

Single-Implant Overdenture Retained by an Innovative T-OVER Abutment: 5-Year Follow-Up Report

Luciana Silva Colepícolo, Maria Auxiliadora Mourão Martinez,
Luís Otávio Miranda Cota, Rafael Paschoal Esteves Lima, and Fernando Oliveira Costa*

ABSTRACT

This prospective case report evaluated the 5-year clinical performance of a complete mandibular denture supported by an innovative T-OVER abutment system with PLUG T, anchored on a single midline implant. The system features a T-Connect paraboloid contour with double curvature and three pins in a tripod configuration. A 62-year-old edentulous female with severe mandibular atrophy, who declined bone grafting for personal and financial reasons, received a single 3.5×11 mm implant at the mandibular midline. After a 4-month healing period, the T-OVER system was activated, and complete dentures were fabricated with proper border molding and occlusal adjustments. The mandibular denture was semi-rigidly connected to the abutment via the PLUG T. Clinical and radiographic follow-ups were conducted four weeks post-loading and every six months thereafter. Over five years, the implant showed no bleeding on probing, stable probing depths (2–3 mm), and no marginal bone loss. The patient reported high satisfaction and an improved oral health-related quality of life. This case suggests that a single-implant mandibular overdenture using the T-OVER and PLUG T system may be a practical and, effective solution for edentulous patients unable to undergo complex or costly procedures.

Keywords: Abutment design, dental implants, mandibular overdenture, mechanotransduction.

Submitted: August 04, 2025

Published: October 11, 2025

 10.24018/ejdent.2025.6.5.401

Federal University of Minas Gerais, Brazil.

*Corresponding Author:
e-mail: focperio@gmail.com

1. INTRODUCTION

Edentulism remains a reality for many individuals, with high global prevalence rates and wide variation across countries, age groups, and socioeconomic levels, estimated at approximately 22.0% [1]. It is considered a major functional and aesthetic limitation due to its negative impact on oral function and the psychosocial aspects of quality of life [2].

As a result, the restoration of oral function through implant placement and oral surgery is often well received. Long-term studies have demonstrated that edentulous arches can be successfully rehabilitated using implant-supported fixed or removable prostheses [3]–[5].

However, many individuals with edentulous jaws face financial challenges or anatomical limitations such as advanced bone resorption, which make implant rehabilitation an unattainable goal [1]. Bone atrophy is often

accompanied by a reduction in soft tissue volume, making the use of conventional removable complete dentures (RCDs) more uncomfortable and increasing the risk of pressure-induced lesions [6]–[8].

Additionally, the retention and stability of RCDs are often compromised, leading to discomfort, pain during mastication, denture displacement, and impaired speech (especially with labiodental and sibilant phoneme) which significantly impacts quality of life and self-esteem [9], [10].

From a technical perspective, in severely atrophic maxillae, there may be insufficient space to establish an adequate buccal flange extension or to perform effective functional impressions, making it difficult to achieve proper peripheral seal and suction [11], [12].

Despite major advances in implant dentistry and the regeneration of hard and soft tissues, [13] many individuals are still discouraged by their inability to undergo extensive

surgeries or by financial limitations, as these procedures are costly and often associated with greater morbidity [1].

In this context, the use of a removable complete denture supported by a single implant may represent a valid and effective treatment alternative, as it minimizes the adverse effects of inadequate support and retention. Therefore, the objective of this case report is to evaluate the 5-year clinical performance of a mandibular complete denture supported by an innovative triple-abutment system (T-OVER and PLUG T) anchored to a single midline implant in a fully edentulous patient.

2. METHODS

2.1. Description of the T-OVER System

The use of an innovative abutment system featuring a double paraboloid design (DA) and a triple configuration (TA) was previously presented by Colepícolo *et al.* [14] in 42 clinical cases involving a single implant supporting two dental crowns (DA; $n = 28$) and three dental crowns (TA; $n = 15$), with follow-up periods of up to 12 years. These cases demonstrated excellent stability of the peri-implant soft and hard tissues.

Building on the concept of multiple abutments, another innovative abutment system named T-OVER and PLUG T was developed to support overdenture on a single midline implant (Fig. 1). T-OVER features a multidimensional hyperbolic paraboloid contour (T-Connect—Fig. 1b) with a tripod design and a dual-shape curvature. It includes a specific attachment mechanism for the denture: the PLUG T (Fig. 1d), which fits onto the T-OVER abutment (Fig. 1e, 1f). This attachment can be configured as a male-female coupling, button-type, pressure-fit using a plastic sleeve (bar-clip), or

magnet-based (patent Brazil112020009609A2; Índia 517585; Europe n 17932138,5; USA 11.701.206 B2). It is noteworthy that, in this case, a pressure-fit retention system was used for the mandibular complete denture.

