EFFECT OF IMMEDIATE AND DELAYED IMMEDIATE LOADED SMALL DIAMETER IMPLANTS ON LOWER OVERDENTURE SUPPORTING STRUCTURE

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ABSTRACT

No statistical significance was found in bone height changes around Twenty-four endosteal one-peace small diameter implants inserted at the symphyseal area of six completely edentulous patients to support mandibular overdentures. The patients were divided into two equal groups. The implants in the first group were immediately loaded. While for the second group, the implants were loaded forty five days after implants insertion (delayed immediate group).

Periapical radiographs using Parallel technique were conducted to monitor the changes in crestal bone height, using Rinn film Holders at the time of implant insertion, 3, 6 and 12 month after insertion.

The periapical radiographs were then processed to the Digora software to measure the changes in crestal bone height around each implant through the follow up period.

The results revealed no statistical significance in bone height changes around the immediate and delayed immediate loaded implants.

INTRODUCTION

The residual ridge supporting complete denture inherently instable due to unpredictable resorption and remodeling of alveolar bone when natural teeth are removed⁴. Consequently, resorption of the residual ridge disturbs the comfort and retention of a denture, which, in turn, can irritate the peripheral mucosa to produce an epulis fissuratum ⁵. Clinical trial reveals that discomfort of an ill-fitting complete denture especially in the mandible, can be very difficult for the denture wearer to manage ⁶.

Most denture wearers, especially men, have some clinical evidence of denture-induce stomatitis, denture-related hyperplasia, angular cheilitis, or inflammation of the denture supporting mucosa. Surprisingly, evidence show that denture quality does not seem to have much influence on the prevalence of these disorders ⁷.

A study of the positional changes of the complete dentures due to the alveolar resorption revealed particularly marked changes of the lower denture. In addition to a pronounced settling on the basal seat, the lower denture displayed also a forward slide on the residual ridge. The
upward rotation of the mandible and the forward slide of the lower denture led to a reduction in the horizontal overlap, and in some patients, even to a horizontal overlap of the lower teeth over the upper ones\(^5\).

Severe atrophied mandibular ridge is problematic. Patients experiencing this condition frequently complain of ill-fitting mandibular denture and have poor ridge form and loss of vestibular depth. Stability and retention of the denture are limited and pain in function is not uncommon\(^6\).

Pain may also elicit from impingement by the mandibular prosthesis on inferior alveolar nerve presented on the superior aspect of the resorbed mandible\(^7\).

Since 1980, the endoesseous implant has largely supplanted this treatment. Two decades of experience indicate that, endoesseous root form implants supporting denture offer many advantages over surgical procedures to improve denture foundation for severely atrophic mandible. The endoesseous root form implants may be placed and restored in nearly all edentulous mandibles. Immediate loading of implants offers many pragmatic advantages for both the clinician and patient. Current available data supports the successful application of immediate loading of implants in the edentulous mandible\(^8\).

The use of standard diameter implant of nearly 4mm in diameter requires at least 6mm of bone in a facial-lingual dimension for placement without grafting additional bone to augment the site. After years of placing implants in all locations of the mouth, it is observed that seldom you can find 6mm of bone in a facial-lingual dimension\(^9\).

The use of these implants to support an over denture often requires ridge augmentation procedure in order to place the implant in bone of sufficient volume. Some implant companies have recognized the challenge of minimal bone presence and made implants of a smaller diameter (ranging from 3 to 3.5mm)\(^10\).

Although this change is only a slight reduction in diameter, it has allowed easier placement of root-form implants in the maxillary lateral incisor area, mandibular anterior sites or in any area in which bone has shrunken.

In the last few years, root- form implants ranging from (1.8mm) to slightly more than (2mm) in diameter have been promoted for long-term service. These so- called “mini”-diameter implants have been used successfully as interim implants to support provisional prostheses, while larger-diameter implants were integrating into bone. When minis were used as interim implants, the intent was to remove the mini-implants when the larger-diameter implants were put into service. As might have been anticipated, when attempting to remove these interim mini-implants, practitioners found that they could not be removed, because they had integrated into the bone during the interim service period. As a result, some of the companies producing mini-implants have applied for approval of the small-diameter implants for long-term use\(^11-12\). Victor I. Sendax expanded on Branemark’s ideas when he learned that long-term denture stabilization could be similarly achieved with the use of small-diameter posts inserted directly into the alveolar ridge\(^13\).

