

IMMEDIATE PLACEMENT AND IMMEDIATE LOADING OF DENTAL IMPLANT IN MANDIBULAR POSTERIOR REGION THROUGH PRECISE IMPLANT SIZE PARAMETERS SELECTION: A CASE REPORT

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Abstract

Differences in anatomy and biomechanics make treatment of posterior quadrants with dental implants substantially different to that of anterior areas. Moreover, when an implant is placed after extraction with a time gap it becomes complicated due to bone resorption with buccal and lingual cortical plate collapsing over time. Placing implant immediately into a fresh extraction socket reduces the treatment time, cost, preserves cortical bone and increases the comfort of the patient. But this success can be achieved only when the exact size, design and length of an implant with strict surgical protocol is used to place in fresh extraction site. This article describes a guideline to follow for immediate implant placement and loading in fresh extraction socket in the posterior region. A complete review with clinical and radiographic illustrations has been presented here to follow starting from choosing the right implant to giving final restoration.

Keywords: Primary implant stability, Posterior Fresh extraction socket, Resonance frequency analysis

Introduction

In the last two decades, oral rehabilitation with implants has been widely accepted by dentists and patients because of its reliable functional and aesthetic results. So far, dental implant has turned out to be a great success in long-term clinical applications with a survival rate of over 90%.¹ However, in the posterior areas primary stability is difficult to achieve leading to poor survival rate of implants.² The primary stability is the initial engagement between the bone and implant and one has to ensure that it is strong and paramount. If the primary stability is good, the implant can be loaded immediately.^{3,4}

The success of dental implants in posterior fresh extraction sockets is based upon many factors including implant design, implant surface texture, implant length, surgical procedures and many more.⁵ Among the implant designs, diameter and length directly influence the primary stability, placement and removal torque values of dental implant.⁵ Horiuchi suggested that implants should be at least 10 mm long to ensure a high success rate.⁶ Chiapasco proposed that it would be better to use implants more than 14 mm in length and more than 4 mm in diameter.⁷ However, it is a well-established fact that more the implant engages the bone, greater is the initial stability which is the primary requirement for implant success.^{7,8}

This article presents a complete guideline from placing an implant to loading it immediately in a fresh posterior extraction socket. The method to select the implant size and design using radiographic and cephalometric means has been elaborated in this case report.

Case report

A 50-year-old male patient presented with a chief complaint of grossly decayed teeth in posterior region of maxilla and mandible. Patient was subjected to intra and extra oral examination along with careful review of the

medical and dental history. Clinical and radiographic examinations revealed root stumps with respect to 14,16,24,47 with unfavourable prognosis. [Figure 1]

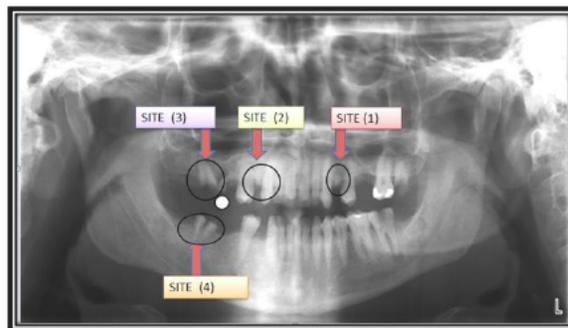


Figure 1: - Pre-operative OPG showing poor prognosis of posterior teeth.

The patient was given a detailed explanation concerning the present state, alternative treatment plans and the proposed procedure which included immediate implant placement and early loading. The patient showed keen interest for earliest possible restoration of his teeth and he opted for immediate implant placement in fresh extraction site and immediate restoration.

