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Article

# Immediate Loading of Immediate Implants Placed in Fresh Sockets. A 10 Year Clinical Follow-Up

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## Abstract

Implant dentistry constitute an important option in the prosthetic treatment of patients with tooth loss. This study reports the evaluation of treatment by immediate loading of immediate placed implants in fresh sockets. Methods. 52 partially edentulous patients, 27 females and 25 males, (mean age of 53.6 years), were treated with 112 Galimplant® immediate placed implants in fresh sockets for prosthodontic rehabilitation. Implants were loaded immediately. Clinical findings (implant and prosthodontics) were followed during 10 years. Results. Nine patients (17.3%) had a previous history of periodontitis, 26.9% were smokers and 21.1%) exhibited chronic systemic conditions. Clinical results indicate a survival and success rate of implants of 97.1%, demonstrating that immediate placed implants with immediate loading achieve and maintain a successful osseointegration. Three implants was lost during during the healing period. The mean marginal bone loss was 1.09±0.75 mm. 21.4% implants were associated with mucositis and 11.6% were associated with peri-implantitis. Fourteen implants (7.1%) were associated with technical complications (loss screw, chipping). Conclusions. Clinical results of this study showed that the immediate loading of immediate placed implants in fresh extraction sockets demonstrates good treatment outcomes. Regarding to implants and prostheses, the study shows a high success rate.

**Keywords:** immediate placed implants; fresh sockets; immediate loading

## 1. Introduction

Dental implants have revolutionized dentistry and implant therapy has become a widely acceptable treatment modality for missing teeth. Implant-supported prostheses are often used in the rehabilitation of partially or totally edentulous patients, achieving significant functional and aesthetic success [1,2]. The outcomes of dental implant treatment are directly related to osseointegration process, which is the consequence of biological phenomena that occur after the surgical placement of a dental implant into the alveolar bone. Furthermore, the functional loading of the implants represents the biomechanical culmination of the treatment [3,4].

Long term studies have shown favorable survival and success rates for implants in the general population. Increased implant survival has been recorded in various clinical situations and patient populations [5,6]. Advancements in implant design and materials have led to extensive use of implants in various clinical scenarios such as immediate placement in fresh sockets and immediate loading [7,8].

Following tooth extraction, the alveolar socket undergoes dimensional changes during healing, with significant reductions in ridge width and height occurring within the first year. Immediate implant placement involves inserting the implant directly into the extraction socket after tooth removal. The immediate placement and restoration of dental implants following tooth extraction

necessitate careful diagnosis and treatment planning to achieve optimal outcomes. Immediately placed implants offer advantages such as reduced treatment time, number of surgeries and bone preservation, which may lead to better treatment outcomes [9,10].

A critical factor for the success of immediate implant placement is stabilization of the implant. Achieving good primary stability of implants in fresh extraction sites is quite challenging due to the socket morphology. Once the implant has been placed in a fresh socket, the stability will come from how much mechanical bone-to-implant contact there is in the apical bone. The stability is influenced by the density of the bone and the preparation protocol; there is no biological network between the implant and the surrounding bone. Osseointegration then occurs through bone remodelling and bone formation, resulting in biological stability [11,12].

In cases treated with immediate loading of the implants, primary stability is a very important factor, especially in implants inserted into fresh post-extraction sockets. Immediate implant placement with immediate loading is a complex technique that should only be performed by experienced clinicians, as it requires specific expertise and careful management of the occlusal forces on the implant during healing [13]. The most important requirement appears to be the volume and amount of residual bone. To reduce problems arising from tooth extraction, implants must be placed immediately following the atraumatic extraction of the tooth. Furthermore, the clinician must assess the maintenance of bone architecture along with the soft tissue profile, by immediate prosthetic restoration [14,15].

## 2. Materials and Methods

This prospective study included treated patients at the clinic of the Master's in Implant Dentistry of the Faculty of Dentistry in the University of Seville, Spain, and who required tooth extraction and replacement with dental supported prostheses between January 2013 to July 2025.

The study was conducted in accordance with the principles outlined in the Declaration of Helsinki on clinical research involving humans. The University of Seville's ethics committee approved the study, and all patients provided informed written consent for treatment with immediate implant placement.

An inclusion criteria were adopted: healthy patients with good oral hygiene. Exclusion criteria included the presence of uncontrolled chronic systemic disease, smoking  $\geq 10$  cigarettes/day, bruxism, active periodontal disease, and alcohol or drug abuse.

All placement sites showed  $\leq 4$  mm of bone beyond the root apex to ensure primary implant stability, atraumatic extraction of the tooth, the integrity of the vestibular plate, and an insertion torque of  $\geq 35$  Ncm. Treatment planning included diagnostic casts for intermaxillary relations, periapical and panoramic radiographs, and clinical photographs. Patients were informed of all possible implant options for tooth replacement and accepted the immediate placement implant with immediate loading.