Mini dental implants (MDI) have been in use in various forms for approximately 20 years, and now mini dental implant has the US Food and Drug Administration approval for both ongoing and long-term use\(^14\).

Mini implants were developed to support fixed provisional restorations. They also allow for load free Osseo integration of conventional implants and provide a patient with immediate esthetics and function\(^15\).

Mini implants have many diverse applications. The foremost advantage of any transitional implant (TI) system is the delivery of stable fixed provisional prosthesis prior to or at the time of conventional implant placement. Transitional implants may function as dependable anchors for restorations functioning during healing of bone grafts and sinus lifts\(^16\).

Mini implants also facilitate accurate implant placement providing improved stability of the surgical template. Mini implants have also been used for orthodontic anchorage and overdenture support\(^17-18\).
Small diameter implants formerly used as only transitional implants can now be used for other applications including use in areas of limited bone, limited space, in physically impaired patients, and with patients who have limited finances (19).

The use of small diameter implant: reduces bleeding, decreases postoperative discomfort and shortens healing time. It can also placement into narrow ridges and immediate loaded with flapless surgery (20).

The purpose of this study was to evaluate the use of small diameter implants as overdenture abutments with two loading strategies (immediate and delayed immediate loading).

MATERIALS AND METHODS

Patient’s selection:

The study conducted on six patients selected from the outpatient clinic of the prosthetic department, faculty of dentistry, Ain Shams University according to the following criteria:-

* Age range between 55-65 years.
* Male patients were selected.
* Patients were free from any signs of oral pathology.
* Patients were free from systemic disease, affecting bone metabolism.
* Patients were free from obvious TMJ disorder.
* Blood analysis was carried out to exclude the diabetic patient.
* Patients were subjected to several sessions of patient education about implant importance, need, advantage disadvantage, maintenance and care.

Treatment plan:

For each patient full arch upper and lower impressions were made and diagnostic casts were obtained. Complete upper and lower dentures were constructed and delivered with the conventional manner after secondary impression making, bite registration and try in.

A duplicate of the patient’s lower denture was constructed to act as a radiographic and a surgical stent.

Two metal balls 5mm in diameter were used with the radiographic stent at the canine area one on each side while taking the panoramic radiographic picture to locate the site of the mental foramen bilaterally and to estimate magnification occur with panoramic view.

Radiographic Examination:

For each patient Panoramic radiograph to examine the conditions of the bone, and bone height was carried out before denture construction. After denture insertion another panoramic radiograph was made with transparent radiographic stent containing two metal balls.

Implant selection and Location:

Four screw-type one-piece implants with 2.4 mm diameter and 10mm length were used in this study.

For each patient four implants were inserted at the symphyseal area. The radiographic acrylic stent was modified to serve as a surgical stent. This stent was used with the panoramic radiograph to guide the insertion of the implants in the symphyseal area in between the two mental foramina.

Surgical and prosthetic Procedures:

The intact edentulous ridge was examined for any inflammation, soreness, or ulcer before proceeding to the surgical procedure.

Nerve block anesthesia administrated to both sides of the arch. Some patients only subjected to mental nerve block anesthesia.

The transparent radiographic acrylic stent is modified from the anterior region exposing the anterior segment of the lower arch. The locations of the four implants were determined and marked for the best balance and support of the denture. Thus an even number of implants were inserted on each side of the midline.
Dentatus needlepoint profile drill was used to initiate the osteotomies at approximately 800-1000 RPM. Operate with copious amounts of biocompatible sterile water or saline solution.

The Atlas implant and abutment is a single piece that is screwed into the bone like a wood screw, installed with the Atlas Drivers, and the Atlas Dome Keeper implant’s slots were aligned with the curve of the ridge. (Fig 1)

The two components of Tuf-Link liner were expelled to a mixing pad and spatulated with pressure for (40-60) seconds. The liner, spread over the base and the encasement groove and the denture was guided quickly into place in the mouth. The denture was maintained without motion for 5-7 minutes under the patients biting force in the centric occluding relation, at which time the liner has set to a resilient stable form. (Fig: 3).