Methodology

Pre-treatment Calculations

Step 1) Determination of Actual Root Length: The size of roots in an IOPA radiograph does not simulate with actual root length, as some amount of magnification is always present. In order to calculate the actual root length, it was required to calculate amount of magnification in the radiograph using the given formula:

$$\frac{\text{Size of Ball Bearing in IOPA}}{\text{Actual size of Ball Bearing}} = \frac{\text{Size of Root Length in IOPA}}{\text{Actual size of Root Length}}$$

A measured size of ball bearing embedded in wax was placed over the tooth to be replaced and IOPA was done. [Figure 2]

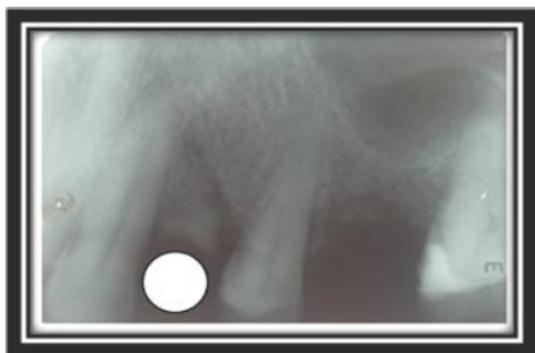


Figure 2: - IOPA of 24 with pressured sized ball bearing.

With known 3 variables out of 4, the actual root length can be calculated. For example: In case of tooth no- 24

It is: -

$$\frac{5.1}{5} = \frac{5}{x}$$

Where x= (actual root length); x= 4.90, therefore actual root length is 4.90.

Step -2 Calculation of Final Implant Length:

Final size of the implant depends upon amount of periapical bone present apical to root apex. Therefore, to calculate the final implant length following formula can be used.

Root Length + Length of Periapical Bone available = Final Implant length

Therefore,

$$\begin{aligned} \text{Final implant length} &= \text{Actual root length} + \text{Periapical bone available beyond apex.} \\ &= 4.90 + 10\text{mm} \\ &= 14.90 \end{aligned}$$

(Safety margin = 5mm due to maxillary sinus). Thus, size =8mm or 10mm of implant length.

Step-3 Assessment of bone to tooth contact: Tentative bone-implant contact with the socket wall using tentative implant size was done. The IOPA's of concerned tooth were traced on cephalometric sheets along with adjacent limiting structures seen in the radiograph. [Figure 3]

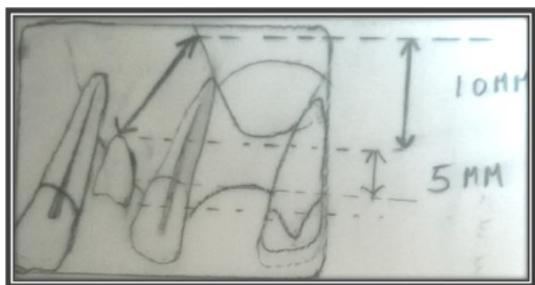


Figure 3: - Tracings of IOPA on cephalometric sheets

Step-4 Implant Image Tracings: True to their size images of implants were drawn on graph paper, with dimensions similar to exact dimensions of implant size. [Figure 4]

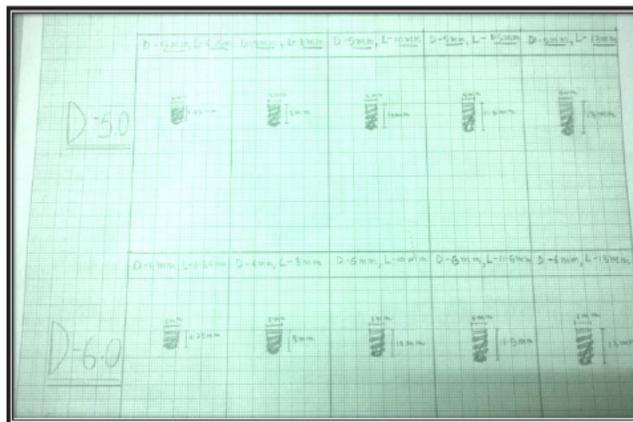


Figure 4: - Two-Dimensional Implant Images of Exact Implant Size.