2.2. Clinical Case

This clinical investigation was designed as a pre-post case study and is reported in accordance with PROCESS [15] and CARE [16]. All procedures performed in this study were in accordance with the ethical standards of the 1975 Declaration of Helsinki, revised in 2013. After receiving a thorough explanation of this pilot study, she provided informed consent and signed an approved ethical agreement (CEP/UFMG: protocol number 5895732).

The patient (M.F.P) was a 62-year-old systemically healthy female who, at baseline in 2019, presented with severe mandibular atrophy. She declined bone grafting procedures due to personal preference and financial constraints. Based on cone beam computed tomography (CBCT) evaluation, a single implant (Implacil Ltda, 3.5×11 mm, internal hexagon, São Paulo, Brazil) was placed in the mandibular midline.

After a 4-month osseointegration period, the implant was activated. A careful transfer impression of the implant and both arches was made using addition-cured silicone (Futura, DFL Ltda, Rio de Janeiro, Brazil). Stone casts were fabricated, and the T-OVER abutment was modeled in acrylic using a burn-out UCLA-type abutment for a 3.5 mm internal hex connection (Implacil, São Paulo, Brazil), and then cast in a cobalt-chromium alloy (Fig. 2).

A set of complete dentures was fabricated, with proper border and occlusal adjustments. The mandibular denture was adapted to the T-OVER abutment using a retentive slot for the pressure-fit retention system.

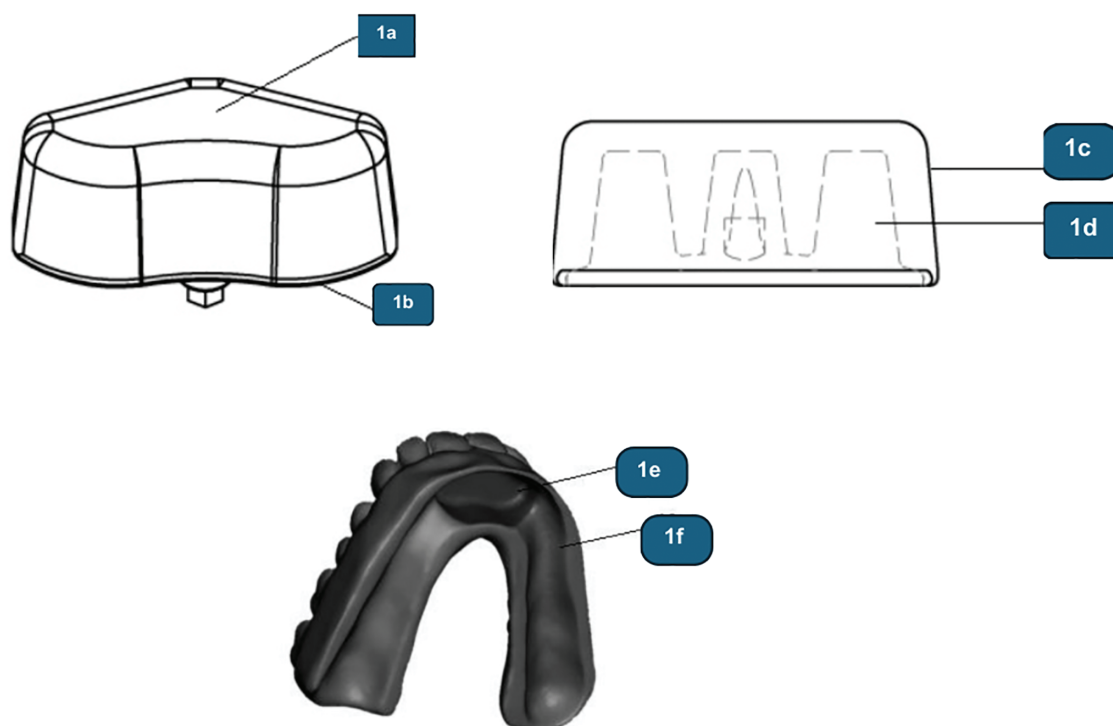


Fig. 1. T-OVER and PLUG T system. [1a = Occlusal view; 1b = TConnect connection; 1c = Lateral view; 1d = PLUG T (tripod plug); 1e = Retentive slot for pressure-fit retention system; 1f = Denture base area for overdenture adaptation].

