

A Scientometric Exploration of the Socket-shield Technique in Oral Implantology: Trends and Spatiotemporal Dynamics

Carla Buchelli-Ramirez¹, Randy Samillán-Arbulú², Fran Espinoza-Carhuancho³, Frank Mayta-Tovalino⁴

Received on: 10 September 2024; Accepted on: 26 November 2024; Published on: 13 January 2025

ABSTRACT

Aim: The socket-shield technique arises from the efforts to stop the dimensional changes of the bone crest and gingival tissues. This technique consists of leaving a vestibular fragment of a naturally attached root with the purpose of keeping the crestal bone nourished through the periodontium. The aim of this research was to perform a scientometric analysis of the scientific production on the socket-shield technique in oral implantology.

Materials and methods: A descriptive, observational study was carried out with a scientometric approach. A specialized search was performed, with variants of the keywords extracted from the Medical Subject Heading (MeSH) thesaurus of PubMed and the Embase thesaurus. For Web of Science (WOS) data, including only documents as original articles, reviews, and as sources corresponding to the subject. Production, trends, and impact indicators were performed.

Results: During the study period 2000–2023, the scientific production of research increased in the last 3 years. The journal with the highest scientific production of research was “Clinical Oral Implant Research”, and the USA was found to be the dominant country in scientific production. Initially, the development of the research topic of interest was “tooth extraction and socket” between 2000 and 2015, and “dental implants and alveolar ridge preservation” between 2015 and 2023.

Conclusion: The socket-shield technique in oral implantology is a growing field of research, with extensive international collaboration and significant impact in terms of citations. As this growth continues, we are likely to see even more advances and discoveries in this field.

Clinical significance: The study on the socket-shield technique in oral implantology highlights its clinical importance by demonstrating that this technique can preserve crestal bone and gingival tissues, improving the stability, and esthetics of dental implants. In addition, its growing research and international collaboration underscore its relevance and potential for future innovations in the field.

Keywords: Bibliometrics, Dental implant, Socket-shield.

The Journal of Contemporary Dental Practice (2024); 10.5005/jp-journals-10024-3768

INTRODUCTION

The processes of remodeling and bone loss, that the alveolar bone and soft tissue healing undergo after a traumatic situation such as a dental extraction are evident and have been widely described.^{1–3} The vestibular ridge is the anatomical area that loses the most volume after a dental extraction.⁴ This whole process is caused by the lack of blood supply that originates from the periodontium, which is attached to the extracted tooth.⁵

The literature has described several proposals and alternatives to prevent the loss of vestibular alveolar bone along with the installation of immediate dental implants, which involve bone graft regeneration, surgery with and without flap, and placement of the implant axis.^{6,7} However, it was shown, there is no procedure or technique that stops or avoids the biological dimensional changes developed over time.⁸

To solve the problem of alveolar bone resorption with sequelae in the gingival margin post-exodontia, an alternative was developed that proposes to leave the vestibular fragment of a root naturally attached to the internal face of the vestibular table, with the objective of maintaining the alveolar ridge bone in a natural position nourished by a healthy periodontium. This technique takes the name of “Socket-shield Technique,” being one of the techniques with the greatest clinical impact as a proposal for a tangible problem.⁹ Therefore, it is important to know the development and nature of this technique.

The socket-shield technique in oral implantology represents a significant advance in the preservation of alveolar bone and

^{1,2}Department of Periodontics, School of Stomatology, Universidad Científica del Sur, Lima, Peru

^{3,4}Department of Academic, Grupo de Bibliometría, Evaluación De Evidencia y Revisiones Sistemáticas (BEERS), Human Medicine Career, Universidad Científica del Sur, Lima, Peru

Corresponding Author: Frank Mayta-Tovalino, Department of Academic, Grupo de Bibliometría, Evaluación De Evidencia y Revisiones Sistemáticas (BEERS), Human Medicine Career, Faculty of Medicine, Universidad Científica del Sur, Lima, Peru, Phone: +5113171023, e-mail: fmaytat@cientifica.edu.pe

How to cite this article: Buchelli-Ramirez C, Samillán-Arbulú R, Espinoza-Carhuancho F, et al. A Scientometric Exploration of the Socket-shield Technique in Oral Implantology: Trends and Spatiotemporal Dynamics. *J Contemp Dent Pract* 2024;25(10):941–949.

Source of support: Nil

Conflict of interest: None

soft tissues after tooth extraction. This innovative technique, which retains part of the tooth root in the socket, has proven to be effective in preventing bone resorption and maintaining gingival esthetics. A scientometric analysis of this technique reveals its increasing adoption and interest in its long-term efficacy. Research in this field is essential, as it can improve clinical and esthetic outcomes in prosthetic rehabilitation, offering a less invasive and more conservative alternative to traditional methods.^{1–9}

As digital libraries expand, and research materials in various medical and dental fields become increasingly accessible across numerous platforms, bibliometric analysis has become crucial in identifying the most beneficial research areas.¹⁰⁻¹⁴ The longevity of treatment, esthetics, predictable results, or simply the reduction of complications in oral implantology has piqued the interest of periodontists, implantologists, maxillofacial surgeons, and prosthodontists. The “Socket-shield Technique” has elicited contributions from diverse geographical locations, from authors with varied backgrounds and affiliations. Consequently, a bibliometric analysis will enable students, researchers, and academics to pinpoint the most commendable articles in their respective fields of interest.^{15,16}

A descriptive and observational approach with a scientometric analysis was chosen for this study. The need for a bibliometric analysis lies in its ability to map and evaluate the scientific production on the socket-shield technique in oral implantology. This method makes it possible to identify research trends, measure the impact of publications, and detect patterns of collaboration between authors and institutions.¹¹⁻¹⁴

In addition, bibliometric analysis provides a clear view of the growth and development of the field, which is essential for understanding thematic evolution and determining key areas for future research. A bibliometric study of the socket-shield technique in oral implant dentistry is essential to map the development and influence of this innovative practice in the scientific community. This type of analysis makes it possible to identify the main research trends, the most influential authors, and the leading institutions in the field. It also provides a clear picture of how knowledge about this technique has spread over time and in different geographic regions. By understanding these patterns, researchers and practitioners can better target their efforts to areas with the greatest potential for impact, thereby optimizing resources and fostering strategic collaborations that will advance oral implant dentistry.¹¹⁻¹⁴

Thus, the aim of this study was to perform a scientometric examination of the socket-shield technique in oral implantology.

