

Original Research Article

COMPARATIVE EVALUATION OF CRESTAL BONE LOSS AROUND COMPRESSION SCREW IMPLANTS PLACED IN HEALED SITES AND FRESHLY EXTRACTED SOCKETS

ABSTRACT

Aim: The aim of the study is to evaluate crestal bone loss around immediate loading compression screw implants.

Study design: A Randomized controlled clinical trial

Method: In this randomized study, 15 subjects with 30 edentulous sites in the maxillary and mandibular anterior regions (incisors and canines) willing for replacement were taken into consideration. 14 implants were placed in healed sites and 16 implants were placed in freshly extracted sockets and immediately loaded in both groups. Provisional restoration was delivered on the same day of implant placement. Crestal bone loss was evaluated at baseline (immediately after implant placement), 1 month and, 4 months. The final prosthetic restoration was delivered at 4 months following implant placement.

Results: No statistically significant difference for crestal bone loss was observed between delayed and immediate implant placement at 4 months interval.

Conclusion: Within the limitations of this study, one-piece implants with immediate loading can be considered as a viable solution for replacement of missing teeth in relation to maxillary and mandibular anterior regions.

Key words: Dental implant, one-piece implant, immediate loading, crestal bone loss

INTRODUCTION

Oral health and its care are very important to maintain proper mastication, phonation, esthetics, and psychological well-being of an individual. Loss of teeth adversely affects oral health care. The replacement of missing teeth with dental implants has now become a treatment modality for fully and partially edentulous patients. For many years, the use of the original Branemark dental implants system in the rehabilitation followed a protocol of implant submersion for 3-6 months during osseointegration for uneventful healing and to avoid implant micro movement around the bone-implant interface during the healing phase which may influence fibrous tissue formation instead of osseointegration, leading to implant failure [1]. The prolonged nature of the waiting period before loading raised concerns about treatment length and is sometimes the reason for not choosing implant supported restorations.

Recently, improvement in surgical technique, implant design, and treatment of titanium surface (micro and macrostructure of the implant), led to the concept of immediate loading protocol [2]. The prototype has thus shifted from "No load on implants during healing" to "No micro movements of implants" [3]. Immediate loading of implants is defined as a situation where the superstructure is attached to the implants no later than 72 hours post-surgery [4,5]. This concept has gained popularity by offering shortened treatment time, reduced trauma, decreased patient anxiety and discomfort and also improvement in function and esthetics [6]. Studies conducted by Schnitman [7] and Schincaglia GP [8] have reported 95-100% success rates with immediate loading of implants. Studies conducted by Barewal RM [9], Pellicer Chover H [10], Felice P [11]

reported similar rates of success, implant survival and Crestal Bone Loss (CBL) for Delayed Loading (DL) and Immediate Loading (IL) of implants.

One-piece implant is defined as an anchorage unit and contiguous prosthetic part manufactured as one unit. The unique design of one-piece implants eliminates the fixture abutment interface (microgap) and resembling the natural tooth with a seamless transition of the radicular unit to the coronal unit [12]. The other advantages of one-piece implants are, it is less time consuming, better healing, more patient satisfaction, immediate function as well as immediate placement into fresh extraction sockets, using either a traditional flap or flapless surgical procedure [13]. More recently, compression screw implants have been introduced which can result in condensation of spongy bone areas. Compression of bone along the vertical axis of the screw implant leads to "corticalization of bone" leading to increased primary stability [14].

However, very little information is currently available regarding outcomes of immediate loading compression screw implants with no clinical studies. Therefore, the aim of the study is to evaluate crestal bone loss around immediate loading compression screw implants.

MATERIALS AND METHODS

The study was conducted in the Department of Periodontics & Implantology, Drs. Sudha & Nageswara Rao Siddhartha institute of dental sciences, Chinaoutapalli, Andhra Pradesh. A total of 15 subjects with 30 edentulous sites were divided into two groups in the maxillary and mandibular anterior regions (Incisors and canines) willing for replacement were taken into consideration. Sample size was determined from the site www.openpi.com. The study protocol was approved by the institutional ethical committee and written informed consent was obtained from all the patients. Healthy subjects with good oral hygiene, stable occlusal relationships with no pronounced bruxism and deep bite, presence of sufficient bone volume for placing implants with a length of atleast 10mm, implant site that is free from infection were included in the study. Exclusion criteria included patients with systemic diseases contraindicating any type of surgery, under bisphosphonate therapy, chronic smokers, any evidence of pathology or active diseases of the implant bed, subjects who underwent radiation therapy and need for cantilever prostheses.