After implant insertion, patients were divided into two groups (I & II). For (group I) the denture base section opposite to the four implants was relieved to accommodate the silicone liner and deeper space was made for the Dome Keeper section.(Fig 2)

The Dentatus spherical #1 depth guide instrument was used to mark the reduction depth for a uniform level reline of the denture. The spherical #2 instrument was used to remove the depth marks.

The Dentatus encasement #3 instrument was used for making a groove in the periphery of the denture. It is further refined with the encasement #4 instrument, creating a heavier beveled finishing line for firmly locking in the liner in place. 2-3 shallow locating indents were made in the hollowed-out section of the denture base with the #4 instrument for self-alignment of the silicone reline.

The liner was removed from the denture with a pointed tool and gentle tug. The flash excess material is cut away outside the denture with fine scissors along the visibly delineated encasement groove. The reline was reinserted into the denture with gentle finger pressure or a rounded smooth handle to its indexed position. The loading of this group was immediate loading.
For (group II) the denture base was only relieved opposite to the implants for about forty-five days after surgery. After that period, soft liner was added to the denture with the same procedure followed with (group I). So the loading of the implants in (group II) was delayed immediate loading.

Depending on variable conditions, the Tuf-Link silicone should maintain its resiliency for 12-18 months. It can be quickly replaced if needed without preparation or adjustment in the denture base.

**Post surgical Medication:**

After the surgery, all patients were instructed to follow post surgical medication to avoid inflammation and infection. Antibiotic (Amoxicillin clavinic acid 625mg every 8 hours for at least 7 days), and analgesic (Diclofenac sodium 50mg) were prescribed.

All patients were instructed to rinse 3 times per day with 0.1% chlorhexidine mouth wash post surgical and for the rest of the treatment and follow up period.

**Radiographic of evaluation:**

The effect of the immediate and delayed immediate loading of the implants supporting mandibular overdenture was radiographically evaluated, Periapical radiographs using Parallel technique ware conducted to monitor the changes in crestal bone height around the implants, using Rinn film Holders. The periapical radiographs were taken at the time of insertion of the implant, 3, 6 and 12 month after insertion.

A radiographic acrylic stent was fabricated for each patient to standardize the periapical radiographs and to hold the Rinn XCP Holder*.

The periapical radiographs were processed to the Digora software Single user Demo** to measure the changes in crestal bone height mesial and distal to each implant and 20mm distal to the implant through time. (Fig: 4)

**Patients Follow Up:**

Follow up visits were carried out on 3, 6 months and one year intervals. Patient’ satisfaction was evaluated by questionnaire. Radiographic evaluation and occlusal adjustments of each case were performed. The data obtained were collected and tabulated for statistical analysis.

**Statistical Analysis:**

Statistical analysis of this study was carried out using SPlus Statistical Software (SPSS - Release 12) for Windows.

Paired t-test was used for testing significance between means of the changes in crestal bone height between the two groups studied. It was also used for testing the effect of time on the studied variables.

**RESULTS**

All patients attempted the follow up period during which data was extracted from their radiographs, to evaluate the crestal bone height changes of the immediate loaded implants (group I) and the delayed immediate loaded implants after 45 days (group II).

All patients were satisfied with their prosthesis and no complaints were recorded especially after surgery. The prosthesis met both functional and aesthetics for all patients.
Patients’ satisfaction that evaluated by questionnaire, revealed more patient satisfaction of group I than group II especially after denture insertion, i.e.: during the adaptation period.

Statistical analysis of the radiographic findings was carried out using S-plus statistical software (SPSS-Release 12) for Windows.

**Paired t-test:** Was used for testing significance between means of the changes in the crestal bone height supporting implants of the two groups and for testing the effect of time on the studied variables.

Statistical significance was achieved when the (P-value < 0.05).

**Effect of time on marginal bone height mesial to the implants**

Paired t-test was used to study the effect of time on marginal bone height mesial to the implants for group I and II. Means, standard deviation values (SD) and results of paired t-test are presented in Table (1).

