ISSN (O) : 2582-3271
PubMed-National Library of Medicine - ID: 101766917

International Journal of Dental Science and Clinical Research (IJDSCR)

Dr. Angel Vaidic Publication

Available Online at: http://www.ijdscr.org

Volume - 6, Issue – 1, February - 2024, Page No. : 06 – 17

A Radiographic Evaluation of Crestal Bone Levels Change Following Early Vs Delayed Implant Placement – Comparative Study

[1]Dr Anil Sharma, [2]Dr Akhilesh Sankhyayan, [3]Dr Shiva Chauhan, [4]Dr Vikas Jindal

[1]Medical Officer (Dental) Health and Family Welfare Department H.P, India

[2]Private Practitioner, Sankhyayan Dental Care and Implant Centre, Shimla, India

[3]Reader, Department of Periodontics, Himachal Dental College, Sundernagar, India

[4]HOD, Department of Periodontics, Himachal Dental College, Sundernagar, India

Citation of this Article: Dr. Anil Sharma, Dr. Akhilesh Sankhyayan, Dr. Shiva Chauhan, Dr. Vikas Jindal, "A Radiographic Evaluation of Crestal Bone Levels Change Following Early Vs Delayed Implant Placement – Comparative Study.'' IJDSCR – February – 2024, Vol. – 6, Issue - 1, Page No. 06-17.

Corresponding Author: Dr. Akhilesh Sankhyayan, Private Practitioner, Sankhyayan Dental Care and Implant Centre, Shimla, India

Type of Publication: Original Research Article

Conflicts of Interest: Nil

ABSTRACT

Aim

To radiographically evaluate the crestal bone level changes around Osseo-integrated implants placed using early and delayed implant placement protocol.

Materials and Methods

A prospective randomized comparative study was done in total of thirty edentulous sites in patients with age group of 18 to 65 years, comprising of both male and female were randomly allocated in two groups,15 edentulous sites using early implant placement protocol(test group) and 15 edentulous sites using delayed implant placement protocol(control group) for the present study.

Results

Observed results showed less crestal bone loss in early implant placement protocol as compared to delayed implant placement protocol.

Conclusion

This study conclude that early implant placement protocol (test group) may offer advantages in terms of both soft and hard tissues changes, when compared with the delayed implant placement protocol (control group).

Keywords

Osseo-integrated implants, Early implants, Crestal bone loss.

INTRODUCTION

During the course of life tooth loss reflects the ultimate outcome of the oral disease. A number of prosthetic techniques are available over time for the rehabilitation of partial or complete loss of tooth/teeth. In order to overcome the problems like eating difficulties, psychological problems and problems related to aesthetics, retention and stability of prosthesis etc. associated with conventional prosthetic treatment, the dental implants came into existence.[1]This revolutionary breakthrough was first evolved from the research efforts of the Swedish orthopaedic surgeon P.L. Branemark in late 1960s.[2]To achieve long term success, rigid fixation of the implants within the host bone site is required. Branemark et al (1997)[3] termed the bone bonding ability of implant as "Osseo-integration". Original protocol in implant dentistry advocated a non-loaded healing period for implants of 3 to 6 months as a prerequisite for osseointegration. In this context, both the time of implant placement and the initiation of function play a significant role. At a recent consensus workshop (Chen et al. 2004[4] ; Hammerle et al. 2004) , three different protocols were defined: (i) immediate or type 1 when the implant are placed in the same surgical intervention as the dental extraction; (ii) type 2 or early implant placement when implants are placed in the early stages of healing (from 4 to 8 weeks); and (iii) type 3 or delayed implant placement when implants are placed when the ridge has healed (from 3 to 6 months).

Delayed implant placement i.e. type-3 implant placement (gold standard).This technique requires several months of waiting period before implant placement. Studies have also demonstrated that approximately 45% of the residual alveolar ridge may be resorbed after tooth extraction, with the majority of resorption occurring during the first 6 months after extraction.[5]To overcome these potential drawbacks, different alternative approaches have been proposed, such as immediate implant placement (i.e. type-1).