MATERIALS AND METHODS

Study Design

A descriptive, cross-sectional study with a scientometric approach was carried out to map published research on the subject.¹⁷ The search was conducted on August 27, 2023, and the articles published in the Web of Science databases corresponding to the topic were evaluated.

Information Sources and Search Strategy

Only a Web of Science database was selected due to their extensive reputation for hosting high-quality journals and research papers. A specialized search strategy was employed, incorporating various terms and keywords. Once standardized, these search terms were interrelated using Boolean connectors “AND” and “OR”, ensuring a comprehensive search across titles, abstracts, and keywords. This meticulous approach enabled the construction of a precise search equation tailored for research on the socket-shield technique in oral implantology. The detailed search formula facilitated the identification of relevant scientific publications, ensuring a thorough and robust scientometric analysis. The search formula constructed for the research was: TS = (“socket-shield” OR “socket-shield” OR “socket preservation” OR “Buccal plate preservation” OR “Buccal bone preservation” OR “Buccal bone grafting” OR “Partial

Table 1: Main data information

Description	Results
Timespan	2000:2023
Sources	114
Documents	411
Annual growth %	16.86
Document average age	5.35
Average citations per doc	22.5
References	8,778
Keywords plus	775
Author's keywords	769
Authors	1,590
Authors of single-authored docs	11
Single-authored docs	12
Co-authors per doc	5.08
International co-authorships %	37.96
Documents per author	0.258
Article	323
Article; early access	7
Article: Proceedings paper	4
Meeting abstract	1
Review	74
Review; early access	2

extraction therapy” OR “Ridge preservation” OR “Alveolar ridge preservation” OR “Buccal bone support technique” OR “Partial extraction socket healing” OR “Shield technique in dentistry” OR “Socket partitioning technique” OR “Tooth partitioning technique”) AND TS=(implantology OR periodontics OR “dental implants” OR “dental implantology” OR “oral implantology” OR “implant dentistry” OR “implant surgery” OR “dental implant placement”).

The search was conducted on August 27, 2023. The search was limited to only original article and review-type documents as sources corresponding to the topic, and further narrowed to titles and keywords to increase the effectiveness of collecting articles from the target fields. Conference papers, book chapters, editorials, letters, notes, and errata were excluded.

Data Analysis

The metadata analysis was conducted using a variety of systems and software, with the aim of delineating impact and trends based on citations, authors, institutions, and research articles throughout the course of the study. These systems included Scholarly Output, Citations per Publication, Citation Count, and Document Count. Additionally, various metrics were employed to detect dynamism and trends. Data analysis was performed using Studio R version 4.2.3 (2023-03-15 ucrt) and CiteSpace version 6.2.R4.

RESULTS

From 2000 to 2023, the Web of Science online database listed 411 original articles on the socket-shield technique in oral implant Dentistry. These articles originated from 114 different sources and utilized over 775 keywords, with 769 of them being author keywords. A collective of 1590 authors contributed to these articles. The international co-authorship percentage stood at 37.96, signifying a substantial level of international collaboration in the publications. The ratio of documents to authors was 0.258 (Table 1).

Table 2: Principal countries, institutions, authors and sources*

<i>Institutions</i>	<i>Scholarly output</i>
Complutense University	4
University of Bern	4
University of Otago	4
University of Texas Health Science Center at San Antonio	4
University of Zurich	4
<i>Countries</i>	<i>Scholarly output</i>
United States	17
Italy	8
Switzerland	7
Brazil	6
Germany	5
<i>Authors</i>	<i>Scholarly output</i>
Alsabeeha, Nabeel HM	3
Atieh, Momen A	3
Gluckman, Howard	3
Jung, Ronald Ernst	3
Mealey, Brian L	3
<i>Scopus sources</i>	<i>Scholarly output</i>
International journal of Periodontics and Restorative Dentistry	7
Journal of Periodontology	5
Clinical Oral Investigations	4
Clinical Implant Dentistry and Related Research	3
Journal of Clinical Periodontology	3

*These data correspond to the period January 2019–November 2024, according to the Scopus database (SciVal)

During the period January 2019 to November 2024, according to the Scopus database (SciVal), the institutions with the highest academic output in the area were the Complutense University, the University of Bern, the University of Otago, the University of Texas Health Science Center at San Antonio, and the University of Zurich, each with 4 publications. In terms of countries, the United States led with 17 publications, followed by Italy with 8, Switzerland with 7, Brazil with 6, and Germany with 5. The most prolific authors were Nabeel HM. Alsabeeha, Momen A Atieh, Howard Gluckman, Ronald Ernst Jung, and Brian L Mealey, each with 3 publications. The top publication sources were the International Journal of Periodontics and Restorative Dentistry with 7 publications, the Journal of Periodontology with 5, Clinical Oral Investigations with 4, Clinical Implant Dentistry and Related Research with 3, and the Journal of Clinical Periodontology with 3 (Table 2).

The WOS Core Collections database contained 411 articles on Socket-shield Technique research in oral implantology from 2000 to 2023. The number of publications in this research area allows us to divide the development of this field into two distinct phases. The first phase, from 2000 to 2011, was a period of gradual development, with the number of published references slowly increasing, hovering around 11 in total. The second phase marked a period of rapid development. From 2012 to 2014, the number of publications in this field saw a significant increase. In 2015, the number of related publications jumped from 17 in 2014 to 28, and the growth trend continued for the next three years, reaching 40 in 2019. From 2020 to 2023, the research field continued to expand, with a total of 168 publications in these last years (Fig. 1).



