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Original Article

Radiological Evaluation of Marginal Bone Loss around Dental Implants with Two Different Collar Designs

Muhammad Imran, Hassam Anjum Mir*, Mubashir Sharif, Saad Mansoor*, Shoaib Rahim*, Afra Ramzan**

Department of Dentistry, 04 Military Dental Centre, Bahawalpur Pakistan, *Department of Dentistry, Foundation University College of Dentistry, Islamabad Pakistan, **Department of Dentistry, Armed Forces Institute of Dentistry/National University of Medical Sciences (NUMS), Rawalpindi Pakistan

ABSTRACT

Objective: To compare mean peri-implant Marginal Bone Loss in patients receiving dental implants with micro-threaded collars with those receiving dental implants with machined collars.
Study Design: Quasi-experimental study.
Place and Duration of Study: Prosthodontics Department, Armed Forces Institute of Dentistry, Rawalpindi Pakistan, from Feb to Aug 2022.
Methodology: Marginal bone loss surrounding dental implants was evaluated by measuring peri-implant bone levels at the time of placement (T0), and at 3 months (T1) and 6 months (T2) after placement. Bone level around implant was measured from the top of dental implant to the first point of contact between the marginal bone and implant body with the help of digital peri apical radiograph (Care stream RVG 6500) with built in software measuring tool (Dental Imaging Software 6.14.0).
Results: A total of 80 implants were placed in which 40 were with rough micro-threaded collar (Group-A) and 40 were with smooth machined collar (Group-B). Out of 80 patients, 51(63.75%) were males and 29(36.25%) were females. Mean and SD of age in years was 40.52±11.75 years. Highest bone loss was at T2 in machined collar implant i.e. 0.72±0.04 mm, and lowest bone loss at T2 in micro-threaded collar implant i.e. 0.54±0.04 mm. A statistically significant difference was found between MBL in machined and micro-threaded implants at T2 (*p*-0.001).
Conclusion: Marginal bone loss around rough-surfaced micro-threaded collar implants was significantly lower than machined collar implants.

Keywords: Marginal Bone Loss, Machined Collar, Micro-threaded collar.

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INTRODUCTION

The introduction of dental implants has been a revolutionary treatment modality for the rehabilitation of function and esthetics related to oral cavity. Dental implants are prosthetic devices that are placed within the jawbone to replace missing teeth.[1] The survival, and hence the success, of dental implant depends upon its ability to integrate with the bone known as Osseo-integration.[2] Owing to decades of research, it is now possible to achieve a sound connection between the bone and the implant.

It may, however, be emphasized that the success of a dental implant cannot be assessed exclusively based on Osseo-integration. The key to an esthetically and functionally successful dental implant treatment is the maintenance of peri–implant hard and soft tissues.[3] Studies reveal that peri-implant marginal bone undergoes remodeling after implant placement and its functional loading, with a resultant bone loss beginning at the implant collar and extending up to the first thread on implant body.[4,5] Around 1.5 mm of MBL is generally seen during the first postoperative year is commonly encountered.[6]

Peri–implant MBL has a multi factorial etiology. One major contributing factor is the design of the collar of the dental implant.[7] Implant collar is the topmost portion of a dental implant fixture and provides attachment for the implant abutment. Conventionally, implant collars were smooth machined surfaces to avoid the accumulation of plaque and calculus.[8] Some manufacturers now offer dental implants with threads incorporated in their collars.[9] They claim that the presence of threads in the collar region will result in improved osseointegration. This, in turn, will lead to reduced marginal bone loss around implants. Present study was conducted to compare mean peri-implant marginal bone loss (MBL) in patients receiving dental implants with micro-

Correspondence: Dr Hassam Anjum Mir, Department of Dentistry, Foundation University College of Dentistry, Islamabad Pakistan
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threaded collars with those receiving dental implants with machined collars.

METHODOLOGY

The quasi-experimental study was conducted in the Prosthodontics Department, AFID, Rawalpindi from Feb 2022 to Aug 2022. Approval was sought from the Institutional Ethics Review Committee before starting the recruitment of subjects (AFID/ERC/2022/04). WHO calculator was used to calculate the sample size.[10]

Inclusion criteria: Patients of either gender aged between 25-60 years, with one or more missing molars or premolars in the lower jaw having sufficient bone quantity and a bucco-lingual mucosal thickness >2 mm at the prospective implant site were included.

Exclusion criteria: Patients with any systemic disease, history of chemotherapy, radiotherapy or any drugs affecting bone metabolism e.g. Bisphosphonates, those with active periodontal disease or with poor oral hygiene were excluded.

The total of 80 patients were recruited using non-probability consecutive sampling after obtaining written. The selected patients were divided into two groups: one in which rough-surfaced micro-threaded neck implants were placed (Group-A) and the other in which machined-neck implants were placed (Group-B) (Figure).