Immediate implant was first introduced in 1976[6] and this method involves the implant placement immediately after the tooth extraction and now it has become successful, predictable and alternative treatment modality.[7]Immediate implant have several advantages such as reduced treatment time, preserve the integrity of the extraction socket, less crestal bone loss when compared to conventional protocol; along with increased patient satisfaction and treatment acceptance[8] .This approach helps to preserve alveolar bone dimension, allowing placement of longer and wider implants and improving the crown-implant ratio. As a result, the bone- implant contact(BIC) surface area increases, which could decrease the amount of stress due to occlusal load at bone-implant surface and allow better stability and success. There are certain disadvantages that could jeopardize the success of immediate implant procedures, such as lack of soft tissue closure over the extraction site[9,10]varying dimensions of implant and empty alveolus, a partially or totally missing bony housing, and peri apical and/or periodontal infection.[11,12]

To overcome some of these potential risks, the early implant placement protocol (type2) has been proposed by Zitzmann et al. in 1999, as it may share some of the advantages of immediate placement, mainly by utilizing the socket walls before they become fully resorbed, but at the same time allowing primary healing after tooth extraction and thus achieving enough soft tissues in case of need for flap closure.[13]

It has been suggested that the soft tissue healing

allows for the resolution of local pathology and provides enhanced soft tissue volume,[14]this reduces the risks for infection during implant placement. These all facts were later confirmed by Nemcovsky and Artzi 2002.[15]

However, there are no definitive studies available in this regard. Therefore, the present study was undertaken to compare the level of crestal bone loss around theosseointegrated implants with the type 2(early) and delayed implant placement techniques.

AIM AND OBJECTIVE

The present study was done to radiographicallly evaluate the crestal bone levels changes around Osseo-integrated implants placed using early and delayed implant placement techniques.

MATERIALS AND METHODS

A prospective randomized comparative study was done in total of thirty edentulous sites in patients with age group of 18 to 65 years, comprising both male and female patients visited the Out-patient Department of Periodontics, Himachal Dental College, Sundernagar, Distt. Mandi, H.P were randomly selected for the present study. The approval for this study had been obtained from the institutional ethical committee. Each patient was explained about the details of the risk and benefits of participation in this study. Those who agreed voluntarily were signed a consent form prior to their inclusion in the study. Only those patients were included in the study that satisfied the following inclusion and exclusion criteria.

Inclusion Criteria

Patients within the age group of 18 to 65 years willing to comply with all the study requirements. Absence of any relevant systemic diseases. Full mouth plaque scores of less than 30%. Full mouth bleeding scores of less than 30 %.Patients requiring extractions in case of residual and fracture root(s); carious tooth, periodontally healthy tooth without any periapical or periodontal abscess (of 4-8 weeks).when healing of soft tissues completed but residual alveolar ridge still in regenerative phase(early implant case).Healed extraction sockets (of >3months) and residual alveolar ridge. (Delayed implant case).

Exclusion Criteria

Poor oral hygiene. Any systemic diseases. Poor patient compliance. Trauma affecting the alveolar bone at the implant site . Drug or alcohol abuse, smokers. Acute periapical pathology. Pathologic changes at the recipient site. Irradiation in the implant area. Pregnant women and lactating mothers.

Radiographic Armamentarium

1. X-ray unit with paralleling cone device.
2. X-ray film holder.
3. Intra-oral Peri-apical Radiographs (IOPAR) X-ray films with grids and orthopantomogram (OPG).
4. Radio visual graph (R.V.G.) with grid.

PRE-SURGICAL THERAPY

Patients who satisfied the inclusion criteria were randomly allocated to:

- In Group I (15 edentulous sites) (Control group) :- Delayed implant placement i.e.3-6 months after extraction).
- In Group II (15 edentulous sites)(Test group) :- Early implant placement i.e.4-8 weeks after extraction)

Each case was evaluated through examination of diagnostic casts for intra-arch relationship, panoramic and periapical radiographs to evaluate the anatomic conditions were taken. All patients were subjected to proper oral hygiene instructions, full mouth scaling

and root planing was done before the surgical procedure.

