Comparative Study of Implant Stability and Bone Height Changes Among Different Implant Designs Retaining Partial Overdenture

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COMPARATIVE STUDY OF IMPLANT STABILITY AND BONE HEIGHT CHANGES AMONG DIFFERENT IMPLANT DESIGNS RETAINING PARTIAL OVERDENTURE

Fardos N. Rizk*

ABSTRACT

Objective: This study was conducted to assess the primary stability of Trabecular Metal Dental Implant and Tapered Screw Vent Implant to determine the appropriate time for their loading by lower partial overdenture and to follow up for one year the changes in implant stability and crestal bone height surrounding the implant after loading it.

Materials and Methods: The study was performed on ten lower Kennedy class I partially edentulous male patients. Each patient received one implant at the second molar area in each side of the ridge, where Trabecular Metal Dental Implant was inserted in the left side of the ridge (Group I) and Tapered Screw Vent Implant was inserted in the right side of the ridge (Group II). Primary implant stability quotient was measured using Osstell® and according to the results early loading of all implants was performed. All patients received lower partial overdenture retained by ball attachment. Patients were followed up clinically to measure secondary implant stability using Osstell® and radiographically to measure crestal bone height changes surrounding the implants using cone beam computed tomography.

Results: Both groups showed increase in implant stability and decrease in crestal bone height however, Trabecular Metal Dental Implants showed higher primary and secondary stability mean value and less decrease in crestal bone height throughout one year follow up period.

Conclusion: The primary stability of both Trabecular Metal Dental Implant and Tapered Screw Vent Implant allow for early loading yet, Trabecular Metal Dental Implant showed higher primary stability values which could allow for immediate loading. Trabecular Metal Dental Implant reached higher stability values and showed less crestal bone resorption than Tapered Screw Vent Implant in one year follow up period.

Keywords: Tapered Screw Vent Implant, Trabecular Metal Dental Implant, Implant stability, Crestal bone height, Osstell®, Cone beam computed tomography

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INTRODUCTION

Distal extension removable partial dentures drive their support from relatively stable supporting abutment tooth or teeth and resilient soft tissues overlying the residual edentulous ridge. These two tissues exhibit different degrees of displaceability. The resiliency of the mucoperiostium is twenty five times greater than that of periodontal membrane of the abutment teeth, thus the distribution of the load would not be equal when functional pressure is applied. Consequently, torque would be applied on the abutment teeth which must be controlled to reach successful clinical outcome.\textsuperscript{1,2} Osseointegrated implant-born removable prostheses has been tried with reasonable success in distal extension cases.\textsuperscript{3-5} The placement of osseointegrated implants beneath distal extension denture base results in stable occlusion with reduced stresses, improved function and comfort.\textsuperscript{6}

Continuing dental and orthopaedic research has focused on various techniques for enhancing bone apposition to implanted titanium surfaces. Research in implant biomaterials and surface technologies has led to development of trabecular metal material which is a three dimensional porous biomaterial not an implant surface coating. It is fabricated by coating a vitreous carbon skeleton (2\%) with tantalum (98\%) creating a metallic strut configuration similar in structure and stiffness to cancellous bone.\textsuperscript{7-17} Trabecular metal technology significantly differs from sintered bead surfaces, titanium plasma-sprayed surfaces, titanium fiber mesh and titanium foam in the high degree of its interconnected porosity (up to 80\%) and the regularity of its pore size and shape.\textsuperscript{9-13} In contrast to conventional bone-to-implant contact achieved by non-porous surfaces, trabecular metal technology’s geometrical network of interconnected pores provides a scaffold for bone in growth and interconnection, allowing for rapid and substantial mechanical attachment.\textsuperscript{11-16} Researches on trabecular metal material concluded that bone grows inside its pores, gets mineralized and develops cellular components.\textsuperscript{18-20} In samples of trabecular metal material, new bone occupied 42\% of the pores at four weeks, 63\% at 16 weeks and 80\% at one year.\textsuperscript{10,21}

This material has been used extensively in orthopaedic reconstructions for over a decade.\textsuperscript{8,10,12,14,22,23} Based on this, dental researchers modified a conventional tapered, multithreaded, root-form, titanium dental implant design by replacing the threads in the midsection of the implant body with an unthreaded sleeve of the highly porous trabecular metal material developing Trabecular Metal Dental Implant (Zimmer Dental Inc., Carlsbad, CA, USA) which introduces a new dimension in implant dentistry. Trabecular Metal Dental Implant allows bone in growth and on growth on its surface creating a new process called osseoincorporation. Osseoincorporation refers to the healing potential of bone onto an implant surface and into an implant structure providing high potentials for immediate stabilization of the implants and reporting positive outcomes for immediate loading of implants.\textsuperscript{24,25} Moreover, the use of attachments optimizes stresses and minimizes denture movement resulting in stable partial denture with reduced stresses placed on the remaining teeth.