One hour prior to surgery, the patients received prophylactic antibiotic therapy (500 mg amoxicillin and 125 mg clavulanic acid 1 hour before surgery); they also continued the treatment after the procedure, taking 3 capsules daily for 5 days. After surgery, a chlorhexidine mouthwash was prescribed for twice-daily use for 15 days. Ibuprofen (600 mg, 2 times daily) was prescribed in cases of pain or inflammation. All patients were treated under local anesthesia using articaine 4% and with adrenaline 1:100.000.

A flapless approach was chosen for the procedure, and tooth extractions were performed with elevators to help minimize trauma. Great care was taken to maintain the integrity of the buccal bone wall. After extraction, the socket was carefully curetted; subsequently, the implant bed was prepared according to the following procedure. None of the sites presented any periapical lesion. The implant site was prepared using standard drills, following the palatal bony walls and always placed  $\geq 4$  mm beyond the root apex. The coronal margin of the implant was located at the buccal level of the bone crest. IPX® screw implants (Galimplant®, Sarria, Spain) with a sandblasted, acid-etched surface and

internal connections were used for all implant placements. No grafting materials or barriers membranes were used.

After the surgical procedure, all patients immediately received abutments and temporary prosthetic restorations. Acrylic resin-cemented crowns were used for single-tooth replacements. Immediate loading was performed when an insertion torque of  $\geq 35$  N-cm was reached. The temporary crowns were removed three months after implant placement. Impressions were made of silicone material using open individual trays. Definitive metalceramic restorations were cemented onto the osseointegrated implants.

The criteria used to assess survival rates were implant stability and the absence of radiolucency around the implants, mucosal suppuration, and pain. Follow-up visits were scheduled at 3 months after implant placement and at each year post-implantation. During these check-ups, the patients' prostheses and implants were cleaned and examined both clinically and radiologically. Marginal bone loss was evaluated based on digital periapical radiographs taken at a perpendicular angle to the long axis of the implants, assessing the difference between the 1-year follow-up radiography and the each year follow-up radiography. The following patient information was recorded: age, gender, smoking habits ( $< 10$  cigarettes/day), history of periodontitis, etiology of extraction, placement site, diameter, implant length, and biological and technical complications. The unit of analysis was the patient for the first four variables, and the implant for the latter four.

The available data from all examinations were included in analyses using the SPSS (SPSS 11.5.0, SPSS, Chicago, USA) software package. Descriptive statistics were used to report the general results of the study as mean  $\pm$  standard deviation. The Mann-Whitney U and Kruskal-Wallis non-parametric tests were used to compare differences between the groups created based on different measured risk factors. The level of significance was set at 5%.

### 3. Results

The study population consisted of 52 patients (treated consecutively), 27 females and 25 males, ranging in age from 40 to 69 years old (mean age of 53.6 years). No significant statistical differences were found related to sex and age (chi-square test,  $p=0.83408$ ).

Nine patients (17.3%) had a previous history of periodontitis. Fourteen patients (26.9%) were smokers (Table 1). Eleven patients (21.1%) exhibited chronic systemic conditions (i.e. hypertension, diabetes, cardiovascular diseases).

**Table 1.** Description of patient's characteristics.

	n	%
Females	27	51.9
Males	25	48.1
History of periodontitis	9	17.3
Smokers	14	26.9
Medical conditions	11	21.1

n = patient.

One hundred twelve implants were placed immediately after tooth extraction. The reasons for tooth extraction included caries and endodontic treatment failure, periodontal disease, and tooth fracture. The implant sites were incisors (60 maxillary and 12 mandibular) and premolars (24 maxillary and 16 mandibular)

Sixteen implants (14.3%) were 10 mm in length, 69 implants of 12 mm (61.6%) and 27 (24.1%) of 14 mm. Twenty-eight implants (25%) had a diameter of 3.5 mm, 80 implants (71.4) of 4 mm (3.6%) and 4 (24.1%) of 5 mm. In total, 3 implants (2.9%) failed during the initial healing period and were considered early failures (Table 2). Subsequently, patients who had lost their implants were successfully treated with new implants. The cumulative survival rate for all implants was 97.1%.

**Table 2.** Description of implant's characteristics.

	n	%
10 mm implant length	16	14.3
12 mm implant length	69	61.6
14 mm implant length	27	24.1
3.5 mm implant diameter	28	25
4 mm implant diameter	80	71.4
5 mm implant diameter	4	3.6
Loss of implant	3	2.9

n = implant.