Therefore, cephalometric tracings of IOPA's were superimposed on true implant size images of implant body so that best fit with maximum bone implant contact can be achieved [Figure 5]

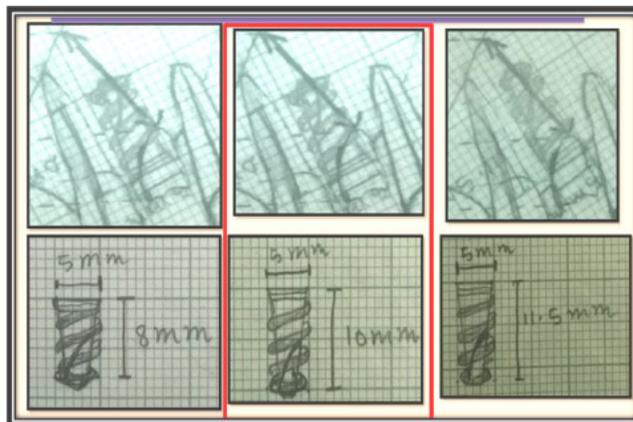


Figure 5: - Tracings of IOPA Superimposed on Different Implant Sizes.

Step-5 Assessment of Implant diameter: In posteriors tooth region, sizes of individual root are usually narrower mesio-distally as compared to bucco-lingual dimensions. Therefore, in order to achieve primary stability, it is required to have snug fitting of implants within 2 walls out of 4 walls during implant placement. Therefore, implant diameter was selected using mesio-distal dimensions of extraction socket. [Figure 6]

Tooth no	Estimated implant size	Actual implant size
24	5 x 8 mm	5 x 8 mm
16	6 x 6.25mm	6.25 mm
14	5 x 10mm	5 x 10 mm
47	6 x 13mm	6 x 13 mm

Table 1: Tentative implant size selection.

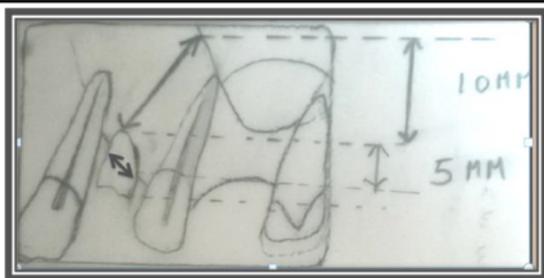


Figure 6: - Assessment of Implant Diameter Mesio-Distally.

Procedure

Pre-Surgical protocol:

The patient was instructed to use 0.2% chlorhexidine gluconate for the chemical control of plaque to commence one day before implant surgery and to continue for 15 days, postoperatively. Constant reinforced on oral hygiene was done till satisfactory level were achieved. Antibiotic prophylaxis involved daily administration of 2 grams of amoxicillin and clavulanic acid beginning 1 hours before surgery and for 6 days thereafter.

Surgical protocol:

Surgical procedure started with the extraction of teeth with poor prognosis, in an atraumatic way to preserve labial, lingual cortical plates and inter-radicular bone in multi rooted tooth. After thorough debridement of socket, hydrogen peroxide and normal saline in alternate fashion were used to remove granulation tissue attached to wall of extraction socket. A cotton plug dipped in chlorhexidine gluconate was placed inside the socket for 5-10 minutes.

In molars extraction sites with widest roots were further prepared peri-apically using implant drills in sequential manner gradually till desired length is achieved so as to achieve primary stability. ADIN Implants were placed into extraction sockets along with abutment and the remaining space between implant and socket walls were filled using alloplastic graft material (hydroxyapatite crystals) followed with soft tissues approximation using silk suture.

Impressions were made using rubber base impression material and restored with provisional restoration.



Figure 7: - ISQ Reading Immediately after Implant Placement

Immediately following implant placement, resonance frequency analysis measurements with an Osstell instrument (Integration Diagnostics AB, Goteborg, Sweden) were done and ISQ values were obtained for each implant. [Figure 7]

Fabrication of the Provisional Restoration in immediately loaded Implant: After abutment placement, implants were restored with provisional restoration within 72 hours of surgery. The provisional restoration was adjusted 2mm out of occlusion before polishing procedures. [Figure 8]



Figure 8: - Immediate loading with non-functional provisional restoration.

After 3 to 4 months, the provisional restoration was replaced by a permanent restoration. [Figure 9 and 10]



Figure 9: - Pre-operative View before Crown Cementation.



Figure 10: - Post-operative View with Permanent Restoration Cementation.