Fig. 1: Publications on socket-shield technique

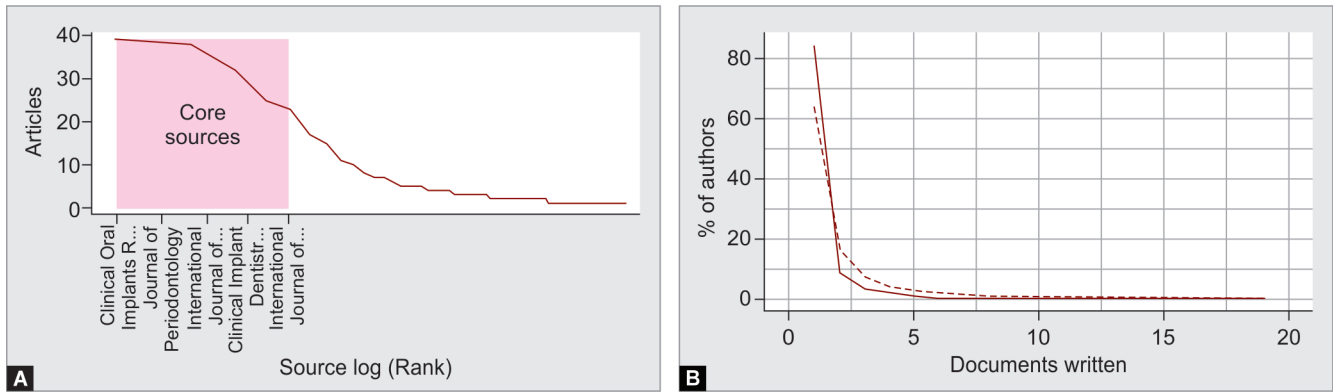
The production of articles in the journals has a highly unequal distribution, where the largest number of articles is concentrated in a small population of journals, firstly ‘Clinical Oral Implants Research’, followed by ‘Journal of Periodontology,’ ‘International Journal of Periodontics & Restorative Dentistry,’ ‘Clinical Implant Dentistry and Related Research,’ and finally the ‘International Journal of Oral & Maxillofacial Implants.’ Furthermore, it shows us that a minimal proportion of articles are dispersed over a high number of journals (Fig. 2A). The highest percentage of publication production is concentrated in a minority group of three authors who have produced a total of 27 articles compared to a larger group of authors, 1,341, who only had 1 publication concerning the research topic, and is shown in Figure 2B.

As depicted in Figure 3, the top 10 authors with the highest publication and citation strength are listed. The first column of the table displays the author’s name and the journal, while the second column indicates the year of commencement. The third column represents the intensity at which it started. The fourth and fifth columns denote the years in which the publication began and ended, respectively. The final column provides a visual representation of citation burst detection, with red lines indicating highly cited research or topics that garnered significant research attention.

There is an interplay between the journal, author, and the country of publication. This relationship is divided into three fields based on the Sankey graph, which illustrates the connection between journals, countries, and authors. The rectangular nodes correspond to the frequency of a given journal, author, or country in the collaborative network, while the width of the lines between nodes gives the number of connections. The United States appears as the dominant country, accounting for eight of the top ten journals, followed by Italy and China. The journal ‘Clinical Oral Implants Research’ has the most publications in most countries, with Covani U and Botticelli being the authors who have conducted the most studies on this research (Fig. 4).

A diagram of 10 different clusters was made, where the strongest cluster is the one referring to ‘dental extraction’ (group #0), around which the other clusters revolve. Clusters from #1 to #9 are also observed; they are grouped together; the ‘Clinical Trials’ and ‘Socket-shield’ clusters are the closest to the ‘dental extraction’ cluster, while the ‘Bone Graft’ cluster is the furthest away (Fig. 5).

During the development of 10 schemes in the research, it was possible to interpret 3 important clusters in two moments; first moment was between 2008 and 2015, where the research initially centralizes the scheme ‘dental extraction’ (group #0) and the



Figs 2A and B: (A) Journals with the highest production of articles on socket-shield technique; (B) Development of productivity according to authors on the research of the socket-shield technique

Top 10 references with the strongest citation bursts

References	Year	Strength	Begin	End	2013–2023
Tan WL, 2012, CLIN ORAL IMPLAN RES, V23, P1, DOI 10.1111/j.1600-0501.2011.02375.x, DOI	2012	10.7	2014	2017	█ █ █ █ █ █ █ █ █ █
Vignoletti F, 2012, CLIN ORAL IMPLAN RES, V23, P22, DOI 10.1111/j.1600-0501.2011.02331.x, DOI	2012	8.88	2014	2017	█ █ █ █ █ █ █ █ █ █
Hammerle CHF, 2012, CLIN ORAL IMPLAN RES, V23, P80, DOI 10.1111/j.1600-0501.2011.02370.x, DOI	2012	6.72	2014	2017	█ █ █ █ █ █ █ █ █ █
Ten Heggeler JMAG, 2011, CLIN ORAL IMPLANTS RES, V22, P779, DOI 10.1111/j.1600-0501.2010.02064.x, DOI	2011	6.66	2014	2016	█ █ █ █ █ █ █ █ █ █
Wood RA, 2012, J PERIODONTOL, V83, P329, DOI 10.1902/jop.2011.110270, DOI	2012	5.64	2014	2017	█ █ █ █ █ █ █ █ █ █
Avila-Ortiz G, 2014, J DENT RES, V93, P950, DOI 10.1177/0022034514541127, DOI	2014	7.43	2016	2019	█ █ █ █ █ █ █ █ █ █
Jung RE, 2013, J CLIN PERIODONTOL, V40, P90, DOI 10.1111/jcpe.12027, DOI	2013	6.13	2016	2018	█ █ █ █ █ █ █ █ █ █
Avila-Ortiz G, 2019, J CLIN PERIODONTOL, V46, P195, DOI 10.1111/jcpe.13057, DOI	2019	10.94	2020	2023	█ █ █ █ █ █ █ █ █ █
Gluckman H, 2018, CLIN IMPLANTDENT R, V20, P122, DOI 10.1111/cid.12554, DOI	2018	5.55	2020	2023	█ █ █ █ █ █ █ █ █ █
Buser D, 2017, PERIODONTOL 2000, V73, P84, DOI 10.1111/prd.12170, DOI	2017	6.6	2021	2023	█ █ █ █ █ █ █ █ █ █

Fig. 3: Top 10 authors with the highest number of publications and citation strength

second moment was between 2015 and 2022, where the schemes or topics of interest are; “clinical trials” (group #1) and “socket-shield” (group #2). From these topics in the research, an interest in the remaining 8 schemes or topics was developed (Fig. 6).

The authors who achieved the greatest impact on the development of the research are shown in the special diagram, where the size of the circles shows the number of articles published, and the separation at the top shows the number of citations per year. Where the research impact of Tan WL in 2012 stands out, as a pioneer in the subject, in addition to Chapuis V and Baumer D, during the period of 2017, obtaining the greatest impact during the period of study of the research; however, the academic impact and the highest number of articles published by Avilla - Ortiz, during the period of 2019, stand out (Fig. 7).

During the evolution of the topic, in the period from 2000 to 2023, four stages were divided: 2000–2015, 2016–2019, 2020–2021, and 2022–2023. The first stage was the initial stage of the research, where studies were conducted on the topics of extraction and alveolus, alveolar ridge preservation, and dental implants. After the second stage, interest was focused on alveolar

ridge preservation, dental implants, and platelet-rich plasma. The third and fourth stages involved in-depth studies on bone augmentation, platelet-rich plasma, dental implants, and alveolar ridge preservation (Fig. 8).

