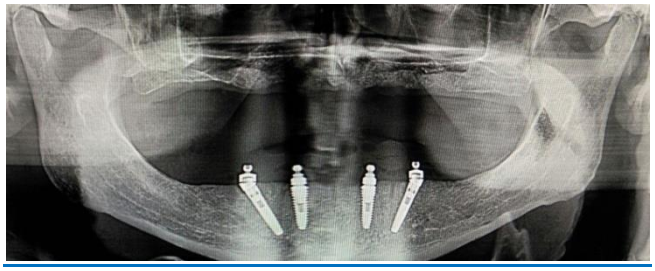
When comparing the metabolic activities around posterior implants of the two groups in T3 and T6 intervals, there was an insignificant difference in the total means of GAGs. This may indicate that the peri-implant metabolic activity in this period was more related to the osseointegration process than the design of implant overdentures.

When comparing the total means of C4S values around posterior implants of the two groups at T3 there was a significant difference, as the level of C4S values in group B was higher than group A that may be attributed to the more stresses around inclined and non-splinted implants that adversely affect the osseointegration process. This explanation is concurred with the study of P Cardelli et al who concluded that the occlusal loads on inclined implants can cause more lateral stress as the loads are not with the long axis of the implants.(17) This is in contrary to Luca Francetti et al and Leonard Krekmanov et al who stated that the use of tilted and splinted implants in rehabilitation of the two jaws are safe and not associated with higher marginal bone loss in comparison with axially placed implants.(18)(19) The insignificant difference between the total means of C4S values around posterior implants in the two groups at T6 may be due to the bone remodeling and complete osseointegration after 6th month of implant insertion.

When comparing between the metabolic activity in the two groups regarding the total means of GAGs and C4S around all implants along the T3 and T6 intervals, there was an insignificant difference. This may be due to the short follow up periods in the two groups which can be considered an inflammatory and remodeling phase. In agreement with Flichy-Fernandez AJ et al who reported that during the first 6th month after insertion of implants, bone remodeling is more obvious and have higher bone loss than the second 6th month.(20) Also Turkyilmaz stated that after the first 6th month, bone formation is obvious and positively affects the stability of the implant(21). Also the two groups are similar in using non-splinted four implants.



Group A: parallel axially placed implants.



Group B:4-implants with all on four design

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