Dentascan Evaluation of Hard Tissue Changes around Implants Placed in Healed Sockets: A Cross-sectional Study

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ABSTRACT

Aim: Implant placement is a lucrative and offers several advantages. This study was done to find out any hard tissue changes around the implants in faciolingual/palatal direction before and after 6 months of implant placement.

Materials and methods: This study was done on 12 patients (29 implants) who has undergone implant placement. Implant system used was Alpha-Bio®. Dentascan, intraoral periapical (IOPA) and orthopantomogram (OPG), were taken to assess the quantity and the quality of the bone, proximity anatomical structure, dimension of the tooth to be replaced and the faciolingual/palatal width of bone at 1 mm apical to the crest. Then 3 mm apical to the crest and 6 mm apical to the crest was calculated. Second stage surgery was carried out after 6 months depending upon the quality of the bone.

Results: Statistical analysis was done on statistical packages for the social sciences (SPSS) version 15 software. The results were tested using normality tests (Kolmogorov-Smirnov and Shapiro-Wilk). The mean value faciolingua/palatal at the crest was 5.59 ± 0.87 mm before implant placement and 5.12 ± 0.78 after 6 months, 3 mm apical to the crest the mean value was 8.57 ± 1.25 and after 6 months it was 8.39 ± 1.21 and 6 mm apical to thecrest the mean value before was 10.55 ± 1.61 and after 6 months it was 10.36 ± 1.64 mm. Results from this present study showed statistically significant bone loss in faciolingual/palatal direction.

Conclusion: We can say that delayed implant placement is a safe and predictable option, and bone remodeling bound to occur after implant placement but the faciopalatal/lingual changes are clinically not significant.

Keywords: Computed tomography, Dentascan, Delayed implant, Faciopalatal/lingual.


Source of support: Nil
Conflict of interest: None

INTRODUCTION

Once the father of modern implants, Dr Per-Ingvar Branemark said “No one should die with their teeth sitting in a glass of water”. He discovered that when pure titanium, when placed in a suitably prepared site in the bone, could become fixed in place due to close bond that developed between the two, a phenomenon that he later described as osseointegration. These alternative strategies have been based on principles of creating and maintaining an interface between the surrounding bone and implant, which is capable of load transmission associated with healthy adjacent tissues, which is predictable in outcome and with high success rate. This outcome proved elusive until the phenomenon of osseointegration was developed.

It is accepted that after the implant placement and through time of function, implants will display some extent of bone loss. However, peri-implant marginal bone loss should be limited, since bone loss may induce pocket formation, which could be unfavorable for long-term health of the peri-implant tissue.

It is always advisable to go for either Dentascan or cone-beam computed tomography (CBCT) before implant placement. Dentascan is a unique computer software, which provides us with computed tomography (CT) imaging of maxilla and mandible in three different planes: panoramic, axial and oblique sagittal. The identical scale and clarity between various views permits us with evaluation of distinct facial and palatal/lingual cortical bone margins, as well as accurate and clear visualization of internal structures, such as incisive and inferior alveolar canals.

Dentascan is a unique new computer software program which provides CT imaging of the mandible and maxilla in three planes of reference: axial, panoramic,
and oblique sagittal (or cross-sectional). The clarity and identical scale between the various views permits uniformity of measurements and cross-referencing of anatomic structures through all three planes. Unlike previous imaging techniques, the oblique sagittal view permits the evaluation of distinct buccal and lingual cortical bone margins, as well as clear visualization of internal structures, such as the incisive and inferior alveolar canals. Today, the main use of dentascan is in preoperative case planning and preoperative modeling of endosseous implants. It enables the dentist to visualize bony structures before placement of implants. One does not have to make decisions at the time of surgery when mucoperiosteal flap is already elevated.\textsuperscript{9-11}

One can say that classic parameters to evaluate the success rates of endosseous implants are the lack of mobility, persistent infection and discomfort; continuous periapical radiolucence and absence of pain. These features accounted for the popularity of the delayed implants.\textsuperscript{12}

Delayed implants is preferred in sites where the available bone height apical to the tip of the root is less than 3 mm, it is impossible to obtain primary implant stability in the bone beyond the apex of the extracted tooth, in addition when there is wide alveolus is precluding the engagement of its bony walls.\textsuperscript{13}

It is proposed that patient exhibiting a pronounced scalloped biotype should be treated with a delayed placement rather than going with immediate implant installation approach.\textsuperscript{14,15}

