

## Assessment of Crestal Bone Loss Surrounding the Implant before Prosthetic Loading of Dental Implant Systems: A Pilot Study

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### How to cite the article:

Vikhe DM, Tambe SD, Mascarenhas R, Bawane S, Jadhav R, Kathariya R. Assessment of crestal bone loss surrounding the implant before prosthetic loading of dental implant systems: A pilot study. J Int Oral Health 2016;8(12):1110-1113.

### Abstract:

**Background:** Dental implantology is technique to replace missing teeth. Crestal bone loss along implant surface jeopardizes its longevity and success of treatment. The bone must remain healthy after dental implant is placed for the dental implant to last. However, the bone surrounding a dental implant is sometimes lost. There are several reasons for bone loss around a dental implant. In most cases, the bone loss starts at the top of the crest and progresses around the dental implant to form a saucer type defect.

**Materials and Methods:** About 10 two-stage implants of life care implant system and 10 two-stage implants of Noble biocare implant system were placed in patients in fourth quadrant. Digital orthopantomograph (OPG) was taken on day of implant placement. After 6 months, at time of second stage surgery, the implant stability was evaluated by the periotest instrument. The crestal bone loss was evaluated on digital OPG. Same procedure for each system was carried out.

**Results:** About 6 months after the implant placement, radiographic evaluation on digital OPG showed a mean crestal bone loss of 1.6 mm on the mesial side of implant and 1.8 mm on distal side of implant for Noble biocare system and radiographic evaluation on digital OPG showed a mean crestal bone loss of 0.7 mm on the mesial side of implant and 0.6 mm on distal side of implant for life care system.

**Conclusion:** A study was conducted to evaluate crestal bone loss, occurring 6 months after implant placement in two implant systems, before loading it. More stress should be given on developing implant collar design to reduce the initial crestal bone loss. The smooth polished collar design of the implant may have contributed to crestal bone loss.

**Key Words:** Collar design, crestal bone loss, implant, stability

### Introduction

Dental implants have become main option between different treatment modality for replacing missing teeth. Ability of dental implants to osseointegrate with the alveolar bone of the patient leads to its success, to help a dental crown or bridge to withstand occlusal load during the function. Dental implant prognosis is poor when there is crestal bone loss. Bone loss could be due to infection and forces, stresses acting around the implant collar. Bone loss begins from the collar region of a dental implant and progresses apically.

Dental implants with various surface designs are being used for replacing teeth. Surface design of the implant collar can affect bone loss.<sup>1</sup> Many of them are two-piece, submerged implants with a 2 mm smooth collar design. Implants with smooth collar design show bone loss.<sup>2-4</sup> It has also been studied that rough/coated collar design implants show decreased bone loss.<sup>5,6</sup> Marginal bone loss with both collar designs needs to be assessed. Endosseous implants during placement forms an intimate union with the surrounding bone, this process is known as osseointegration. The prognosis of dental implants depends on this connection between implant and hard, soft tissues of the oral cavity. The implant-tissue interface generally begins at the crestal region in successfully osseointegrated endosteal implants.<sup>7-9</sup> In particular, after the first year of function (prosthesis loading), crestal bone loss to or beyond the top of titanium screw implants.

There is a lack of agreement as to why greater bone loss occurred during the initial year of implant function than later years. There are many possible etiologies to early implant bone loss. There are different parameters to assess the success rates of dental implants like lack of mobility, discomfort, infection, and continuous periapical radiolucency.<sup>10,11</sup> There are various implant designs developed to achieve osseointegration and reduce bone loss crestal bone loss. 1 mm of marginal bone loss during the first year of implant placement and loading and afterward 0.1 mm yearly bone loss has been documented by previous studies. Various implant neck collar designs are being proposed to reduce bone loss. Some implant systems have a polished collar design to reduce plaque accumulation and to promote seal between biologic tissues. This polished collar design may have led to crestal bone loss. Studies show that there is crestal bone loss initially after loading of dental implant with prosthesis. But

how much marginal bone loss will be there before loading of two-stage implants with prosthesis, needs further assessment. Keeping this in mind, a study was undertaken to assess marginal bone loss, occurring 6 months after the implant placement, but before loading of dental implant with prosthesis.

### **Purpose of the study**

To compare crestal bone loss, before prosthetic loading of life care and Noble biocare dental implant systems.

