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ORIGINAL RESEARCH

Impact of Implant Length in Posterior Mandible Region with Early Loading

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ABSTRACT:

Background: Longer implants have always been considered more reliable due to both an improved crown-to-implant ratio and a greater surface area available for osseointegration, which dissipates the imposed occlusal forces. However, the biomechanical rationale behind the use of short implants is that the crestal portion of the implant body is the most involved in load-bearing, whereas very little stress is transferred to the apical portion**. Material and method:** The study was conducted on patients divided into two groups: A total of 20 implants were placed (10 implants per group) in subjects requiring placement of mandibular and maxillary implants. All implants placed in both study groups are 3.8mm in diameter. Follow up for radiographic and clinical evaluation which was made at 1 week, 3 months and 6 months after implant loading for evaluation of crestal bone changes with help of radiographs**. Results**: Short and long implants showed comparable survival rates and success both clinically and radiographically in early loading in posterior mandible.

Conclusion: Early loading of dental implants are highly predictable modality for replacing missing teeth in the atrophic alveolar ridge.

Key words: Implant, Posterior, Loading

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INTRODUCTION

Osseointegrated dental implants are an effective alternative in the rehabilitation of partial or total edentulous patients.[1] Primary stability depends mainly on the endosseous design of the conventional implant including the functional length, besides surgical technique and properties of local bone. The loss of teeth leads to bone resorption limiting the use of regular length implants of 10 mm or above[2]. Its use may be restricted in the presence of limitations related to the morphology and volume of the bone ridge. These limitations are usually more common in the posterior maxillary and mandibular regions.

Short implants have been proposed as an alternative choice for the prosthetic treatment of alveolar ridges, which may provide surgical advantages including reducing morbidity, treatment time, and costs[3]. Longer implants have always been considered more reliable due to both an improved crown-to-implant ratio and a greater surface area available for osseointegration, which dissipates the imposed occlusal forces. However, the biomechanical rationale behind the use of short implants is that the crestal portion of the implant body is the most involved in load-bearing, whereas very little stress is transferred to the apical portion[3].

Early loading protocols include implants loaded 1 week to 2 months after insertion, permit a longer healing time than immediate loading protocols and can achieve the same clinical outcomes as conventional loading with shorter time[5].Although various studies has been conducted on short versus conventional implants survival, but none with specific loading protocol thus our study intends to evaluate clinically and radiographically short implants versus conventional implants of same diameter with early loading protocol.

MATERIAL AND METHOD

The study was conducted on patients divided into two groups: A total of 20 implants were placed (10 implants per group) in subjects requiring placement of mandibular and maxillary implants.All implants placed in both study groups are 3.8mm in diameter. Selected groups were grouped on the basis of length of implant used.

Group I Short length implants with early loading.
Group II Conventional length implants with early loading.

PRESURGICAL ASSESSMENT

IOPA and Orthopantomogram (OPG), 3D CBCT was done to determine position of bony walls (buccal and lingual/palatal), their height and width and accordingly the position and orientation of implant in relationship to critical structures was analyzed. Final planning for the size of implant was done.

SURGICAL PREPARATION :

The patients were pre-medicated with antibiotics (Amclaid 625mg) 1 hour prior to surgery. Local anesthesia was then administered at the surgical site using lignocaine with adrenalin in the ratio of 1:100,000 at the involved site.

IMPLANT PLACEMENT IN BOTH GROUPS:

Crestal incision was given for full thickness flap reflection, to expose the implant site. Surgical stent was then placed over the crest to mark the implant site. Implant site was marked to create bleeding point and initially osteotomy. After marking the implant site pilot drill was used, followed by subsequent drills of increasing diameter , and final drill up to the decided depth in order to create an osteotomy site of required dimensions for each patient. The implants were then inserted into this osteotomy site. Once the cover screw were placed, the surgical site was thoroughly irrigated and flap was closed with tight non-resorbable 3-0 silk sutures and the patients were prescribed with antibiotics and analgesics for 1 week, post operatively. Second stage surgery was performed after 4 weeks and gingival former was placed. After 2 weeks abutment were placed and the impression was made by polyvinylsiloxane material using indirect impression technique. Impression was then poured in die stone to fabricate the cast. After cast fabrication die cutting was done and wax pattern fabricated, metal casting was then fabricated from investing and casting of this wax pattern.
Metal try in was then made followed by shade selection. Final prosthesis was fabricated and then tried in patient’s mouth and occlusion adjusted, after final trial the prosthesis was cemented with the help of type1 glass ionomer cement (Luting).

FOLLOW UP

The patient was then recalled for follow up for radiographic and clinical evaluation which was made at 1 week, 3 months and 6 months after implant loading for evaluation of crestal bone changes with help of radiographs. The standardrised periapical radiographs were digitized using digitized image analysis, Med Calc Software version 4.3.5.0. The known implant length was used to calibrate the images in the computer software.
The results obtained were subjected to statistical analysis paired T-test.

