Immediate Loading of Short Dental Implants: A Case Report

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Immediate Loading of Short Dental Implants: A Case Report

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Learning Objectives: After reading this article, the individual will learn: (1) the use of plasma-rich growth factors (PRGF) for bone regeneration in an extraction socket, and (2) a technique for placement of a short implant and immediate loading in a maxillary molar extraction site.

About the Author

Dr. Anitua earned a degree in medicine and surgery from the University of Salamanca (Salamanca, Spain), a PhD in medicine from the University of Valencia (València, Spain), and a specialist degree in stomatology from the University of the Basque Country (Vizcaya, Spain). He is the director of the Instituto Aduardo Anitua, the president of the Eduardo Anitua Foundation for Biomedical Research, and the scientific director of Biotechnology Institute (BTI) in Vitoria, Spain. He is visiting professor at more than 20 universities worldwide, has published more than 300 papers, and is the author of 8 books and co-author of 7 books and chapters. He is the editor and director of the journal Implant Dialogue, and has presented more than 600 courses and conferences on tissue regeneration, implantology, prostheses, and dental aesthetics. He holds 39 international patents developed in the areas of regenerative therapy and oral implantology. He can be reached at the email address: eduardoanitua@eduardoanitua.com.

Disclosure: Dr. Anitua is the scientific director of BTI Biotechnology Institute and he is the head of the Foundation Eduardo Anitua, both located in Vitoria, Spain.

Short dental implants (≤ 8.0 mm in length) have presented predictable outcomes. However, there is a paucity of long-term evaluations of immediately loaded short implants. In this case report, the outcome of the restoration of a missing tooth with a single-unit short implant is presented. The 7.5 mm implant was inserted after transcrestal sinus floor augmentation and was immediately loaded. The follow-up time was 9 years with successful outcomes in terms of implant and prosthesis survival, and marginal bone stability.

Since the first publication on the immediate loading of implants, an increasing number of research and systematic reviews are being published. In 2000, a review of the available clinical and experimental studies accepted the idea of immediate implant loading and recommended the type of fixation that minimizes implant micromovements. The data compiled for immediate loading have shown a similar implant survival as delayed loading. Insertion torque is one of the most influential parameters in treatment success. The recommended values have ranged between 30 and 45 Ncm for single-unit prostheses and a minimum of 20 Ncm for multiple prostheses, or an implant stability quotient between 60 and 65.

The successful performance of immediate loading generated the question about the possibility of immediate function. In 2014, a meta-analysis concluded that the functionalization protocol does not significantly affect the implant survival nor the crestal bone loss. In a systematic review, the implant and prosthesis survival have different outcomes corresponding to the anatomical area (maxilla, mandible, anterior, and posterior). Immediate implants with immediate loading have a higher failure rate in posterior areas than anterior areas when rates were estimated together in different published studies (0.54% to 0.45% respectively). The implants in the maxilla have also been shown to have a higher annual failure rate (0.73%) compared with those inserted in the mandible (0.50%).

The use of short implants may limit the need for bone augmentation. The predictability of short implants has been assessed in a recent survey of randomized clinical trials of implants placed in the augmented sinus. Short (length ≤ 8.0 mm) implants have presented predictable survival rates and have resulted in 3 times lower intraoperative complications compared to long implants. Short implants placed in a posterior partially edentulous situation have presented a high initial survival rate similar to long implants. From all the above, shorter implants may be the preferred treatment in atrophic alveolar bone as they have been associated with lower biological complications and decreased morbidity, costs, and surgical time.

The predictability of immediate implant loading has raised the question of whether the immediate loading of short implants is predictable, as well. In a recent work published by our study
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A 43-year-old female patient attended the dental clinic complaining of pain in the posterior area of the upper left jaw. After careful clinical examination, the maxillary left first molar was diagnosed with a vertical root fracture and tooth extraction was recommended (Figure 1). The patient accepted the treatment plan.