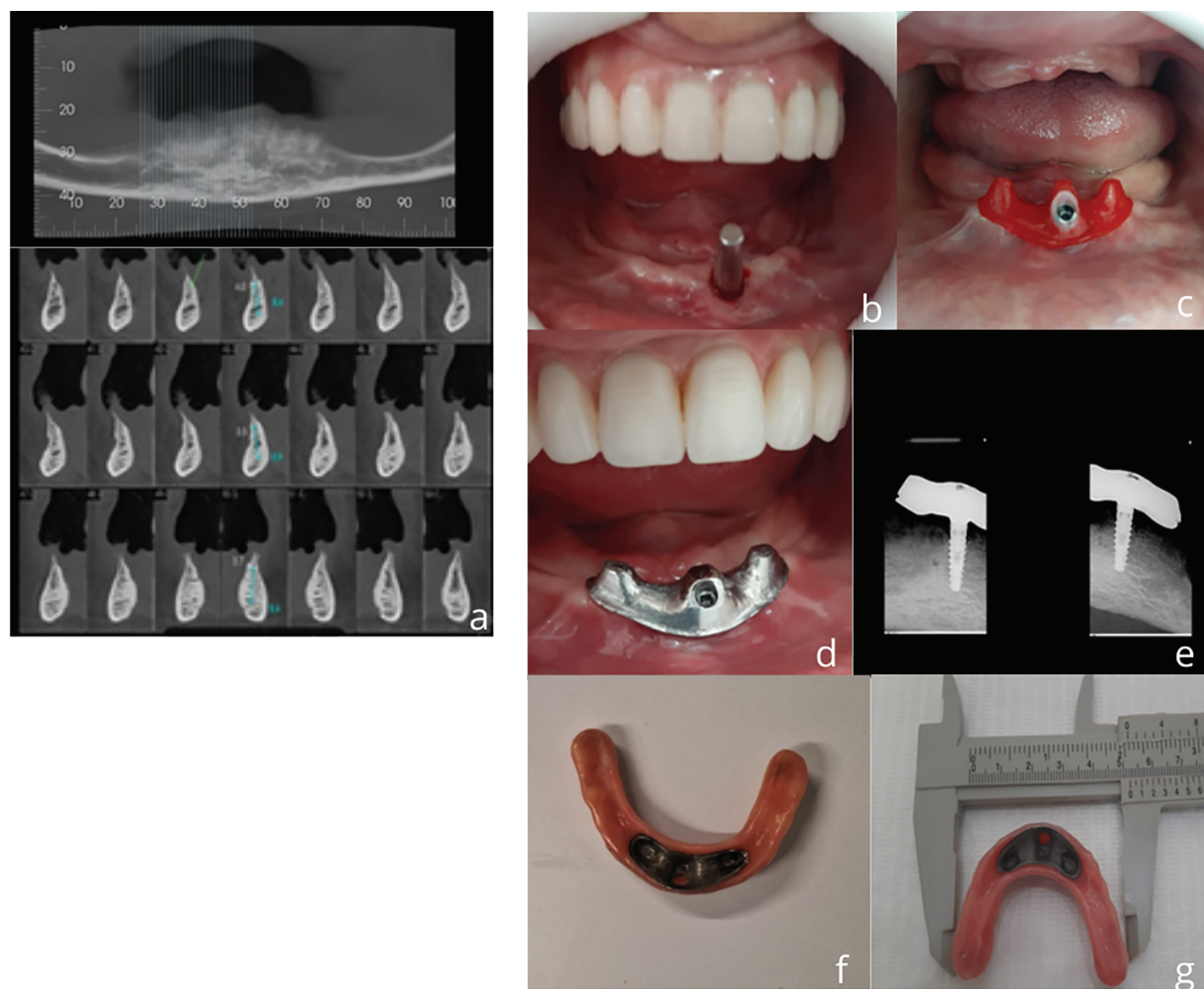


Fig. 2. Clinical study: baseline (2019)–a) Initial CBCT scan; b) buccal inclination of the implant (3.5/10 mm; internal hexagon); c) T-OVER abutment in acrylic modeling; d) periapical radiograph with T-OVER installed; e) T-OVER cast in cobalt-chromium; f) basal view of the prosthesis; (g) overdenture base adaptation area measuring 45 mm.