RESULTS AND DISCUSSION

Dental implants todays have become a highly predictable mode of replacement of missing teeth[12].Short dental implants were introduced for simplified placement in compromised alveolar situations to avoid interference with vital anatomical structures, minimize surgical trauma and associated risks, and consequently reduce the morbidity of advanced surgical procedures[13].The biomechanical rationale for use of short implants is that osseointegrated bone-implant interface distribute most prosthetic loads to crestal portion of an implant body.Finite element analysis reveals that highest strains to a bone stimulant occur in crestal region of implant and little stress transferred to apical portion[11].
At present, there is no consensus on the definition of a short implant. Some authors defined short implants as $\leq$7mm, $\leq$8mm, or $\leq$10mm long[7]. In this study, a short implant is defined as a dental implant that is <10 mm long whereas a standard length dental implant is $\geq$10 mm[7]. Accordingly, in clinical situations with little bone availability, short implants are a viable, simple, and predictable alternative[1].
In a 3D finite element analysis, it was demonstrated that increasing the implant diameter resulted in a 3.5-fold reduction in crestal strain. On the contrary,increasing the implant length resulted in a 1.65-fold reduction in crestal strain[17]. However, other studies showed that increasing implant diameter did not compensate for the reduction in length[14,15]. All implants placed in both study groups are 3.8mm in diameter placed in mandibular posterior region . Implant length is generally selected according to maximum amount of bone height at recipient site. Functional surface area of implant is considered important as it transfers the compressive & tensile loads to bone and does not includes passive portion of the implant[4].
The early investigations of Branemark led to the establishment of an osseointegration protocol recommending a load free post-operative healing period 3-4 months for the mandible and 4 to 6 months for the maxilla. The concept of unloaded healing period has been challenged during recent years. Modifications of implant shape and surface characteristics have suggested that it may be possible to restore implants predictably and safely

with shorter healing times[16].Immediate loading may impose a higher risk for implant failure due to decreased healing period and conventional loading is troublesome to patient because of longer duration lead to the introduction of early loading. Early loading permit a longer healing time than immediate loading protocols and can achieve the same clinical outcomes as conventional loading with shorter time[5].

We have conducted a prospective clinical study with the purpose of evaluating the treatment outcomes of 20 early loaded short implants and standard implants. We have selected and included patients (10 implants per group) in our study. The surgery was performed by same operator under standard conditions. All implants showed adequate primary stability, as measured clinically in both groups. There was no implant mobility and adverse effects in either group. Present study shows that crestal bone loss in short implants is less than conventional implants but were insignificant. Only crestal bone loss on mesial side of short implants show significantly lesser as compared to conventional implants. The results of this study are in accordance with studies done by Rokni S[10] et al in which 199 implants placed and followed for 4 years which concludes long implants had greater crestal bone loss(0.2mm more) than short implants. These effects might be related to “stress-shielding” effects on crestal bone and resultant disuse atrophy. The survival rates of implants shorter than 10mm seem to comparable to longer implants(Anitua & Gorka 2010;Annibali et al 2012; Brocard et al 1997; Buser et al 1997;Fugazzotto etal 2004, Pommer et al 2011;Renouard and Nisand 2005;Telleman et al 2011)[22]. The results of this study are in accordance with the studies[(22,23,24,25,28,29,33)] which states that length does not appear to influence the survival rates of the implants. Similar overall outcomes are seen in short & long implants[(8,21,26,27,30,31,32)].However few studies, Wyatt & Zarb(1998),Winkler(2000),Herrmann(2005) shows short implants have less survival rate compared to conventional implants[19]. These differences in the studies may be due to other variables affecting implant survival, including the implant surface, surgeons learning curve,bone quality and quantity, implant primary stability, prosthodontics protocol, and the lack of a common definition of short implant[18].

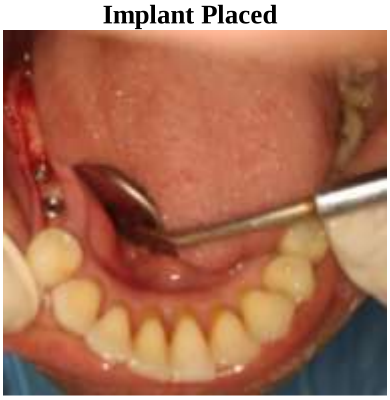
When an implant is loaded, the majority of stress is distributed at level of first few threads to crestal cortical bone; therefore once a minimum implant height is osseointegrated, implant width is more important than additional length[18].Effective implant length or Effective bone-to-implant surface which satisfies the functional needs of the prosthesis,is the key to ensure the long-term outcomes of the short implants supporting single crowns[20].

The drawbacks of this study included the fact that in this study, intra-oral radiography was used to evaluate the radiologic changes in peri implant bone level, which is quite a sensitive method. However, it should be noted that this technique could only record bone level in two dimensions (mesial and distal). Therefore, it is highly likely that some information (bone loss in the buccal and lingual dimensions) might be missing. Other limitations of the study were the small sample size consisting 10 patients in each group and 6 months post-operative follow-up is a short duration, hence a study with a large sample with longer follow up time period is required to analyse the results.

Preoperative intra oral photograph

OPG

Implant Placed



Indirect impression

Post operative IOPA

Post operative intra oral photograph

CONCLUSION

In our study, we compared the clinical success of short dental implants with conventional dental implants with early loading protocol. An analysis of the data obtained in course of this study, coupled and compared with data obtained while reviewing literature, directs us to the conclusion that early loading of dental implants are highly predictable modality for replacing missing teeth in the atrophic alveolar ridge. It must however be noted that patient selection and primary stability of implants plays a crucial role in the success of early loaded short dental implants. A few conclusions drawn from this study were: - Short implants with early loading must gain sufficient primary (mechanical) stability for successful outcome. Short and long implants showed comparable survival rates and success both clinically and radiographically. However, further trials involving a larger sample size, longer follow-up periods and other sites of maxilla and mandible are necessary before declaring short implant placement with early loading protocol as reliable procedure.

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