### TABLE (1) Effect of time on marginal bone height mesial to the implants for Group I and II

<table>
<thead>
<tr>
<th>Mesial</th>
<th>Row data changes</th>
<th>Paired t-test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean mm ± SD</td>
<td>Mean mm ± SD</td>
</tr>
<tr>
<td>Group I:</td>
<td>At insertion</td>
<td>10.974 ± 0.020</td>
</tr>
<tr>
<td></td>
<td>After 3m.</td>
<td>10.948 ± 0.025</td>
</tr>
<tr>
<td></td>
<td>After 6m.</td>
<td>10.943 ± 0.028</td>
</tr>
<tr>
<td></td>
<td>After 12m.</td>
<td>10.926 ± 0.033</td>
</tr>
<tr>
<td>Group II:</td>
<td>At insertion</td>
<td>11.039 ± 0.014</td>
</tr>
<tr>
<td></td>
<td>After 3m.</td>
<td>11.023 ± 0.001</td>
</tr>
<tr>
<td></td>
<td>After 6m.</td>
<td>11.013 ± 0.009</td>
</tr>
<tr>
<td></td>
<td>After 12m.</td>
<td>10.995 ± 0.011</td>
</tr>
</tbody>
</table>

**Group I:** Immediate loading

**Group II:** delayed immediate loading after 45 days

As shown in (Table 1) The mean changes of bone height mesial to the implants group I after 3 months was 0.023 mm, with SD 0.066. This change is of statistical significance of 0.020 P-value. Compared to group II of the same period the mean change was 0.017 mm, with SD 0.006 with the P-value 0.038, which is statistically significant.

From the implant insertion to 6 month follow up period, the mean change of bone height mesial to the implants in group I was 0.030 mm, with SD 0.010 with the P-value 0.035, which is statistically significant. However, for group II it was 0.027 mm, with SD 0.021 and P-value 0.157, which is statistically non-significant.

After 12 month follow up period the mean change of the bone height mesial to the implants of group I patients was 0.047 mm, with SD 0.012 with P-value 0.020 which is statistically significant, while for group II it was 0.047 mm, with SD 0.021 with P-value 0.060 which is statistically non significant.

**SD:** standard deviation, *: significant at P-value <0.05
**Effect of time on marginal bone height distal to the implants**

Paired t-test was used to study the effect of time on marginal bone height distal to the implants for group I and II.

Means, standard deviation values (SD) and results of paired t-test are presented in table (2).

**Group I**: Immediately loading

**Group II**: delayed immediate loading after 45 days

(Table 2): The mean changes of bone height distal to the implants in group I after 3 months was 0.025 mm, with SD 0.005 which is statically significant (P-value 0.001). While for group II the mean change was 0.023 mm, with SD 0.006 with the P-value 0.020 which is also statistically significant.

From the time of implant insertion to 6 month follow up period, the mean change of the bone height distal to the implants was 0.029 mm, with SD 0.011 with the P-value 0.002 for group I, which is statistically significant. While for group II it was 0.033 mm, with SD 0.015 and P-value 0.063 which is statistically non significant.

By the end of the follow up period (12 months) the mean change of the bone height distal to the implants of (group I) was 0.045 mm, with SD 0.014 and P-value <0.001 which is statistically significant, while for (group II) it was 0.053 mm, with SD 0.015 and P-value 0.026 which is statistically significant also.

**Effect of time on marginal bone height on both mesial and distal surfaces of implants in the two groups.**

Paired t-test was used to study the effect of time on marginal bone height on both mesial and distal surfaces of the implants for group I and II. Means, standard deviation values (SD) and results of paired t-test are presented in table (3) and figures (5).

