BULLETIN OF STOMATOLOGY AND MAXILLOFACIAL SURGERY
Volume 21, Issue 2

DOI: 10.58240/1829006X-2025.2-31

CASE REPORT

EVALUATION OF THE EFFECTIVENESS OF IMMEDIATE DENTAL IMPLANTS PLACED IN EXTRAXTION SOCKETS WITH PERIAPICAL PATHOLOGY. A CONTROLLED CASE SERIES

Tigran Hakobyan DDS,[1]* Alfred Grigoryan,[2] Harutyun Harutyunyan[3], Karen Lalayan DMSc,PhD[4]
[1]Assistant professor of the Department of Oral and Maxillofacial Surgery Yerevan State Medical University after M. Heratsi, Founder of Kamar Dental Center, Yerevan, Armenia
[2]Doctor of the Kamar Dental Center, Yerevan, Armenia
[3]Doctor of the KLANSE Dental Medical Center, Yerevan, Armenia
[4]Professor of the Department of Oral and Maxillofacial Surgery Yerevan State Medical University after M. Heratsi Yerevan, Armenia
* Corresponding author: Tigran Hakobyan, Kamar Dental Center, Yerevan, Armenia; e-mail: info@kamar.am
Received: *Dec 18, 2024;* ***Accepted:*** *Dec 16, 2024;* ***Published:*** *Jan 20, 2025*

Abstract

Background: Immediate placement of implants in post-extraction sockets is a common and well-established treatment modality. However, extraction sockets with periapical pathology may negatively impact the outcome of this treatment procedure.

Objective: The aim of this study was to evaluate the clinical outcomes of immediate placement of dental implants in infected extraction sockets with periapical pathology.

Materials and Methods: The study included 37 patients who underwent tooth extraction with periapical pathology and immediate 151 Bio3 GmbH (Germany) implants placement.

Postoperative results; implant survival, implant failure, marginal bone loss (MBL), and patient-reported function of the implants were assessed clinically and radiographically.

Results: There were no complications during implant placement and in the postoperative period, no signs of infection around the implants were detected at the follow-up visit 4 weeks after implant placement, the soft tissues were in good condition, as evidenced by their healthy color and texture. The mean RFA for151 implants was 63.7 ISQ (implant stability), and after 3-5 months, respectively, 72.4 ISQ. The mean MBL after 12 months was 0.94, after 36 months the mean MBL was 1.28, at 60 months follow-up the mean MBL was 1.42.

The functional and aesthetic results of prosthetic restoration were satisfied by the patients, as chewing function was restored, the esthetics of the facial profile and occlusion improved. The success rate of immediate implants after 5 years was 96.8%, and shows a similar survival rate to the published success rates for immediate implants placed in non-infected sites.

Conclusion: Evidence suggests that immediate placement of implants in areas with periapical infections is a predictable and effective treatment protocol if the areas are thoroughly debrided prior to implant placement, high implants stability is achieved during implant placement, and systemic antibiotics are used.

Keywords: post-extraction sockets, periapical infections, immediate implants, Bio3 GmbH implants

INTRODUCTION

Currently, immediate placement of implants in fresh post-extraction sockets is an accepted established treatment option and has been shown to be a predictable and successful procedure when proper protocols are followed. Immediate implant placement has several advantages over delayed placement, such as reduced healing time and number of surgeries[1,2].

Immediate implant placement has a number of contraindications, and among them, the presence of active infection at the extraction site is considered one of the main contraindications due to the risk of infection spreading, which can lead to implant failure or retrograde peri-implantitis[3,4].

Some studies suggest that immediate implant procedures should be avoided in cases of periapical pathosis[5-9].

According to several publications, the survival rate of immediately placed implants in sites with endodontic infections ranges from 92-98.7%[10-12].

Several studies have evaluated the survival rates of dental implants placed directly in infected sockets compared to those placed in healthy sites and have not found significant differences in outcomes[13-15].

Immediate placement of the implant after tooth extraction and immediate loading of the implant with a fixed temporary reconstruction is preferred by the patient as postoperative pain after flapless surgery is significantly reduced compared to the traditional open approach[16,17].

With computer-aided design/computer-aided manufacturing (CAD/CAM) temporarily and the final designs provide high quality and esthetics of permanent prostheses[18,19]. Although computer-assisted implant placement and CAD/CAM have contributed to simplifying the patient rehabilitation workflow, the combination of immediate implant placement and immediate loading protocols is complex and requires a high level of organization between the implantologist, technician, and patient[20,21].

The aim of this study was to evaluate the clinical outcomes of immediate placement of dental implants in infected extraction sockets with periapical pathology.

