Periodontal Evaluation of One-Piece and Two-Piece Single Implant Loaded in Esthetic Zone

Rezan Anwar[1], Ziwar Al Qasab[2]

[1]B.D.S., Master Student, [2] B.D.S., M.Sc., PhD. Assis.Prof, Department of Periodontolpgy, College of Dentistry, Hawler Medical University, Kurdistan Region, Irbil- Iraq

Abstract

Background: Soft tissue around dental implant is an important anatomical feature contributing to the long-term implant success and esthetics, different factors may influence the soft tissue-implant interface. The purposes of the current study were to evaluate the soft tissue profile around one-piece and two-piece implants loaded in esthetic zone.

Method: Totally thirty patients who had single missing tooth in premaxillary region were included in the study. Fifteenth patients' group-A were assigned to immediate loading one-piece implant and fifteen patients' group-B were assigned to early loading two-piece implant protocol. Flapless approach was performed for both groups. In group-A, implants were loaded immediately with a temporary crown within 48h, while group-B, were loaded after two months following conventional impression for metal ceramic crown. Clinical outcomes were evaluated after two and six months in terms of success rate, papillary index, plaque index and width of keratinized mucosa.

Results: The success rate in group-A found to be 80%, which was lower than the success rate in group-B (100%). On comparison, there was no statistically significant difference in success rate between the two study groups. There was no statistically significant difference between both groups over time in clinical parameters like plaque index, width of keratinized gingiva and papillary index.

Conclusion: The results of this study indicated that using either immediately loading one-piece implants or early loaded two-piece implants protocol demonstrated the same enhancements of implant esthetics.

Keywords: *One-piece implant, Two-piece implant, immediate load, Esthetic zone.*

Introduction

Rehabilitation of missing teeth in the anterior maxilla with an implant-supported fixed prosthesis is a broadly accepted treatment modality[1]. Many research studies have been done in implantology correlated to implant design, surgical technique, immediate implant placement and loading protocols. Traditionally, implants were subjected to delay load healing for several months, letting the implant to osseointegrate without being exposed to external forces.

Over the last few years, the concept of immediate loading or early loading flapless implant protocol has gained attention. This concept is defined as the application of a load by means of an occluding or a non-occluding restoration within 48 h for immediate loading and 48h to two months for early loading implant placement [2].

Patients with a lost anterior tooth may benefit from immediate loading. Placement of the temporary crown after implant placement reduces the total treatment time, avoids a second-stage operation and offers immediate comfort during healing stage. Immediate loading, has some disadvantages, for example, might induce micromotion and instability of the implant.[3,4]

The surgical protocol for implant placement consists of both flap and flapless procedures. Reduced postoperative bleeding, fewer discomfort for the patient, shorter surgery time, and decreased healing time are reported advantages for the flapless procedure compared to flap surgery [5,6].

Lately, a new description of implant success criteria was proposed, according to which implant success should be detected by using composite outcome measures, including patient-reported outcome measures, peri-implant tissue health and functional and esthetic outcomes related to implant-supported reconstruction[7case-control and cohort].

An early effort to assess the esthetic aspects of dental implants was made in 1997 by Torsten Jemt who proposed a papilla index, which evaluated the size of the interproximal papilla [8].

Meanwhile, successively described assessment methods of esthetic results have been subjected to several studies aiming to test the accuracy and effectiveness of these methods. Nowadays, numerous factors in addition to the size of interproximal papilla including the color, form, and the level of peri-implant soft tissues have been included in evaluation of the esthetic outcomes [9].

The purpose of this study was to evaluate the soft tissue profile of one-piece and two-piece single loaded implant in esthetic zone

Matrial and Methods

Patients and Methods

For this randomized clinical trial, 30 patients requiring single-tooth implant in the premaxillary region are going to be recruited at the periodontology department-College of Dentistry- Hawler Medical University in Erbil city. The subjects randomly assigned to one of two groups: One-piece implant -OPI- group-A (15 patients) or Two pieces implant -TPI- group-B (15 patients). Group-A had their implants loaded immediately within 48h with temporary crown which are out of occlusion, and temporary crown replaced with permanent crown two months later, while group B had implants with early loading two months after implant placement, then follow-up period started: the first assessment done at the day of permanent crown insertion and the second assessment performed six months after loading permanent crown. Informed consent obtained from all subjects, and the use of human subjects in this project was under the approval of the Ethics committee in College of Dentistry. The study period (from patient enrollment to data collection) was between November 2018 and July 2019.