After four weeks of functional loading (T1), clinical follow-up visits were performed quarterly during the first year and biannually thereafter. Clinical assessments included the modified plaque index, peri-implant bleeding on probing (BOPi), peri-implant probing depth (PPDi), and keratinized mucosa height. Radiographic evaluation involved measuring the marginal bone levels from the implant platform to the alveolar bone crest (Fig. 2). The final follow-up (T2) was performed in 2024, representing a 5-year follow-up period (Fig. 3).

3. RESULTS

Table I summarizes the clinical and radiographic peri-implant parameters at T1 and T2 time points. Throughout the entire follow-up period, a low modified plaque index was maintained, no peri-implant bleeding was observed, probing depths remained stable at approximately 3 mm, keratinized mucosa height consistently measured around 2 mm, and marginal bone levels showed improvement at T2.

Fig. 2 illustrates the baseline clinical conditions (2019), including the initial CBCT, implant placement, T-OVER fabrication, and intraoral clinical and radiographic images of the installed abutment and prostheses. Fig. 3 presents the 5-year follow-up (T2, 2024), including updated CBCT

images, clinical view of the T-OVER abutment, and prosthesis in function. The most common intervention was pressure adjustment to achieve adequate retention (N = 3).

The patient reported a high level of satisfaction and oral health-related quality of life, scoring 9 out of 10 on a visual analog scale satisfaction (VAS-S) following the use of the new mandibular complete denture.

4. DISCUSSION

This clinical case reports describes peri-implant tissue health around a single implant supporting a mandibular overdenture over a 5-year follow-up period. Additionally, the patient reported a high level of satisfaction and favorable self-perceived oral health-related quality of life.

Similar to the innovative TA abutment described by Colepícolo *et al.* [14], the T-OVER abutment was developed based on the Biodynamics Optimized Peri-Implant Tissue (BOPIT) concept. This model incorporates principles of bone mechanotransduction [17], [18], biotensegrity [19], [20], and mechanobiology [17]–[19], [21], [22]. OPIT combines mathematical and biophysical principles related to vectors and load distribution, enabling the transmission of forces to the peri-implant tissues in a distinct and

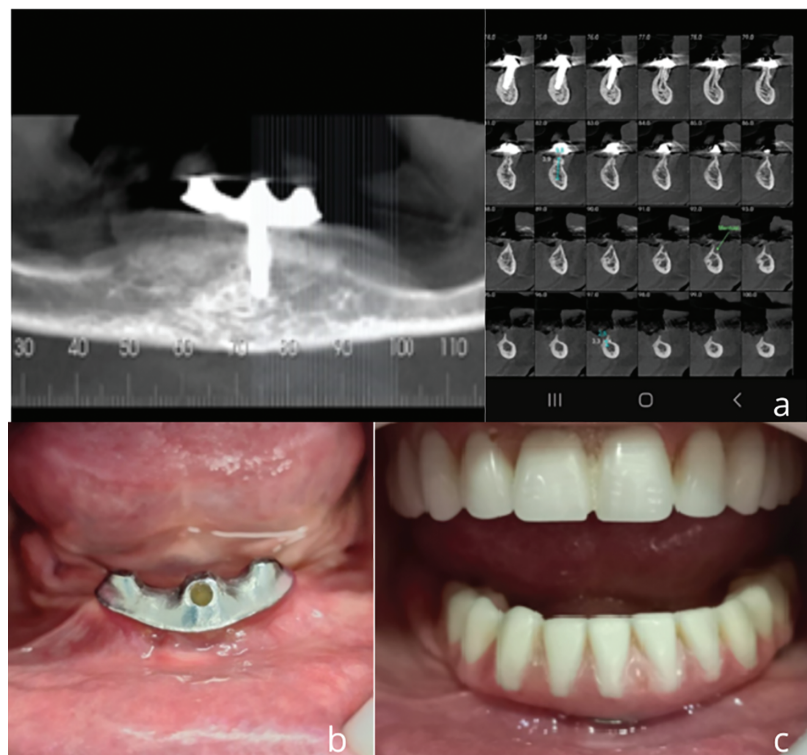


Fig. 3. Five-year follow-up (2024)–a) CBCT image at 5 years; b) clinical view of the T-OVER abutment and c) the complete mandibular overdenture.