It is seen that to achieve safe predictable, safe and cost-effective mechanism of rehabilitation, Branemark developed certain recommendations regarding treatment protocols. According to one of the recommendations, there should be waiting time of at least 12 months was necessary following tooth extraction before an endosseous dental implant could be placed. The rationale for this reasoning was to allow resolution of any hard or soft tissue pathology in a proposed recipient site.\textsuperscript{2}

The goal of modern dentistry is to restore the tooth to normal contour, function, comfort, esthetics and health. Now, it has become common to use dental implants for the replacement of missing teeth and it is also a preferred alternative for the restorative dentists without involving adjacent teeth. Patients have gained awareness of the new options that they increasingly request modification or replacement of existing dental restorations (e.g. dentures, fixed partial dentures, and removable partial dentures).

Considering all the above factors, the present study has been taken up with the following aims and objectives: To evaluate the hard tissue profile around the delayed implant using dentascan software.

### MATERIALS AND METHODS

The study population consisted of 12 patients; 4 females and 8 males, ranging in age from 20 to 63 years. The Implant system used was Alpha-Bio®. The patients included in this study on the basis of the following criteria: Absence of any local or systemic factors that would inhibit or jeopardize the healing process needed for osseointegration. Patients who were cooperative and those patients who were having good oral hygiene method. The patients were excluded from the study who were medically compromised, having Para functional habits like bruxism, patients who were on medications that might interfere with the peri-implant healing process. Patients who were pregnant and lactating mothers were also excluded. Patients suffering from psychiatric disorders were also excluded from the study. Before implant placement study cast. Orthopantomogram (OPG) and dentascan evaluation was done.

**Preoperative Evaluation of Implant Site**

Before starting surgical procedure, evaluation of soft and hard tissue was done. Gingiva was examined to see the consistency, texture and thickness. The occlusion, periodontal integrity of the dentition, an alignment and the interocclusal space was assessed.

In all the cases, preoperative CT scan of the jaw, intraoral pariapical (IOPA) and OPG were taken to assess the quantity and the quality of the bone at the implant placement site, proximity of the implant site to vital anatomical structure, dimension of the tooth to be replaced and the buccolingual width of bone at the crest, 3 mm apical to the crest and 6 mm apical to the crest is calculated (Figs 1 to 6).

![Fig. 1: Three-dimensional image before placement](image-url)
Surgical Procedure

After injecting appropriate local anesthesia, the osteotomy was initiated with 2 mm pilot drill. By using the sequential large drill sizes, the osteotomy site was enlarged according to the width of implant to be used, keeping one thing in mind that the width of last drill should be 0.5 mm short of the width of the implant. With the use of the ratchet the implant is tightened in a clockwise direction.

Patient is prescribed with appropriate antibiotics and analgesics as and when required. Chlorhexidine 0.2% mouth wash was given for 2 weeks postoperatively. The patient was evaluated on a monthly basis.

Second stage surgery was carried out after 4 to 6 months depending upon the quality of the bone. This procedure was also carried out under LA with number 15 blade, a crevicular incision was given over the implant site. The cover screw was removed and healing cap was placed. The soft tissue was then suture back. Before starting a second stage surgery the dentascan evaluation was done to calculate the buccolingual width of the bone at the crest (which is 0.5 mm apical to crest) (Figs 7 to 13).

RESULTS

At the second stage surgery, all of the implants were clinically stable and asymptomatic. The results were tested using normality tests (Kolmogorov-Smirnov and Shapiro-Wilk). Dentascan examination failed to show any kind of peri-implant bone loss. If we talk about the buccolingual width, the mean value at the crest was 5.62 ± 0.87 mm before implant placement and 5.35 ± 0.78 after 6 months, 3 mm apical to the crest the mean value was 9.08 ± 1.25 and after 6 months it was 8.87 ± 1.21 and 6 mm apical to the crest the mean value before was 10.81 ± 1.61 and after 6 months it was 10.55 ± 1.64 mm (Table 1).