SURGICAL PROCEDURE

In both groups following administration of local anaesthesia, a mid-crestal incision on the edentulous area with sulcular/relieving incision on the adjacent teeth was extended using blade followed by vertical releasing incisions to spare the adjacent papillae at faciomesial/faciodistal line .The site was surgically exposed by raising mucoperiosteal flap on both lingual and buccal aspects of alveolar ridge. A series of drills were used to prepare the implant osteotomy sites precisely and incrementally for an implant. A guide pin was placed in osteotomy site to confirm position and angulation. The implant was placed into the prepared site with optimal torque until resistance was met and seated into final position. Following implant insertion an appropriate healing cap was inserted. The procedure was completed by repositioning and suturing the surgical flap with interrupted 4-0 nylon sutures.

II – EARLY IMPLANT

Fig 23: Intraoperative photograph W.R.T 21

Fig 24: Intraoperative photograph after flap reflection

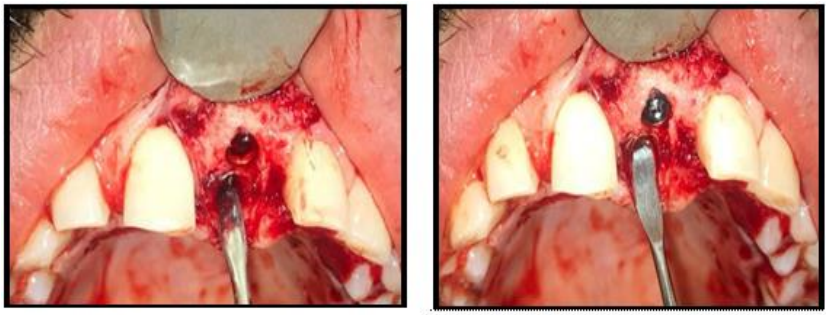


Fig- 25: Intraoperative photograph showing ostectomy done

Fig-26: Intraoperative photograph showing implant placement.