SURGICAL PROCEDURE

Surgical site was examined and implant length and diameter were selected for each patient based on Cone Beam Computed Tomography (CBCT) interpretation. Local anesthesia was given i.e., lignocaine 20mg/ml with adrenaline 1:80,000. After incision and surgical site exposure, osteotomy site was prepared and implant of desired width and length were placed according to manufacturer's instructions. It is made sure that minimum torque of 35 Ncm is obtained while screwing in the implant as this is pre-requisite for immediate loading. Flaps are approximated and sutured with 3-0 black braided silk sutures. After implant placement, hydrocolloid impression is made and immediate temporary crown with acrylic was made, which was cemented onto the abutment on the same day of implant placement with Glass Ionomer luting cement. It was made sure that crown was relieved out of occlusal contacts.

Post-surgery, all the patients were prescribed with Amoxicillin with Clavulanic acid of 625mg (Augmentin) twice daily for 5 days, Ibuprofen 400mg thrice daily for 5 days along with 0.2% chlorhexidine mouth rinse twice daily until complete oral hygiene habits were resumed. Patients were advised not to brush on the operated site for a week and recalled after 1 week for suture removal. Patients were instructed not to bite hard on the prostheses. Procedure for fabrication of permanent prostheses was performed 4 months following implant placement. Crestal bone loss was assessed radiographically using standard intra-oral periapical radiographs along with grid and statistical analysis was made. Radiographs were taken at baseline, 1 month and 4 months post-operatively.

STATISTICAL ANALYSIS

Comparison of implant diameter and length between 2 different types of implant placement was done by unpaired t test. Comparison of bone loss between immediate implant placement and delayed implant placement at different time intervals was done by Mann-Whitney U test.

RESULTS

A total of 15 patients with 30 edentulous sites were included in this study. Among these 15 patients, 8 were males and 7 were females aged between 19-60 years. One implant was

Baseline	Delayed implant	0.00	0.00	188.50	97.50	0.0000	1.0000
	Immediate implant	0.00	0.00	217.50			
1 month	Delayed implant	0.31	0.48	194.50	91.50	-0.2764	0.7822
	Immediate implant	0.23	0.37	211.50			
4months	Delayed implant	0.50	0.65	184.50	93.50	-0.1843	0.8538
	Immediate implant	0.53	0.64	221.50			
BL to 1M	Delayed implant	0.31	0.48	194.50	91.50	-0.2764	0.7822
	Immediate implant	0.23	0.37	211.50			
BL to 4M	Delayed implant	0.50	0.65	184.50	93.50	-0.1843	0.8538
	Immediate implant	0.53	0.64	221.50			
1M to 4M	Delayed implant	0.19	0.33	176.50	85.50	-0.5528	0.5804
	Immediate implant	0.30	0.41	229.50			

Statistically significant ($p < 0.05$)

DISCUSSION

According to Branemark et al [15], the unloaded healing period of 3-6 months is essential for achieving osseointegration in two stage implant surgery. However, this two-stage surgical protocol with delayed loading of implants has disadvantages of prolonged implant treatment, interim period of edentulism (without conventional denture prostheses) for a minimum of 2 weeks after implant placement, and wearing of conventional denture until 2nd stage surgery may prove inconvenient to the patient, which can cause psychological, social and functional problems especially if the edentulous area is in an esthetic zone. Other disadvantages are loose denture, difficulty in chewing with transitional removal prostheses, and the necessity for second surgery which may prove inconvenient to the patient, and further more longterm waiting period leading to discomfort and anxiety, thereby discouraging the pursuit of such treatment [3,16,17].

The successful healing after immediate loading of implants was 1st documented by Ledermann et al [18] in year 1979. Although studies conducted by Aparicio et al [4] and Chow et al [19] reported that immediate loading may be unpredictable with poor bone qualities, consequently improvements in implant design and surface patterns have demonstrated encouraging results for immediately loaded non-splinted [20,21] and splinted implants placed in regions with non-optimal bone quality and also reported that immediate loading implants have more bone to implant contact with more mature cortical bone than delayed loaded implants [22,23].