**TABLE (2) Effect of time on marginal bone height distal to the implants for Group I and II**

<table>
<thead>
<tr>
<th>Distal</th>
<th>Row data</th>
<th>Difference</th>
<th>Paired t-test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean mm ± SD</td>
<td>Mean mm ± SD</td>
<td>T</td>
</tr>
<tr>
<td>Group I</td>
<td>At insertion</td>
<td>11.017 ± 0.029</td>
<td></td>
</tr>
<tr>
<td>After 3m.</td>
<td>10.963 ± 0.006</td>
<td>0.025 ± 0.005</td>
<td>12.200</td>
</tr>
<tr>
<td>After 6m.</td>
<td>10.965 ± 0.002</td>
<td>0.029 ± 0.011</td>
<td>6.191</td>
</tr>
<tr>
<td>After 12m.</td>
<td>10.952 ± 0.009</td>
<td>0.045 ± 0.014</td>
<td>8.156</td>
</tr>
<tr>
<td>Group II</td>
<td>At insertion</td>
<td>11.042 ± 0.005</td>
<td></td>
</tr>
<tr>
<td>After 3m.</td>
<td>11.019 ± 0.003</td>
<td>0.023 ± 0.006</td>
<td>7.000</td>
</tr>
<tr>
<td>After 6m.</td>
<td>11.008 ± 0.008</td>
<td>0.033 ± 0.015</td>
<td>3.780</td>
</tr>
<tr>
<td>After 12m.</td>
<td>10.990 ± 0.011</td>
<td>0.053 ± 0.015</td>
<td>6.047</td>
</tr>
</tbody>
</table>

SD: standard deviation, *: significant at P-value <0.05
TABLE (3) Effect of time on marginal bone height on both mesial and distal surfaces of the implants for Group I and II

<table>
<thead>
<tr>
<th>Time</th>
<th>Group I</th>
<th>Group II</th>
<th>T-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-3m.</td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
<td>t</td>
</tr>
<tr>
<td></td>
<td>0.025 ± 0.005</td>
<td>0.020 ± 0.006</td>
<td>1.568</td>
</tr>
<tr>
<td>0-6m.</td>
<td>0.027 ± 0.008</td>
<td>0.030 ± 0.017</td>
<td>0.391</td>
</tr>
<tr>
<td>0-12m.</td>
<td>0.042 ± 0.010</td>
<td>0.050 ± 0.017</td>
<td>0.994</td>
</tr>
</tbody>
</table>

SD: standard deviation, *: significant at P-value <0.05

**Group I**: Immediately loading

**Group II**: delayed immediate loading after 45 days

As shown in (Table 3): The Mean changes of the bone height on both mesial and distal surfaces of the implants in group I after 3 months was 0.025 mm, with SD 0.005, while for group II it was 0.020 mm, with SD 0.006. No statistical significant difference was observed, (P-value 0.147).

After 6 months of implants insertion, the mean change of the bone height on both mesial and distal surfaces of the implants in group I was 0.027 mm, with SD 0.008. However, for group II it was 0.030 mm, with SD 0.017 and P-value was 0.703, which is statistically non-significant.

After 12 months follow up period the mean change of the bone height on both mesial and distal surfaces of the implants of group I was 0.042 mm, with SD 0.010, while it was 0.050 mm, with SD 0.017 for group II, P-value was 0.343 which is statistically non significant.

*Effect of time on Marginal Bone Height 20mm distal to the last implant on each side*

Paired t-test was used to study the effect of time on marginal bone height distal to the last implant on each side for group I and II. Means, standard deviation values (SD) and results of paired t-test are presented in Table (4) and Figure (6).

**Group I**: Immediately loading

**Group II**: delayed immediate loading after 45 days

The mean changes of the bone height 20 mm distal to the last implant in group I after 3 months was -0.003 mm, with SD 0.006, while after 6 months was -0.010 mm with SD 0.010 which was the same changes in group II of the same periods. After 12 month it was -0.020 mm, with SD 0.010 while in group II it was -0.027 mm with SD 0.006.
**TABLE (4)** Effect of time on marginal bone height 20mm. distal to the last implant on each side for Group I and II