Diagnosis of direct bone apposition on the implant surface with no interposition of soft tissue considers the level of stable marginal bone and absence of mobility which is based on radiographic and mechanical stability criteria.\textsuperscript{26} Peri-implant radiolucent areas and marginal bone height can be identified radiographically. Cone beam computed tomography is used with high degree of accuracy to measure bone height on buccal, lingual, mesial and distal bone surfaces surrounding the implant.\textsuperscript{27,28} Mechanical criteria of implant stability is based on primary and secondary stability. Primary stability is the absence of mobility in the bone bed upon insertion of the implant and it depends on the quantity and quality of bone, surgical technique and implant design. Secondary stability depends on bone formation and remodelling at the implant-bone
interface and is influenced by the implant surface and the wound-healing time. Primary stability and absence of micro movements are considered the fundamental prerequisites for the osseointegration of endosseous implants.\(^{26,29}\)

There are different ways of measuring implant stability, such as the Periotest (Gulden, Bensheim, Germany) or the Dental Fine Tester (Kyocera, Kyoto, Japan), however they have been criticized for their lack of resolution, poor sensitivity and their susceptibility to being influenced by the operator.\(^{30}\) Resonance Frequency Analysis (RFA) offers a clinical measure of stability and presumed osseointegration of implants,\(^{31,32}\) being a useful tool to establish implant loading time.\(^{33}\) The RFA values are represented by a quantitative unit called the Implant Stability Quotient (ISQ) on a scale from 1 to 100, and are measured with the Osstell® (Integration Diagnostics AB, Gothenburg, Sweden). The Osstell® system is a portable, hand-held device that emits signals repeated by a transducer screwed directly into the implant or transepithelial abutment with a force of 5-10 Ncm, calculating the resonance frequency (in ISQ values) from the response signal. Increased ISQ value indicates increased stability.\(^{31}\) By means of ISQ value, initial implant stability can be quantitatively assessed and followed with time as a function of implant’s stiffness in bone. Its use provides a possibility to individualize implant treatment with regards to healing periods, detecting failing implants, type of prosthetic construction, and if one or two staged procedures should be used.\(^{34,35}\) Immediate loading of implants with ISQ values greater than 70 at time of implant placement can be performed. Moreover, early loading of implants with ISQ values 64-70 at day of loading is carried out while, implants with ISQ values less than 64 should utilize traditional loading.\(^{36}\) This study was thus conducted to assess the primary stability of Trabecular Metal Dental Implant and Tapered Screw Vent Implant to determine the appropriate time for their loading by lower partial overdenture and to follow up for one year the changes in implant stability and crestal bone height surrounding the implant after loading it.

**MATERIALS AND METHODS**

**Patient Selection**

Ten lower Kennedy class I partially edentulous male patients having the second premolar as a last standing abutment on both distal extension sides were selected. All patients had full set of teeth in the upper jaw. Patients were carefully informed about the treatment procedure and agreed to take part in the study for a period of one year. Diagnostic cone beam computed tomography was taken for each patient which showed bone density ranging from 600-10000HU (Division D2, D3)\(^{37}\) in the posterior region of the mandible. Only patients having bone height and width more than 11mm and 5mm respectively in the posterior region of the mandible (Division A)\(^{37}\) were included in the study. Smokers, diabetics, patients with any chronic bone disease or history of radiotherapy to head and neck region were excluded from the study.

**Implants Grouping**

**Group I:** Trabecular Metal Dental Implants (Zimmer Dental Inc., Carlsbad, CA, USA) were inserted at the second molar area in the left side of the ridge of all patients (Fig. 1 a, b).

**Group II:** Tapered Screw Vent Implants (Zimmer Dental Inc., Carlsbad, CA, USA) were inserted at the second molar area in the right side of the ridge of all patients (Fig. 2 a, b).