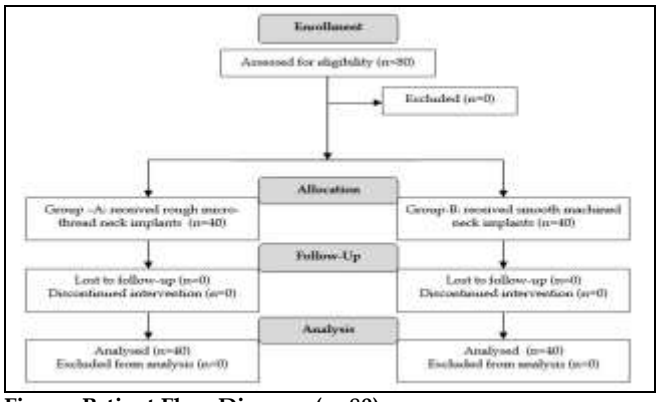

Figure: Patient Flow Diagram (n=80)

MBL around dental implants was evaluated by measuring peri-implant bone levels at the time of implant fixture placement (T0), and at 3 months follow up (T1) and 6 months follow up (T2) after placement. Peri-implant bone level was measured from the top of dental implant to the first point of contact between the marginal bone and implant body with the help of digital peri apical radiograph (Care stream RVG 6500) with built in software measuring tool (Dental Imaging Software 6.14.0).

Statistical Package for Social Sciences (SPSS) version 25.0 was used to analyze the recorded data. Descriptive statistics were calculated for quantitative variables like marginal bone loss for both groups at T0, T1 and T2, and was presented as Mean±SD. Paired Sample t–test was used to compare mean marginal bone loss between both the groups. *p*-value ≤ 0.05 was considered as significant.

RESULTS

A total of 80 implants were placed in which 40 were with rough micro-threaded collar (Group-A) and 40 were with smooth machined collar (Group-B). Out of 80 patients, 51(63.75%) were males and 29(36.25%) were females. Mean and SD of age in years was 40.52±11.75 years. The amount of marginal bone loss measured at T0, T1 and T2 is shown in the Table. Comparison of bone loss of machined and micro-threaded implants at T0 revealed no significant result *p*-value =0.602 whereas there was a statistically significant difference in bone loss at T1 and at T2 as *p*-value =0.001

Table: Comparison of Bone Loss at T0, T1, T2 Between the Groups (n=80)

Stages	Bone Loss(mm)		*p*-value
	Gorup-A (n=40)	Group-B (n=40)	
T0	0.23±0.06	0.24±0.06	0.602
T1	0.42±0.04	0.48±0.04	0.001
T2	0.54±0.04	0.72±0.04	0.001

DISCUSSION

Our study showed that dental implants with rough surfaced micro-threaded neck caused lesser MBL compared to machined-neck implants thus affecting the rate of bone loss. Research has proven that bone around the implants undergoes resorption following insertion of implant fixture and after loading. 1.5 mm early bone loss occurs after loading, during the first year of function. Thereafter, 0.2 mm bone loss occurs every year.[10]

Different designs of implant collars have been proposed to maintain a sound implant-bone contact.[11,12] There is reduced plaque accumulation around smooth neck implants, thus presumably prevent peri-implantitis.[13,14] However, it was revealed in finite element analysis investigations that there is high concentration of stress in marginal bone around the neck of implant with polished surface. Thus

marginal bone loss somewhat be due to the unfavorable stress distribution at the neck portion of the implants.[14] It was revealed, that the bone implant interface was much better around rough surface dental implants than smooth surfaced dental implants, and also the rate of bone loss was less.[15] Moreover, there might be increased interlinking of implant surface and bone in implant with micro-thread structure, leading to reduced marginal bone loss.[14,15]

It was found in a study that implants with smooth necks had less bone loss and peri implant mucositis at multiple follow ups when compared with roughened neck implants. This was a 10-year retrospective study in which 1244 implants were studied.[16] On the other hand, one study[17] reported less bone changes around rough neck implants after a follow up period of 5 to 9 years. The connection of implant with abutment also influences marginal bone levels. Studies comparing two different implants; Osseous implant which were machined neck, externally connected with platform matching with Inhex implant with rough, internally connected with platform switching, found MBL greater in Osseous implants. However, the limitation of this study was that the effect of platform switching, or implant abutment connection was not considered.[18]

Nicholson *et al*.[19] reported that incidence of peri-implant mucositis was more for smooth necks (14.41%) than roughened neck implants (2.92%). There is a very important confounding factor in all these studies is the method for assessing bone loss. Different radiographic techniques and the difference in exposure parameters and magnification of different X-ray sources can create error in calculation marginal bone loss.[8] In the studies mentioned above, the bone levels were measured using periapical radiographs, orthopantamograms and cone beam CT scans. Likewise, some studies used built-in software to measure the bone levels whereas some measured it manually.

CONCLUSION

The present study revealed that Marginal Bone Loss (MBL) around rough-surfaced micro-threaded collar implants was significantly lower than machined collar implants.

Conflict of Interest: None.

Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

MI & HAM: Conception, study design, drafting the manuscript, approval of the final version to be published.

MS & SM: Data analysis, data interpretation, critical review, approval of the final version to be published.

SR & AR: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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