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CLINICAL AND RADIOGRAPHIC EVALUATION OF MARGINAL BONE STATUS AROUND TWO DIFFERENT TYPES OF DENTAL IMPLANTS

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ABSTRACT

The aim of the study was to evaluate the marginal bone status around two types of implant abutment junction, which are platform switched and non-platform switched types using cone beam CT. 8 patients, 4 males and 4 females with an average age 32 year (range from 22 to 43 years), with posterior edentulous area of the mandible were included in this study. A thorough preoperative assessment of all patients was carried out including history taking, clinical examination including plaque and gingival index and radiographic examination. Study casts were created for evaluation of edentulous areas and occlusion, cone beam computed tomography(CBCT) scans were used as the final investigation, it was possible to correctly assess the width of each implant site, the thickness and density of the cortical plates and the cancellous bone, as well as the ridge angulation and a virtual implant treatment plane was performed. The implants used in this study were 3.4 mm in diameter, Submerged superline fixtures with dual abutments and non-submerged tissue level simple line implants with dual abutments (Dentium Co., Ltd., Gangnam-gu, Seoul, Korea). Implant insertion was performed according to manufacturer's instructions. Non submerged installation procedures were performed. Para crestal incisions with releasing incisions were done at surgical sites and Full-thickness flaps were reflected exposing the alveolar ridge, Sequential drills were used until the 3.4 diameter final drill under constant irrigation. Abutments were installed at time of surgery, and flaps were closed by interrupted sutures using 3"0" silk. At 2 months, a definitive abutment level impression was made and Acrylic restorations were cemented to the abutments. Modified plaque index (mPlI) and modified Sulcus Bleeding Index (mBI) was carried out was carried out. Cone beam computed tomography (CBCT) has been carried out to evaluate buccal and lingual crestal bone changes . All radiographs for each case were taken under constant conditions. CBCT scans were carried out at baseline and 9 months post-surgically. The Comparison between the two groups showed no statistically significant difference between amounts of crestal bone loss in the two groups after 9 months.

INTRODUCTION

Dental implants have been considered as one of the most important innovations in the contemporary dentistry. Since the introduction of titanium implants for an intra-oral use in the late 1950s, dental implantology has an active as well as promising option for the oral rehabilitation of partially dentate or edentulous patients[1]. It is of value to note that clinical case studies[2-4] and retrospective studies[5,6] applying platform- switching indicated a lower rate of bone loss around these dental implants compared with implants received prosthetic abutments of the same diameter platform. The platform-switching (PS) concept is based on the use of an abutment smaller than the implant neck[7]. This type of connection moves the perimeter of implant abutment junction (IAJ) to implant axis center [8–10]. Moving the IAJ inward brings out bacteria more internally and, therefore, away from bone crest [11]. This technique has an important biomechanical advantages [12], as the use of a narrow abutment in a PS configuration may shift the stress concentration away from peri- implant marginal bone, thus decreasing its bone resorptive effect [9,13].

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In dental implant treatment planning, one of the most frequently reported applications of CBCT is linear measurement of the ridge. CBCT images have been found to provide reliable bone quantity information for preoperative implant planning in different areas of the maxilla and mandible both in clinical and experimental studies[14–18]. It has been shown that magnification of CBCT-obtained linear measurements does not occur and measurements have been found to be more accurate than those obtained with medical CT[19,20]. Furthermore, dental metallic artifacts do not alter the accuracy of linear measurements obtained with CBCT[21]. Another important advantage of CBCT in preimplant treatment planning is the ability to evaluate the ridge topography and proximity to vital anatomical structures three dimensionally to determine whether advanced grafting is necessary for appropriate implant site development. CBCT images have proven to be superior in this regard compared with other 2D imaging modalities[22–25] .CBCT can accurately assess the thickness of cortical bone such as the facial/buccal and lingual/palatal cortical plates, the floor of the nasal cavity, and the medial and lateral walls of the maxillary sinuses.

SUBJECTS AND METHODS

Patients Selection

Twenty units dental implants , 10 Submerged superline fixtures with dual abutments(platform switched) and 10 non submerged tissue level simple line implants with dual abutments(non platform switched)were inserted in 8 patients ,4 males and 4 females with an average age 32 years (range from 22 to 43 years) were included in this study . They were selected from the outpatient clinic of Department of Oral Medicine, Periodontology, Diagnosis and Oral Radiology, Faculty of Dental Medicine (Boys – Cairo), Al-Azhar University. Research procedures were explained to all patients, and they signed the informal consent.