Atraumatic tooth extraction was performed, preserving the socket walls. The extraction socket was then treated with BTI Biotechnology Institute’s Endoret (plasma-rich growth factors [PRGF]). For that procedure, peripheral venous blood was extracted by venipuncture into 9-mL extraction tubes containing sodium citrate as an anticoagulant (BTI Biotechnology Institute). Then, the blood-containing tubes were centrifuged in a BTI System centrifuge. Next, the plasma column was separated into 2 fractions with one having the highest platelet concentration (Figure 2). Ten minutes before surgery, the Endoret was activated with calcium ions to initiate growth factor release from the platelets and the formation of a fibrin scaffold.

The Endoret clot was used to fill the extraction socket and the fibrin membrane was used to cover the extraction socket. Monofilament 5/0 nylon suture with one or more cross-stitches was then applied (Figure 3).

Figure 4 describes the correct healing and clinical evolution of the extraction socket. At one month, complete regeneration of the socket was observed and the planning of the dental implant was set (Figures 5 to 8). In order to make a proper treatment plan, the patient underwent standard diagnostic protocol consisting of clinical examination and the study of the diagnostic wax-up and cone-beam computerized tomography scan (Figure 9).

The technique for transcrestal sinus floor elevation is explained elsewhere. Briefly, conventional drills working at low speed (150 rpm) without irrigation were used to prepare the implant site. A frontal cutting drill was then introduced to prepare the last 1.0 mm of the implant alveolus. When a window (the size of half of the sinus floor) was created, a well-retracted Fraction 1 (F1) plug was introduced. A blunt hand instrument was introduced to simultaneously push the fibrin membrane apically and elevate the Schneiderian membrane. The area below the Schneiderian membrane was grafted with Endoret clot. Before installation, the implant was embedded in Endoret and the surgical motor was set at 25 Ncm. The implant
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was finally seated manually by a calibrated torque wrench. The final insertion torque was 70 Ncm and the inserted implant was 6.0 mm in diameter and 7.5 mm in length. The bone loss was 0.25 mm in mesial point and was 0.20 mm in distal point.

The immediate loading was performed 24 hours after the surgery with a personalized definitive abutment and a cemented crown (Figure 10). After completing the surgical and prosthetic phases, the patient was reviewed at 6 and 12 months during the observation period of the study.

Implant success was defined according to the criteria suggested by Buser et al.\textsuperscript{11} and modified by Albrektsson et al.\textsuperscript{12} Survival of the implant was evaluated positively when the implant was present at the end of the follow-up period irrespective of the conditions. During the follow-up appointments, the data of prosthetic and implant-related complications were recorded (abutment screw loosening, abutment screw fracture, loss of retention of the permanent crown, and/or fracture of veneer material). Survival of the prosthesis and success of the prosthetic treatment were considered to be confirmed when the criteria were fulfilled according to Lang et al.\textsuperscript{6}

During the follow-up period (9 years), the single-implant restoration was free of prosthesis- or implant-related complications.

**DISCUSSION**

The immediate loading of short implants in posterior areas has not been a risk factor for implant survival and marginal bone stability in this case. Cannizzaro et al.\textsuperscript{13} have reported the 4-year outcomes of immediate versus early loading of 6.5-mm-long single implants in a controlled, randomized split-mouth clinical trial. The insertion torque was $> 40$ Ncm in both groups and implant success rate was 96.7% for both groups. In another randomized controlled clinical trial, the one-year outcome of the immediate loading of 5-mm-long implants by fixed cross-arch prostheses has been compared to those of 11.5 mm-long implants.\textsuperscript{14} The insertion torque of most of the implants has been $> 50$ Ncm. Two short implants and one long implant have failed. The differences have not reached statistical significance. In a recent study about the rehabilitation of edentulous maxillae, the survival rate of immediately loaded short implants (length between 7.0 and 8.5 mm) has been 95.7%.\textsuperscript{15} However, most of the
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implants (68 of 74 implants) had been placed at the position of the lateral incisor.