The cluster on the right side of the graph represents the topics of the cited articles, while the cluster on the left signifies the cited discipline. Path analysis reveals a trajectory from the group on the left to the one on the right, with the curve it forms representing the citation line. It is evident that the most cited articles in dentistry, medicine, dermatology, nursing, and sports rehabilitation originate from dentistry, dermatology, and surgery. Hence, it can be inferred that the socket-shield technique is pertinent to a multitude of disciplines (Fig. 9).

DISCUSSION

There is a constant interest in knowing the most important publications in various topics, fields and specialties by researchers, students, and academics. This study was conducted to determine the general trends through a scientometric (bibliometric) analysis



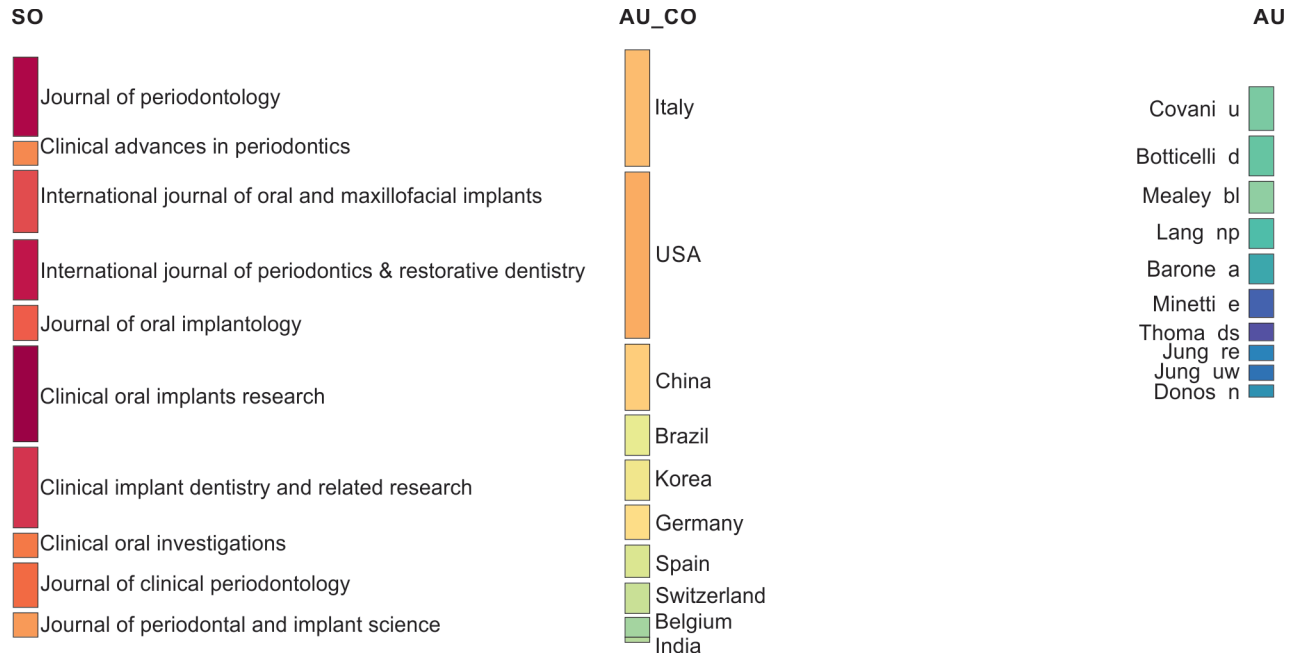


Fig. 4: Three-field graph showing the network between journals (left), countries (center), and authors (right)

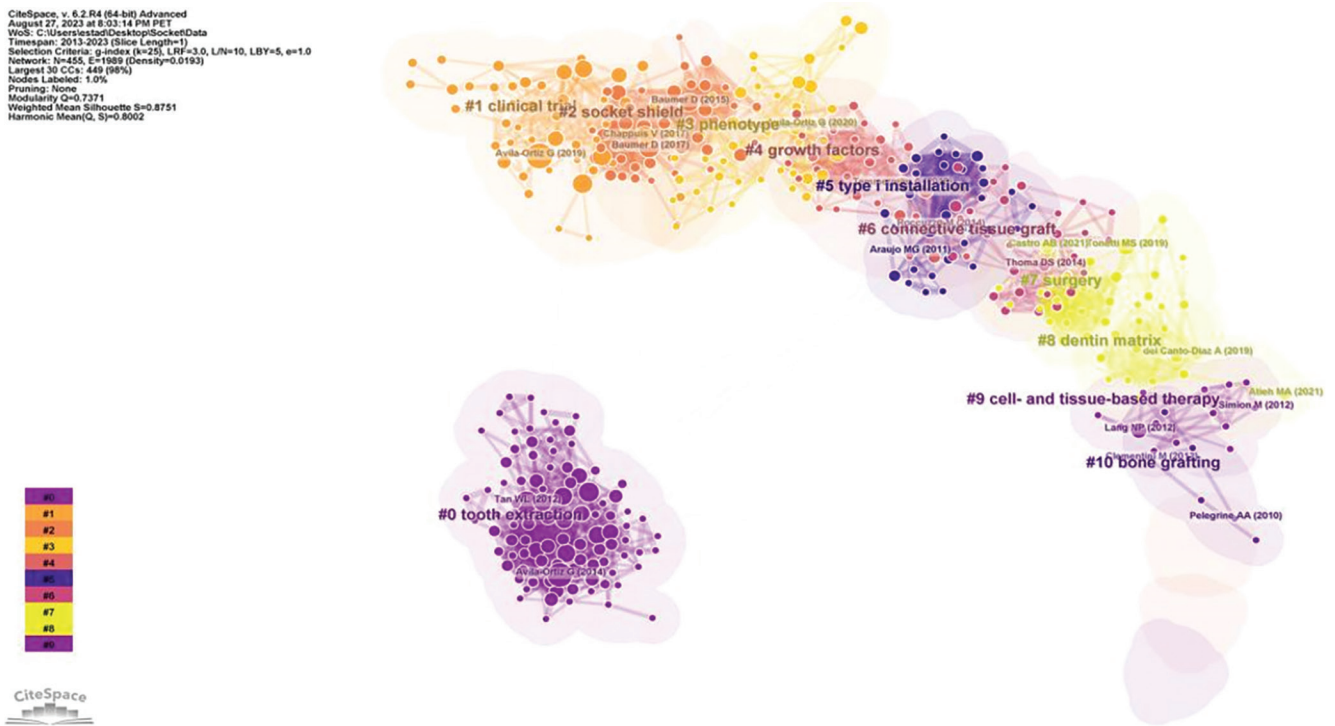
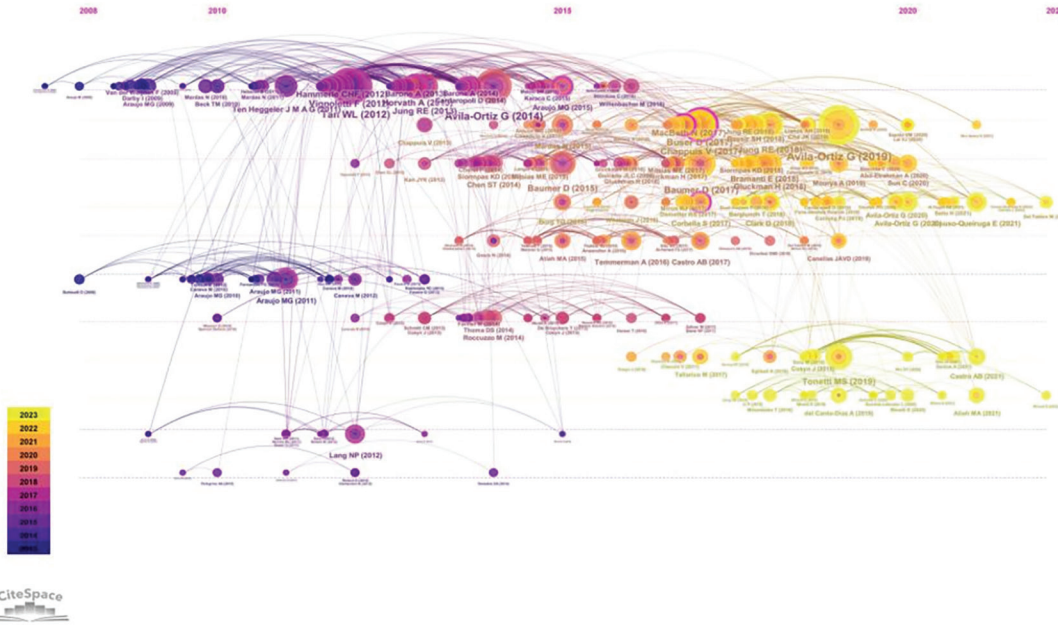