Patient selection

Subjects who lost single tooth in premaxilla at least three months of post-extraction healing were selected to participate in the study. Entry criteria includes: periodontal healthy subjects; age 18-60 years old; agreed to follow up visits for 6 months; controlled oral hygiene; absence of any lesions in the oral cavity; presence of a minimum of 1.5-2mm of vertical thickness KM at the crest of alveolar mucosa in implant zone, Adequate amount of available bone for implant placement.

Exclusion criteria: Any history of metabolic or systemic disease affecting the integration of implant or connective tissue health surrounding implant, history of head or neck radistion, smokers, pregnant or lactating women, untreated generalized periodontitis, poor oral hygiene, psychiatric disorders, acute infection (abscess) at the intended site and Under treatment or had previous treatment with bisphosphonates

Surgical procedure

Before commencing surgery, surgical site is examined clinically and radiographs were taken to get the brief idea of surrounding structures. During surgical procedure all 30 patients were prepared well-informed about flapless immediately loaded OPI and TPI protocols. Local anesthesia was induced by infiltration with lignocaine (2%) and adrenaline (1:80,000) for the both groups.

Group-(A) OPI:

- Patients were instructed to rinse preoperatively for 1min with 0.12% chlorhexidine solution, to reduce total mouth bacterial load,

- An initial pilot drill with select length were used for site preparation to give needlepoint accuracy for position, angle, and depth along with the use of copious saline irrigation. The drill should pass through the cortical bone and then the cancellous bone, and then shaping drill were used to prepare the exact bed size of the implant.

- Implant was then placed using a carrier and rotated clockwise and final implant position should carry out by using a torque rachet (torque 30-40Ncm). Primary stability was mandatary.

- The provisional acrylic resin restoration (temporary crown) was fabricated and care should be taken to

achieve a smooth contour to avoid soft tissue irritation, which was temporarily cemented out of occlusion for 2 months. The patients were instructed to avoid directly biting on the provisional restoration and to consume easily chewable food and maintain good oral hygiene. following which, permanent restoration procedures, porcelain fused to metal (PFM) crown fabricated and cemented (figure1).

Group-(B) TPI:

- Same surgical procedure was performed for TPI but it was differed in loading protocol.

- Healing cap placed for gingival growth. The patients were instructed to maintain good oral hygiene.

- Two months after healing cap was removed, permanent restoration procedures were performed using silicone impression material (open tray technique). Finally, porcelain fused to metal (PFM) crown was fabricated and cemented (figure2).

Figure1: Group-A (OPI)– (a) Pre-operative; (b)Immediate post-operative; (c)Temporary prosthesis placed; (d)Final prosthesis after 2 two months; (e)Final prosthesis after six months

Figure2: Group-A (TPI) – (a)Pre-operative; (b,c)Intera-operative; (d)healing cover placed; (e)Abutment after two months; (f) final prosthesis after two months (g)Final prosthesis after six months.

Evaluation of treatment outcome

Patients were evaluated with the following clinical parameters at baseline (BL) two month after implant placement (definitive prosthesis placement) and six months follow up (6M).

A. Width of keratinized mucosa (10)

The width of the keratinized mucosa was measured at the mid-facial aspect of each implant using Williams probe. Each measurement was made from the gingival margin to the mucogingival junction. The mucogingival junction was identified by the rolling technique, in which the mucosa was rolled until the non-movable portion of the attached keratinized tissue was identified.

B. Papilla preservative index (8)

Dental papilla evaluated clinically using a papilla preservative index PPI described by Jemt (8).

0 will be assigned when no papilla was present;

1 when less than half of the papilla present measured from the reference line to contact point;

2 when at least half of the papilla was present but not all the way up to the contact point;

3 Papilla filled up the entire proximal space and was in good harmony with adjacent papillae;

4 when the papilla was hyperplasic.

C. Plaque index (11)

The oral hygiene status was evaluated by the presence or absence of visible plaque present at soft tissue margin.

Score 0: No plaque

Score 1: Plaque recognized by running a probe across marginal surface of implant

Score 2: Plaque can be seen by naked eye

Score 3: Abundance of soft matter within the gingival pocket, gingival margin and the adjacent tooth surface.

Data management and statistical analysis

The data were recorded on a specially designed questionnaire, collected and entered in computer via Microsoft Excel worksheet (Excel 2010) and then analyzed using appropriate data system which is called Statistical Package for Social Sciences (SPSS) version 25 and the results were compared between patients with different variables, with a statistical significance level of < 0.05. The results presented as rates, ratio, frequencies, percentages in tables and figures and analyzed using T-test and Chi square tests.