<table>
<thead>
<tr>
<th>Bone</th>
<th>Row data</th>
<th>difference</th>
<th>Paired t-test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean mm ± SD</td>
<td>Mean mm ± SD</td>
<td>t</td>
</tr>
<tr>
<td>Group I</td>
<td>At insertion</td>
<td>3.687 ± 1.526</td>
<td>-0.003 ± 0.006</td>
</tr>
<tr>
<td></td>
<td>After 3m.</td>
<td>3.688 ± 1.528</td>
<td>-0.010 ± 0.010</td>
</tr>
<tr>
<td></td>
<td>After 6m.</td>
<td>3.694 ± 1.524</td>
<td>-0.020 ± 0.010</td>
</tr>
<tr>
<td></td>
<td>After 12m.</td>
<td>3.705 ± 1.527</td>
<td>-0.027 ± 0.006</td>
</tr>
<tr>
<td>Group II</td>
<td>At insertion</td>
<td>2.675 ± 0.580</td>
<td>-0.003 ± 0.006</td>
</tr>
<tr>
<td></td>
<td>After 3m.</td>
<td>2.687 ± 0.578</td>
<td>-0.010 ± 0.010</td>
</tr>
<tr>
<td></td>
<td>After 6m.</td>
<td>2.687 ± 0.578</td>
<td>-0.027 ± 0.006</td>
</tr>
<tr>
<td></td>
<td>After 12m.</td>
<td>2.703 ± 0.583</td>
<td>-0.027 ± 0.006</td>
</tr>
</tbody>
</table>

**SD**: standard deviation, *: significant at P-value <0.05

**DISCUSSION**

**Discussion of Methodology**

Complete edentulous patients only with angle class I were chosen to be subjected to the study to avoid abnormal forces on the implant, and all patients with parafunctional habits were excluded.

The mandible was chosen in this study for implantation, since the amount of bone reduction is generally greater in the mandible than maxilla, which implies that mandibular denture usually poses greater clinical problem for patient and prosthodontist. The patients experiencing this condition frequently complain of ill-fitting denture, retention and stability of these denture are limited and pain in function may result.
Blood analysis and fasting blood sugar level were evaluated for each patient to exclude diabetic patient as this may alter the rate of bone resorption and may change the pattern of healing (21).

Patients who smoke were also excluded from the study due to the effect of tobacco on the peripheral circulation and soft tissue healing (22).

Oral hygiene measures were instructed to the patient as it helps in the success of the implant therapy. Improper oral hygiene measures may lead to plaque deposition, increase in gingival bleeding, which may lead to periimplantitis and then implant failure (23).

All patients filled a diagnostic sheet with complete medical and dental history with written consent for the surgical and post surgical procedure performed by the operator giving full agreement about the steps carried out. Patients read and understood the condition and all of them signed with no hesitation and patients who cannot read the consent was read for them in presence of witnesses, to be aware and cooperative and to share in the success of the procedure.

The occlusal concept used is the lingualized occlusal concept that provides better chewing efficiency than zero degree occlusal form and decreases the stresses transmitted to the abutment fixtures of the implant overdentures (24). The protocol for a successful implant is one that demonstrates osseointegration, as well as optimal position of the implant for the fabrication of an aesthetic and functional restoration (25). Ideal placement facilitates the establishment of favorable forces on the implants and the prosthetic components while ensuring an aesthetic outcome. To increase the predictability of success, it is essential that the implants are placed properly.

A radiographic stent was fabricated from transparent acrylic to see the tissues and pressure areas. The radiographic stent with 2 balls in the canine areas used to reveal the degree of magnification of the panoramic radiograph as well as to define the site of vital structures as the mental foramina and the inferior dental canal (26). Radiographic templates commonly converted into surgical stents to be used as a guide for proper implant placement.

The distance between the last implant and the mental foramen was at least 3 mm to avoid any anterior looping of the nerve and for more safety, which was guided by the panoramic radiograph and the surgical stent (27).

According to Immediate loading guidelines (28), the implant body should engage cortical plate of bone apically and crestal that’s why the interferomimal area of the mandible was selected for implant insertion as well as the absence of any vital structure that may be injured due to implant length. The optimal bone density in this area was considered for its selection over the posterior mandible (29).

Both internal and external saline solution irrigation systems were used to reduce to satisfactory levels the high temperatures that are generated during drilling of implant sites. This reduces the harmful effect to the bone while drilling (30).

Screw type implant was used in this study as its geometry enhances better initial stability and better bone implant interface as well as better transmission of compressive forces to the bone which enhance osseointegration (31).