Materials and Methods

The study included 37 patients who underwent immediate dental implants placement in areas with periapical lesions between 2020 and 2024. All patients underwent a comprehensive clinical and radiographic diagnosis.

Demographic Distribution

37 patients, the ages (38 -64 year) with a mean age of 64.7 ± 10.6 years old, (21 males and 17 females).

Inclusion criteria

- Good health (ASA I or II).
- Presence of four bony walls of the alveolus.
- Periapical teeth pathology could not be treated.

Exclusion criteria

- severely poor oral hygiene;
- uncontrolled chronic systematic disease;
- severe osteoporosis;
- patients using bisphosphonates;
- patients using antiresorptive drugs;
- patients who received radiotherapy from the head and neck region;
- alcohol or drug abuse;
- acute/chronicauto-immune mucosal diseases.
- smoker.

All patients included signed the informed consent forms according to the latest edition of the World Medical Association's Declaration of Helsinki and declared their commitment to participate for the full duration of the study.

All patients underwent complex clinical and radiographically diagnostics. Chronic periapical pathology was defined as periapical radiolucency lesions larger than 2 mm observed in the apical part of decayed teeth, teeth with failed endodontic treatment.

CT scan allowed to assess the quality and quantity of bone characteristics. The DICOM (digital imaging and communication in medicine) files acquired with CT were also imported in a three dimensional reconstruction software. Based on anatomical conditions and prosthetic planning, the position of the implants was virtually planned using 3D computer-aided design software (3Shape implant Studio).

Surgical protocol

Informed consent was obtained from all patients for extraction and immediate placement of dental implants. Patients were prescribed antibiotics (Augmentin-GlaxoSmithKline) 1 day before surgery. The teeth were extracted atraumatically, in some patients using a minimally invasive technique with a piezotome without flap elevation. The affected tissues of the extracted tooth were removed by careful needle curettage, treated with an antiseptic aqueous solution of 0.2% chlorhexidine digluconate, and then washed several times with sterile saline.

Implants were placed via standard protocols in the bone beyond the root apex and in the extraction sites, providing primer stability using a one-stage surgical technique, and CT was obtained.

151 Bio3 implants GmbH (GmbH, Germany) were placed was minimum of 30-35Ncm insertion torque upper (65) and lower (86) jaw, anterior or posterior sites (table 3). Implant stability was measured using Osstell Mentor during implant installation and after 3-5 months before fixation final prosthetic structur then, multi-unit abutments were immediately placed their height adjusted and suturing was done using 3/0 black silk sutures (Ethicon Mersilk, Johnson & Johnson Pvt Ltd). es.

Prosthetic protocol

Immediate functional loading using precise temporary prostheses was applied to 58 implants.

The impression transfer was fixed before scanning. The scanner is a data acquisition system that records the 3D geometry of the infrastructure and converts the actual dental model into a virtual dental model.

After 6 hours temporary prosthetic structures fitting in the oral cavity, they were fixed onto multiunit abutments using screws with 25Ncm.

The functional load on dental implants was performed with 62> ISQ values above 2-4 months after implantation with CAD/CAM using metal-ceramic or zirconium dioxide restorations and was fixed with screws of 25 Ncm.

Follow-Up

At intervals of 6 months to 60 months, the following parameters were taken into account: resonance frequency analysis (RFA), inflammatory processes in the peri-implant tissue, loss of marginal bone tissue in men (MBL), aesthetic and functional results.

Statistical analysis

Statistics were used to calculate and analyze the mean marginal bone loss of implants. The differences between follow-up periods were tested by paired Student's t test. All analyses were carried out using SPSS (SPSS Software Company, Chicago, IL, USA). Differences between observation periods were checked using the paired Student's t test. The p values < 0.05 were considered statistically significant.

Case series report presents a patients treated with immediate implants and implant-supported prosthesis.

Case 1.

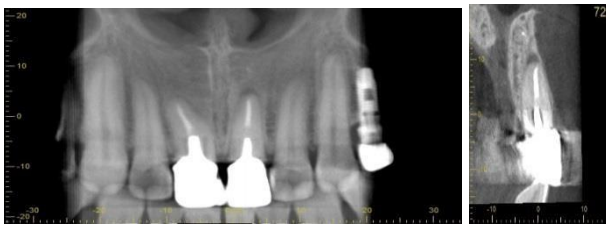

Figure 1. Preoperative CT showing periapical lesions in the 12 tooth region

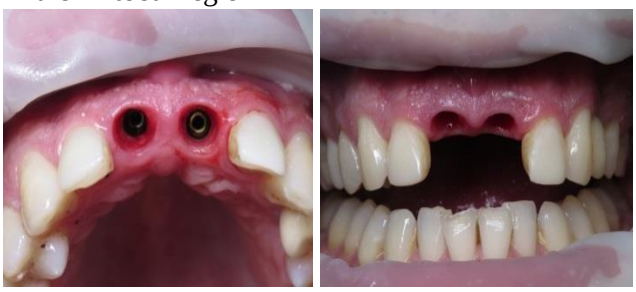

Figure 2. Intraoral view of 2 implants on the 11,21 tooth lower jaw before prosthetic rehabilitation.