Inclusion criteria

The patients who had all the inclusion criteria were selected. 1) At least 18 years old age with good oral hyegine. 2) Missing one tooth or more in the mandibular posterior region (excluding third molars), 3) Have bone density type 2 or 3 at place of surgery.

Exclusion criteria

1) History of alcohol or drug dependency, or any medical, physical, or psychological factor that might affect the surgical or prosthodontic treatment and required follow-up examinations, 2) Smokers, 3) Head and neck radiation treatment, 4) Pregnant, 5) Patient with bad oral hygiene, 6) Presence of any systemic disease affecting wound healing and success of procedures, 7) Severe bruxism or clenching habits, 8) Abnormal ridge relationships.

Patient grouping:

Patient will be randomize divided in two equal groups:

Group 1: patients will receive platform switched implants.

Group 2: patients will receive non-platform switched implants.

Clinical evaluation:

Modified plaque index (mPlI) was carried out as follows:

Score 0; No detection of plaque. Score 1: Plaque only recognized by running a probe across the smooth marginal surface of the implant. Implants covered by titanium spray in this area always score 1. Score 2: Plaque can be seen by the naked eye. Score 3: Abundance of soft matter.

Modified Sulcus Bleeding Index (mBI) was carried out as follows:

Score 0: No bleeding when a periodontal probe

is passed along the gingival margin adjacent to the implant. Score I: Isolated bleeding spots visible. Score 2: Blood forms a confluent red line on margin. Score 3: Heavy or profuse bleeding.

Both Modified plaque index(mPlI) and modified Sulcus Bleeding Index (mBI) were carried out after 3, 6 and 9 months after surgery.

Radiographic evaluation:

Cone beam computed tomography (CBCT) has been carried out to evaluate buccal and lingual crestal bone changes. All radiographs for each case were taken under constant conditions. CBCT scans were carried out at baseline and 9 months post-surgically. Radiographic evaluation was established and Equalization was carefully established in both CBCT readings for every patient by adjusting focal trough at the same positions in both scans and adjusting axial, coronal and sagittal planes in fixed positions.

Readings were obtained by drawing vertical line in the mid of implant which is the long axis line of implant, then drawing horizontal line tangent to the apex of implant which makes right angle with the long axis line, another horizontal line was drawn at fixed reference point at abutment which also is at right angle with the long axis line. Two horizontal lines at the level of crestal bone buccally and lingually were drawn at right angle to the long axis line. Two vertical lines parallel to long axis line were drawn at each side (buccal and lingual), one of them connecting the horizontal line at crestal bone with the horizontal line at implant apex and the other line was connecting the horizontal line of reference point with the horizontal line at implant apex. The shorter line was subtracted from the other line and readings were collected [26,27]. (Figure 1,2).

Measurement of crestal bone level for Measurment of crestal bone level for platform switched implant (baseline) platform switched implant (9 months)

FIG (1)

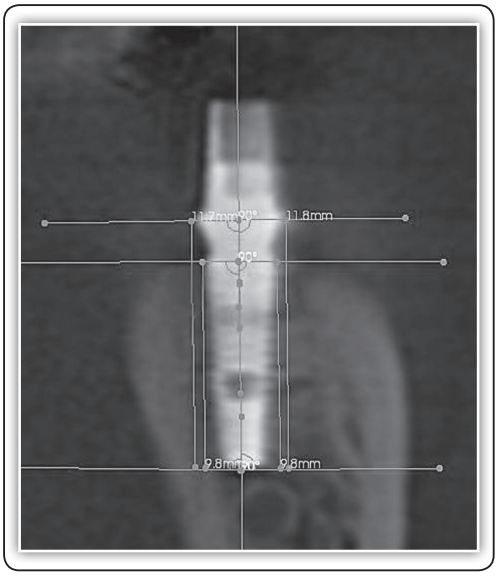

FIG (2)

RESULTS

Crestal bone loss

Results of crestal bone loss (mm) of the two studied groups are presented in Table (1).It was evident that Group I showed Mean of 0.53±13 while Group II showed Mean of 0.7±0.16.

TABLE (1) Descriptive statistics of crestal bone loss (mm) after 9 months recorded from the two groups.

Group	Mean	SD	Median	Minimum	Maximum	95% CI	
						Lower bound	Upper bound
Group I	0.53	0.13	0.53	0.40	0.70	0.40	0.66
Group II	0.71	0.16	0.68	0.55	1.00	0.54	0.88

The Comparison between the two groups showed no statistically significant difference between amounts of crestal bone loss in the two groups after 9 months (Table 2) and (Fig. 7).