Fig-27: Intraoperative photograph

Fig 28: Photograph showing healing

Fig-29: Photograph showing open tray transfer at the implant site

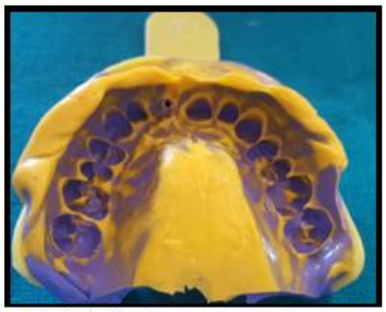


Fig-30: Photograph showing open tray impression

Fig 31: Photograph showing abutment placed at the implant site

Fig 32: Post-operative photograph showing implant with final restoration

GROUP II- RADIOGRAPHS

Fig-33: Pre-operative OPG

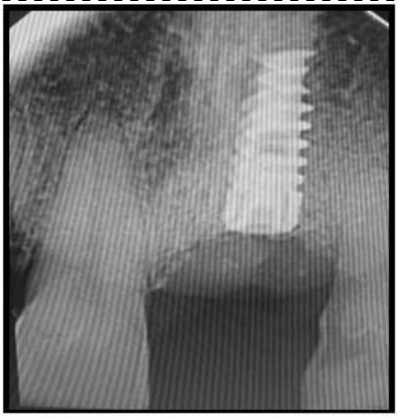


Fig-34: Pre-operative IOPAR **Fig-35: Post-operative IOPAR**

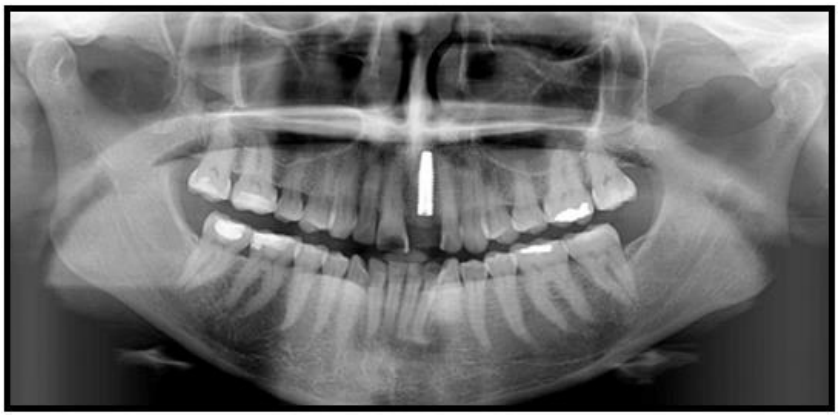


Fig-36: Post-operative OPG

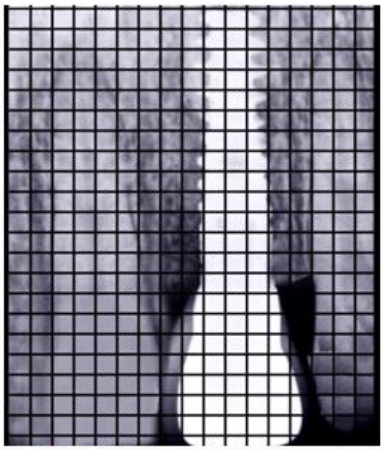


Fig-37: RVG showing crestal bone level (mesial & distal) at baseline

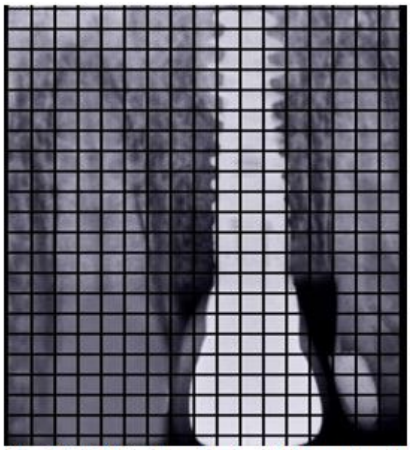


Fig-38: RVG showing crestal bone level (mesial & distal) at 3months

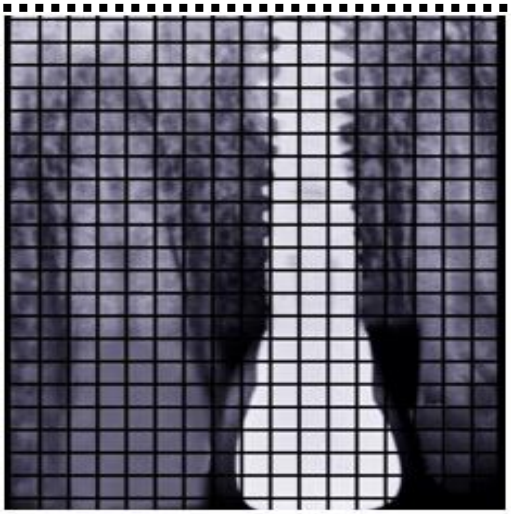


Fig 39: RVG Showing Crestal Bone Level (mesial & distal) at 6 months

POSTOPERATIVE INSTRUCTIONS

- Patients were prescribed Amoxicillin and Clavulanic acid (625mg) and Ibuprofen (400mg) thrice daily for 5 days, cold and soft diet for first few days and advised 0.2% Chlorhexidinedigluconate mouth rinse for 1 minute three times daily for 14 days .

The patients in both groups were recalled after 7-10 days for removal of the sutures. After 3 months post operatively second stage surgery was done to uncover the placed implant by using mid-crestal incision technique. Then the gingival former was placed for proper shape of the gingival soft tissue around the implant for two weeks. Prosthesis was placed in both groups after two weeks of gingival former placement.