Figure.3 Intraoral view after implant prosthetic rehabilitation

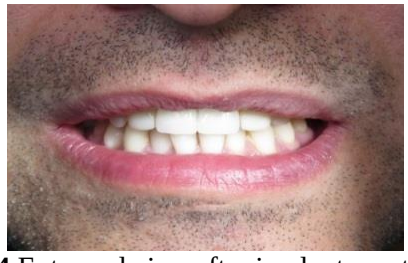

Figure 4.Extraoral view after implant prosthetic rehabilitation

Case 2.

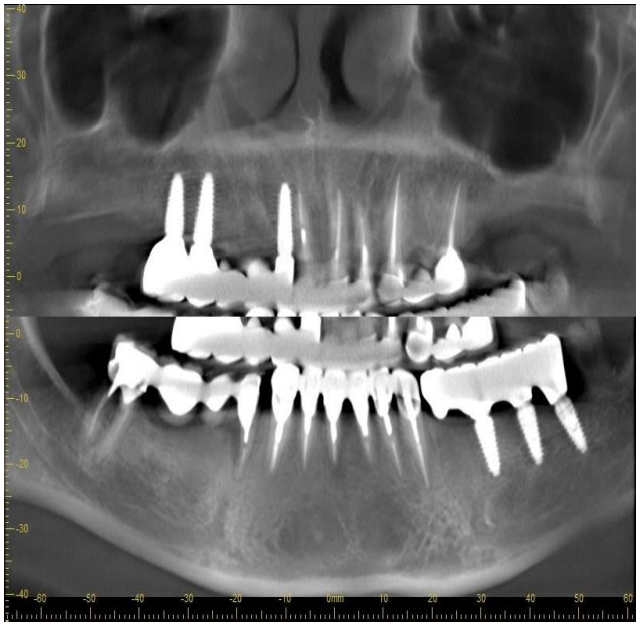

Figure 5. Preoperative CT showing periapical lesions in the 44 tooth region

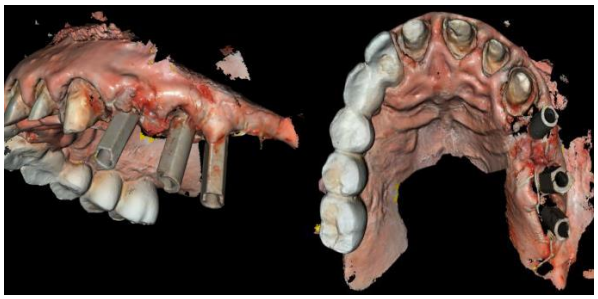

Figure 6. The impression transfers is installed on a multi- unit abutments on the upper jaw and scanned

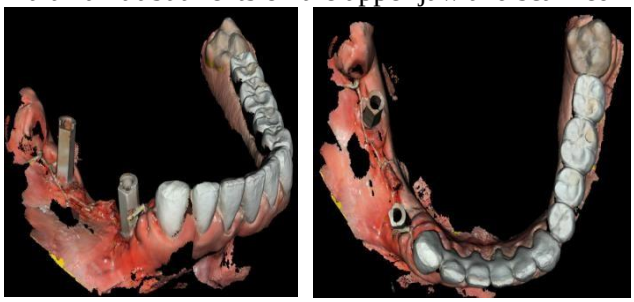

Figure 7. The impression transfers is installed on a multi- unit abutments on the lower jaw and scanned