Fig. 5: Cluster development and relationship graph

of the socket-shield technique in oral implantology. In recent times, bibliometric studies have made a significant contribution to the research field by revealing the outcomes of systematic, reproducible, and transparent review processes. This has led to an enhancement in quality and acknowledgment of reviewers. Nevertheless, it plays an important role in the observation of the literature, manifesting an orientation of the subject to be studied toward publications with greater influence in the field of research.¹⁸

This study provides a scientometric approach to the socket-shield technique in oral implant dentistry. Bibliometrics has taken a lot of weight on research in medical sciences compared to traditional systematic review studies.¹⁹ The importance of this study lies in showing a production scheme in the bibliometric field, observing quantitatively, and pointing out the relevance of the scientific production that corresponds to the indexed database, using various production and impact indicators. For the future,

CiteSpace, v. 6.2.R4 (64-bit) Advanced
 August 27, 2023 at 8:03:14 PM PET
 WoS: C:\Users\test\Desktop\SocketData
 Timespan: 2013-2023 (Slice Length=1)
 Selection Criteria: g-index (k=25), LRF=3.0, L/N=10, LBY=5, e=1.0
 Network: N=455, E=1989 (Density=0.0193)
 Largest 30 CCs: 449 (99%)
 Nodes Labeled: 1.0%
 Pruning: None
 Modularity Q=0.7371
 Weighted Mean Silhouette S=0.8531
 Harmonic Mean(Q, S)=0.7908



- #0 tooth extraction
- #1 clinical trial
- #2 socket shield
- #3 phenotype
- #4 growth factors
- #5 type i installat...
- #6 connective tissu...
- #7 surgery
- #8 dentin matrix
- #9 cell- and tissue...
- #10 bone grafting

Fig. 6: Development of research topics during the study period

CiteSpace, v. 6.2.R4 (64-bit) Advanced
 August 27, 2023 at 8:46:16 PM PET
 WoS: C:\Users\test\Desktop\SocketData
 Timespan: 2013-2023 (Slice Length=1)
 Selection Criteria: g-index (k=25), LRF=3.0, L/N=10, LBY=5, e=1.0
 Network: N=455, E=1989 (Density=0.0193)
 Largest 30 CCs: 449 (99%)
 Nodes Labeled: 1.0%
 Pruning: None
 Modularity Q=0.7371
 Weighted Mean Silhouette S=0.8737
 Harmonic Mean(Q, S)=0.7996