Radiographic bone level changes were assessed in both groups at Baseline (1 month, after placement of prosthesis), 3rd and 6th month post-operatively.

RADIOGRAPHIC EVALUATION

Standardized intraoral peri-apical radiograph were obtained for each implant site at baseline, 3rd and 6th month after placement of the implant. The X-ray unit with long cone paralleling device was used. The level of bone was measured on the mesial and distal aspect of each implant. The reference point was taken from implant shoulder to the crest of interproximal alveolar bone. To assess the changes in bone height, the distance between the implant shoulder and the first visible bone-implant contact (DIB) was determined by measuring the squares on radiograph and expressed in millimetres.

Healing had progressed and final prosthetic stage was initiated. Final impression were made directly on the abutment, and the definitive porcelain-fused- to metal (PFM) splinted restorations were delivered.

The data so collected was analysed for each implant site at baseline, 3rd month and 6thmonth and thereafter subjected to statistical analysis for discussion and conclusion.

RESULTS

Intergroup analysis showed a statistically non-significant difference in mean values of Mesial CBL in both Group I and Group II at **baseline** (p value 0.240), **3 months** (p value 1.000) **and** the analysis of **6 months** is statically significant(p value 0.006), at

different time periods as shown in **Table 1**and **Graph 1** and of Distal CBL in both Group I and Group II at **baseline** (p value 0.924), **3 months** (p value 0.073) **and** the analysis of **6 months** is statically significant(p value 0.008), at different time periods as shown in **Table 2** and **Graph 2**.

- **RADIOGRAPHIC ASSESSMENT**
- **Crestal Bone Loss (Mesial)**

Table 1: Comparison of Mesial crestal bone loss between test and control group

	Group				Comparison done using Mann-Whitney U Test		
	Control		Test				
	Mean	SD	Mean	SD	Z-value	P-value	Sig.
Baseline	0.52	0.07	0.49	0.08	-1.176	0.240	NS
3 Months	0.60	0.08	0.60	0.05	0.000	1.000	NS
6 Months	0.71	0.05	0.65	0.05	-2.773	0.006	S

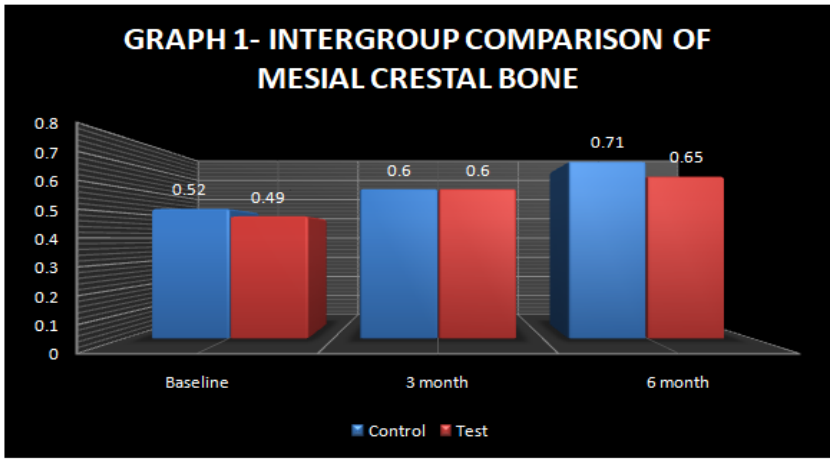
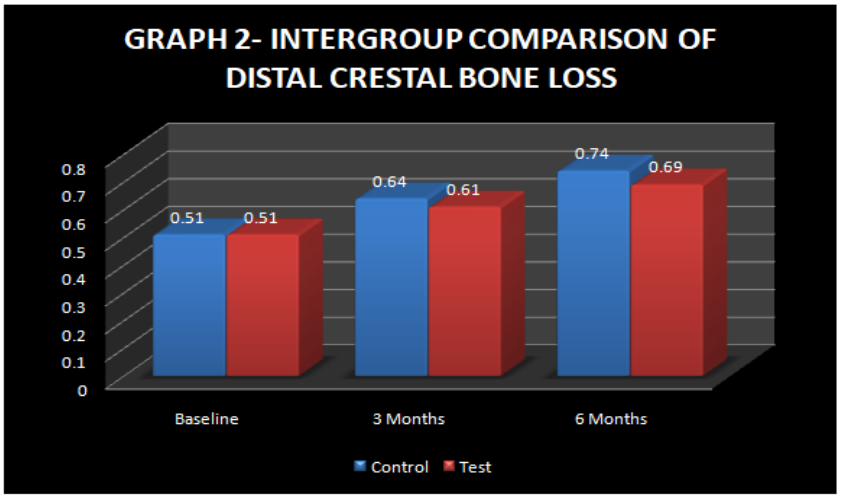