The average follow-up period was  $127.7 \pm 44.1$  months (ranged: 60-166 months). The mean marginal bone loss (MBL) was  $1.09 \pm 0.75$  mm, ranging from 0 to 2.6 mm from the time of implant insertion to the 10-year follow-up evaluation (Table 3). MBL were related to the clinical variables. In smokers, marginal bone loss was significantly greater ( $1.11 \pm 0.90$  mm) than in nonsmokers ( $0.93 \pm 0.84$  mm) (Mann-Whitney U test;  $p = 0.0217$ ). In maxillary implants, there was significantly greater MBL ( $1.05 \pm 0.75$  mm) than in mandibular implants ( $0.92 \pm 0.79$  mm) (Mann-Whitney U test;  $p = 0.0437$ ).

**Table 3.** Description of marginal bone loss.

	+	-
History of periodontitis	$1.07 \pm 0.87$ mm	$0.95 \pm 0.66$ mm
Smoking	$1.11 \pm 0.90$ mm	$0.93 \pm 0.84$ mm
Systemic diseases	$1.02 \pm 0.89$ mm	$0.89 \pm 0.78$ mm

During the follow-up period, 24 implants (21.4%) were associated with peri-implant mucositis. Mucositis was significantly more frequent among patients with a history of periodontitis (chi-square test,  $p = 0.00002$ ) and smokers (chi-square test,  $p = 0.02670$ ). Thirteen implants (11.6%) were associated with peri-implantitis (Table 4). Peri-implantitis was significantly more frequent in smoking patients (chi-square test,  $p = 0.00010$ ) and those who suffered from any chronic systemic disease (chi-square test,  $p = 0.00837$ ).

**Table 4.** Description of patients with complications.

	n	%
Mucositis	24	21.4
Peri-implantitis	13	11.6
Technical complications	8	7.1
Implant loss	3	2.9

n = implant.

Temporary crowns were removed 3 months after implant insertion. Definitive prosthetic restorations consisted of metalceramic single-cemented crowns. The prosthetic restorations were functional throughout the 10-year period, showing a cumulative success rate of 92.9%. Fourteen implants (7.1%) were associated with technical complications (loss screw, chipping) (Table 4).

#### 4. Discussion

The immediate placement and restoration of dental implants in fresh sockets requires careful diagnosis and treatment planning to achieve optimal results from both a functional and aesthetic perspective. For patients requiring tooth extraction, the placement of an immediate implant with a provisional restoration can provide relatively rapid treatment and favorable aesthetics. However, this technique is complex and requires certain conditions to achieve positive results. In this regard, the

volume of residual bone is an important requirement. This implant technique offers advantages such as reduced treatment time and less surgical trauma, which increases overall patient satisfaction, although the practitioner should limit its use and practice only when clinical conditions are favorable [7–12].

In the present study, the bone healing process was successful for immediately loaded implants placed in fresh sockets. A total of 112 immediate implants were inserted, with a cumulative survival rate of 97.1%. All cases were treated with tooth extraction, flapless immediate placement, and immediate loading. The clinical findings from this 10-year follow-up study suggest that implants inserted immediately after tooth extraction and immediately loaded produce favorable outcomes and stable peri-implant conditions. These outcomes are confirmed by several studies demonstrating that the technique of inserting immediate post-extraction implants in fresh sockets and immediately loaded with provisional prostheses represents an implant protocol with a high success rate [13,14,16,17].

A recent study reported the clinical outcomes of a total of 20 patients had received immediately placed tapered and an immediate loading (patient-specific abutments) for single tooth replacements in the anterior maxilla. Patient-reported outcomes were evaluated. At 24 and 36 months, implant survival amounted to 100%, respectively. Technical and mechanical complications were not observed. Patients expressed an overall high satisfaction at 36 months [16]. A clinical study assesses the outcomes of 30 patients treated with 43 implants immediately inserted into fresh and infected sites and immediately loaded. Implants were inserted at torque  $\geq 35$  Ncm. Mean follow-up time was 6 years (range: 1 to 8 years), and 65% of implants had a follow-up time  $>5$  years. No implant failure occurred, and implant success rate was 93% [17].

The insertion of immediate implants in fresh sockets compared to healed sites remains a topic of interest and controversy in current implant dentistry with different approaches and results related to the methodology of clinical studies and systematic reviews [9,11,14]. However, the immediate post-extraction implant technique has been increasingly incorporated into daily practice [18]. Some review studies indicate that implants placed in fresh extraction sockets may have a significantly higher risk of failure and complications than implants placed in healed sites [8,9,19,20]. One possible explanation is that there is a significant divergence in the shape and size of the socket, which does not usually correspond to the macrogeometry of the implant. Consequently, the primary stability of the implant may be compromised. In general, implants do not fit with the walls of the alveolar bone, but only in the apical part of the socket. In fact, it is recommended to insert the implant at least 3–5 mm from the apical bone. Other problems arising from the lack of adaptation of the implants to the walls of the fresh sockets are when there are also bone defects that may indicate the need for simultaneous alveolar preservation procedures with bone substitutes [19,20].