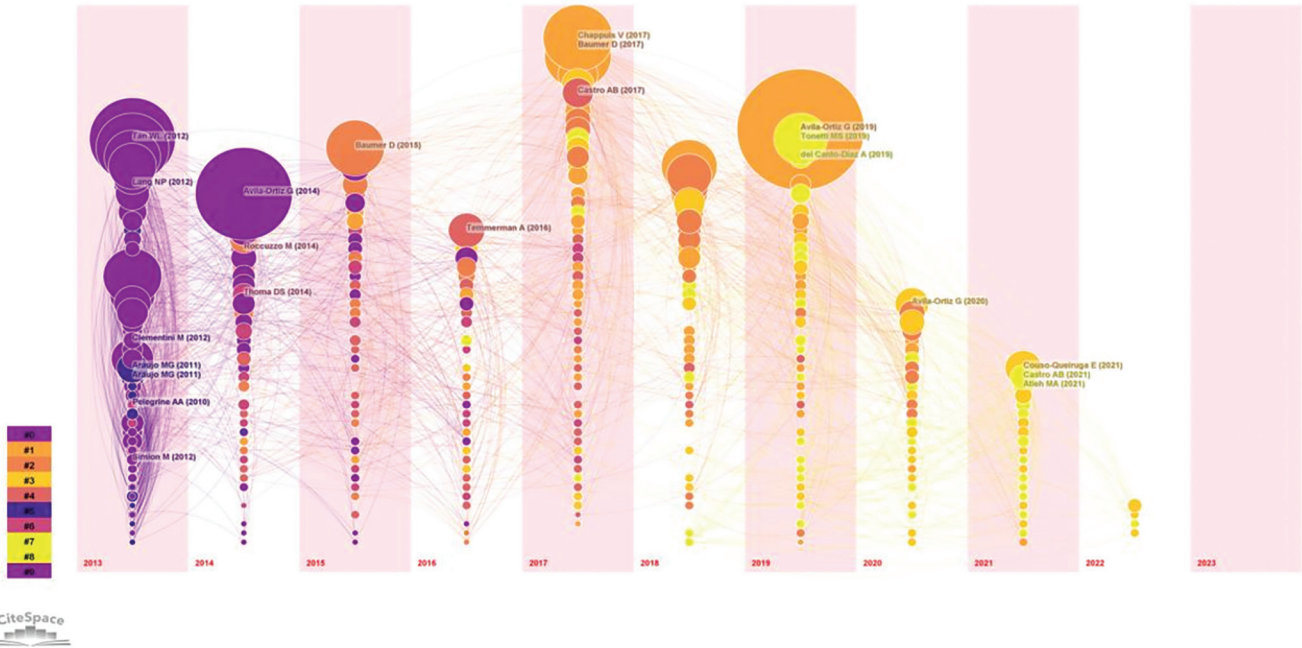


Fig. 7: Impact of articles according to authors on research in the study period



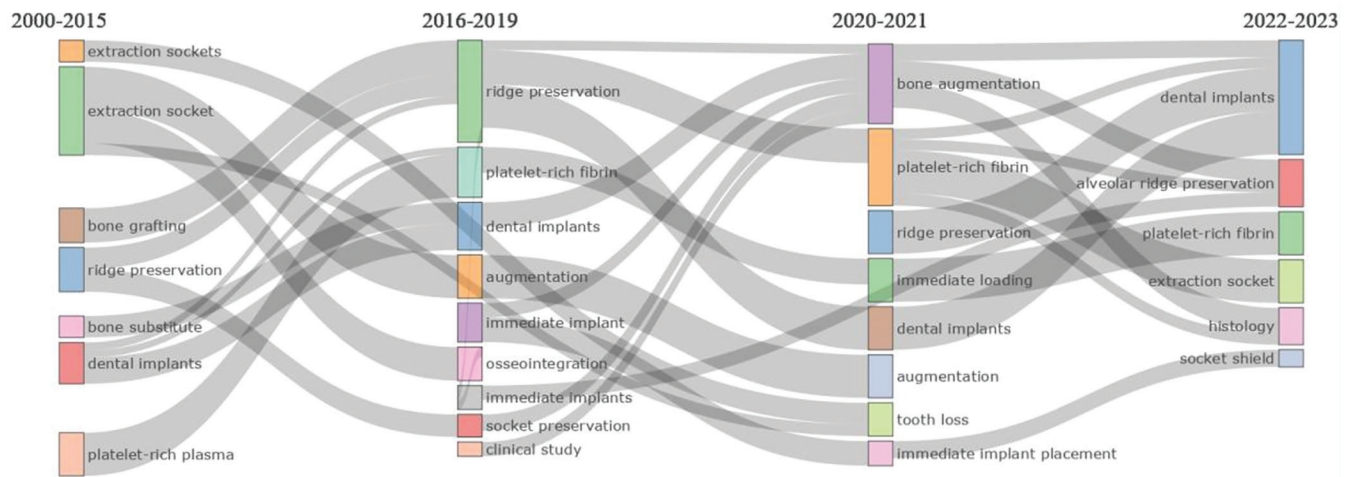


Fig. 8: Evolution of the research topic during the study period

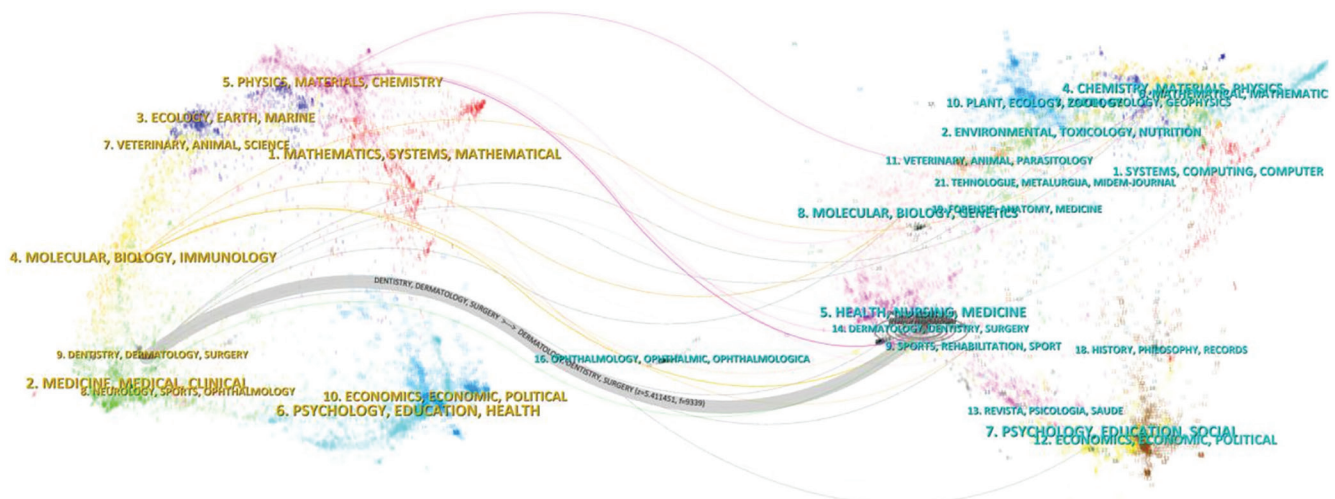


Fig. 9: Analysis of overlapping double figures in the research

it is essential to conduct long-term clinical studies, comparative research with other bone preservation methods, and explore innovations in materials and customized approaches. Key countries to focus these efforts include the United States, Germany, Japan, Brazil, and South Korea, due to their leadership and significant contributions to dental research. The objective was to outline the production according to journals, keywords, authors, countries, and documents in visual representations.^{19,20}