Table 2: Intergroup Comparison of Distal crestal bone loss between test and control group

S. No.	Group				Comparison done using Mann-Whitney U Test		
	Control		Test				
	Mean	SD	Mean	SD	Z-value	P-value	Sig.
Baseline	0.51	0.07	0.51	0.05	-0.095	0.924	NS
3 Months	0.64	0.05	0.61	0.05	-1.791	0.073	NS
6 Months	0.74	0.05	0.69	0.05	-2.659	0.008	S



DISCUSSION

Implant dentistry has improved dramatically in the last 20 years providing clinicians with the new opportunities for dental rehabilitation that were previously considered impossible.

CRESTAL BONE LOSS (MESIAL & DISTAL)

Radiographic interpretation of alveolar bone loss has been proven to be one of the most valuable means to elucidate implant success as stated by **Dehlin C, et al. 1988.** [16]The mean crestal bone loss in both the groups, on both mesial and distal sides, increased from baseline to 6 months at different time periods.

On Intergroup comparison of mean difference of crestal bone loss in different time intervals from baseline to 3 months, baseline to 6 months and 3 months to 6 months, were statistically significant **.**The results were similar with the study done by **Esposito M 2009,**[17] who stated that peri-implant bone loss is more accentuated in the first 6months after surgery**. Albrektson T, et al. 1986,**[18]**Smith DE 1989,**[19] **Warren, et al. 2002,**[20]reported that crestal bone loss between 1.0 and 1.5 mm may occur after second stage implant surgery and after prosthesis loading. **Yaffe A, et al. 1994.**[21]**Cardaropoli G (2003)**,[22]suggested that the bulk of bone resorption, following implant surgery, occurs within the first few months, or even weeks, post implantation. This may be due to bone remodelling, which is very active after 8 weeks of healing and presents a diverse degree of bone maturation **Lopes CDC 2002.**[23]According to **Robert EW1987,**[24] there is increased bone loss after second stage surgery then 1 year later after prosthetic loading. The variety of factors stated by **Misch CE 2008,**[25]which causes crestal bone loss like reflection of the Periosteum during surgery, preparation of the implant osteotomy, bacterial invasion etc. This loss of crestal bone during the first year after placement of the implant could also be attributed to the process of wound healing at the bone-implant interface **RV Sunitha 2008.**[26] Bone loss from 0.5 mm to as high as 2 mm within first year of implant placement done by **Ellegard 1997,**[27] **Fourmosis1999.**

Various studies done by **Buser, Chappuis, Bornstein et al., 2013,**[28]**Arora & Ivanovski, 2018,** showed that during the placement of early implants, facial bone tended to show a peak of resorption between the extraction and the implant placement

which was usually compensated by the regeneration procedures .Study conducted by **Gotfredsen 2012,**[29] showed that the total amount of distal and mesial resorption appeared limited (<1 mm) in case of type 2,in comparison to Type 1(immediate) and Type 4 (delayed),bone appeared more resorbed 1 year after loading in Type 3 (late early) implants;however, no differences were noted 10 years after loading **Schropp et al., 2014**.[30]