Post-Operative Care & Post-Surgical Instructions:

After completing surgery antibiotics, antimicrobial, and analgesics were advised for six days. Patient was advised to have soft diet and not to put any kind of excessive load on the provisional prosthesis. Brushing was advised in routine manner with the area of surgery to be brushed softly, till wound heals. Patient was instructed to rinse gently with a 0.2% chlorhexidine mouth rinse two times a day. Patient was advised to report back immediately, if any loosening of the provisional restoration is observed.

Follow-up: The patient was recalled for clinical and radiographic evaluation during 1st, 3rd and 6th months post-operatively. [Figure 11,12,13]



Figure 11: - Post Treatment View of Maxilla and Mandible



Figure 12: - IOPA after 3 months Immediate loading

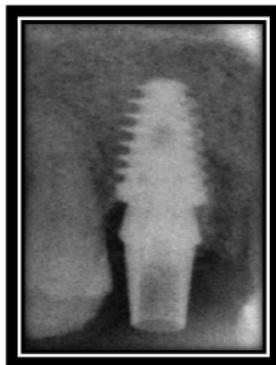


Figure 13: - IOPA with respect to tooth no. 24 after 6 month.

Even the ISQ values for loaded implants were measured at 3rd and 6th month. [Figure 14]



Figure 14: - Post-operative ISQ reading after 3 month and 6 months respectively

Discussion

Literature showed that Implants placed in posterior sites were successfully Osseo integrated without any sign of mobility, pain or inflammation. Prosper compared clinical and radiographic difference between immediate loading and delayed loading of implants following immediate extraction where he reported a survival rate of 96.67% after 5 years.^{8,9} Penarocha compared wide diameter implants placed in mature bone versus implants placed in post extraction bone.¹⁰ He concluded that wide-diameter implants placed in recent molar extraction sites has been provided results similar to the placement of implants in healed mature bone after 12 months.¹⁰

Cafiero placed immediate implants with an endosseous diameter of 4.8 mm into fresh molar sockets where all the implants healed uneventfully, yielding a survival rate of 100% and healthy soft tissue conditions after 12 months.¹¹

By following strict surgical protocols, considering all factors to protect implant from being at potential risk of micromovement early within the healing phase resulting into no implant failure afterwards. The Probable reasons for success during this study were as follows –

Periapical Anchorage: Due to the difference in the anatomy of natural roots and the much-rounded Implants, there is always a misfit in implant & extraction socket. The coronal third of socket shows discrepancy between implant size and socket wall, whereas implants attains good bone-implant- contact in middle & apical third. Moreover, the root apex is always 3-6 mm short of next anatomical structure in periapical region, therefore to increase primary stability it is beneficial to go beyond root apex. Osteotomy drills were used in apical end of the extraction socket to further increase osteotomy site to provide initial primary stability to implant. In coronal third there was presence of jumping distance, which was managed by condensing alloplastic graft material and thus compensating the loss of primary stability in this region.^{13,14,15}

Percentage of Bone Implant Contact in Fresh Extraction Socket: Placing implant in extraction socket, gives a larger bone volume and allow to put wider & longer implant than otherwise.¹⁰ The wider-diameter implants bear better occlusal loading in molar areas, allowing for higher mechanical stability, as compared to standard 3.75-mm-diameter implants.^{10,13}

Debridement & Disinfection of Extraction Socket: Mechanical cleaning of socket wall was done using surgical curettes in decreasing order, so to reach narrowest apical portion. Followed by disinfection with hydrogen peroxide and normal saline to remove granulation tissue and chlorhexidine gluconate cotton plug was placed inside the socket for 5-10 minutes.

Role of Lamina Dura of Extracted Tooth: Implant placed in extraction socket gets greater cortical anchorage from lamina Dura as compared to anchorage received from cancellous bone in case of healed socket.¹⁵

Implant Design (tapered shaped): As bone available maximum in middle & apical 3rd in extraction socket, the implant design should be with deeper and sharper threads (active design) especially in apical 3rd region. ADIN implant presents an active implant design to keep implant well anchored during the remodeling phase.