However, the structural weakness built in two-piece implants and the presence of micro-gaps (micro-leakage) between 2 implant analogues (implant body and abutment), can lead to the development of micro-organisms followed by inflammation of soft tissue around the implants and sometimes can lead to implant failure. To avoid the above situation and to reduce manipulation of soft tissues around the implants during initial healing periods, one-piece implants were introduced which incorporate the trans-mucosal abutment as an integral part of the implant and thus eliminate the structural weakness of two-piece implants. One-piece implants resemble the natural tooth which has a strong uni-body design with no split parts and has many advantages over two-piece implants [24].

One-piece implant is intended for immediate function as well as for immediate placement in fresh extraction sockets [25]. Lazzara RJ et al [26] reported that one-piece implants when placed in fresh extraction sockets may preserve the alveolar bone height and width, and provide optimal soft tissue esthetics. Moreover, manipulation of the peri-implant soft tissue after initial healing can be avoided with one-piece implant design.

In the present study, one implant had to be removed as it showed a sign of mobility indicating lack of osseointegration. The failure can be attributed to one of the following factors such as inadequate primary stability compromising healing phase, apically placed crown margins, patient

related factor such as excessive occlusal force by not complying with the post-operative instructions after loading of the implant or from the transmission of force from the tissues (tongue, cheek).

An implant is thought to be successful only after the 1year modeling phase of osseointegration, but in this study, only a short follow-up period of 4 months is considered where in the remodeling is not yet complete. Other limitations are, the effect of occlusal loading on bone remodeling is not ascertained, smaller sample size, and the implants are placed only in anterior regions. Further longitudinal studies with long term follow-up periods and larger sample size are required to confirm the results, in addition, it is necessary to evaluate the effects of one-piece implants placed in posterior regions (premolars & molars) where the prosthetic load is higher.

CONCLUSION

Within the limitations of this study, one-piece implants with immediate loading can be considered as a viable solution for the replacement of missing teeth in relation to maxillary and mandibular anterior regions. Furthermore, one-piece implants placed in fresh extraction sockets may be considered as a predictable treatment procedure that improves patient satisfaction.