On intergroup comparison of crestal bone loss in both Group I and II, showed non significant results at baseline and 3 months and significant results at 6 months, in both mesial and distal sides as shown in Table 10 and 12 and Graph 10 and 12. These results were in accordance with the study done by Burak Beckcioglu et al. 2012,[31]Schropp et al. 2014, 2015, Derks et al.[32]

CONCLUSION

Within limitations of this study, it can be concluded that there was significantly less crestal bone loss in **Group II** (Early implant) placement at both mesial and distal surface during 3rd to 6th month's observation period. Also a slight bone resorption was observed over the time in the both groups, but crestal bone loss is less in case of early implant placement due to adequate width of keratinized gingiva with thick phenotype. This study showed that early implant placement protocol (test group) may offer advantages in terms of both soft and hard tissues changes, when compared with the delayed implant placement protocol (control group). In spite of almost similar results reported for early and delayed placement, it is very important to understand the risk factors related to each procedure, to have careful case selection and to closely follow the surgical and prosthetic protocols. Due to small sample size and short duration of follow up in the study long term survival of two piece implants in both the groups cannot be determined so further studies are required to be done.

REFERENCES

1. Pal US, Dhiman NK, Singh RK, Mohammad S, Malkunje LR. Evaluation of mplants placed immediately or delayed into the extraction sites. *Natl J Maxillofac Surg. 2011; 2(1):54-62.*
2. Turkyilmaz I. Implant Dentistry – A Rapidly Evolving Practice [internet]. *Europe; 2011. Chapter 3,* Osseointegration and Bioscience of Implant surfaces – current Concepts at Bone-Implant Interface.
3. Branemark PI, Hansson BO and Adell R. Osseointegration implants in the treatment of the edentulous jaw. Experience from a 10-year period. *Scand J PlastReconstr Surg. 1977;16:1-13.*
4. Hammerle CH, Chen ST, Wilson TG Jr. Consensus statements and recommended clinical procedures regarding the placement of implants in extraction sockets. *Int J Oral Maxillofac Implants. 2004; 19(Suppl.): 26–8.*
5. UgoCavani, Roberto Crespi, Roberto Cornelini, Antonio Barora. Immediate implants supporting single crown restoration: A 4-year prospective study. *J periodontol. 2004;75(7-12):982-8.*
6. Schulte W, Heimke G. The Tubinger immediate implant. *Quintessenz.1976; 27: 17–23.*
7. Block MS, Kent JN. Placement of endosseous implants into tooth extraction sites. *J Oral Maxillofac Surg.1991;49: 1269–76.*
8. Becker W, Clockle C, Sennerby L, Urist MR, Becker BE. Histologic findings after implantation and evaluation of different grafting materials and titanium micro-screw into fresh extraction