TABLE (2) Mean, standard deviation (SD) values and results of Student's t-test for comparison between crestal bone loss (mm) in the two groups

Group I		Group II		*P*-value
Mean	**SD**	**Mean**	**SD**	
0.53	0.13	0.71	0.16	**0.061**

**: Significant at P ≤ 0.05*

DISCUSSION

It has been acknowledged that marginal bone loss is often unavoidable after implant placement, especially after the abutments are connected. In this respect the causes of marginal bone loss are complex, comprising a variety of mechanical and biologic factors[28]. Some studies postulated that microgaps at the interface between the implant platform and the abutment may contribute to its incidence[29,30]. In-vitro studies showed that microleakage occurs through these microgaps, and the degree of leakage is dependent on the type of abutment connection, the gap size, and the amount of micromovement[31,32]. In addition, the microgap permits bacterial multiplication with an open channel and then penetrate into the implant system, leading to inflammation, bone resorption and apical migration of the biologic width [33] . Standardized digital or conventional periapical radiographs were used to evaluate marginal bone loss[29]; unfortunately, they provide no information regarding buccolingual alveolar bone. Therefore, CBCT to acquire 3D images is a valuable tool to evaluate changes in the buccal alveolar bone around an implant over time. The present study applied this technique in the evaluation of the studied groups. With the advent of 3D CBCT, visualization of the bony anatomy has become possible because of the inherent accuracy of the CBCT and the clipping function, which can visualize craniofacial structures [34,35].

In this study twenty implants were inserted in eight patients: ten implants with platform switching (PS) abutments and the others ten were performed using non platform switching(NPS) technique, these implants were clinically and radiographically evaluated, to examine crestal bone behavior with both types of implants. Clinical evaluation was carried out using modified plaque index (mPlI) and modified sulcus bleeding index (mBI), Radiographic evaluation was carried out using Cone Beam CT scans at baseline and 9 months after implants insertion. The results demonstrated that the

marginal peri-implant hard tissue changes that occurred using an implant system with platform switched abutments in comparison with another types having non platform switching were minimal and with no significance during the first 9 months after implant installation. Further, no implant failure was seen, resulting in an overall survival rate of 100%.

It was evident from the obtained results that after 9 months of implant installation the mean crestal bone loss occurred in the PS implants group was (0.53 mm), and the other group (NPS) showed mean of (0.71 mm). There was no statistically significant difference between amounts of crestal bone loss in the two studied groups after 9 months. This finding agrees with many studies [36–42]. Platform switching (PS) technique was supposed to be one of the technical driven factors to achieve marginal or crestal bone stability; systematic reviews and meta-analyses supported this assumption. The effectiveness of the PS technique, significantly limiting marginal bone resorption around endosseous dental implants, while the cumulative estimated implant success rate was detected to reveal no statistically significant difference between both intervention groups of PS and non platform switching (NPS) implants[43].

Significant differences of peri-implant marginal bone level (MBL) changes favoring the PS technique were found in five out of six randomized controlled trials (RCTs) with a follow- up period exceeding 12 months and in seven of eight RCTs with a 12-month follow-up following prosthetic loading. A single RCT reporting a follow-up of 12 months following implant insertion failed to show a significant impact of the PS technique on peri-implant marginal bone level changes[44]. Considering the results of this systematic review, only three studies indicated a peri-implant marginal bone level change significantly less in the PS groups compared to those utilizing PM implant-abutment connections. In one study, this difference was remarkable in favor of the PS group obviously, but a statistical analysis to calculate the level of significance was not performed [45] Nevertheless, meta-analysis of 13 RCTs revealed a significantly less mean marginal bone level change at platform switched implants compared with non platform switched implants, thus confirming the supposed bone level stabilizing effect of platform switched implant-abutment configurations at least when considering short-term observations. The longest follow-up period within the RCTs was 27 months (25 months in average)[46], whereas the longest follow-up period within the public communication and culture studies(PCCS) was 5 years[47] .

It has been reported that that PS implants installed under the cortical bone level showed more significant resorption when compared with implants placed at the bone level. Additionally, a study [48] established subcrestal implants installation for both PS and NPS ,with follow up 12 months . The mean marginal bone loss was 1.67 mm for NPS and 0.95 mm for PS, with statistical significance. Another study [49] found a mean crestal bone loss for PS of 0.18 versus 2.18mm when PS was not applied.

Results of the present study showed no relevant bone-protective effect of platform switching which is in agreement with other results as theses reported no differences in vertical bone-level alterations between platform switching and nonplatform switching implants could be demonstrated [42,50]. In addition these results were comparable with that of another study(showed no differences in vertical bone-level alterations between platform switching and nonplatform switching implants could be demonstrated [44] .

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