ISSN: 2581-5989
PubMed - National Library of Medicine - ID: 101738774

International Journal of Dental Science and Innovative Research (IJDSIR)

IJDSIR : Dental Publication Service

Available Online at: www.ijdsir.com

Volume – 6, Issue – 3, June - 2023, Page No. : 289 – 293

Comparison of radiographic outcomes of implants with two different collar designs: An in vivo study

[1]Dr. Sanjay Lagdive, [2]Dr. Rupal Shah, [3]Dr. Jaydeep Katariya, [4]Dr. Nilesh Gadiya, [5]Dr. Nilesh Patel, [6]Dr Meet Dodiya, [7]Dr. Real Brahmbhatt

[1-7]Civil Hospital, Ahmedabad

Corresponding Author: Dr. Nilesh Gadiya, Civil Hospital, Ahmedabad.

Citation of this Article: Dr. Sanjay Lagdive, Dr. Rupal Shah, Dr. Jaydeep Katariya, Dr. Nilesh Gadiya, Dr. Nilesh Patel, Dr Meet Dodiya, Dr. Real Brahmbhatt, "Comparison of radiographic outcomes of implants with two different collar designs: An in vivo study", IJDSIR- June - 2023, Volume – 6, Issue - 3, P. No. 289 - 293.

Type of Publication: Review Article

Conflicts of Interest: Nil

Abstract

Background: Crestal bone loss around dental implant surface jeopardizes its longevity and success of treatment. There are several factors responsible for bone loss around a dental implant, one of which is Implant Crestal module design.

Aim and objectives: Aim of our study was to compare and radiographically evaluate the crestal bone loss around implants with smooth vs microthreaded implant crestal module.

Materials and Methods: About 20 implants with smooth collar design implant system and 20 implants with microthreaded collar design implant system were placed in patients in mandibular posterior edentulous arch. Radiographs with PSP (Photosentitive plate) were taken on the day of implant placement, after 3 months, 6 months, and 12 months follow-up. Bone loss were measured digitally. Same procedure for each implant design was carried out.

Results: About 6 months after the implant placement, radiographic evaluation 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 Smooth collar system and 0.7 mm on the mesial side of implant and 0.6 mm on distal side of implant for microthreaded system.

Conclusion: The smooth polished collar design have greater crestal bone loss compared to microthreaded implant design.

Keywords: implant, microthread, osseointegration, rough collar

Introduction

Serving as analogs to the teeth, dental implants have proven remarkably successful treatment from both functional and esthetic point of view. Regardless of their success, nevertheless, some biologic and mechanical limitations remains. One of which is marginal bone loss.

The long-term success and predictability of implant-supported restorations depend on maintaining peri-implant hard and soft tissues.[1] During the first year of

function, bone resorption will be of 1.5 to 2mm, generally considered as a normal physiologic process. Thereafter, an annual bone loss of 0.2mm can be expected under normal circumstances.[2]The implant's neck design may reduce marginal bone loss, and many different implant designs have attempted to preserve bone height after implant installation.

One of the criteria for successful dental implant treatment is radiographic vertical peri-implant bone loss of <2.0 mm.(Misch CE, Perel ML)[3]

Implant collars, sometimes called implant crest modules in other studies, are defined as the transosteal region of dental implants. They transfer stress to the crestal compact bone during loading [4,5]. Crest module is that portion of a two-piece metal dental implant, designed to hold the prosthetic components in place and to create a transition zone to the load bearing implant body.

The purpose of this in vivo study was to evaluate and compare the Crestal Bone Loss (CBL) occurring around the implants with smooth collar and implants with micro-threaded collar design.

Method

40 Partially dentate (Figure 1) subjects with one or two missing teeth were selected for prosthetic replacement of missing teeth using implant supported fixed prosthesis.

Figure 1: Partial Dentate Patient

It was presented to ethical committee. Patient were explained about the study in detail, about the procedure which was to be carried out and were willingly allowed to be a part of the study. A written consent was obtained from the subjects selected.

Two types of implant system:- DENTIUM SUPERLINE (Smooth collar) and DENTIUM NRLINE (Microthreaded Collar) (Group A and B respectively) were used in this study with standardized diameter as per Branemark criteria. Patients having missing lower posterior teeth to be treated with implants depending on the available bone type, volume and according to prosthetic needs.

The implant size was selected by using CBCT and study cast examination. Patient was prepared for surgery under local anaesthesia. The osteotomies in all groups were performed using two stage surgical protocol. All the implants were placed at the level of alveolar crest. A coverscrews were placed to close opened implant site and flap was closed using suture. Check up visits and post operative instructions were given.

Radiographs were taken at the following intervals:

1) On the day of implant placement
2) Three months after placement
3) Six month after placement
4) One year after placement

All radiographs were taken by Introral PSP film by paralleling technique using Rinn XCP (extension cone paralleling) device and they were examined using the computer software program – CRUXELL. The distance between implant abutment junction and the crestal bone was measured using digital scale tool for the measurement.

Patients bite were recorded with Putty index to standardize the paralleling technique, so that at every time patient holds the paralleling device in same

position. Subsequent radiographs were taken using these putty index at different time intervals.[14]

The Implant abutment junction in both the groups can be clearly defined. shows smooth collar design and shows microthreaded design. Each radiograph obtained from the PSP plate was saved in the computer program. Bone loss observed in radiograph was calculated with help of this software.

All the radiographs taken at different time intervals were analyzed for bone loss measurement in sequential manner. Implant shoulder was taken as reference point for measuring bone loss.

The measurements were taken for each of the radiographs as follow:

1) Mesial bone loss: The distance between mesial edge of implant platform point and the mesial point where the implant meets the alveolar crest point in millimetres.