sockets. Case reports. *J Periodontol.1998;69:743-50.*

9. Paolantonio M, Dolci M, Scarano A, d'Archivio D, di Placido G, Termini V et al. Immediate implantation in fresh extraction sockets. A controlled clinical and histological study in man. *J Periodontol.2001;72:1560–71.*
10. Rosenquist B, Grenthe B. Immediate placement of implants into extraction sockets: Implant survival. *Int J Oral Maxillofac Implants.1996;11:205–9.*
11. Gelb DA. Immediate implant surgery: Three-year retrospective evaluation of 50 consecutive cases. *Int J Oral Maxillofac Implants.1993;8:388–99.*
12. Ibbott CG, Kovach RJ, Carlsson-Mann LD. Acute periodontal abscess associated with an immediate implant site in the maintenance phase: A case report. *Int J Oral Maxillofac Implants.1993;8:699–702.*
13. Hammerle CH, Chen ST. Consensus statements and recommended clinical procedures regarding the placement of implants in extraction sockets. *Int J Oral Maxillofac Implants*. 2004;19(Suppl):26–8.
14. Nemcovsky CE, Artzi Z, Moses O, Gelernter I. Healing of marginal defects at implants placed in fresh extraction sockets or after 4–6weeks of healing *Clin. Oral Impl. Res, 13, 2002; 410–9.*
15. Evans CD, Chen ST.Esthetic outcomes of immediate implant placements. *Clin Oral Implants Res.* 2008;19:73–80.
16. Cardaropoli G, Arau´jo M, Lindhe J. Dynamics of bone tissue formation in tooth extraction sites. An experimental study in dogs. *J ClinPeriodontol 2003; 30, 809–18.*
17. Esposito M, Grusovin MG, Chew YS, Coulthard P, Worthington HV. One-stage versus two-stage implant placement. A Cochrane systematic review of randomised controlled clinical trials. *Eur J Oral implantol. 2009;2:91-9.*
18. Smith DE, Zarb GA. Criteria for success of osseointegrated end osseous implants. *J Prosthet Dent.1989;62:567-72.*
19. Warren P. et al. A retrospective radiographic analysis of bone loss following placement of TiO_2 – grit blasted implants in the maxilla and mandible. *Int J Oral Implant Res.2008;19:1141-7.*
20. Yaffe A, Fine N, BindermanI. Regional accelerated phenomenon in the mandible following mucoperiosteal flap surgery. *J Periodontol. 1994 Jan;65(1):79-83.*
21. Cardaropoli G, Araujo M, Lindhe J. Dynamics of bone tissue formation in tooth extraction sites. An experimental study in dogs. *JClin Periodontol.2003;30:809-18.*
22. Claudia de Carvalho Lopes. Bone remodeling analysis of various dental implant surfaces using polyfluorochrome sequential labeling in rabbit tibias. *Annals of Anatomy.2004;186(4):289-384.*
23. Robert EW, et al. Interface histology of rigid endosseous implants. *J Oral Implantol.1986;12(3):406-16 Implantol. 1986;12 (3): 406-16*
24. Misch CE. Posterior single-tooth replacement: Surgical guidelines. In: Contemporary Implant Dentistry. 3rd ed., Ch. 30 .St. Louis, Missouri*; Elsevier Inc.; 2008. p. 668-83.*
25. Sunitha RV, Ramakrishnan T, Kumar S, Emmadi P. Soft tissue preservation and crestal bone loss around single tooth implants. *J Oral Implantol. 2008;34:223-9.*

26. B. Ellegaard, V. Baelum. Implant therapy in periodontally compromised patients. *Clin Oral Implants Res.1997;8(3):180-88.*
27. Fourmosis L, Bragger U. Radiographic interpretation of peri-implant structures. In: Lang NP, Karring T, Lindhe J (eds). *Proceedings of the 3rdEuropean Workshop on Periodontology. Chicago: Quintessence.1999: 228–36.*
28. Buser D, Chappuis V, Bornstein MM, Wittneben JG, Frei M, Belser UC. Long-term stability of contour augmentation with early implant placement following single tooth extraction in the esthetic zone: a prospective, cross-sectional study in 41 patients with a 5- to 9-yearfollow-up. *J Periodontol. 2013;84:1517–27.*
29. Gotfredsen K. A 5-year prospective study of single-tooth replacements supported by the Astra Tech® implant: a pilot study. *ClinImplant Dent Relat Res. 2004;6:1–8.*
30. Schropp L, Wenzel A, Stavropoulos A. Early, delayed, or late single implant placement: 10-year results from a randomized controlled clinical trial. *Clin Oral Implants Res. 2014; 25:1359–65.*
31. BurakBekcioglu, DurduKarasoy, Murat Cehreli et al. Two-Year Follow-up of Early and Conventionally-Placed Two-Stage Implants Supporting Fixed Prosthesis November 2012, *TheInt.J. oral & maxillofac implants 27(6):1554-9.*
32. Derks J, Hakansson J, Wennstrom JL, Tomasi C, Larsson M, Berglundh T. Effectiveness of implant therapy analyzed in a Swedish population: early and late implant loss. *J Dent Res.2015;94:44–51.s*