However, several systematic reviews on immediate implants found a higher survival rate with similar clinical outcomes of implants placed in fresh sockets and healed sites [21–23]. These outcomes are confirmed by a retrospective study that analyzed patient data from 10 university dental clinics between during more 10 years and examined dental implant treatment outcomes [10]. Records of 20,842 patients with 50,333 dental implants inserted were analyzed. Both immediate and delayed implant placements were viable therapeutic approaches demonstrating predictable outcomes. Dental implants placed immediately after extraction had a comparable survival rate (98.4%) to those placed in healed sockets (98.6%) [10].

In the present study, all cases of immediate placed implants were treated with immediate loading by temporary crowns than were removed 3 months after implant insertion, and definitive prosthetic restorations consisted of metalceramic crowns. The prosthetic restorations were functional throughout the 10-year period, showing a cumulative success rate of 92.9%. In anterior sites (incisors) were placed 64.3 % of the implants and 35.7% in posterior sites (premolars).

Previously, immediate implant placement and immediate loading was limited to the aesthetic zone, especially the anterior maxilla [7,8,14]. However, in recent years there has been increasing interest in immediate placement in the posterior area, with the aim of reducing bone remodelling and

decreasing the necessity for bone augmentation [13]. A crucial factor for the success of immediate implant placement is their stabilization. Recently, implant placement in fresh sockets of extracted molars in the maxilla and mandible has been incorporated into implant practice [24].

Immediate implants may offer some benefits, such as better preservation of peri-implant tissues, which may reduce subsequent bone resorption. This concept is important because it can improve the emergence profile with more favorable aesthetics in anterior areas, achieving prosthodontic restorations that can even seal fresh sockets with provisional crowns almost immediately, thus maintaining the architecture of the soft and hard tissues [25,26].

In order to maintain the bone architecture along with the soft tissue profile in the maxillary esthetic zone, immediate prosthetic restoration on immediately placed implants following atraumatic extraction will be of better choice [15,27]. Abutment placement is an important step in the immediate loading of post-extraction implants that exhibit good primary stability. A recommended insertion torque of 35 Ncm is recommended. The design of definitive restorations should be based on functional and aesthetic criteria, to achieve a restoration that withstands high occlusal forces and a color that complements the patient's smile. In this regard, all participants achieved equally satisfactory results [13–15].

The importance of immediate restorations on immediate placed implants is highlighted by several studies confirming their importance in peri-implant tissues [28–30]. A prospective study indicated that the use of a prosthetic template can successfully assist in the design of provisional crowns on immediately placed implants, ensuring the contact areas with the adjacent teeth are maintained [28]. A clinical trial evaluated the outcomes of 55 patients treated with 60 implants placed in extraction sockets and undergoing immediate provisionalization. The definitive prostheses were placed within the first year. The cumulative survival rate was 98.3% at 2 years. One implant failed before 3 months. Patient evaluations of function, esthetics, and self-esteem also showed significant improvement [29]. A prospective study presents the esthetic outcomes of 64 anterior maxillary single-tooth implants inserted according to the concepts of immediate postextractive placement and immediate loading of implants. After 3 years of functioning, the implant success rate was 100% because no implants had failed. These clinical findings can be considered as the use of an immediate loading postextractive is a predictable technique for achieving good functional and esthetic results [30].

MBL is considered an important clinical parameter for long-term success of immediate placed implants [12,27,29,31]. Several conditions are associated with MBL. In fact, patients related factors (periodontitis background, smoking, diabetes), implant factors (surgery, position, macrogeometry, surface) and prosthetic factors (time of loading, abutments, type of prosthetic rehabilitation) can be considered risk factors for MBL [32–34].

The present study reports a mean MBL  $1.09 \pm 0.75$  mm, during a 10-year follow-up period. MBL was significantly greater in smokers and maxillary implants. These results are reported by a recent study that radiographically detects an amount of MBL at one year ( $0.93$  mm  $\pm 0.83$  mm) and three years ( $1.04$  mm  $\pm 0.97$  mm) after implant placement. The study shows a clear trend of higher MBL in implants placed in the upper jaw and in smokers. The combination of these two factors further amplifies the tendency for early marginal bone remodeling [35].

Moreover, the design and size of the abutment can be an important factor for MBL in immediate placed implants. A two-year retrospective analysis was conducted on patients suffering from single-tooth edentulous areas in premolar, cuspid and incisive areas were treated with fresh-socket implants and immediate preformed anatomical healing caps. The design of a healing abutment was very important to preserve the emergence profile immediately after extraction and implant placement. The length of the implant collar used with an immediate healing abutment appeared to affect the preservation of the alveolar crest with predictable final results [33].

