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Major considerations on the periodontal biological space and treatments for dental implants: a concise systematic review

Livia Baldan Landin Santos[1,*], Gabriella Granucci Ferreira[1], Bárbara Soares Carolino[1], José Augusto Parola da Cruz[1]

[1] UNORTE - University Center of Northern São Paulo - Department of Dentistry, Sao Jose do Rio Preto, Sao Paulo, Brazil.

*Corresponding author: Livia Baldan Landin Santos.
UNORTE - University Center of Northern São Paulo -
Department of Dentistry, Sao Jose do Rio Preto,
Sao Paulo, Brazil.
E-mail: liviabaldan1@outlook.com
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Abstract

Introduction: Proper planning, coupled with improved technique, knowledge of the dental anatomy and adjacent structures, commences for successful treatment. In preparing for a prosthesis, we must know how to respect the limits of soft-tissue anatomy. The biological space must be strictly respected, in order that there is harmony between the prosthesis and the soft tissue. **Objective:** This study aimed to review, through literature, the importance of respecting the limits of the biological space when preparing for a fixed prosthesis. **Methods:** The PRISMA Guidelines were followed. The search was conducted from January to February 2026 across the Web of Science, Scopus, Embase, PubMed, ScienceDirect, SciELO, and Google Scholar databases. The quality of the studies was assessed using the GRADE instrument, and the risk of bias was evaluated according to the Cochrane instrument. **Results and Conclusion:** According to the GRADE instrument, most studies presented homogeneous results, with X2 = 65.7% > 50%. A total of 120 articles were found and submitted for eligibility analysis, with 16 final studies selected to compose the results of this systematic review. Considering the Cochrane tool for risk of bias, the overall assessment resulted in 31 studies with a high risk of bias and 28 studies that did not meet GRADE and AMSTAR-2 standards. Information on the biological space and its limits that must be respected is consistent in the literature. Harmony and success of treatment depend on strict planning, adequate materials, and respect for biological limits.

Keywords: Periodontal surgery. Increase of clinical crown. Biological space. Prothesis adaptation.

Introduction

The periodontal biological space is a denting-gingival union composed of the structure of the gingival sulcus with approximately 0.69 mm, junctional epithelium with 0.97 mm, and conjunctive insertion with an average of 1.07 mm. These measurements may vary from tooth to tooth, with the most variable structure being the junctional epithelium and the most constant being the conjunctive insertion, according to this space located coronally to the alveolar bone crest, and may be rounded to approximately 3 mm. This distance is fundamental for the adhesion of the junctional epithelium and insertion of the gum connective fibers to the tooth structure [1,2].

Thus, the biological space is the whole set of tissues that ensure the functioning, maintenance, and vitality of gum health. The periodontium is divided into gingiva (oral epithelium, gingival sulcus, sulcus epithelium, junctional epithelium: these are the parts that together cover the entire alveolar bone and surround the cervical location of the teeth; in cells, which surround the roots of the teeth and make the connection between the root cementum to the alveolar bone; Root cementum: Specialized, highly calcified tissue that covers the root surfaces of the teeth. Not being vascularized, lymphatic, or containing innervations, it does not undergo morphological changes; however, has the characteristic of continuous deposition throughout life. Alveolar Bone is defined as

the parts of the maxilla and mandible that form and support the dental alveoli [2-6].

Respecting this anatomical site is of utmost importance so that every fixed or crown-type fixed prosthesis is adapted so that it can live harmoniously with the tissues adjacent to the periodontal and periodontal itself, without causing irritation and inflammation [2,3]. In some situations in which preparations with subgingival endings are observed, they cannot always be satisfactorily performed to be successful in treatment. When the inefficient invasion of the biological space occurs, the organism tends to promote the resorption of the bone structure, which supports the dental element and its adjacent structures in order to compensate for the lost space [3,4].

Thus, one can observe subgingival cavity margins invading the biological space, thus requiring surgical intervention in order to restore normality to the supporting tissues. To be successful in restorative treatment and not cause damage to the periodontal tissues, the preparation should be completed 3 to 4 mm from the alveolar bone crest, preserving the supporting tissues (junctional epithelium and connective insertion). Thus, clinical crown augmentation surgery has been highly recommended because it promotes a better working view, bringing to treatment a greater chance of success [4-8].