TABLE I: KEY FEATURES OF THE CLINICAL CASE	
Age	T1 = 62 and T2 = 67 years old
Implant	3.5/10 mm; internal hexagon
Follow-up time at T2	5 years
Number of maintenance visits at T2	N = 12
Modified plaque index	T1 = 1.0; T2 = 0.5
Peri-implant probing depth	T1 = 3.0 (±0.82); T2 = 3.0
Peri-implant bleeding on probing	T1 = 0; T2 = 0.0
Height of keratinized tissue on implant (%)	T1 = 1.0; T2 = 2.0
Marginal bone loss	T1 = 2.0 mm; T2 = 1.0 mm

dynamic manner through the new T-OVER abutment, whose geometry is biologically active.

The hyperbolic paraboloid geometry of the T-OVER abutment enables high rigidity with reduced flexural stress, allowing for force redirection and equalization. Its design is well-suited to absorb shear forces across a hyperbolic shell surface, thereby distributing off-axis axial loads uniformly to the edge structures of the system. Vectorial loads are minimized, helping prevent the transverse shear stress that typically leads to early bone loss at the implant–abutment interface [17].

Subsequently, Colepícolo *et al.* [23] reported a finite element analysis comparing the DA abutment with a conventional distal cantilever (CC) on a single implant. The study evaluated stress and strain distribution in cortical and cancellous bone, as well as in the abutment, UCLA, implant, and retention screw under axial and oblique loading (30° in the Y-axis direction), applying 100 N forces.

Using the von Mises criterion, the DA abutment demonstrated significantly lower stress levels and improved strain distribution compared to the CC abutment, indicating a more favorable biomechanical interaction among the components.

In this context, the T-OVER with PLUG T abutment offers the following advantages: reduced stress concentration at the implant platform and screw; support for overdentures using a single implant; feasibility in cases involving angled implants; and complete passivity and ease of hygiene (the prophylactic parabolic emergence profile of the TA14 and T-OVER allows regular use of dental floss due to its segmented tripod configuration).

When applied clinically, T-OVER offers several potential benefits for the long-term stability of single-implant overdenture rehabilitation. These include: reduction in bone resorption, decreased risk of implant fracture, enhanced abutment–screw joint stability, minimized micromovements, and improved patient comfort.

Furthermore, T-OVER optimizes the use of atrophic or irregular bone regions and preserves anatomically critical areas by allowing various implant angulations, which are biomechanically compensated through the abutment’s multidimensional geometry. Specifically, the increased stress caused by implant inclination is mitigated by the abutment’s structural design.

Importantly, despite advancements in hard and soft tissue regenerative techniques, such procedures remain invasive and financially burdensome. Many patients are either unwilling or unable to undergo extensive surgeries. Therefore, the use of T-OVER with PLUG T may help overcome the typical drawbacks of conventional removable complete dentures, such as poor retention, instability, discomfort, masticatory pain, dislodgement, and speech

impairments—all of which significantly affect quality of life and self-esteem in edentulous patients with resorbed ridges [9], [10].

It is worth emphasizing that in implant-supported prosthetic rehabilitation, abutment selection plays a critical role in achieving optimal outcomes. The abutment serves as a vital link for the long-term success of implant-supported restorations. Implantologists must have a deep understanding of the available abutment options to deliver superior aesthetic and functional results. Ongoing research into innovative materials and abutment designs is essential for enhancing patient care and satisfaction [24].

Additionally, it is well established that the design of prosthetic connections (abutments) and use of materials that ensure stability under regular masticatory loads are critical factors for implant predictability. One of the major challenges in contemporary implant dentistry is the long-term preservation of peri-implant bone levels [24].

As a limitation, this study reports a single clinical case; therefore, we recommend further studies with different designs and larger samples to validate our findings.

5. CONCLUSION

The concept of a mandibular complete denture supported by the innovative T-OVER abutment on a single implant appears to be a valid and effective treatment option for edentulous patients—particularly those who cannot afford multiple implants or are not candidates for regenerative or extensive surgical procedures.

CONFLICT OF INTEREST

None declared.