Size and length of implant used: There is a fact that every 1mm increase in implant diameter, provides 30 % increase in surface area and every 1 mm increase in length provides 10% increase in surface area. Therefore, with increase in surface area, there is increase in bone implant contact & hence better implant stability.¹⁵

Conclusion

This case report demonstrates that it is possible to place implant with immediate loading in posterior extraction socket with great success. The use of a provisional restoration with an ideal crown form facilitates the formation of natural contour of the peri-implant mucosa. We were able to enhance service and treatment offered to our patients in regard to our treatment time, less surgical trauma, patient comfort and aesthetics. Although this procedure allows maintenance of soft and hard tissue but careful patient selection and treatment planning remains significant.

References

- Ataullah K, Chee LF, Peng LL, Tho CY, Wei WC, Baig MR. Implant placement in extraction sockets: A short review of the literature and presentation of a series of three cases. *J Oral Implantol* 2008;34(2):97–106.
- Schropp L, Kostopoulos L, Wenzel A. Bone healing following immediate versus delayed placement of titanium implants into extraction sockets: A prospective clinical study. *Int J Oral Maxillofac Implants* 2003;18(2):189–99.
- Quirynen M, Van Assche N, Botticelli D, Berglundh T. How does the timing of implant placement to extraction affect outcome? *Int J Oral Maxillofac Implants* 2007;22(Suppl):203–23.
- Paolantonio M, Dolci M, Scarano A, d'Archivio D, di Placido G, Tumini V *et al*. Immediate implantation in fresh extraction socket: A controlled clinical and histological study in man. *J Periodontol* 2001;72(11):1560–71.
- Hahn J, Babbush CA. Dental implants: The art and science. Immediate implant placement after extraction: Contemporary materials and techniques. 2nd ed. United States of America: W.B. Saunders; 2001. pp. 305–34.
- Horiuchi K, Uchida H, Yamamoto K, Sugimura M. Immediate loading of Brånemark system implants following placement in edentulous patients: a clinical report. *Int J Oral Maxillofac Implants* 2000;15(6):824–830.
- Chiapasco M, Abati S, Romeo E, Vogel G. Implant-retained mandibular overdentures with Brånemark system MKII implants: a prospective comparative study between delayed and immediate loading. *Int J Oral Maxillofac Implants*. 2001;16(4):537-546.
- McNutt MD, Chou CH. Current trends in immediate osseous dental implant case selection criteria. *J Dent Educ* 2003;67(8):850–9.
- Schwartz Z, Boyan BD. Underlying mechanism of the bone-biomaterial interface. *J Cell Biochem* 1994;56(3):340–347.
- Penarrocha-Oltra D, Penarrocha-Diago M, Canullo L, Covani U, Penarrocha M. Patient-reported outcomes of immediate versus conventional loading with fixed full-arch prostheses in the maxilla: a nonrandomized controlled prospective study. *Int J Oral Maxillofac Implants* 2014;29(3):690-698.
- Cafiero C, Annibaldi S, Gherlone E, Grassi FR, Gualini F, Magliano A *et al*. Immediate transmucosal implant placement in molar extraction sites: A 12-month prospective multicenter cohort study. *Clin Oral Implants Res* 2008;19(5):476-82.
- Del Fabbro M, Testori T, Francetti L, Taschieri S, Weinstein R. Systematic review of survival rates for immediately loaded dental implants. *Int J Periodontics Restorative Dent*. 2006;26(3):249–63.
- Attard NJ, Zarb GA. Immediate and early implant loading protocols: A literature review of clinical studies. *J Prosthet Dent* 2005;94(3):242–58.
- Eazhil R, Swaminathan SV, Gunaseelan M, Kannan GV, Alagesan C. Impact of implant diameter and length on stress distribution in osseointegrated implants: A 3D FEA study. *J Int Soc Prev Community Dent* 2016;6(6):590–596.
- Ferrara A, Galli C, Mauro G, Macaluso GM. Immediate provisional restoration of postextraction implants for maxillary single-tooth replacement. *Int J Periodontics Restorative Dent*. 2006;26(4):371–7.

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