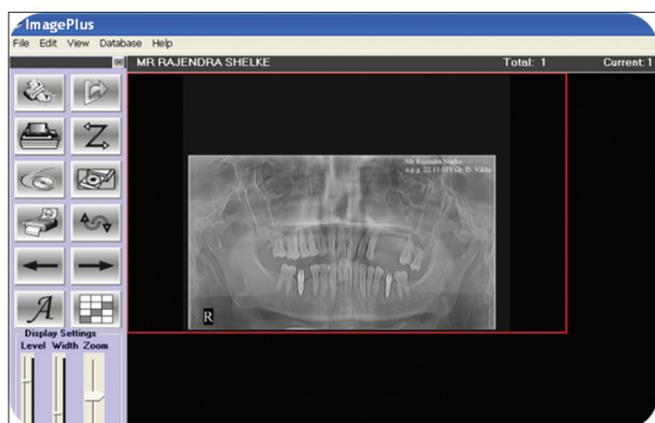
### **Aims and objectives**

To determine and assess marginal bone loss on the proximal (mesial and distal side) of the life care dental implant system and Noble biocare care dental implant system before prosthetic loading.

### **Materials and Methods**

#### **Materials**

Lifecare dental implant system (System A), Noble biocare dental implant system (System B), digital orthopantomograph (OPG) machine (Xtronics imaging systems), Digital OPG and computer tomography (CT-scan), films (Kodak) (Figure 1).



**Figure 1:** Digital orthopantomograph.



**Figure 2:** Intraoral photographs showing missing teeth in posterior region.

### **Methods**

About 20 Partial dentate subjects with one or two missing teeth were selected (25-50 year age group). Missing teeth were mostly in the mandibular posterior quadrant that is in 36 or 46 region (Figure 2). All steps involved in treatment study were told to the patients. Ethical clearance from the institution was taken. Diagnostic Impressions (Alginate Impression Material, IMPRINT, DPI) was made. All necessary investigations were carried out, before implant placement. With the consent of the patients, the study was further carried.

### **Selection criteria's**

Subjects\patients included in the study are with age between (25 and 50 years), who are medically fit, without any systemic diseases and can come for post-operative follow-up. Implants were placed in the mandibular posterior region with adequate bone support. The study duration was kept of 6 months.

Subjects\patients excluded in the study are with any oral pathological conditions. Subjects undergone any corticosteroid therapy. Subjects\patients with any bone disorders. Female patients with pregnancy. Patient having habit of tobacco chewing and smoking.

About 10 implants were placed with the help of life care dental implant system, EZ HI-Tech implant (life care), and other 10 implants were placed with the help of Noble biocare dental implant system, replace select implant (Noble biocare), by following proper manufacturer's instructions. Both types of dental implants are root-form, TPS-coated, pure Titanium two-stage dental implants.

### **Surgical procedure**

Dental implants were placed equicrestal. Implant site was closed with the help of the flap. The patient was kept on medication for one week, post-operatively. Follow-up visits and post-operative instructions were kept and given.

### **To assess marginal bone loss on mesial and distal sides**

This study was undertaken to assess marginal bone loss on the proximal sides of the dental implant, by OPG in both systems at the end of 6 months after implant placement, but before loading them prosthetically. Crestal bone loss was measured on Digital OPG. A horizontal line tangential to the most coronal border of the implant was used as reference. Measurements from this line to the crestal bone around the implant were performed along a line parallel to the long axis of implant to measure vertical bone measurement. The distance between the neck of dental implant and at the level of marginal bone (first bone to implant neck contact) along the implant surface on both proximal side was assessed on the OPG machine monitor, using its software (Image Plus Software) (Figure 3). Values obtained were up to one unit after decimal. The radiographic assessment was done by Digital OPG, with standardized values. Marginal bone loss values were tabulated.

## Results

Distribution of mean and standard deviation (SD) values of crestal bone loss after 6 months for life care implants (System A) on mesial and distal sides (Table 1). Distribution of mean and SD values of crestal bone loss after 6 months for Noble biocare implants (System B) on mesial and distal sides (Table 2). Comparison of crestal bone loss after 6 months for life care implants (System A) and Noble biocare implants (System B) on mesial and distal sides (Table 3).

## Discussion

According to the biologic principals proposed by Branemark, evidence shows success of dental implants.<sup>12</sup> Conventional protocol proposed by Branemark states that the complete healing of the alveolar bone before placement of dental implant after tooth extraction; requires healing period of 6-12 months.<sup>12,13</sup>

Panoramic radiographs and intraoral periapical X-rays are the most commonly used imaging source in implant dentistry.<sup>14</sup> The great advantage of digital panoramic radiography is the broad overview provided. The digital panoramic radiograph allows assessing the structures such as maxillary sinus or the course of the mandibular canal and it provides the vertical measurement of the alveolar ridge.<sup>14,15</sup> The panoramic radiographs were found to be as reliable as conventional periapical radiographs when used to assess the level of peri-implant bone level following implant treatment.<sup>15</sup> In the present series of patients, the Digital panoramic and periapical radiographs were used to assess the peri-implantal surface marginal bone changes. The digital OPG and radiographs were taken immediately after the procedure and 6<sup>th</sup> months postoperatively to measure the vertical and horizontal height of the crestal bone. The measurement was made by three observers and average mean value taken. The observer variability should be considered when comparing the values of radiographic assessment of level of marginal bone around the osseointegrated implants from the follow-up studies.<sup>16</sup>