**Design of implants**

**Group I:** Trabecular Metal Dental Implant (Fig.3a), the premium addition to Tapered Screw Vent Implant is a tapered, multi-threaded, endosseous design similar to its predicate Tapered Screw-Vent Implant at its coronal and apical structures which are made of titanium alloy (Ti-6Al-4V grade 5) with a microtextured surface (MTX Surface) and self-tapping threads having a pitch distance 1mm.
The midsection is modified with trabecular metal material made of tantalum (98%) deposited on a vitreous carbon substrate (2%). It features the interconnected porosity of the trabecular metal material with regular size and shape.

**Group II:** Tapered Screw Vent Implant with MTX Surface (Fig.3b) is a tapered micro threaded endosseous design made of titanium alloy (Ti-6Al-4V grade 5) with a microtextured surface (MTX Surface). The threads start 2.5mm apical to the top with a pitch distance 1mm and it extends the whole length of the implant with a vent at the apical end of the implant.

**Surgical procedures for implant installation**

For each patient upper cast was mounted on a semi-adjustable articulator (Dentatus type ARH, AB Dentatus, Stockholm, Sweden) according to face bow record (Dentatus face bow Dentatus, Stockholm, Sweden) while lower cast was mounted by the aid of centric occluding relation record. Occlusion was evaluated and corrected in the patient’s mouth. Trial setting up of artificial teeth in edentulous areas of mounted lower casts was carried out. Transparent clear acrylic resin (Vertex Rapid Simplified; Vertex-Dental BV, Zeist, The Netherlands) surgical stent was fabricated on lower cast to assure proper placement of implants beneath the planned position. Standard surgical procedures were followed for implant installation at second molar area parallel to long axis of the anterior abutment. All implants were inserted with an insertion torque 35 Ncm according to the manufacturer instructions. All the inserted implants had 3.7mm width and 11.5mm length.

**Measuring primary implant stability:**

Primary implant stability was measured using resonance frequency analysis (Osstell® Integration Diagnostics AB, Gothenburg, Sweden) at the time of implant placement (Fig. 4). For each measurement, the transducer (smart peg) was placed perpendicular to the long axis of the implant location and then secured with a torque of 10 Ncm as per manufacturer
instructions. Measurements were made at 2 - 3 mm away so that the probe tip of the analyser would point to the small magnet above the smart peg (Fig. 5). Measurements were taken twice and if any difference was observed the lower one was registered.\(^{38,39}\) Healing collars were then screwed to the implants for about one week to allow healing of the mucosa.

**Removable Partial Denture Framework Construction:**

After healing of the mucosa ball attachments (Zimmer Dental Inc., Carlsbad, CA, USA) with height 2mm were screwed to the implants (Fig 6). For each patient lower alginate impression was taken in properly adjusted stock tray and poured in an improved stone to produce lower study cast. Custom made perforated acrylic resin tray was constructed and preliminary surveying of the lower study cast was carried out to establish a suitable path of insertion and removal, and the needed mouth preparation. Inside the patient’s mouth, mesial occlusal rest seat and distal guiding plane were prepared on the second premolar bilaterally and distal occlusal rest was prepared on the first premolar bilaterally. Final impression was taken and poured into improved dental stone to obtain master cast. Secondary surveying was done for master casts before duplication. The partial denture framework was casted in cobalt-chromium alloy and tried in the patient’s mouth (Fig. 7) Wax rim was made on the metal framework, centric occluding relation was registered. Setting up of artificial teeth was carried
out using low cusp angles cross linked acrylic resin teeth (Vita, Bad Sackingen-Germany). Waxed partial dentures were then tried inside patient’s mouth, and then processed using heat cured acrylic resin (Acrostone Dental Factory, Cairo, Egypt), finished and polished.

**Partial denture design:** The design of all finished partial dentures was the same.

a) **Direct retainer:** RPI clasp was used on lower second premolar bilaterally.

b) **Major connector:** Lingual bar major connector was used.

c) **Denture base:** combination denture base

**Loading procedures:**

Implant stability was measured at three weeks after implant insertion and according to the primary stability values recorded at the time of implant placement and at three weeks, early loading of implants (three weeks after implant insertion) was preferred in both groups. Partial denture base was relieved to accommodate the nylon cap of the ball attachment. The denture was tried in the patient’s mouth to ensure complete seating. Any undercuts were blocked out using temporary filling (Litark, Lascod SpA-Vita L. Longo, Sesto F. no Firenze Italy). A mix of self cure acrylic resin (Acrostone Dental Factory, Cairo, Egypt) was applied in the relieved region for direct pick-up of the super-structure following close-mouth technique (Fig 8). Necessary adjustments were carried out to eliminate occlusal interference and the denture was delivered to the patient and checked after 24 and 72 hours for any needed adjustment and to ensure that the patient was satisfied with esthetics, stability and retention of the denture (Fig 9). All patients were instructed for proper oral hygiene and asked to return back for inspection according to the planned schedule.