The use of standard, diameter implant to support an overdenture in atrophied mandible often requires ridge augmentation procedure in order to place the implant in bone of sufficient volume. Small diameter implants with flapless surgery supporting conventional denture, used in this study, present a method of restoring patient with an atrophic mandible without any bone augmentation surgery and it’s possible complications (32). In addition, the advantages of minimally invasive procedure of reduced bleeding, decreased postoperative discomfort, shortened healing time, and decreased possibility to infection during surgery procedure.

Because of the low profile of the dome cap (3mm), parallel inconsistencies and divergent angles are not a problem. The Tuf-Link silicon dentures reline material leaves room for error. The Atlas implant head is much
larger than the implant body creating better retention. Studies have shown that bacteria thrive in many adhesives and cements, causing irritation and inflammation from their toxins. No adhesives are required to retain the Tuf-Link silicone in the denture, thus alleviating this potential problem.

Postoperative medications were used to ensure for good oral environment and to enhance soft tissue regeneration in absence of infectious elements because of its antimicrobial effect on the organisms in the oral cavity (33).

The reasonable cost of these implants allows the dentist to receive a fair fee for the procedure and affords a great opportunity to a majority of denture patients. Rinn holder has been used in this study because of its proved accuracy in literature with the paralleling technique and standardization of periapical radiographs during the follow up period (12 months) (34).

DISCUSSION OF RESULTS

A major reason for failure with immediate loaded implants is the too much stress or movement. Since the Atlas implants require no 0-rings or copings, they do not have lateral forces applied that could prevent osseointegration through pressure and movement. The soft silicone reline material cushions the bony ridge against the forces of mastication caused by the pressure of the hard acrylic denture base (35). Therefore, patients of group I (immediate loading) were more satisfied especially during the adaptation period, which is the result of more denture retention and stability.

The change in the marginal bone height around the implants was statistically significant after 3 months, which may be due to the surgical procedure of the implant insertion in groups (I & II). This change was statistically significant after 6 and 12 months follow up period for group I (immediate loading) while it was nearly insignificant for group II (delayed immediate loading) which may be attributed to delaying the loading during the Osseo integration period.

The change in the marginal bone height on the ridge 20 mm distal to the implants was statistically insignificant through the follow-up period in the two studied groups, which proves more stability and retention of the implant retained overdenture that decrease the denture movement on function. So trauma to the underlying tissues of the ridge decreases and subsequently the rate of residual ridge resorption. However, change in marginal bone height on both mesial and distal surfaces of the implants in group I showed statistically insignificant less resorption than group II and this may be attributed to the less movement of the denture during function and less stresses transmitted to the implants during the healing period because of the soft silicone reline material that acts as a cushion against forces of mastication. In addition, the reline silicon material provides retention with free torque (35).

SUMMARY

Twenty-four endosteal root form screw-type one-piece small diameter implants with 2.4 mm diameter and 10 mm length were inserted at the symphyseal area of six completely edentulous patients to support mandibular overdentures. The patients were divided into two equal groups. The implants in the first group were immediately loaded and the denture base section opposite to the four implants was relieved to accommodate the soft silicone liner. While for the second group, relief of the denture base opposite to the implants was made for about forty five days after surgery after that period soft silicone liner was added to the denture as the first group.

The effect of the immediate and delayed immediate loading on the implant’s supporting structure was radiographically evaluated.

Periapical radiographs using Parallel technique were conducted to monitor the changes in crestal bone height, using Rinn film Holders. The periapical radiographs were taken at the time of implants insertion, 3, 6 and 12 months after insertion.

The periapical radiographs were then processed to the Digora software to measure the changes in crestal bone height around each implant through the follow up period.
The results revealed no statistical significance between the two studied groups (immediate loading & delayed immediate loading), in bone height changes around the implants during the observation period.

**CONCLUSION**

The results of this study lead to the following conclusions:

1. As regard the marginal bone height changes, there was no statistical significant difference between immediate loading and delayed immediate loading of small diameter implants supporting mandibular complete overdentures.

2. Immediate loading group Patients’ were more satisfied as a result of increased retention and stability of the lower dentures.

3. Statistical significant reduction of the crestal bone height was observed around the immediate loaded implants during the follow-up period.

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