All of these factors related to MBL are confirmed in a study evaluating MBL over a follow-up period of up to 36 months in immediate dental implants [32]. Regarding smoking, a greater MBL at 2 months was observed in smokers. Implants placed in the upper jaw showed greater MBL at 12

months and at 24 months. Regarding abutment type, anti-rotational abutments for single-unit prostheses showed significantly higher MBL at 12 months than rotational abutments for multiple. Abutment height, differences were observed at 6 and 12 months [32].

In the present study, 9 patients (17.3%) had a previous history of periodontitis. Implants placed in patients with periodontal background showed greater MBL. These findings are confirmed by a one year retrospective study included 95 patients and 234 implants treated with immediate implant placement [36]. Clinical assessments showed a significant increase in MBL with greater periodontal disease severity. MBL was significantly higher in Stage IV than in Stage II and III of periodontitis, demonstrating that periodontal disease severity and progression rate may influence clinical outcomes in immediate placed implants in periodontitis patients [36].

Mucositis and peri-implantitis are the most frequent complications affecting the soft and hard tissues that support the implants. Peri-implantitis is an inflammation in the peri-implant tissues with a progressive loss in the supporting bone [37,38]. In the present study, mucositis was significantly more frequent among patients with a history of periodontitis and smokers, affecting 24 implants (21.4%). Thirteen implants (11.6%) were associated with peri-implantitis. Peri-implantitis was significantly more frequent in smoking patients and those who suffered from any chronic systemic disease. A prospective observational study aimed at evaluating clinical success of immediate placed implants in the single-tooth replacements over a period of 3 years. Although most patients have a good level of oral hygiene, however the frequency distribution of peri-implant diseases at 24 and 36 months reports the incidence of peri-implant mucositis amounted to 31.3% at 24 months and to 25.0%, respectively [16]. A prospective cohort multicenter study was undertaken following single-tooth immediate implant placement and loading in esthetic areas [39]. Data of 215 implants in 215 patients were collected in 15 centers in 2 years. Although, the peri-implant tissues remained stable after the final restoration and the patients were very satisfied during the follow-up; however, 5 patients mucositis cases (2.3%) and one peri-implantitis (0.5%) case were observed in the follow-up [39].

Fourteen implants (7.1%) were associated with technical complications (loss screw, chipping, fracture of the prosthetic screw). Technical complications are frequent in studies with patients treated with restorations supported by immediate implants placed in fresh sockets [12,17]. A clinical study reports the findings of the treatment by immediate implant placed in fresh sockets and loaded with provisional prosthesis inserted 24 hours after surgery [17]. The mean follow-up was 6 years. No single-unit provisional restorations were placed in occlusion, only multi-unit provisional restorations. The definitive prosthesis was made after a period of adaptation of the peri-implant tissues achieved by the provisional prosthesis. The prosthetic survival rate was 93%. Technical complication rate (7%) was due to fracture of veneer material [17]. Ten patients were treated with immediate placed implants an restored with a screw-retained provisional restoration that was placed on the same day that the implant was uncovered [12]. After 3 months, definitive crowns were manufactured. After a 10 year period, 2 patients (20%) experienced technical complications, one patient required a new restoration due to a fracture, and one patient experienced debonding of the abutment restoration [12].

## 5. Conclusions

This 10-year follow-up clinical study showed that the immediate loading of immediate implants placed in fresh extraction sockets demonstrates good treatment outcomes. Regarding to implants and prostheses, the study shows a high success rate. The response of the peri-implant tissues was favorable with controlled marginal bone loss. Biological and technical complications did not affect the overall success of the study. Immediate loading of immediate placed implants constitutes a clinically predictable treatment when strict selection criteria and clinical plans are applied.

**Author Contributions:** For research articles with several authors, a short paragraph specifying their individual contributions must be provided. The following statements should be used "Conceptualization, E.V.-O. and J.L.-

L.; methodology, L.M.-G. and I.O.-G.; software, N.M.-G.; validation, A.J.-G., and J.M.-M.; formal analysis, J.L. R.-R.; investigation, E.V.-O. and I.O.-G.; resources, L.M.-G. and N.M.-G.; data curation, J.L.-L. and J.L. R.-R.; writing—original draft preparation, J.M.-M. and E. N.-M.; writing—review and editing, A.J.-G.; and E.V.-O.; visualization, J.L.-L.; project administration, A.J.-G. and I.O.-G.; and funding acquisition, E.V.-O.; L.M.-G. All authors have read and agreed to the published version of the manuscript.