![Fig. (8) Nylon cap with its metallic housing in the fitting surface of the denture](image1)

![Fig. (9) Final partial overdenture in the patient’s mouth](image2)

**Clinical follow up:**

Implant stability quotient (ISQ) was measured after 6 weeks, 12 weeks (3 months), 24 weeks (6 months) and 12 months following implant insertion. This was done using Osstell® following the same manner used for measuring primary implant stability at time of implant insertion and at three weeks (Fig. 4, 5).

**Radiographic follow up using Cone Beam Computed Tomography (CBCT)**

Evaluation was scheduled at the denture insertion, three, six and twelve months following denture insertion.
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Image Analysis

**Linear measurements for evaluation of crestal bone height:**

On each follow up visit, mesial and distal crestal bone levels were calculated from the reconstructed corrected sagittal views by drawing a line parallel to the implant serration extending from the crestal bone to the apical end of the implant (Fig.10). Similarly, buccal and lingual bone levels were calculated by using cross-sectional views (Fig.11). Average readings of the four sides at each interval were calculated and tabulated for statistical analysis.

Statistical analysis:

All the data was collected and tabulated. Statistical analysis was performed by Microsoft Office 2013 (Excel) and Statistical Package for Social Science (SPSS) version 20.

The significant level was set at $P \leq 0.05$.

Kolmogorov-Sмирnova and Shapiro-Wilk tests were used to assess data normality.

Independent t test was used to compare between groups.

ANOVA for repeated measures was used to compare between follow up periods within groups followed by simple main effect pairwise comparison with bonferroni correction.

RESULTS

I-Implant stability

Trabecular Metal Dental Implants (Group I) showed increase in ISQ value through all follow up periods and ANOVA for repeated measures showed significant difference. Pair wise comparison with bonferroni correction showed significant difference between all follow up periods except between first and 2nd follow up period and between fifth and sixth follow up period as shown in table I.

Tapered Screw Vent Implants (Group II) showed decrease in ISQ value at 3 weeks followed by increase in ISQ value through all follow up periods and anova for repeated measures showed significant difference. Pair wise comparison with bonferroni correction showed significant difference between all follow up periods except between first and 3rd follow up period and between fifth and sixth follow up period as shown in table I.

Trabecular Metal Dental Implants (Group I) showed statistically significant higher ISQ value than Tapered screw vent implants (Group II) throughout all follow up periods as shown in table II and Fig. 12.
II- Crestal bone height

Trabecular Metal Dental implants (Group I) showed decrease in crestal bone height surrounding the implants throughout the different follow up periods. The second follow up interval (3 to 6 months) showed the highest change in bone height followed by the third follow up interval (6 to 12 months) then the first follow up interval (insertion to 3 months) which showed the least change in bone height. However, anova for repeated measures showed no significant difference between the different intervals as shown in table III.

Tapered Screw vent Implants (Group II) showed decrease in crestal bone height surrounding the implants throughout the different follow up periods. The third follow up interval (6 to 12 months) showed the highest change in bone height followed by the second follow up interval (3 to 6 months) then the first follow up interval (insertion to 3 months) which showed the least change in bone height. Anova for repeated measures showed significant difference between studied groups. Post hock pair wise comparison with bonferrioni correction showed significant difference between the third follow up interval and other intervals as shown in Table III.

Trabecular Metal Dental Implants (Group I) showed less crestal bone height reduction than Tapered screw vent implants (Group II) throughout the different follow up intervals with statistically significant difference between them except at the second interval (3 to 6 months) where the difference was statistically none significant. Regarding Overall bone change Group I showed less crestal bone resorption than Group II and independent t test showed significant difference between groups as shown in (Table IV and Fig13).