The socket-shield technique is an innovative approach in dentistry used in the placement of dental implants, a root preservation technique to maintain the integrity of a natural tooth after the extraction of one or more neighboring teeth.²¹ The main findings related to this technique are based on research and clinical experience accumulated to date.²² For example, in 2010, Hürzeler et al. published the first article on the socket-shield technique, where they proposed a novel approach in dental implant placement to maintain buccal bone plaque and improve esthetic predictability. In this study, we found documents dating back to the year 2000, and the number of publications on this technique has increased steadily, reaching the current number of 411 articles related to this research.⁹

It is now known that the socket-shield technique in oral implantology, being a technique largely subject to the skill of the clinician, certain common complications have been described, so that future studies merit rigorous calibration to parameterized protocols in order to follow a single line of clinical protocol.²³ The socket-shield technique in oral implantology has gained a lot of weight in clinical research; however, being a technique described and moderately investigated in recent years, more results need to be collected, effectiveness and success rates need to be assessed over time; currently it is considered to interpret the results of success with caution.²⁴

The findings of this research suggest that, based on Lotka's Law, there is a moderate to high degree of productivity in scientific pursuits. Therefore, it can be inferred that the socket-shield method will continue to attract attention, with an anticipated rise in the number of publications going forward. However, according to Bradford's Law, a larger number of articles are concentrated in a select few research journals. Furthermore, the surge in publications on the socket-shield technique appears to be primarily propelled by developed countries as opposed to developing ones. In terms of the quantity of publications, the USA has produced the most

studies on the technique, particularly in the past five years, thereby playing a pivotal role in this field.

At present, the primary goal of immediate implant placement following extraction is to achieve optimal esthetic outcomes while preserving or reconstructing hard and soft tissues. However, immediate implant placement alone does not prevent hard-tissue resorption and subsequent changes in soft tissue.²⁵ In response to this problem, a range of methods have been suggested, starting with Hürzeler's study in 2010. This was the first real validation of the socket-shield technique, showing that keeping the root helps maintain alveolar bone and doesn't hinder the osseointegration of the implant that is directly in contact with the root.

Expanding on the principle of partial root extraction, Gluckman et al.²⁶ proposed the use of a particulate bone graft to fill the void between the buccal root fragment and the implant.^{27,28} In contrast, Mitsias et al.²⁹ redefined the technique as Root Membrane, arguing that bone grafting is not required. They maintained that the preservation of the vestibular bone plate is dependent on the conservation of the periodontal ligament, and a segment of the root.

In 2019, Nguyen et al.³⁰ introduced the periosteal inhibition technique, which aims not to fill the remaining space to compensate for cortical bone resorption, but to prevent it mechanically by using a d-PTFE (dense polytetrafluoroethylene) film placed on the external part of the extraction socket. In the complete absence of buccal plaque, one can employ the multilayer technique proposed in 2021 by Schuh et al.,³¹ which involves removing a connective tissue graft and placing a 0.5 mm thick, soft film (horse or porcine membrane), and a biomaterial in the space between the device and the film.

As recently as 2022, Grassi et al.³² presented the modified periosteal inhibition technique, which uses a soft cortical film instead of a d-PTFE film. The research findings indicate that the gap between the implant and the socket walls can be occupied by a variety of bone replacement materials. The nature of the newly formed bone may vary based on the specific substitute utilized.³³

A significant constraint of this study is that it does not provide a critical analysis of each article's content; instead, it merely outlines the research trend of this topic. The bibliometric analysis is selective and limited by the database, as well as by restricted access to publications in their most comprehensive form. As a result, the Web of Science was selected for bibliometric scrutiny due to the essential attributes exhibited by each indexed article, including the author, source, cited references, keywords, and research field. Looking ahead, we intend to explore additional data sources such as Scopus and PubMed to identify prospective trends.³⁴

Research on the socket-shield technique in oral implant dentistry is crucial to improve the esthetic, and functional results of dental implants. This innovative technique promotes the preservation of bone and gingival tissues, essential for implant stability and appearance. Future research should focus on standardization of clinical protocols and long-term evaluation of their effectiveness and success rate. Countries such as the United States, Germany, and Japan, which are leaders in scientific production and international collaboration, should continue to be the focus of research. However, it is also vital to encourage studies in developing countries to expand global knowledge and clinical applications of the technique.

CONCLUSION

Within the limitations of the scientometric approach, the study of the socket-shield technique in oral implantology has grown

significantly from 2000 to 2023, with an increase in publications and diversity of authors and keywords. International collaboration is high, and publications are concentrated in specific journals, but are also dispersed. Authors and journals have considerable impact, and there is interaction between journals, authors, and country of publication. In summary, this field is growing, with international collaboration and significant impact.