Results

A total of 30 patients enrolled in this study, fifteen per each group. The surgical intervention (implantation) failed in three cases of OPI group with a success of rate 80%, while all TPI cases ended with success (success rate 100%) though this difference was not statistically significant and p-value was 0.06.

The data of Table 1 show that there were no any statistically significant differences between OPI and TPI groups in regard to PPI both mesially and distally, PI and WHK measurements at baseline and after six months of follow up. T – test was performed to compare between the average and standard deviations of both groups and p – values were more than 0.05 in all conditions as the averages were close to each other.

Table 1: Comparison between OPI and TPI regarding different measures.

Measure	Groups	N	Mean	Std. Deviation	P
PPIm, baseline	OPI	12	2.41	0.51	0.80
	TPI	15	2.46	0.51	
PPId, baseline	OPI	12	2.16	0.71	0.90
	TPI	15	2.20	0.67	
PI, baseline	OPI	12	0.84	0.03	0.26
	TPI	15	0.86	0.04	
WKM, baseline	OPI	12	5	0.97	0.31
	TPI	15	5.4	1.17	
PPIm, six months	OPI	12	2.50	0.52	0.87
	TPI	15	2.53	0.51	
PPId, six months	OPI	12	2.50	0.52	0.40
	TPI	15	2.67	0.48	
PI, six months	OPI	12	0.58	0.66	0.95
	TPI	15	0.60	0.73	
WKM, six months	OPI	12	4.83	0.83	0.28
	TPI	15	5.23	1.01	

Discusion

The current study was performed to assess the clinical soft tissue outcomes of single-tooth implants, comparing immediately loaded OPI and early loaded TPI. All TPI were successfully integrated and in function for 6 months, leading to a 100% success rate. However, three of 15 immediately loaded OPI failed to osseointegrate, yielding 80% success rate (20% failure rate) and this result is near to previous study done by Oh et al [12]. Previous studies reported a wide range of failure rates in immediately loaded single tooth implants, 0% to 19% .[5,13–15] On the other hand, other studies reported no failures in immediately loaded single-tooth implants in the anterior maxilla[16]. The differences in the failure rate between the studies might have resulted from several factors: different case selection criteria, time of functional loading (i.e., permanent crown placement) and poor bone quality. Another reason for failure in the IL group maybe due to excessive occlusal forces applied by patient.

Generally, the cause for papilla reduction after implant placement could be due to elevation of adjacent papilla during implant surgery[17]. This was minimized by using a flapless approach in our study. The interdental papilla height slightly increased after six months of implant placement for both groups, which might have resulted from tissue remodeling after surgery and reformation of biological width. This is similar to a previous randomized controlled clinical trial by Oh et al [12].

The PI were recorded using the index described by Mombelli A et al[11]. When the mean score between the groups were compared at different time points, there was no statistically significant difference. This is in accordance with other studies by Buser et al [18] and Oh et al [12] In general, the patients performed good home care and maintained good oral hygiene. Patients were informed about the subsequent consequences of plaque accumulation around implants and they were motivated to maintain oral hygiene by demonstrating oral hygiene techniques at every visit.

The WKM was measured at the mid-facial aspect of each implant using Williams probe. When the mean width of keratinized mucosa between group-A and group-B were compared at different time points, there was no statistically significant difference. This is in accordance with other studies by Oh et al [12] Buser et al [18] and Watzak et al [19] which showed results close to our findings.

The contemporary study has several limitations, including small sample size, short-term follow up, and relatively high failures in group-A. However, within the limitations of this study, it can be concluded that flapless implant surgery may provide esthetic soft tissue results in single-tooth implants either immediately loaded OPI or early loading TPI. More studies with larger sample size and long term follow up are recommended to verify the soft tissue outcomes of both groups.

Conclusion

From the results of this randomized clinical trial, we concluded that, after six months follow up there were no significant differences in implant esthetic between the immediately loaded OPI and early loaded TPI treatment protocols regarding clinical parameters like PPI, WKM and PI.

Conflict of Interest: Not

Ethical Clearance: The study was approved by the Ethics Committee of the College of Dentistry, Hawler Medical University, Kurdistan Region, Irbil - Iraq.