TABLE (I) Effect of time on ISQ value within each group

<table>
<thead>
<tr>
<th>Group I</th>
<th>Group II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trabecular Metal Dental Implants</td>
<td>Tapered Screw Vent Implants</td>
</tr>
<tr>
<td>Mean ISQ</td>
<td>Std. Deviation</td>
</tr>
<tr>
<td>At implant placement</td>
<td>70.5±</td>
</tr>
<tr>
<td>At 3 weeks</td>
<td>70.5±</td>
</tr>
<tr>
<td>At 6 weeks</td>
<td>72.4</td>
</tr>
<tr>
<td>At 12 weeks</td>
<td>74.6</td>
</tr>
<tr>
<td>At 24 weeks</td>
<td>76±</td>
</tr>
<tr>
<td>At 12 m</td>
<td>76.5±</td>
</tr>
</tbody>
</table>

Similar superscript letters indicate no significant difference

Table (II) Comparison between ISQ value of different groups:

| | Group I | | Group II | | P value |
| | Mean ISQ | Std. Deviation | Mean ISQ | Std. Deviation | |
| At implant placement | 70.5 | 1.08012 | 67.5 | .84984 | <0.001 |
| At 3 weeks | 70.5 | 1.35401 | 66.7 | .82327 | <0.001 |
| At 6 weeks | 72.4 | .96609 | 68± | 1.15470 | <0.001 |
| At 12 weeks | 74.6 | 1.07497 | 69.9 | 1.28668 | <0.001 |
| At 24 weeks | 76± | 1.15470 | 71.4± | 1.17379 | <0.001 |
| At 12 m | 76.5 | 1.08012 | 71.5 | 1.17851 | <0.001 |
Table (III) Effect of time on changes in crestal bone height within each group:

<table>
<thead>
<tr>
<th>Bone change (Group 1) Trabecular Metal Dental Implant</th>
<th>Mean (mm)</th>
<th>Std. Deviation</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insertion to 3months</td>
<td>-.0970</td>
<td>.03622</td>
<td>0.233</td>
</tr>
<tr>
<td>3 to 6months</td>
<td>-.2690</td>
<td>.33696</td>
<td></td>
</tr>
<tr>
<td>6 to 12months</td>
<td>-.1980</td>
<td>.04315</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bone change (Group II) Tapered screw Vent Implant</th>
<th>Mean (mm)</th>
<th>Std. Deviation</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insertion to 3months</td>
<td>-.2000a</td>
<td>.04830</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>3 to 6 months</td>
<td>-.2230a</td>
<td>.05143</td>
<td></td>
</tr>
<tr>
<td>6 to 12months</td>
<td>-.5330</td>
<td>.11567</td>
<td></td>
</tr>
</tbody>
</table>

*Similar superscript letters indicate no significant difference*

Table (IV) Comparison between changes in crestal bone height of different groups:

<table>
<thead>
<tr>
<th>Bone change</th>
<th>Group 1</th>
<th>Group 2</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (mm)</td>
<td>Std. Deviation</td>
<td>Mean (mm)</td>
</tr>
<tr>
<td>Insertion to 3months</td>
<td>-.0970</td>
<td>.03622</td>
<td>-.2000</td>
</tr>
<tr>
<td>3 to 6months</td>
<td>-.2690</td>
<td>.33696</td>
<td>-.2230</td>
</tr>
<tr>
<td>6 to 12months</td>
<td>-.1980</td>
<td>.04315</td>
<td>-.5330</td>
</tr>
<tr>
<td>Overall</td>
<td>-.4200</td>
<td>.04643</td>
<td>-.9560</td>
</tr>
</tbody>
</table>

Fig. (12) Comparison between ISQ value of different groups.

Fig (13) Comparison between changes in crestal bone height of different groups.
DISCUSSION

In this study implants were used to retain partial overdenture in distal extension cases since most problems of the free end saddle can be solved by improving its support and retention through the use of implants. To assure same bone quality the two study implants were inserted for the same patient in right and left sides of the ridge. To standardize values of forces transmitted to the implants all patients were chosen with opposing full set of teeth, and with second premolar being the last standing abutment in the lower arch. Simple and hygienic design was considered, where every component of the partial denture had definite function.