The use of Endoret (PRGF) as a biomaterial for tissue regeneration has resulted in bone regeneration of the extraction socket and the space underneath the Schneiderian membrane. The healing of the extraction socket has permitted the early implant insertion, shortening the time for treatment. PRGF represent a biological technique for the localized release of proteins and autologous growth factors, present in the patient's own plasma and platelets, to stimulate haemostasis and tissue regeneration. PRGF usage has been reported to improve osseointegration and the implant stability quotient at 12 weeks after placement.16,17 Furthermore, increasing implant diameter was more effective than implant length in decreasing the stress transmitted to the peri-implant bone.18 The use of platelet-rich plasma in maxillary sinus augmentation has been reported to have favorable effects on soft-tissue healing and the reduction of postoperative discomfort.19 The activation of PRGF with calcium ions triggers the formation of fibrin scaffold and the release of autologous growth factors.20,21 A positive effect on soft-tissue healing has been observed during bone augmentation surgery. The use of fibrin membrane has been effective in preventing titanium mesh exposure and in minimizing the risk of failure due to graft infection.22 During the early phases of healing (3 to 6 months), the use of platelet-derived growth factors could be beneficial, as indicated by Del Fabbro et al.19 PRGF usage could increase the bone formation supported by anorganic bovine xenograft.19,22-24

**SUMMARY AND CONCLUSION**

In this case report, the outcome of the restoration of a missing tooth with a single-unit, short dental implant is presented. The 7.5 mm-long implant was inserted after transcrestal sinus floor augmentation and was immediately loaded. The follow-up time was 9 years with successful outcomes in terms of implant and prosthesis survival, and marginal bone stability. In this case, the immediate loading of a short implant, in the posterior area, supporting a single-unit prosthesis, continues to not be a risk factor for either implant or prosthesis success.26

**References**

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POST EXAMINATION QUESTIONS

1. The data compiled for immediate loading of implants have shown a similar implant survival as delayed loading.
   a. True.
   b. False.

2. The insertion torque is one of the most influential parameters in implant treatment success. Recommended values have ranged between 30 and 45 Ncm for single-unit prostheses.
   a. The first statement is true, the second is false.
   b. The first statement is false, the second is true.
   c. Both statements are true.
   d. Both statements are false.

3. Immediate implants with immediate loading have a higher failure rate in posterior areas versus anterior areas. Implants in the maxilla have a higher annual failure rate compared to implants in the mandible.
   a. The first statement is true, the second is false.
   b. The first statement is false, the second is true.
   c. Both statements are true.
   d. Both statements are false.

4. Short implants (length < 8 mm) result in _____ times lower intraoperative complications compared to long implants.
   a. 2.
   b. 3.
   c. 4.
   d. 5.

5. In the case presented, complete regeneration of the extraction socket was observed at:
   a. one month.
   b. 6 weeks.
   c. 2 months.
   d. 12 weeks.

6. In the case presented, loading of the implant was performed _____ after surgery.
   a. 8 hours.
   b. 24 hours.
   c. 48 hours.
   d. 72 hours.
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7. Cannizzaro et al reported 4-year outcomes of immediate versus early loading of 6.5-mm-long single implants and found an implant success rate of _____ in both groups.
   a. 88.7%.
   b. 92.5%.
   c. 96.7%.
   d. 98.5%.

8. The PRGF usage has been reported to improve osseointegration and implant stability quotient at 12 weeks after implant placement.
   a. True.
   b. False.

9. In the case presented, the single-implant restoration was free of prosthesis or implant-related complications during the follow-up period of ____ years.
   a. 6.
   b. 7.
   c. 8.
   d. 9.

10. Which of the following statements is/are true?
    a. Increasing implant diameter is more effective than implant length in decreasing stress transmitted to peri-implant bone.
    b. Activation of PRGF with calcium ions triggers the formation of fibrin scaffold.
    c. The use of fibrin membrane has been effective in preventing titanium mesh exposure.
    d. All of the above.
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ANSWER FORM: COURSE #: 212
Please check the correct box for each question below.

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