REFERENCES

1. Fickl S, Zuh O, Wachtel H, et al. Dimensional changes of the alveolar ridge contour after different socket preservation techniques. *J Clin Periodontol* 2008;35:906–913. DOI: 10.1111/j.1600-051X.2008.01305.x.
2. Araújo MG, Lindhe J. Dimensional ridge alterations following tooth extraction. An experimental study in the dog. *J Clin Periodontol* 2005;32:212–218. DOI: 10.1111/j.1600-051X.2005.00642.x.
3. Araújo MG, Sukekava F, Wennström JL, et al. Tissue modeling following implant placement in fresh extraction sockets. *Clin Oral Impl Res* 2006;17(6):615–624. DOI: 10.1111/j.1600-0501.2006.01317.x.
4. Lars S, Ann W, Lambros K, et al. Bone healing and soft tissue contour changes following single-tooth extraction: A clinical and radiographic 12-month prospective study. *Int J Periodontics Restorative Dent* 2003;23:313–323. PMID: 12956475.
5. Tarnow D, Salama M, Salama H, et al. Flapless postextraction socket implant placement in the esthetic zone: Part 1. The effect of bone grafting and/or provisional restoration on facial-palatal ridge dimensional change—a retrospective cohort study. *Int J Periodontics Restorative Dent* 2014;34:323–331. DOI: 10.11607/prd.1821.
6. Tonetti M, Cortellini P, Graziani F, et al. Immediate vs. delayed implant placement after anterior single tooth extraction: The timing randomised controlled clinical trial. *Eur Res Group Periodontol* 2016. DOI: 10.1111/jcpe.12666.
7. Lee E, Gonzales O, Fiorellini J. Lingualized flapless implant placement into fresh extraction sockets preserves buccal alveolar bone: A cone beam computed tomography study. *Int J Periodontics Restorative Dent* 2014;34:61–68. DOI: 10.11607/prd.1807.
8. Troiano G, Zhurakivska K, Lo Muzio L, et al. Combination of bone graft and resorbable membrane for alveolar ridge preservation: A systematic review, meta-analysis, and trial sequential analysis. *J Periodontol* 2018;89(1):46–57. DOI: 10.1902/jop.2017.170241.
9. Hürzeler MB, Zuh O, Schuppach P, et al. The socket-shield technique: A proof-of-principle report. *J Clin Periodontol* 2010;37:855–862. DOI: 10.1111/j.1600-051X.2010.01595.x.
10. Moed HF. The impact-factors debate: The ISI's uses and limits. *Nature* 2002;415:731–732.
11. Ahmad P, Della E, Stoddart MJ. Applications of bone morphogenetic proteins in dentistry: A bibliometric analysis. *Biomed Res Int* 2020;2020:5971268. DOI: 10.1155/2020/5971268.
12. Feijoo J, Limeres J, Fernández-Varela M, et al. The 100 most cited articles in dentistry. *Clin Oral Investig* 2013;18:699–706. DOI: 10.1007/s00784-013-1017-0.
13. Coats AJS. Top of the charts: Download versus citations in the International Journal of Cardiology. *Int J Cardiol* 2005;105(2):123–125. DOI: 10.1016/j.ijcard.2005.08.004.
14. Shuaib W, Acevedo J, Khan M, et al. The top 100 cited articles published in emergency medicine journals. *Am J Emerg Med* 2015;33:66–71. DOI: 10.1016/j.ajem.2015.04.047.
15. Salem A, Mowafey B, El-Negoly S, et al. Socket-shield technique vs conventional immediate implant placement for esthetic rehabilitation: A systematic review and meta-analysis. *J Contemp Dent Pract* 2022;23:233–244. PMID: 35748456.
16. Corbella S, Francetti L, Taschieri S, et al. Analysis of the 100 most-cited articles in periodontology. *J Investig Clin Dent* 2017;8(3):1–13. DOI: 10.1111/jicd.12222.
17. Torres-Loyola A, Rojas-Arana C, Munive-Degregori A, et al. Bibliometric analysis of the current landscape of global scientific production on the development of vaccines against dental caries. *Int J Dent* 2022;2022:1–9. DOI: 10.1155/2022/7678891.

18. Zupic I, Čater T. Bibliometric methods in management and organization. *Organizational Res Methods* 2015;18(3):429–472. DOI: 10.1177/10944281145626.
19. Tam WW, Wong EL, Wong FC, et al. Citation classics: Top 50 cited articles in “respiratory system”. *Respirology* 2013;18(1):71–81. DOI: 10.1111/j.1440-1843.2012.02262.x
20. Gonzalez de Dios J, Moya M, Mateos Hernandez MA. Bibliometric indicators: Characteristics and limitations of the analysis of scientific activity. *An Esp Pediatr* 1997;47:235–244. PMID: 9499274.
21. Neves RG, Lazari-Carvalho PC, Carvalho MA, et al. Socket shield technique: Stress distribution analysis. *J Indian Soc Periodontol* 2023;27(4):392–398. DOI: 10.4103/jisp.jisp_356_22.
22. Grassi A, Memè L, Rossi R, et al. Modified periosteal inhibition (MPI) technique for immediate implants: A multi-center retrospective case series study. *Appl Sci* 2023;13(15):9034. DOI: 10.3390/app13159034.
23. Oliva S, Capogreco M, Murmura G, et al. The socket shield technique and its complications, implant survival rate, and clinical outcomes: A systematic review. *J Periodontal Implant Sci* 2023;53:99. DOI: 10.5051/jpis.2201780089.
24. Khan M, Zahan N. Comparative outcome of socket shield method and conventional immediate implant implantation with immediate temporization – a 10 years follow-up. *Int J Res Med Sci* 2023;1:2372–2377. DOI: 10.18203/2320-6012.ijrms20232073.
25. Araújo MG, Lindhe J. Ridge preservation with the use of Bio-Oss®collagen: A 6-month study in the dog. *Clin Oral Implants Res* 2009;20(5):433–440. DOI: 10.1111/j.1600-0501.2009.01705.x.
26. Gluckman H, Salama M, Du Toit J. Partial extraction therapies (PET) part 1: Maintaining alveolar ridge contour at pontic and immediate implant sites. *Int J Periodontics Restorative Dent* 2016;36(5): 681–687. DOI: 10.11607/prd.2783.
27. Gluckman H, Salama M, Du Toit J. Partial extraction therapies (PET) part 2: Procedures and technical aspects. *Int J Periodontics Restorative Dent* 2017;37(3):377–385. DOI: 10.11607/prd.3111.
28. Siormpas K, Mitsias M, Kotsiotou-Siormpa E, et al. Immediate implant placement in the esthetic zone utilizing the ‘root-membrane’ technique: Clinical results up to 5 years postloading. *Int J Oral Maxillofac Implants* 2014;29(6):1397–1405. DOI: 10.11607/jomi.3707.
29. Mitsias ME, Siormpas KD, Kotsakis GA, et al. The root membrane technique: Human histologic evidence after five years of function. *Biomed Res Int* 2017;2017:1–8. DOI: 10.1155/2017/7269467.
30. Nguyen V, Von Krockow N, Bolsa J, et al. Periosteal inhibition technique for alveolar ridge preservation as applied to implant therapy. *Int J Periodontics Restorative Dent* 2019;39:737–744. DOI: 10.11607/prd.4178.
31. Schuh PL, Wachtel H, Beuer F, et al. Multi-layer technique (MLT) with porcine collagenated cortical bone lamina for bone regeneration procedures and immediate post-extraction implantation in the esthetic area: A retrospective case series with a mean follow-up of 5 years. *Materials (Basel)* 2021;14(18):5180. DOI: 10.3390/ma14185180.
32. Grassi A, Memè L, Strappa EM, et al. Modified Periosteal Inhibition (MPI) technique for extraction sockets: A case series report. *Appl Sci* 2022;12(23):12292. DOI: 10.3390/app122312292.
33. Grassi A, Bernardello F, Cavani F, et al. Three-punch alveolar ridge reconstruction technique: A novel flapless approach in eight consecutive cases. *Int J Periodontics Restorative Dent* 2021;41(6):875–884. DOI: 10.11607/prd.4913.
34. Mayta-Tovalino F, Diaz-Barrera ME, Runzer-Colmenares FM, et al. RAMIBS: Reporting and measurement of items for bibliometric or scientometric studies in health sciences. *J Int Oral Health* 2024;16(3):253. DOI: 10.4103/jioh.jioh_23_24.