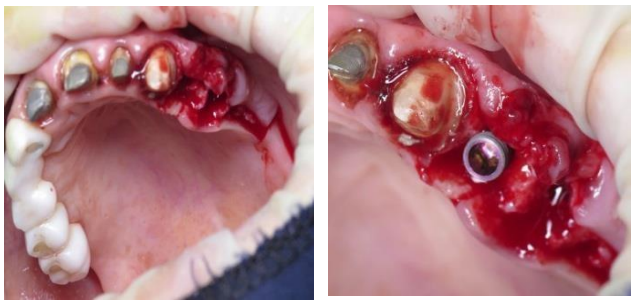

Figure 8. Intraoral view before and after implant placement

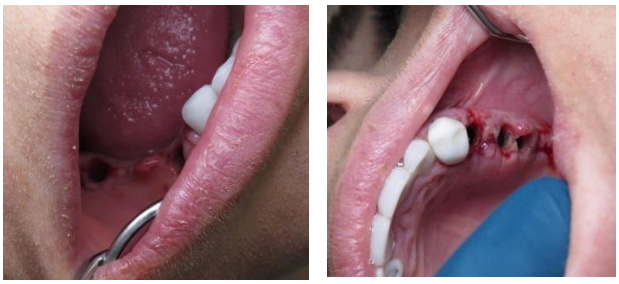

Figure 9. Intraoral view after implant placement

Figure 10 Screw-retained bridges on abutments before implant fixation

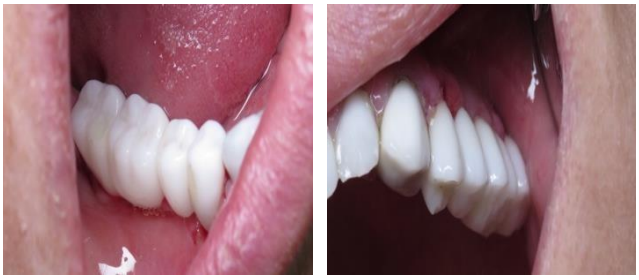

Figure 11 . Intraoral view after implant prosthetic rehabilitation

Case 3.

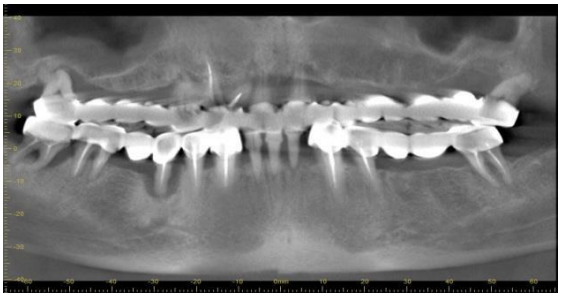

Figure 12. Preoperative CT showing periapical lesions in the 45 tooth

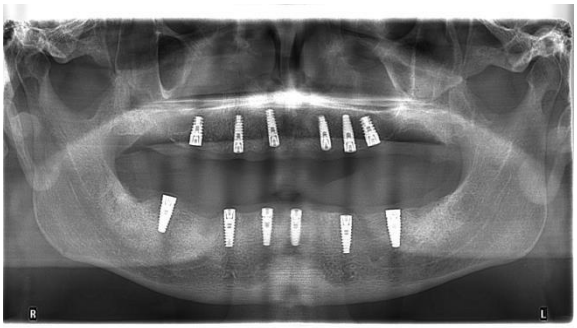

Figure 13. Postoperative CT after implant placement

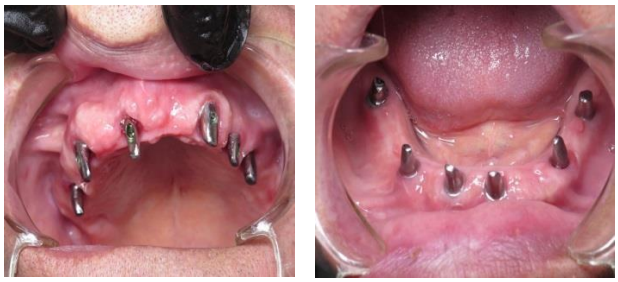

Figure14. Intraoral view of 6 abutments on the upper jaw before prosthetic rehabilitation
Figure 15. Intraoral view of 6 abutments on the lower jaw before prosthetic rehabilitation