2) Distal bone loss: The distance between distal edge of implant platform point and the distal point where the implant meets the alveolar crest point in millimetres.

The amount of bone level present at baseline was measured and was then compared with the amount of bone loss that occurred at different time intervals up to 1year after prosthetic loading.

Results

The bone level measurement was calculated in terms of mean ± standard deviation. The comparison of mean values of bone measurement was compared by using independent t test. Comparison of bone loss values between the two groups showed higher values of bone loss in Group A at all the time intervals.

Also, the values for Group A and B were higher on mesial side as compared to distal side. (Table I and II)

Site	Time interval			
	Baseline (0 month)	3 months	6 months	12 months
Macrothread(n=20) (CONTROL GROUP)	0.175 ±0.238	0.450 ±0.237	0.670 ± 0.2344	0.965 ± 0.216
Microthread(n=20) (TEST GROUP)	0.160 ±0.139	0.340 ±0.143	0.530 ± 0.184	0.815 ± 0.239
P Value	0.809	0.084	0.043*	0.044*

Data presented in mean ± standard deviation,*P<0.05 significant

Table 1: Bone loss measurements at different time intervals on Mesial side

Site	Time interval			
	Baseline (0 month)	3 months	6 months	12 months
Macrothread(n=20) (CONTROL GROUP)	0.195±0.250	0.355±0.167	0.555 ± 0.209	0.760 ± 0.293
Microthread(n=20) (TEST GROUP)	0.200 ±0.172	0.320±0.136	0.460 ± 0.147	0.730 ± 0.205
P Value	0.942	0.472	0.104	0.710

Data presented in mean ± standard deviation, *P<0.05 significant

Table 2: Bone loss measurements at different time intervals on distal side

Discussion

The success rate of dental implant mainly depends on its design and has long been established through various studies. Peri-implant bone level is one of the major concerns regarding implant success that determines the final esthetics of the treatment and is also important to proper prosthetic function.[6] Crest module is the transosteal portion of a two-piece metal dental implant that creates a transition zone to the load-bearing implant body and is designed to hold the prosthetic components in place.[7] Albrektsson et al.[8] proposed criteria for

assessing and evaluating the success of implant survival; these criteria included marginal bone remodeling of <2.0 mm in the 1st year after implant placement and <0.2 mm each year thereafter. These changes are usually related to the use of implants with a conventional machined surface and a conventional neck design.

This study aimed to assess the clinical effectiveness of the microthreaded surface collar of implant on marginal bone loss. The results of this investigation showed a significantly lower bone loss for implants with microthreaded collar surface. This in vivo study also compared the crestal bone loss occurring along the implants with normal smooth collar surface and with rough collar microthreaded design.

Group B implants had a microthreaded collar surface which could have converted part of the shear force component into compressive and tensile components due to its surface roughness and microgrooves & micro threads. The adjacent crestal bone osseointegrates into the micropores, elevations, and depressions of the collar surface area. Micromovements of implant occurring under occlusal forces during function may further dissipate the forces into the adjacent osseointegrated crestal bone. These micromovements result in positive stimulation of the crestal bone and hence cause lesser bone loss around rough collar microthreaded implants.

On the other hand Group-A implants resulted in disuse atrophy of the adjacent alveolar bone due to their smooth collar surface design that failed to produce more positive stimulation of the adjacent alveolar bone, apart from transmitting more shear stresses to the crestal bone.[7]

Conclusion

Irrespective of implant system and designs that are used, crestal bone loss of up to the first thread is often observed. This may be due to the transformation of stress patterns from being shear in nature to compressive. Though various designs of the crest modules have been proposed to overcome this, sufficient clinical studies are needed to determine the actual mechanism of the crestal bone loss. However, implants with micro threaded implant collar have proven to be of an advantage from a mechanical and biological point of view. Their validity needs further research for implants to eventually mimic the natural teeth.

References

1. Oh TJ, Yoon J, Misch CE, Wang HL. The causes of early implant bone loss: Myth or science? J Periodontol 2002;73:322–333.
2. Kronström, M.; Svenson, B.; Hellman, M.; Persson, G.R. Early implant failures in patients treated with Brånemark System titanium dental implants: A retrospective study. Int. J. Oral Maxillofac. Implants 2001, 16, 201–207.
3. Misch CE, Perel ML, Wang HL, Sammartino G, Galindo-Moreno P, Trisi P, et al. Implant success, survival, and failure: the International Congress of Oral Implantologists (ICOI) Pisa Consensus Conference. Implant Dentistry 2008;17:5–15.
4. Misch CE, Bidez MW, Strong JT. Scientific rationale for dental implant design. In: Misch CE (ed). Contemporary Implant Dentistry, ed 3. St Louis: Mosby, 2008:200–209.
5. Misch CE, Bidez MW. A scientific rationale for dental implant design. In: Misch CE (ed). Contemporary Implant Dentistry, ed 2. St Louis: Mosby, 1999:329–343.
6. Chang M, Wennstrom JL, Odman P, et al. Implant supported single tooth replacements compared to contralateral natural teeth. Crown and soft tissue dimensions. Clin Oral Implants Res. 1999;10:185–194.

7. Aparna IN, Dhanasekar B, Lingeshwar D, Gupta L. Implant crest module: A review of biomechanical considerations. Indian J Dent Res 2012;23:257-63
8. Albrektssson T, Zarb G, Wortington P, et al. The long-term efficacy of currently used dental implants: A review and proposed criteria of success. Int J Oral Maxillofac Implants. 1986;1:11–25
9. Cochran David L, Nummikoski Pirkka V, Schoolfield John D, et al. A prospective multicenter 5-year radiographic evaluation of crestal bone levels over time in 596 dental implants placed in 192 patients. J Periodontol. 2009;80:725–733.