Resonance Frequency Analysis (RFA) technique using Ostell® was used in this study for measuring dental implant stability due to the constant increase of its use in scientific researches throughout the recent years which is based on its high effectiveness. Since ISQ value greater than 70 is indicated for immediate loading and ISQ value for early loading is 64-70, thus early loading protocol was preferred for both implant groups as Trabecular Metal Dental Implants showed mean ISQ value 70.5 ±1.08 at time of implant placement which is border line value between choosing immediate or early loading while, Tapered Screw Vent Implants showed mean ISQ value 67.5±0.84 at time of implant placement which does not allow immediate loading. Both implant groups showed increase in ISQ values over twenty four weeks follow up period which supports the findings of Bornstein et al. who reported increase in ISQ values throughout twenty six weeks follow up period. However, the two groups showed slow increase in ISQ values between twenty four weeks and twelve months (plateau effect) which has been reported by Cochran et al. Robert reasoned the great changes in implant stability followed by the slow change due to the formation of woven bone and the deposition of lamellar bone between zero and eighteen weeks however, bone maturity is completed within fifty four weeks. The results from the present study revealed mean ISQ of 76.5 ± 1.08 for Trabecular Metal Dental Implants and 71.5 ± 1.17 for Tapered Screw Vent Implants after one year follow up period. This supports the results of Bailieri et al. which reports ISQ values of 69 ± 6.5 ISQ for successfully integrated implants following one year of loading. In this study Tapered Screw Vent Implants showed decrease in ISQ value at the third week while Trabecular Metal Dental Implants showed no change in ISQ value between zero and three weeks however, both groups showed increase in ISQ values through the other follow up periods. This is in accordance to Esranli et al. and Barewal et al. who concluded lowest average ISQ value at third and fourth week respectively. Bränemark et al. stated that the stability reduction corresponds with the bone remodelling stage which varies between the second and the fourth week. Trabecular Metal Dental Implants showed higher implant stability than Tapered Screw Vent Implants through one year follow up period. This might be due to the difference in material and structure of the two implants where the inter connected porosity of Trabecular Metal Material in the implant midsection allowed for bone in growth and interconnection, leading to rapid mechanical attachment. Researches on Trabecular metal material concluded that bone grows inside its pores, gets mineralized and develops cellular components. In Samples of Trabecular metal material, new bone occupied 42% of the pores at four weeks, 63% at 16 weeks and 80% at one year.

CBCT is a precise and fast method which can be used to assess with high resolution digital images representing the trabecular structure in detail, allowing a three-dimensional reconstruction of the bone structure to be achieved. CBCT was utilized successfully whenever direct measurement of bone height is required. Consequently, using CBCT for assessment of bone changes around the studied implants added accuracy to the results. Some marginal bone loss around oral implants during the first year of function has been observed. Trabecular
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Metal Dental Implants showed 0.42 mm crestal bone level loss and Tapered Srew Vent Implants showed 0.95 mm crestal bone level loss within one year follow up. These values are in accordance with other studies which reported peri-implant crestal bone level changes ranging from 0.19 mm to 2 mm at time interval of 12 months. 53-55 This is within the acceptable range of implant success which is 1.5-2 mm mean marginal bone loss around dental implant in the first year after prosthetic restoration and 0.1-0.2 mm annually after that. 56 This crestal bone loss might be due to the stiffness of oral implants which is several times greater than that of bone. When an oral implant is loaded, the stresses are transferred to the bone with the highest stress in the most coronal portion of the supporting bone. Therefore, an increased strain in the bone would be most likely to happen in the crestal area. 57

In the present study Trabecular Metal Dental Implant showed less crestal bone loss than Tapered Screw Vent implant. This could be explained by the difference in structure and material of both implants where Trabecular Metal Material composing the midsection of the Trabecular Dent implant has an 80% porous structure which allows ingrowth of bone in it. 11-16 The stiffness of this composite material (20% Trabecular Metal Material and 80% bone) is 1800 Mpa which is close to the stiffness of cancellous bone being 1500 Mpa. While the stiffness of titanium being 110000 Mpa is far greater than that of bone. 58-60 When both implants are loaded Tapered Screw Vent Implant induces more stresses within the surrounding bone, and due to the fact that distribution pattern of stresses is concentrated coronally, more crestal bone resorption occurred with the Tapered Screw Vent Implant. This supports the findings of other finite element study 61 which proved that stresses generated in the coronal portion of bone surrounding Trabecular Metal Dental Implants were less than the stresses generated in the coronal portion of bone surrounding Tapered Screw Vent Implants.

CONCLUSION

Within the limitations of this study it could be concluded that :

1- Both Trabecular Metal Dental Implant and Tapered Screw Vent Implant allowed for early loading protocol however, Trabecular Metal Dental Implant showed higher primary stability values which could allow for immediate loading

2- Trabecular Metal Dental Implant reached higher stability values and showed less crestal bone resorption than Tapered Screw Vent Implant in one year follow-up period.

REFERENCES


49. Batenburg R, Meijer H, Raghoebar G, Vissink A. Treatment concept for mandibular overdentures supported


61. Rizk FN. Effect of two different implant structures on stresses induced within the surrounding bone using three dimensional finite element analysis. EDJ 2012;58:1429-1436.