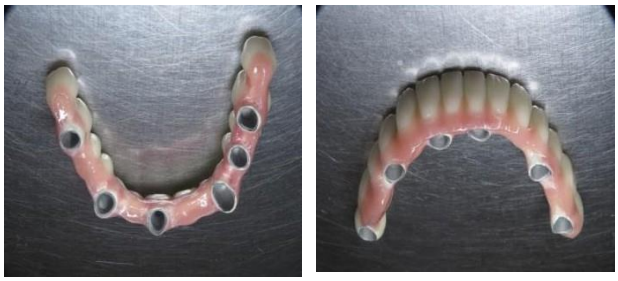

Figure 16,17 Prosthetic structures in upper jaw before prosthetic rehabilitation

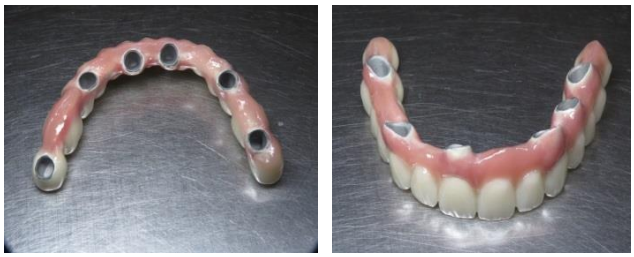

Figure 18,19 Prosthetic structures in lower jaw before prosthetic rehabilitation

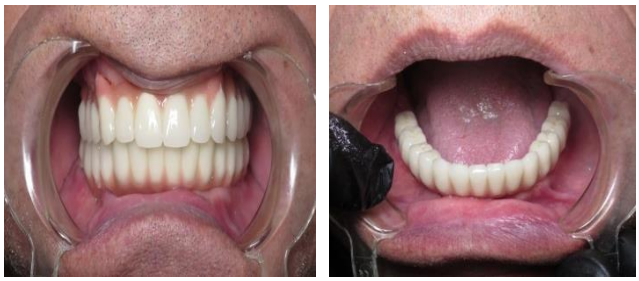

Figure 20,**21** Intraoral view after implant prosthetic rehabilitation

Case 5.

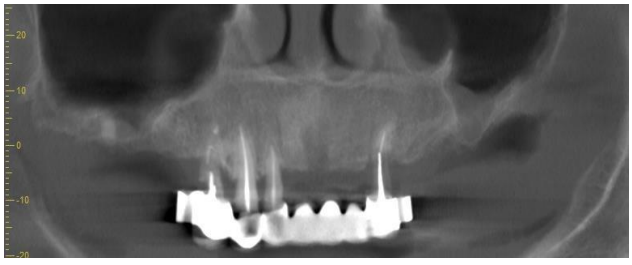

Figure 22. Preoperative CT showing periradicular lesions in the 14 tooth

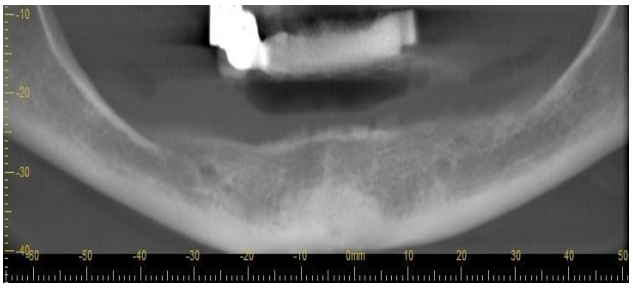

Figure 23. Preoperative CT upper jaw before implant placement

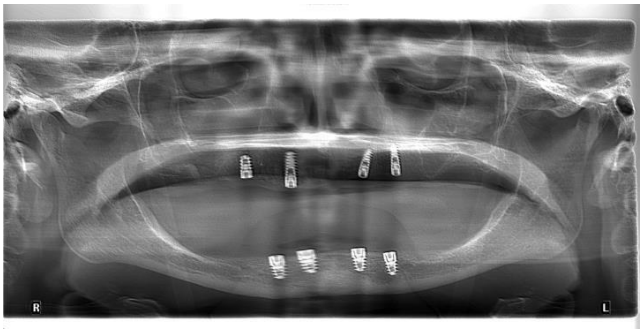

Figure 24. Postoperative CT after implant placement

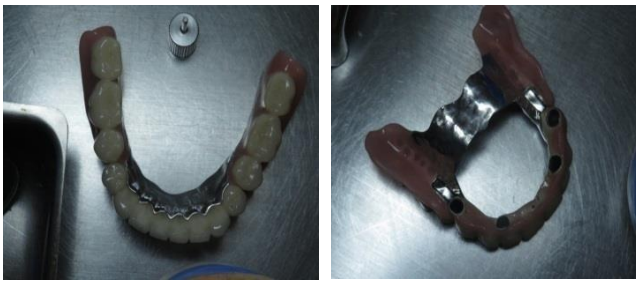

Figure 25,26 Prosthetic structures in upper jaw and lower jaw before prosthetic rehabilitation

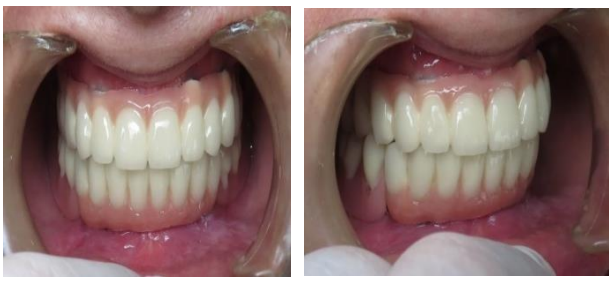

Figure 27,**28** Intraoral view after implant prosthetic rehabilitation

Results

There were no complications during implant placement, immediate postoperatively and the control visit.

4 weeks after implant placement, the soft tissues were in good condition, as evidenced by their healthy color and texture.