**Institutional Review Board Statement:** Ethics Committee of the University of Seville.

**Informed Consent Statement:** Informed consent was obtained from all subjects involved in the study.

**Data Availability Statement:** There are no additional data available, please contact the authors if needed.

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## References

1. Windael, S.; Vervaeke, S.; Wijnen, L.; Jacquet, W.; De Bruyn, H.; Collaert B. Ten-year follow-up of dental implants used for immediate loading in the edentulous mandible: A prospective clinical study. *Clin. Implant. Dent. Relat. Res.* **2018**; *20*:515-521
2. Almasri, M.A. A 5-year satisfaction outcome study of patients receiving six-implant-supported fixed prosthesis. *Clin. Pract.* **2021**, *11*, 827–834. Doi: 10.1111/cid.12612.
3. Velasco-Ortega, E.; Ortiz-Garcia, I.; Jiménez-Guerra, A.; Núñez-Márquez, E.; Moreno-Muñoz, J.; Rondón-Romero, J.L.; Cabanillas-Balsera, D.; Gil, J.; Muñoz-Guzón, F.; Monsalve-Guil, L. Osseointegration of sandblasted and acid-etched implant surfaces. a histological and histomorphometric study in the rabbit. *Int. J. Mol. Sci.* **2021**, *22*, 8507. Doi: 10.1111/cid.12612.
4. Botticelli, D.; Lang, N.P. Dynamics of osseointegration in various human and animal models - a comparative analysis. *Clin. Oral Impl. Res.* **2017**, *28*, 742-748. Doi: 10.1111/clr.12872.
5. McGlumphy, E.A.; Hashemzadeh, S.; Yilmaz, B.; Purcell, B.A.; Leach, D.; Larsen, P.E. Treatment of edentulous mandible with metal-resin fixed complete dentures: A 15- to 20-year retrospective study. *Clin. Oral Implant. Res.* **2019**, *30*, 817–825. Doi: 10.1111/clr.13488.
6. Velasco-Ortega, E.; del Rocío Jiménez-Martin, I.; Moreno-Muñoz, J.; Núñez-Márquez, E.; Rondón-Romero, J.L.; Cabanillas-Balsera, D.; Jiménez-Guerra, Á.; Ortiz-García, I.; López-López, J.; Monsalve-Guil, L. Long-term treatment outcomes of implant prostheses in partially and totally edentulous patients. *Materials.* **2022**, *15*, 4910. Doi: 10.3390/ma15144910.
7. Han, H.S.; Kim, S.; Kim, H.; Yi, Y.; Cho, Y.D. A prospective clinical study of immediate implant placement in the maxillary esthetic zone. *J. Periodontal. Implant. Sci.* **2025**. Doi: 10.5051/jpis.2404240212.
8. Peitsinis, P.R.; Blouchou, A.; Chatzopoulos, G.S.; Vouros, I.D. Optimizing implant placement timing and loading protocols for successful functional and esthetic outcomes: a narrative literature review. *J. Clin. Med.* **2025**, *14*, 1442.
9. Cheng, Y.; Lai, Z.; Yu, W. Influencing factors and survival rates in immediate vs. delayed dental implant placement: a six-year retrospective analysis. *Front. Dent. Med.* **2025**, *6*:1563641. Doi: 10.3389/fdmed.2025.1563641.
10. Chatzopoulos, G.S.; Wolff, L.F. Assessing the long-term survival of dental implants in a retrospective analysis: immediate versus delayed placement. *Clin Exp Dent Res* **2025**, *11*, 70096. Doi: 0.1002/cre2.70096.
11. Bizzi, I.H.; da Silveira, T.M.; Bitencourt, F.V.; Muniz, F.W.M.G.; Cavagni, J.; Fiorini, T. Primary stability of immediate implants placed in fresh sockets in comparison with healed sites: A systematic review and meta-analysis. *Int. J. Oral. Implantol. (Berl).* **2025**, *18*, 33-44. PMID: 40047361
12. Meijer, H.J.A.; Slagter, K.W.; Gareb, B.; Hentenaar, D.F.M.; Vissink A.; Raghoobar, G.M. Immediate single-tooth implant placement in bony defect sites: A 10-year randomized controlled trial. *J. Periodontol.* **2025**, *96*, 151-163. Doi: 10.1002/JPER.24-0251.
13. Velasco-Ortega, E.; Wojtovicz, E.; España-Lopez, A.; Jimenez-Guerra, A.; Monsalve-Guil, L.; Ortiz-Garcia I.; Serrera-Figallo M.A. Survival rates and bone loss after immediate loading of implants in fresh extraction