REFERENCES

1. **Al-Sawai AA, Labib H.** Success of immediate loading implants compared to conventionally-loaded implants: a literature review. *J Investig Clin Dent.* 2016;7(3):217-24.
2. **Ribeiro FS, Pontes AE, Marcantonio E, Piattelli A, Neto RJ, Marcantonio Jr E.** Success rate of immediate nonfunctional loaded single-tooth implants: immediate versus delayed implantation. *Implant Dent.* 2008;17(1):109-17.
3. **Rathee M, Aneja S.** Immediate Implant Loading-A Paradigm Shift. *J Oral Health Comm Dent.* 2014;8(1).
4. **Aparicio C, Rangert B, Sennerby L.** Immediate/early loading of dental implants: a report from the Sociedad Espanola de Implantes World Congress consensus meeting in Barcelona, Spain, 2002. *Clin Implant Dent Relat Res.* 2003;5(1):57-60.
5. **Cochran DL, Morton D, Weber HP.** Consensus statements and recommended clinical procedures regarding loading protocols for endosseous dental implants. *Int J Oral Maxillofac Implants.* 2004;19:109-13.
6. **Romanos GE.** Advanced immediate functional loading: requirements for long-term success in modern implant dentistry. *Compend Contin Educ Dent (Jamesburg, NJ: 1995).* 2014;35(7):474-83.
7. **Schnitman PA, Wöhrle PS, Rubenstein JE, DaSilva JD, Wang NH.** Ten-year results for Brånemark implants immediately loaded with fixed prostheses at implant placement. *Int J Oral Maxillofac Implants.* 1997;12(4).
8. **Schincaglia GP, Marzola R, Scapoli C, Scotti R.** Immediate loading of dental implants supporting fixed partial dentures in the posterior mandible: a randomized controlled split-mouth study--machined versus titanium oxide implant surface. *Int J Oral Maxillofac Implants.* 2007;22(1).
9. **Barewal RM, Stanford C, Weesner TC.** A randomized controlled clinical trial comparing the effects of three loading protocols on dental implant stability. *Int J Oral Maxillofac Implants.* 2012;27(4).
10. **Pellicer-Chover H, Penarrocha-Oltra D, Bagan L, Fichy-Fernandez AJ, Canullo L, Penarrocha-Diago M.** Single-blind randomized clinical trial to evaluate clinical and radiological outcomes after one year of immediate versus delayed implant placement supporting full-arch prostheses. *Med Oral Patol oral Cir Bucal.* 2014;19(3):e295.
11. **Felice P, Soardi E, Piattelli M, Pistilli R, Jacotti M, Esposito M.** Immediate non- occlusal loading of immediate post-extractive versus delayed placement of single implants in preserved sockets of the anterior maxilla: 4-month post-loading results from a pragmatic multicentre randomised controlled trial. *Eur J Oral Implantol.* 2011;4(4):329-44.
12. **Hahn JA.** Clinical and radiographic evaluation of one-piece implants used for immediate function. *J Oral Implantol.* 2007;33(3):152-5.
13. **Finne K, Rompen E, Toljanic J.** Three-year prospective multicentre study evaluating marginal bone levels and soft tissue health around a one-piece implant system. *Int J Oral Maxillofac Implants.* 2012;27(2).
14. **Narang S, Narang A, Jain K, Bhatia V.** Multiple immediate implants placement with immediate loading. *J Indian Soc Periodontol.* 2014;18(5):648.
15. **Branemark PI, Breine U, Adell R, Hansson BO, Lindstrom J, Ohlsson A.** Intra- osseous anchorage of dental prostheses: I. Experimental studies. *Scand J Plast Reconstr Surg.* 1969;3(2):81-100.
16. **Rathod M, Dange SP, Khalikar AN, Khalikar SA.** Immediate Loading of Dental Implants: Survival and Success Rate. *Int J Clin Implant Dent* 2015;1(1):8-13.
17. **Cochran DL.** The evidence for immediate loading of implants. *J Evid Based Dent Pract.* 2006;6(2):155-63.

18. **Ledermann P.** Bar-prosthetic management of the edentulous mandible by means of plasma-coated implantation with titanium screws. *Dtsch Zahnarztl Z.* 1979;34(12):907-11.
19. **Chow J, Hui E, Li D, Liu J.** Immediate loading of Branemark system fixtures in the mandible with a fixed provisional prosthesis. *Appl Osseointegration Res.* 2001;2(1):30-5
20. **Romeo E, Lops D, Margutti E, Ghisolfi M, Chiapasco M, Vogel G.** Long-term survival and success of oral implants in the treatment of full and partial arches: a 7-year prospective study with the ITI dental implant system. *Int J Oral Maxillofac Implants.* 2004;19(2).
21. **Ericsson I, Nilson H, Lindh T, Nilner K, Randow K.** Immediate functional loading of Branemark single tooth implants: An 18 months' clinical pilot follow-up study. *Clin Oral Implants Res.* 2000;11(1):26-33.
22. **Lederman PD, Schenk RK, Buser D.** Long-lasting osseointegration of immediately loaded, bar-connected TPS screws after 12 years of function: a histologic case report of a 95-year-old patient. *Int J Periodontics Restorative Dent.* 1998;18(6).
23. **Balshi SF, Wolfinger GJ, Balshi TJ.** A prospective study of immediate functional loading, following the teeth in a Day™ protocol: A case series of 55 consecutive edentulous maxillas. *Clin Implant Dent Relat Res.* 2005;7(1):24-31.
24. **Rao SJ, Kurapati SK, Joseph JK.** Comparative evaluation of one piece and two piece dental implants-A review. *Int J Sci Res.* 2018;6(8).
25. **Prithviraj DR, Gupta V, Muley N, Sandhu P.** One-piece implants: placement timing, surgical technique, loading protocol, and marginal bone loss. *J Prosthodont.* 2013;22(3):237-44.
26. **Lazzara RJ.** Immediate implant placement into extraction sites: surgical and restorative advantages. *Int J Periodontics Restorative Dent.* 1989;9:332-43.