Surgical procedures that include clinical bladder augmentation can be performed in two ways: soft tissue excision through gingivectomies or gingivoplasty, or removing bone tissue through osteotomy and osteoplasty as needed [4]. Therefore, this study aimed to address the indications, contraindications, and surgical techniques for clinical crown augmentation for restorative purposes.

Methods

Study Design

This study followed the international systematic review model, following the PRISMA (preferred reporting items for systematic reviews and meta-analysis) rules. Available at: http://www.prisma-statement.org/?AspxAutoDetectCookieSupport=1. Accessed at: 02/10/2026. The AMSTAR 2 (Assessing the methodological quality of systematic reviews) methodological quality standards were also followed. Available at: https://amstar.ca/. Accessed at: 02/10/2026.

Search Strategy and Search Sources

The literature search process was carried out from January to February 2026 and developed based on Web of Science, Embase, Scopus, PubMed, Lilacs, Ebsco, Scielo, and Google Scholar, covering scientific articles from various periods to the present day. The following descriptors were used in health sciences (DeCS/MeSH terms): "", and the Boolean "and" was used between the MeSH terms and "or" between the historical findings.

Study Quality and Risk of Bias

Quality was classified as high, moderate, low, or very low regarding the risk of bias, clarity of comparisons, precision, and consistency of analyses. The most evident emphasis was on systematic review articles or meta-analyses of randomized clinical trials, followed by randomized clinical trials. Low quality of evidence was attributed to case reports, editorials, and brief communications, according to the GRADE instrument. The risk of bias was analyzed according to the Cochrane instrument by analyzing the Funnel Plot graph (Sample size versus Effect size), using Cohen's test (d).

Results and Discussion

Summary of Findings

A total of 120 articles were found and submitted to eligibility analysis, with 16 final studies selected to compose the results of this systematic review. The listed studies were of medium to high quality (Figure 1), considering the level of scientific evidence of studies such as meta-analysis, consensus, randomized clinical, prospective, and observational. Biases did not compromise the scientific basis of the studies. According to the GRADE instrument, most studies presented homogeneity in their results, with X^2=65.7%>50%. Considering the Cochrane tool for risk of bias, the overall assessment resulted in 31 studies with a high risk of bias and 28 studies that did not meet GRADE and AMSTAR-2.

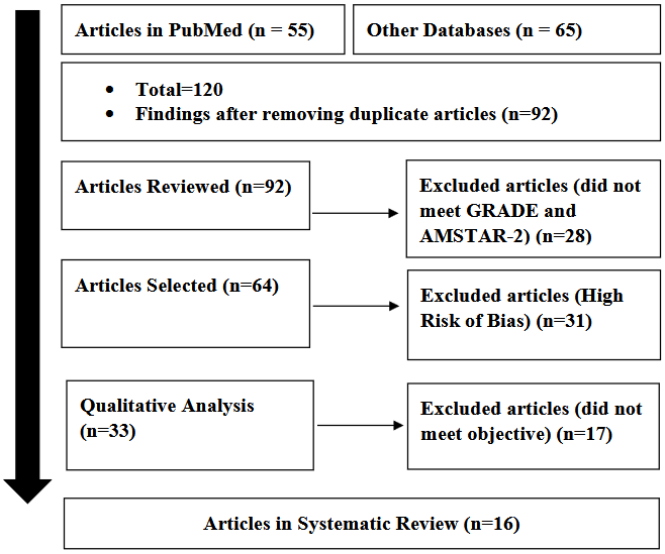

Figure 1. Flowchart showing the article selection process. Source: Own Authorship.

Figure 2 presents the results of the risk of bias of the studies using the Funnel Plot, showing the calculation of the Effect Size (Magnitude of the difference) using Cohen's Test (d). Precision (sample size) was determined indirectly by the inverse of the standard error (1/Standard Error). This graph did not have a symmetrical behavior, suggesting a significant risk of bias, both among studies with small sample sizes (lower precision) that are shown at the base of the graph and in studies with large sample sizes that are presented at the top.