The mean change was 0.27 ± 0.13 mm at crest, 0.21 ± 0.12 mm at 3 mm apical to the crest and the 0.26 ± 0.13 mm 6 mm apical to the crest. Results from this present study also indicate that there is statistically significant bone loss present in buccolingual/palatal direction but the results are not much of clinical significant (Graph 1).
DISCUSSION
The study’s aim was to determine the changes seen at the end of healing of bone around implants facial-lingual/palatal by using dentascan following placement of delayed implants, without any barrier membrane or grafting material. None of the implants failed. When evaluated at second stage surgery, all implants in the current study was clinically stable, asymptomatic and free of any osseous defect. Results from this present study indicate that there is bone loss in delayed implant. The bone loss was present in both vertically as well as in facio-lingual/palatal direction. The bone loss in faciolingual/palatal direction was statistically significant but clinically not much significant.
The implants experienced more extensive buccal bone remodeling as compared to lingual/Palatal site. This remodeling could be due to either because of regional accelerated phenomena (RAP) or it could be because we have reflected flap in all the cases.16,17 It could also be possible that the result of simultaneous new bone apposition to fill the peri-implant defect and buccal and lingual bone resorption. Such kind of remodeling leads to reduction of the width of alveolar bone and can occur around all the implants studied.18

Botticelli et al in one of his study created 1.0 to 2.5 mm wide circumferential defects in dogs. It was seen that at few sites, the labial bone adjacent to socket was reduced. It was also seen that over 4 months of healing period the defects healed with bone. It was also noted that at sites where labial bone was reduced, proper bone healing has occurred at mesial, distal and lingual defects, but also reduced bone volume has occurred on labial side.19

The same authors had repeated the study, this time special implants were inserted into the defects and leaving a gap of 1.0 to 2.5 mm between surrounding bone and implant. Restorable barriers with or without bone grafts was used to augment some of the sites, while others left for spontaneous healing.20

Results from these studies demonstrate that the there is no need to place a bone grafts or membrane in smaller junctional gap. In the present study, no bone grafts/membranes were used to make the study more authentic. In patients whom we have to place the grafts were excluded from the study.

The dentascan was used in this study to calculate the parameters. Dentascan is a software program, which provide CT imaging of mandible and maxilla in three planes, i.e. axial, panoramic and oblique sagittal. Dentascan provides accuracy, clarity and identical scale which permits the uniformity of measurements. It also provides cross-referencing of anatomical structures. The faciopalatal/lingual width can be measured with the help of sagittal view and it also provides the clear visualization of internal structures, such as the incisive and inferior alveolar canals.9,10

The main use of dentascan today is in the preoperative planning and preoperative modeling of endosseous dental implants and subperiosteal implants. It enables the dental surgeon to visualize the bony structures preoperatively, one does not have to make decisions at the time of surgery when the mucoperiosteal flap is already elevated to visualize the bony structures directly.11

We have measured the faciopalatal/lingual width before implant placement and after 6 months of placement. The measurements were made at the crest, 3 mm apical to the crest and 6 mm apical to the crest. The measurements were repeated after 6 months on the same locations.

The results from the present study demonstrate that delayed implants can heal uneventfully. The stability was good and no complications was observed throughout the investigation. The peri-implant osseous gap originally observed in this study at baseline was clinically filled by hard tissue, which could not be probed. No histological analysis was performed to describe the characteristics of the tissue contracting the implant, but the soft tissues

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**Table 1:** The buccolingual/palatal changes before and 6 months after implant placement

<table>
<thead>
<tr>
<th>Level</th>
<th>Before implant</th>
<th>After 6 months</th>
<th>Change</th>
<th>t-value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>At crest</td>
<td>5.622 ± 0.874</td>
<td>5.350 ± 0.788</td>
<td>0.272 ± 0.136</td>
<td>8.470</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>3 mm</td>
<td>9.083 ± 1.254</td>
<td>8.872 ± 1.218</td>
<td>0.211 ± 0.128</td>
<td>7.007</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>6 mm</td>
<td>10.811 ± 1.618</td>
<td>10.550 ± 1.640</td>
<td>0.261 ± 0.133</td>
<td>8.301</td>
<td>&lt;0.001*</td>
</tr>
</tbody>
</table>

*The results were statistically significant; p < 0.001

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**Graph 1:** The mean change was 0.27 ± 0.13 mm at crest, 0.21 ± 0.12 mm at 3 mm apical to the crest and the 0.26 ± 0.13 mm at 6 mm apical to the crest
surrounding the implant appeared free of inflammation. Moreover, the implants themselves did not exhibit mobility and the application of torque forces failed to elicit pain or discomfort.

As per my knowledge so far this is a first study of its kind in which faciolingual width of the bone were calculated using dentascan software.

CONCLUSION

Within the limits of this study, we can say that immediate implant placement is a safe and predictable option, and bone remodeling bound to occur after implant placement but the buccolingual changes are clinically not significant.

However, one should do careful planning and case selection to ensure implant success and final esthetic outcomes.

REFERENCES