- sockets (single gaps). A clinical prospective study with 4 year follow-up. *Med. Oral Patol. Oral Cir. Bucal.* **2018**,23,230-236. Doi: 10.4317/medoral.21651.
14. Gaddale, R.; Chowdhary, R.; Mishra, S.K.; Sagar, K. Soft and hard tissue changes following immediate implant placement and immediate loading in aesthetic zone-a systematic review and meta-analysis. *Evid. Based. Dent.* **2024**. Doi: 10.1038/s41432-024-01091-7.
  15. Bernal, G.; Ruiz, L.; Aellos, F.; Salazar, C.; Sadowsky, S.J. Clinical and cone beam computed tomography outcomes of maxillary anterior implant restorations after immediate implant placement with interim restorations: A 1- to 14-year retrospective analysis. *J. Prosthet. Dent.* **2025**,133,1025-1032. Doi: 10.1016/j.prosdent.2023.05.028.
  16. Schwarz, F.; Trimpou, G.; Montada, A.; Obreja, K.; Parvini, P.; Begić, A. Clinical performance of immediately placed and restored implants with a novel design in the esthetic zone. a 3-year follow-up of prospective case series. *Clin. Oral. Implants. Res.* **2025**. Doi: 10.1111/clr.14438
  17. Anitua, E.; Piñas, L.; Alkhraisat, M.H. Long-term outcomes of immediate implant placement into infected sockets in association with immediate loading: a retrospective cohort study. *J. Periodontol.* **2016**, 87,1135-1340. Doi: 10.1902/jop.2016.160104.
  18. Goker, F.; Mali Rai, P.; De Santis, D.; Colombo, M.; Gornati, L.; Savoini, E.; Panda, S.; Del Fabbro, M. Outcomes of dental implants in routine clinical practice: a retrospective multicenter study. *Int. J. Dent.* **2025**,9930477. Doi: 10.1155/ijod/9930477.
  19. Ibrahim, A.; Chrcanovic, B.R. Dental implants inserted in fresh extraction sockets versus healed sites: a systematic review and meta-analysis. *Materials.* **2021**, 14, 7903. Doi: 10.3390/ma14247903.
  20. Soegiantho, P.; Suryawinata, P.G.; Tran, W.; Kujan, O.; Koyi, B.; Khzam, N.; Algarves Miranda, L. Survival of single immediate implants and reasons for loss: a systematic review. *Prosthesis* **2023**, 5, 378–424.
  21. Mello, C.C.; Lemos, C.A.A.; Verri, F.R.; dos Santos, D.M.; Goiato, M.C.; Pellizzer, E.P. Immediate implant placement into fresh extraction sockets versus delayed implants into healed sockets: A systematic review and meta-analysis. *Int. J. Oral Maxillofac. Surg.* **2017**, 46, 1162–1177. Doi: 10.1016/j.ijom.2017.03.016.
  22. Pigozzo, M.N.; Rebelo da Costa, T.; Sesma, N.; Laganá, D.C. Immediate versus early loading of single dental implants: A systematic review and meta-analysis. *J. Prosthet. Dent.* **2018**, 120, 25–34. Doi: 10.1016/j.prosdent.2017.12.006.
  23. Campi, M.; Leitão-Almeida, B.; Pereira, M.; Shibli, J.A.; Levin, L.; Fernandes, J.C.H.; Fernandes, G.V.O.; Borges, T. Immediate implant placement in damaged extraction sockets: a systematic review and meta-analysis of randomized controlled trials. *Quintessence Int.* **2025**, 56, 34-45. Doi: 10.3290/j.qi.b5768294.
  24. Witoonkitvanich, P.; Amornsettachai, P.; Panyayong, W.; Rokaya, D.; Vongsirichat, N.; Suphangul, S. Comparison of the stability of immediate dental implant placement in fresh molar extraction sockets in the maxilla and mandible: a controlled, prospective, non-randomized clinical trial. *Int. J. Oral Maxillofac. Surg.* **2025**, 54,365–373. Doi: 10.1016/j.ijom.2024.12.011.
  25. Lilet, R.; Desiron, M.; Finelle, G.; Lecloux, G.; Seidel, L.; Lambert, F. Immediate implant placement combining socket seal abutment and periimplant socket filling: a prospective case series. *Clin. Oral Implants. Res.* **2022**, 33,33–44. Doi: 10.1111/clr.13852.
  26. Chu, S.J.; Salama, M.A.; Salama, H.; Garber, D.A.; Saito, H.; Sarnachiaro, G.O.; et al. The dual-zone therapeutic concept of managing immediate implant placement and provisional restoration in anterior extraction sockets. *Compend. Contin. Educ. Dent.* **2012**, 33,534. PMID: 22908601.
  27. Thenmozhi, R.; Sriraam, K.g.; Charumathi, S.; Baskara Pandian, V. Clinical and radiographic evaluation of soft tissue and bone status in immediate loaded implants placed following their extraction in the maxillary anterior region. *Cureus.* **2024**,16,68613. Doi: 10.7759/cureus.68613.
  28. Bruno, V.; O'Sullivan, D.; Badino, M.; Catapano, S. Preserving soft tissue after placing implants in fresh extraction sockets in the maxillary esthetic zone and a prosthetic template for interim crown fabrication: a prospective study. *J. Prosthet. Dent.* **2014**, 111, 195-202. Doi: 10.1016/j.prosdent.2013.09.008.
  29. McAllister, B.S.; Cherry, J.E.; Kolinski, M.L.; Parrish, K.D.; Pumphrey, D.W.; Schoering, R.L. Two-year evaluation of a variable-thread tapered implant in extraction sites with immediate temporalization: a multicenter clinical study. *Int. J. Oral Maxillofac. Implants.* **2012**, 27, 611-618. Doi: PMID: 22616055.