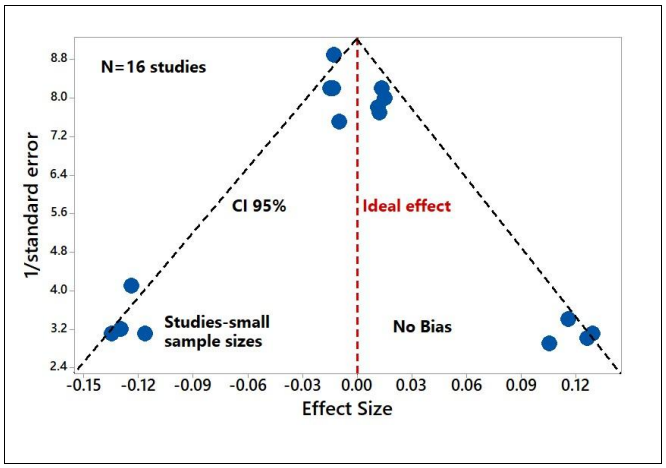

Figure 2. The non-symmetrical funnel plot suggests risk of bias among the studies with small sample sizes that are shown at the bottom of the graph. High confidence and high recommendation studies are shown above the graph (n=16 studies). Source: Own Authorship.

Major Results and Discussion

Dental treatment is only considered satisfactory when several aspects are respected, among which the main ones are mechanical, biological, functional, and aesthetic, aiming to maintain the harmony between soft tissue, bone tissue, and the prosthesis [1,2,5]. The aim is to maintain harmony between the tissues that comprise the supporting tissue (soft tissue, bone tissue, and dental tissue). The biological space consisting of measurements from the free gingival margin to the alveolar bone crest contains auxiliary and bioanatomic structures of the sulcular epithelium, junctional epithelium, and connective insertion [4,6].

The function of the biological space is to protect against bacterial activity and maintain the integrity of the supporting elements, since if the biological space is not respected, sustained periodontal lesions may appear, which may result in bone loss and pouch formation. periodontal disease, gingival recession, and even tooth loss [7].

Invasion of the biological space during preparation for restorations, whether fixed prostheses or direct restorations, can cause gingival recessions, bone resorption, deepening of the gingival sulcus, and inflammation. These changes may be permanent or transient, clinically represented by inflammatory signs such as pain, heat, redness, bleeding, and loss of aesthetic and functional functions [8].

This excessively violated space can be recovered through structure repositioning techniques such as orthodontic traction of the tooth or involved root fragment, followed by periodontal surgical procedure to correct bone defects and gingival tissues, and periodontal surgical access to the tooth or fragment. root canal involved, followed by orthodontic traction, apical flap positioning through resective bone surgery over the involved area (crown conquest) for posterior restoration, which generally compromises the aesthetics and removes the supporting bone of the adjacent teeth, extraction of the tooth involved with subsequent replacement by prosthesis or implant [9].

The choice of orthodontic traction as a treatment, for example, is beneficial because this treatment is extremely conservative, providing the rehabilitation of the dental element without the need for preparation of adjacent teeth and for restoring aesthetic and functional functions in a relatively short time. Some dissatisfaction may appear due to the use of orthodontic braces, and some wear may be necessary in order to allow space for extrusion [10,11].

With all tissue handling, at the end of treatment, there is the possibility of regularizing the gingival bone tissues by remodeling the anatomy with minor periodontal surgery [12,13]. Surgical apical positioning of the flap when resective bone surgery is used on elements that, due to caries or fractures, have lost large portions of the crown, the restorative treatment is simple, as it presents greater exposure of the dental element sufficient for tooth retention and shape, without aggression to periodontal tissues [14,15].

In cases where the extraction of the dental element is chosen, it should be kept in mind that the rehabilitation must be done in a short time so that there is no tooth movement, which can lead to the loss of spaces that would be used for implant or prosthesis installations. punctuated type, which requires spaces [2,3,16].

Conclusion

It was concluded that among several hypotheses of treatments that can be performed, we realize that there is a need to elaborate and study each case in its particularity. It was concluded that the importance of biological space for the success of aesthetic and functional treatment, avoiding failures in subgingival preparations and marginal adaptations.

CRediT

Author contributions: **Conceptualization-** All authors; **Investigation-** All authors; **Methodology-** All authors; **Project administration-** All authors; **Supervision-** José Augusto Parola da Cruz; **Writing - original draft-** All authors; **Writing-review & editing-** All authors.

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Ethical Approval

Not applicable.

Informed Consent

Not applicable.

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No additional data are available.

Conflict of Interest

The authors declare no conflict of interest.

Similarity Check

It was applied by Ithenticate®.

Application of Artificial Intelligence (AI)

Not applicable.

Peer Review Process

It was performed.