After 12 month, the average MBL was 0.94., after 36 month MBL was 1.28, the 60-month follow-up period, the MBL was 1.42(table 1).

Table 1. Average mean clinical index MBL after 1,3,5 year

Clinical index	Time after implant surgery			p-value
	after 1 year	after 3 year	after 5 year	
MBL	0.94	1.28	1.42.	<0.05

For 151 implants, the average RFA was 63.7 ISQ, after implant placement and 72.4 ISQ after 3–5 months (table 2).

Table 2.Average mean ISQ (Implant StabilityQuotient)

Implants	RFA ISQ (Implant Stability Quotient)		p-value
151	**after implant surgery** 63.7 ISQ	**after** 3–5 months **implant surgery** 72.4 ISQ.	<0.05

It was observed that 146 (96.8%) of 151 implants were successful and 5 (3, 2%) failed (table 3).

Table 3. Distribution of Implants Placed Across Sites

	Incisor		Canine		Premolar		Molar		Total	
	Number	Failed	Number	Failed	Number	Failed	Number	Failed	Number	Failed
Maxilla	27	0	18	0	16	1	14	2	65	3
Mandible	24	0	21	0	23	0	18	2	86	2
Total	51	0	39	0	39	0	32	4	151	5

The patients were satisfied, aesthetics and occlusion improved.

Discussion

The delayed dental implant protocol involves several stages after implant placement with an osseointegration healing period of 2 to 6 months followed by placement of the final prosthesis[22].

In recent times, there have been a significant number of clinical studies and systematic reviews that have positively assessed the immediate implants, and have shown a similar level of implant survival as with the delayed loading protocol[23].

The risk of implants immediately placed in sockets of teeth extracted with periapical pathology is that pathogenic bacteria in the socket can cause contamination of the implant during the early healing period[7,24].

Although studies published in recent years have

shown high success rates for immediate implant placement in sockets with chronic periapical pathology, the risks of this method are still a matter of debate in clinical practice[7,8,25].

To reduce the risk of infection, comprehensive curettage of granulation tissue and all soft tissue remnants in the sockets is necessary, irrigation with antiseptic agents for disinfection in mechanically difficult-to-reach areas, prophylactic use of antibiotics to disinfect the sockets of the extracted teeth[26-28].

Modern protocols offer immediate implantation and immediate loading, which is a predictable tooth replacement procedure that provides aesthetic and functional restoration[29-31].

Immediate loading of dental implants has several advantages such as reducing time, improving esthetic and occlusal function, eliminating temporary dentures, preventing reoperations and preserving residual alveolar bone and is considered a predictable procedure[32,33].

The use of preoperative virtual 3D is effective in controlling and immediate implant placement and immediate functional loading with the use of precise provisional prostheses[34,35].

This article describes the use of immediate implant placement protocol in areas with periapical lesions a technology that allows screw-retained and implant-supported temporary restorations using a completely digital protocol. With this accelerated digital treatment protocol, the transition to a restored dentition is achieved without the need for any physical impressions.

The use of CAD/CAM protocol in prosthetics on implants has three advantages: accuracy (or accuracy of fit), durability and simplicity of design. Each of these advantages is discussed as follows. With this protocol, the prosthetic sequence is significantly reduced, providing digital restoration of esthetics and function in one day.

Chronic odontogenic infection is a risk factor but not an absolute contraindication for immediate implants, the removal of teeth with periodontitis eliminates chronic odontogenic foci in the bone, which has a positive effect on the viability of the implants. In evaluated literature data there is no clear consensus on the grafting of the spaces between the implant and the socket.

According to the current research results, satisfactory survival rates (96.8%) were observed. Based on the results of this report, it can be concluded that immediate implant placement may be a favorable treatment option if careful selection of cases, the extracted tooth socket is debrided, antiseptically treated, and the implant has good primary stability in the extraction socket and correct prosthetic protocols. However, immediate implant placement requires a careful case selection and a specific treatment protocol. Although longer-term studies are needed, with a larger number of patients included.

DECLARATIONS

Funding
No funding source

Competing interests
Authors declare that they have no conflicts of interest to disclose.

Clinical trial number
Not applicable.

Ethical approval
This study was conducted in accordance with Good Clinical Practice guidelines and the principles of the Declaration of Helsinki.

Patient consentment
The authors certify that they have obtained appropriate patient consent forms.

Authors contribution
All authors contributed equally to this manuscript. All authors participated significantly to the study design and execution, and have read, revised, and approved the final manuscript.

REFERENCES

1. Koh RU, Rudek I, Wang HL. Immediate implant placement: positives and negatives. Implant Dent.2010;19(2):98–108.doi: 10.1097/ID.0b013e3181d47eaf.