30. Malchiodi, L.; Cucchi, A.; Ghensi, P.; Nocini, PF. Evaluation of the esthetic results of 64 nonfunctional immediately loaded postextraction implants in the maxilla : correlation between interproximal alveolar crest and soft tissues at 3 years of follow-up. *Clin. Impl. Dent. Relat. Res.* **2013**, *15*, 130-142. Doi: 10.1111/j.1708-8208.2011.00424.x.
31. Jalaluddin, M.; Rathod, A.; Mailankote, S.; Bipinchandra, LN.; Raj, BH.; Ahirwar, A. Radiographic assessment of the marginal bone loss around the implant before and after the prosthesis placement-a comparative study. *J. Pharm. Bioallied. Sci.* **2024**,*16*(Suppl 5), S4693-S4696. Doi: 10.4103/jpbs.jpbs\_1184\_24.
32. Rehberger Bescós, F.; Salgado Peralvo, ÁO.; Chamorro Petronacci, CM.; Chele, D.; Camacho Alonso, F.; Peñarrocha Oltra, D.; Lado Baleato, Ó.; Pérez Sayáns, M. Marginal bone loss and associated factors in immediate dental implants: a retrospective clinical study. *Int. J. Implant. Dent.* **2025**,*11*,25. Doi: 10.1186/s40729-025-00602-0 .
33. Crespi, R.; Toti ,P.; Covani, U.; Cosola, S.; Crespi, G.; Menchini-Fabris, GB. Assessment of the alveolar bone loss in fresh socket implant procedures with immediate implant loading via temporary preformed anatomical healing caps: Comparison of two different lengths of the implant collar. *J. Stomatol. Oral Maxillofac. Surg.* **2023**,*124*(6S),101582. Doi: 10.1016/j.jormas.2023.101582.
34. Arai, Y.; Takashima, M.; Matsuzaki, N.; Takada, S. Marginal bone loss in dental implants: A literature review of risk factors and treatment strategies for prevention. *J. Prosthodont. Res.* **2025**, *69*,12-20. Doi: 10.2186/jpr.JPR\_D\_23\_00223.
35. Solderer, A.; Giuliani, C.; Wiedemeier, DB.; Jung, RE.; Schmidlin, PR. Early marginal peri-implant bone loss around tissue-level implants: a retrospective radiographic evaluation. *Int. J. Implant. Dent.* **2025**,*11*,20. Doi: 10.1186/s40729-025-00613-x.
36. Li, G.; Chen, X.; Feng, Y.; Lu, Y.; Liao, W.; Huang, R.; Yang, E.; Lai, R.; Feng, Z. A short-term clinical evaluation of immediate implant placement in periodontitis patients. *Front. Cell Infect. Microbiol.* **2025**,*15*,1555964. Doi: 10.3389/fcimb.2025.1555964.
37. Scarano, A.; Khater, A.G.A.; Gehrke, S.A.; Serra, P.; Francesco, I.; Di Carmine, M.; Tari, S.R.; Leo, L.; Lorusso, F. Current status of peri-implant diseases: A clinical review for evidence-based decision making. *J. Funct. Biomater.* **2023**, *14*, 210. Doi: 10.3390/jfb14040210.
38. Velasco-Ortega, E.; Carretero-Barrado, L.; Moreno-Muñoz, J.; Ortiz-García, I.; Núñez-Márquez, E.; Rondón-Romero, J.L.; López-López, J.; Jiménez-Guerra, Á.; Monsalve-Guil, L. Immediate loading of implants with fixed rehabilitations in geriatric edentulous patients; biological complications. *J. Clin. Med.* **2023**, *12*, 6548. Doi: 10.3390/jcm12206548.
39. Clauser, C.; Sforza, NM.; Menini, I.; Kalemaj, Z.; Buti, J. Collaborators of Accademia Toscana di Ricerca Odontostomatologica (ATRO) IPI Group. Immediate postextraction single-tooth implants and provisional crowns in the esthetic area: 2-year results of a cohort prospective multicenter study- patient-centered outcomes. *Int. J. Oral Maxillofac. Implants.* **2020**,*35*,833-840. Doi: 10.11607/jomi.7203

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