References

1. Szmukler-Moncler S, Kolerman R, Tagger-Green N, Beuer F, Milicescu S. Peri-implant tissue response to three implants engaging retained roots: a histologic report in the pig mandible. Int J Implant Dent. 2026 Apr 6;12(1):15. doi: 10.1186/s40729-026-00676-4.
2. Kunrath MF, Magrin GL, Zorzo CS, Rigotto I, Aludden H, Dahlin C. Membranes for Periodontal and Bone Regeneration: Everything You Need to Know. J Periodontal Res. 2025 Jun 17. doi: 10.1111/jre.70005.
3. Hu YW, Zeng YX, Zhang YX, Lai PY, Liang R, Chen YQ, Huang H, Guo GS. Implants as anchorage for the correction of localized dental malocclusion: a retrospective clinical study. Front Bioeng Biotechnol. 2025 Dec 4;13:1703249. doi: 10.3389/fbioe.2025.
4. Nassani MZ. Immediate versus delayed single-tooth implant placement in bony defect sockets in the aesthetic zone: Is an intact buccal wall necessary? Evid Based Dent. 2025 Jun;26(2):80-82. doi: 10.1038/s41432-025-01152-5.
5. Abella F, Ribas F, Roig M, González Sánchez JA, Durán-Sindreu F. Outcome of Autotransplantation of Mature Third Molars Using 3-dimensional-printed Guiding Templates and Donor Tooth Replicas. J Endod. 2018 Oct;44(10):1567-1574. doi: 10.1016/j.joen.2018.07.007. Epub 2018 Aug 25.
6. Rösing CK, Fiorini T, Haas AN, Muniz FWMG, Oppermann RV, Susin C. The impact of maintenance on peri-implant health. Braz Oral Res. 2019 Sep 30;33(suppl 1):e074. doi: 10.1590/1807-3107bor-2019.vol33.0074. eCollection 2019.
7. Zafar K, Nazeer MR, Ghafoor R. Interdisciplinary management of gingival recession and pathologic teeth migration-Revisiting dental aesthetics. J Pak Med Assoc. 2019 Sep;69(9):1385-1389.
8. Micheline Sandini Trentin. Clinical crown lengthening for restoring biological distances for restorative purposes – literature review. RFO, Passo Fundo, 2012, Brazil.
9. Mestrener SR, Komatsu J. Smile Line Recovery Using Surgical and Restorative Procedures, JBD - Brazilian Journal of Dentistry & Aesthetics 2002, Brazil.
10. Bertolini PFR, Biondi Filho O, Vanessa Harumi Kiyan, Cintia Helena Coury Saraceni. Smile aesthetics recovery: plastic surgery. Periodontal and prosthetic rehabilitation. Rev. Ciênc. Médicas, 2011, Brazil.
11. Machado WAS, David Zuanazzi Machado Junior, Joel Alves da Silva, Júnior, Sérgio Kahn. Clinical crown lengthening with ridge conditioning and interdental papilla reconstruction, Rev Gaúcha de Odontologia, 2005, Brazil.
12. Irineu Gregnanin Pedron, Estevam Rubens Utumi, Ângelo Rafael Calábria Tancredi, Andréia Perrella, Flávio Eduardo Guillin Perez, Gingival smile: resective surgery as an adjunct to dental aesthetics, Rev Metodista Escola de Doenças Médicas e da Saúde, 2010, Brazil.

13. Marcos Rissato, Micheline Sandini Trentin, Clinical crown lengthening for the restoration of biological distances for restorative purposes - Literature review, RFO, Passo Fundo, 2012, Brazil.
14. Carranza Júnior FA, Newman MG. Clinical Periodontics. 8th ed. Rio de Janeiro: Guanabara Koogan, 1997.
15. Newman MG, Takei HH, Klokkevold PR, Carranza FA. (Coord.). Carranza: Clinical Periodontology. 9th ed. Rio de Janeiro: Elsevier; 2004.
16. Althubaiti MM, Nunu DY, Alshawi AH, Alqurashi AH, Al-Lashlash MK, Alnouman AA, Alrashidi NS, Alrashdi WM, AlWatpan SI, Alshammari KF, Almutairi MK, Alalawi MH, Barri ZK, Alswail SS. Esthetic, Periodontal, and Functional Outcomes of Orthodontic Space Closure Versus Prosthetic Replacement for Congenitally Missing Maxillary Lateral Incisors: A Systematic Review. Cureus. 2026 Jan 10;18(1):e101260. doi: 10.7759/cureus.101260.