2. de Carvalho BCF, de Carvalho EMOF, Consani RLX. Flapless single-tooth immediate implant placement. Int J Oral Maxillofac Implants. 2013;28:783–9.

3. Lindeboom JAH, Tjiook Y, Kroon FHM. Immediate placement of implants in periapical infected sites: a prospective randomized study in 50 patients. Oral Surg Oral Med Oral Pathol Oral Radiol Endodontology. 2006;101:705–10.

4. Manor Y, Alkasem A, Mardinger O, Chaushu G,

Greenstein RB-N. Levels of bacterial contamination in fresh extraction sites after a saline rinse. Int J Oral Maxillofac Implants. 2015;30:1362–8.

5. Bell CL, Diehl D, Bell BM, Bell RE. The Immediate Placement of Dental Implants into extraction Sites with Periapical Lesions: a Retrospective Chart Review. J Oral Maxillofac Surg. 2011;69:1623–7

6. Kakar A, Kakar K, Leventis MD, Jain G. Immediate Implant Placement in Infected Sockets: A Consecutive Cohort Study. J Lasers Med Sci.2020;11(2):167-173. doi: 10.34172/jlms.2020.28.

7. Çolak, S., Demïrsoy, M.S. Retrospective analysis of dental implants immediately placed in extraction sockets with periapical pathology: immediate implant placement in infected areas. BMC Oral Health. 2023;304 https://doi.org/10.1186/s12903-023-02986-0

8. Perez, A., Layac, M., & Lombardi, T. Immediate Implant Placement at an Inflammatory Periapical Cyst Site in the Aesthetic Area. Oral.2024; 4(2), 263-273. https://doi.org/10.3390/oral4020021

9. Chen H., Zhang G., Weigl P., Gu X. Immediate placement of dental implants into infected versus noninfected sites in the esthetic zone: a systematic review and meta-analysis. J Prosthet Dent.2018;120(5):658–667.doi: 10.1016/j.prosdent.2017.12.008.

10. Corbella S, Taschieri S, Tsesis I, Del Fabbro M. Postextraction implant in sites with endodontic infection as an alternative to endodontic retreatment: a review of literature. J Oral Implantol.2013;39(3):399–405.doi: 10.1563/AAID-JOI-D-11-00229.

11. Meltzer AM. Immediate implant placement and restoration in infected sites. Int J Periodontics Restorative Dent. 2012;32(5):169–73.

12. Fugazzotto P. A retrospective analysis of immediately placed implants in 418 sites exhibiting periapical pathology: results and clinical considerations. Int J Oral Maxillofac Implants. 2012;27(1):194–202

13. Saijeva A, Juodzbalys G. Immediate Implant Placement in Non-Infected Sockets versus Infected Sockets: a Systematic Review and Meta-Analysis. J Oral Maxillofac Res. 2020;11(2):e1. doi: 10.5037/jomr.2020.11201

14. Mohammed AlMugeiren O, Salem Assari A, Abdullah Alshehri K, Abdulaziz Alsharidah M, Alotaibi AN, Hamad Alzaid A. Placement of immediate dental implants in extraction sockets exhibiting the apical pathosis. A meta-analysis. J Oral Biol Craniofac Res. 2024;14(3):290-300.doi: 10.1016/j.jobcr.2024.03.008.

15. Waasdorp J.A., Evian C.I., Mandracchia M. Immediate placement of implants into infected sites: a systematic review of the literature. J Periodontol.2010;81(6):801–808.doi: 10.1902/jop.2010.090706

16. Pitman J, Christiaens V, Callens J, Glibert M, Seyssens L, Blanco J, Cosyn J. Immediate implant placement with flap or flapless surgery: A systematic review and meta-analysis. J Clin Periodontol.2023;50(6):755-764.doi: 10.1111/jcpe.13795.

17. Ickroth A, Seyssens L, Christiaens V, Pitman J, Cosyn J. Immediate versus early implant placement for single tooth replacement in the aesthetic area: A systematic review and meta-analysis. Clin Oral Implants Res. 2024;35(6):585-597. doi: 10.1111/clr.14261.

18. Aldahian N, Khan R, Mustafa M, Vohra F, Alrahlah A. Influence of conventional, CAD-CAM, and 3D printing fabrication techniques on the marginal integrity and surface roughness and wear of interim crowns.J Appl Sci 2021;11: 1-19

19. Jain S, Sayed ME, Shetty M, Alqahtani SM, Al Wadei MHD, Gupta SG, et al. Physical and mechanical properties of 3dprinted provisional crowns and fixed dental prosthesis resins compared to CAD/CAM milled and conventional provisional resins: a systematic review and meta-analysis. J Polym Sci 2022;14:1-40.