In the present study, radiographic evaluation of mesial and distal vertical crestal bone demonstrated radiographic assessment of mean marginal bone loss of 0.8 mm on the mesial side and 0.7 mm on distal side of implant for implant System A (life care implant system) and mesial bone resorption of mean crestal bone loss of 1.7 mm on the mesial side and 1.9 mm on distal side of implant for implant System B (Noble biocare implant system) at the end of 6<sup>th</sup> month post-operative before functional loading of the implants and a cumulative success rate of implants was 100%. These results are compatible with previously reported data.<sup>15</sup>

The implants used in this study was two-piece, root-form, threaded implants, i.e. Ez implants and replace select implants were placed. The collar of implant had Two mm of smooth polished surface. The radiographic assessment of bone loss was done by OPG. There is less of documentation on why there is marginal bone loss surrounding the dental implant collar,



**Figure 3:** Image plus software to measure bone loss.

**Table 1:** Distribution of mean and SD values of crestal bone loss after 6 months for life care implants (System A) at mesial and distal.

| n=10    | Crestal bone loss after 6 months for life care implants (System A) (n=10) |            |
|---------|---|------------|
|         | M – Mesial  | D – Distal |
| Mean±SD | 0.854±0.86  | 0.784±0.88 |
| Range   | 0-2.29  | 0-3        |

SD: Standard deviation

**Table 2:** Distribution of mean and SD values of crestal bone loss after 6 months for Noble biocare implants (System B) at mesial and distal.

| n=10    | Crestal bone loss after 6 months for Noble biocare implants (System B) (n=10) |            |
|---------|---|------------|
|         | M – Mesial  | D – Distal |
| Mean±SD | 1.733±1.125   | 1.96±0.87  |
| Range   | 0.1-3.70  | 0.65-3.2   |

SD: Standard deviation

during the first year of implant surgery, placement. Different researchers have given different cause for it. The amount of bone loss is influenced by dental implant crest module design of the collar.<sup>5,17,18</sup>

To reduce plaque accumulation, researchers have proposed the smooth polished machined collar of the implant.<sup>17</sup> The cortical bone can withstand more compressive stresses than shear stresses. Dental implants with smooth collar design can transfer shear stresses to the crestal bone, which results in lack of mechanical loading and stimulation of crestal bone, but cannot transfer compressive stresses.<sup>1</sup> This lack of mechanical properties results in bone loss. The implants used are life care (Ez implants) had two mm collar design with micro threads and Noble biocare (replace select implant) had two mm smooth collar without micro threads. Implants were placed equicrestal that is at the level of crest of alveolar bone so that the junction of smooth collar and rough threaded portion lies about 2 mm below the level of crestal bone. Thus, the initial crestal bone loss may be due to smooth collar design, even before Prosthetic loading.

Hermann, Buser, Schenk and Cochra showed that rough-smooth implant border has effect on the peri-implant marginal bone reaction.<sup>19</sup> These clinical trials show that the smooth polished collar length is directly proportional to the crestal bone loss. This gives explanation for the mean crestal bone loss of 1.7 mm on the mesial side and 1.9 mm on distal side

**Table 3: Comparison of crestal bone loss after 6 months for life care implants (System A) and noble biocare implants (System B) at mesial and distal sides.**

| n=10   | Crestal bone loss after 6 months |                                   |                                 |         |                    |
|--------|----------------------------------|-----------------------------------|---------------------------------|---------|--------------------|
|        | Mean±SD                          |                                   | Student's unpaired t-test value | P value | Significance       |
|        | Life care implants (System A)    | Noble biocare implants (System B) |                                 |         |                    |
| Mesial | 0.854±0.86                       | 1.733±1.125                       | 1.98                            | P<0.05  | Significant        |
| Distal | 0.784±0.88                       | 1.96±0.87                         | 3.01                            | P<0.01  | Highly significant |

By applying Student's unpaired t-test there is a significant difference between mean values of crestal bone loss after 6 months on mesial side when life care implants compared with noble biocare implants (i.e., P<0.05) and it is highly significant at distal when life care implants compared with noble biocare implants (i.e., P<0.01)

for implant System B (Noble biocare implant system) and radiographic assessment on OPG showed a mean marginal bone loss of 0.8 mm on the mesial side and 0.7 mm on distal side for implant System A (life care implant system).

### Conclusion

In conclusion, it can be said that the present study achieved a 100% survival rate at 6 months. The design of collar of implant may have led to crestal bone loss. More stress should be given on implant neck collar design. The marginal bone loss may be influenced by the smooth polished collar design of the dental implant.

Since this study is done with smaller sample size, further clinical trials with larger sample sizes and longer follow-up periods are needed to assess the long-term success of Dental implants.

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