Source of Funding: myself

References

1. Rokn A, Bassir S, Rasouli Ghahroudi A, Kharazifard M, Manesheof R. Long-term Stability of Soft Tissue Esthetic Outcomes Following Conventional Single Implant Treatment in the Anterior Maxilla: 10-12 Year Results. Open Dent J. 2016 Nov 16;10:602–9.
2. Gallucci GO, Benic GI, Eckert SE, Papaspyridakos P, Schimmel M, Schrott A, et al. Consensus statements and clinical recommendations for implant loading protocols. Int J Oral Maxillofac Implants. 2014;29 Suppl:287–90.
3. Gapski R, Wang H-L, Mascarenhas P, Lang NP. Critical review of immediate implant loading. Clin Oral Implants Res. 2003 Oct;14(5):515–27.
4. Trisi P, Perfetti G, Baldoni E, Berardi D, Colagiovanni M, Scogna G. Implant micromotion is related to peak insertion torque and bone density. Clin Oral Implants Res. 2009 May;20(5):467–71.
5. Rocci A, Martignoni M, Gottlow J. Immediate loading in the maxilla using flapless surgery, implants placed in predetermined positions, and prefabricated provisional restorations: a retrospective 3-year clinical study. Clin Implant Dent Relat Res. 2003;5 Suppl 1:29–36.
6. Fortin T, Bosson JL, Isidori M, Blanchet E. Effect of flapless surgery on pain experienced in implant placement using an image-guided system. Int J Oral Maxillofac Implants. 2006 Apr;21(2):298–304.
7. Tonetti M, Palmer R, Working Group 2 of the VIII European Workshop on Periodontology. Clinical research in implant dentistry: study design, reporting and outcome measurements: consensus report of Working Group 2 of the VIII European Workshop on Periodontology. J Clin Periodontol. 2012 Feb;39 Suppl 12:73–80.
8. Jemt T. Regeneration of gingival papillae after single-implant treatment. Int J Periodontics Restorative Dent. 1997 Aug;17(4):326–33.
9. Belser UC, Grütter L, Vailati F, Bornstein MM, Weber H-P, Buser D. Outcome evaluation of early placed maxillary anterior single-tooth implants using objective esthetic criteria: a cross-sectional,

retrospective study in 45 patients with a 2- to 4-year follow-up using pink and white esthetic scores. J Periodontol. 2009 Jan;80(1):140–51.

10. Bouri A, Bissada N, Al-Zahrani MS, Faddoul F, Nouneh I. Width of keratinized gingiva and the health status of the supporting tissues around dental implants. Int J Oral Maxillofac Implants. 2008 Apr;23(2):323–6.
11. Mombelli A, van Oosten MA, Schurch E, Land NP. The microbiota associated with successful or failing osseointegrated titanium implants. Oral Microbiol Immunol. 1987 Dec;2(4):145–51.
12. Oh T-J, Shotwell JL, Billy EJ, Wang H-L. Effect of flapless implant surgery on soft tissue profile: a randomized controlled clinical trial. J Periodontol. 2006 May;77(5):874–82.
13. Ericsson I, Nilson H, Lindh T, Nilner K, Randow K. Immediate functional loading of Brånemark single tooth implants. An 18 months' clinical pilot follow-up study. Clin Oral Implants Res. 2000 Feb;11(1):26–33.
14. Lorenzoni M, Pertl C, Zhang K, Wimmer G, Wegscheider WA. Immediate loading of single-tooth implants in the anterior maxilla. Preliminary results after one year. Clin Oral Implants Res. 2003 Apr;14(2):180–7.
15. Andersen E, Haanaes HR, Knutsen BM. Immediate loading of single-tooth ITI implants in the anterior maxilla: a prospective 5-year pilot study. Clin Oral Implants Res. 2002 Jun;13(3):281–7.
16. Gupta DR, Luthra DR, Mehra DA. Clinical and radiographic tissue evaluation of immediately loaded one piece implants placed immediately after extraction: An In vivo study. Int J Appl Dent Sci. 2018 Apr 1;4(2):86–92.
17. Van der Zee E, Oosterveld P, Van Waas MAJ. Effect of GBR and fixture installation on gingiva and bone levels at adjacent teeth. Clin Oral Implants Res. 2004 Feb;15(1):62–5.
18. Buser D, Bornstein MM, Weber HP, Grütter L, Schmid B, Belser UC. Early implant placement with simultaneous guided bone regeneration following single-tooth extraction in the esthetic zone: a cross-sectional, retrospective study in 45 subjects with a 2- to 4-year follow-up. J Periodontol. 2008 Sep;79(9):1773–81.
19. Watzak G, Zechner W, Tangl S, Vasak C, Donath K, Watzek G. Soft tissue around three different implant types after 1.5 years of functional loading without oral hygiene. A preliminary study in baboons. Clin Oral Implants Res. 2006 May 1;17:229–36.