20. Spielau T, Hauschild U, Katsoulis J. Computer-assisted, template-guided immediate implant placement and loading in the mandible: a case report. BMC Oral Health. 2019 11;19(1):55. doi: 10.1186/s12903-019-0746-0.

21. Tallarico M, Esposito M, Xhanari E, Caneva M, Meloni SM. Computer-guided vs freehand placement of immediately loaded dental implants:5-year postloading results of a randomised controlled trial. Eur J Oral Implantol. 2018;11(2):203–21

22. Adell R., Lekholm U., Rockler B., Bra°nemark P.I. A 15-year study of osseointegrated implants in the treatment of the edentulous jaw. Int J Oral

Surg.1981;10:387–416.doi:10.1016/s0300-9785(81)80077-4.

23. Patel, R.; Ucer, C.; Wright, S.; Khan, R.S. Differences in Dental Implant Survival between Immediate vs. Delayed Placement: A Systematic Review and Meta-Analysis. Dent.J. *2023*, 11, *218*. https://doi.org/10.3390/dj11090218

24. Álvarez-Camino JC, Valmaseda-Castellón E, Gay-Escoda C. Immediate implants placed in fresh sockets associated to periapical infectious processes. A systematic review. Med Oral Patol Oral Cir Bucal.2013;18(5):e780-5. doi: 10.4317/medoral.18942.

25. Pranckeviciene, A.; Vaitkeviciene, I.; Siudikiene, J.; Poskeviciene, S.; Maciulskiene-Visockiene, V. Comparison of Immediate Implantation into the Socket with and without Periapical Pathology: Systematic Review and Meta-Analysis. Medicina 2024, *60*,893. https://doi.org/10.3390/medicina60060893

26. Stefano Corbella, Silvio Taschieri, Igor Tsesis,Massimo Del Fabbro.Postextraction Implant in Sites With Endodontic Infection as an Alternative to Endodontic Retreatment A Review of Literature.Journalof Oral Implantology. 2013; 39(3):399-405.DOI:10.1563/AAID-JOI-D-11-00229

27. Jofre J, Valenzuela D, Quintana P, Asenjo-Lobos C. Protocol for immediate implant replacement of infected teeth. Implant Dent. 2012;21(4):287-94. doi: 10.1097/ID.0b013e31825cbcf8

28. Del Fabbro M, Boggian C, Taschieri S. Immediate implant placement into fresh extraction sites with chronic periapical pathologic features combined with plasma rich in growth factors: preliminary results of single-cohort study. J Oral Maxillofac Surg. 2009 Nov;67(11):2476-84.doi: 10.1016/j.joms.2009.04.063.

29. Singh M, Kumar L, Anwar M, Chand P. Immediate dental implant placement with immediate loading following extraction of natural teeth. Natl J Maxillofac Surg. 2015;6(2):252-5. doi: 10.4103/0975-5950

30. Riham Mostafa Eldibany, Joaquín García-Rodriguez.Immediate loading of post-extraction one-piece implants using atraumatic threaded bone expanders: Retrospective study 2001–2011 Revista Española de Cirugía Oral y Maxilofacial.2015;37.4.207214 ;DOI: 10.1016/j.maxile.2014.08.001

31. Alejandro Lanis,Orlando Álvarez Del Canto, Patricio Barriga,Waldemar Polido.Computer-guided implant surgery and full-arch immediate loading with prefabricated—metal framework—provisional prosthesis created from a 3D printed model.2019.Journal of Esthetic and Restorative Dentistry 31(1);DOI:10.1111/jerd.12458

32. Dean Morton,Robert Jaffin,Hans-Peter Weber Immediate Restoration and Loading of Dental Implants: Clinical Considerations and Protocols.The International journal of oral & maxillofacial implants 19:103-8

33. Hölken F, Al-Nawas B, Meereis M, Bjelopavlovic M. Digital Workflow for Implant Placement and Immediate Chairside Provisionalization of a Novel Implant System without Abutment-A Case Report. Medicina (Kaunas).2022;8;58(11):1612.doi: 10.3390/medicina58111612.

34. de Carvalho Formiga, M.; Fuller, R.; Ardelean, L.C.; Shibli, J.A. Immediate Loading Full-Arch 3D-Printed Implant-Supported Fixed Rehabilitation: A Case Report with 24-Month Follow-Up. Medicina 2024,;60;1614. https://doi.org/10.3390/medicina60101614

35. Makarov, N., Pompa, G. & Papi, P. Computer-assisted implant placement and full-arch immediate loading with digitally prefabricated provisional prostheses without cast: a prospective pilot cohort study. Int J Implant Dent.2021;**7**;80 https://doi.org/10.1186/s40729-021-00369-0