REFERENCES

- [1] Yazigi C, Passia N, Wolfart S, Kern M. Single mandibular midline-implant supported overdentures: fifteen-year clinical outcome. *J Dent.* 2025;17(157):105768. doi: 10.1016/j.jdent.2025.105768.
- [2] Borg-Bartolo R, Rocuzzo A, Molinero-Mourelle P, Schimmel M, Gambetta-Tessini K, Chaurasia A, et al. Global prevalence of edentulism and dental caries in middle-aged and elderly persons: a systematic review and meta-analysis. *J Dent.* 2022;127:104335. doi: 10.1016/j.jdent.2022.104335.
- [3] Mericske-Stern RD, Taylor TD, Belser U. Management of the edentulous patient. *Clin Oral Implants Res.* 2000;11(1):108–25. doi: 10.1034/j.1600-0501.2000.011s1108.x.
- [4] Collaert B, De Bruyn H. Immediate functional loading of TiOblast dental implants in full-arch edentulous maxillae: a 3-year prospective study. *Clin Oral Implants Res.* 2008;19(12):1254–60. doi: 10.1111/j.1600-0501.2008.01586.x.
- [5] Balshi TJ, Wolfinger GJ, Balshi SF, Bidra AS. A 30-year follow-up of a patient with mandibular complete-arch fixed implant-supported prosthesis on 4 implants: a clinical report. *J Prosthodont.* 2019;28(2):97–102. doi: 10.1111/jopr.13012.
- [6] Sato T, Hara T, Mori S, Shirai H, Minagi S. Threshold for bone resorption induced by continuous and intermittent pressure in the rat hard palate. *J Dent Res.* 1998;77(2):387–92. doi: 10.1177/00220345980770020701.
- [7] El-Asfahani IA, Abd El-Moatty R, Mohamed GF, Hussein HA. Marginal bone loss and soft tissue health around two-implant mandibular overdenture retained with milled versus selective laser melted cobalt chromium bar: a randomized clinical trial. *BMC Oral Health.* 2024;24(1):1180. doi: 10.1186/s12903-024-04883-6.
- [8] Sokolowski A, Huber S, Arefnia B, Pichler A, Lorenzoni M, Sokolowski A. The influence of prosthetic treatments and implant-supported prostheses on posterior mandibular ridge atrophy: a retrospective cohort study. *BMC Oral Health.* 2025;25(1):100. doi: 10.1186/s12903-025-05467-8.
- [9] Techapiroontong S, Limpuangthip N, Tumrasvin W, Sirotamarat J. The impact of poor dental status and removable dental prosthesis quality on body composition, masticatory performance and oral health-related quality of life: a cross-sectional study in older adults. *BMC Oral Health.* 2022;22(1):147. doi: 10.1186/s12903-022-02103-7.
- [10] Lee SY, Daher R, Jung JH, Kwon HB, Han JS, Lee JH. Prosthetic restorative modality in complete edentulism and its association with masticatory and speech discomforts: a nationwide cross-sectional study from Korea. *J Prosthodont Res.* 2023;67(4):524–30. doi: 10.2186/jpr.JPR_D_22_00160.
- [11] Malachias A, Paranhos Hde F, da Silva CH, Muglia VA, Moreto C. Modified functional impression technique for complete dentures. *Braz Dent J.* 2005;16(2):135–9. doi: 10.1590/s0103-64402005000200009.
- [12] Kršek H, Dulčić N. Functional impressions in complete denture and overdenture treatment. *Acta Stomatol Croat.* 2015;49(1):45–53. doi: 10.15644/asc49/1/6.
- [13] Thalakiriyawa DS, Dissanayaka WL. Advances in regenerative dentistry approaches: an update. *Int Dent J.* 2024;74(1):25–34. doi: 10.1016/j.identj.2023.07.008.
- [14] Colecipiccolo LS, Mourão Martinez MA, Rodrigues AA, Baeta LS, Costa FO. The innovative double or triple dental abutment-implant: Case study with a 3-to-12-year follow-up. *Clin Adv Periodontics.* 2025;15(3):200–212. doi: 10.1002/cap.10300.
- [15] Agha RA, Sohrabi C, Mathew G, Franchi T, Kerwan A, O'Neill N, et al. The PROCESS, 2020 guideline: updating consensus preferred reporting of case series in surgery (PRO-CESS) Guidelines. *Int J Surg.* 2020;84:231–5. doi: 10.1016/j.ijsu.2020.11.005.
- [16] Gagnier JJ, Kienle G, Altman DG, Moher D, Sox H, Riley D, et al. The CARE guidelines: consensus-based clinical case report guideline development. *J Clin Epidemiol.* 2014;67(1):46–51. doi: 10.1016/j.jclinepi.2013.08.003.
- [17] Ban Y, Wu YY, Yu T, Wang Y, Zhou Q, Zhang H. Response of osteoblasts to low fluid shear stress is time dependent. *Tissue Cell.* 2011;43(5):311–7. doi: 10.1016/j.tice.2011.06.003.
- [18] Hart NH, Newton RU, Tan J, Rantalainen T, Chivers P, Siafarikas A, et al. Biological basis of bone strength: anatomy, physiology and measurement. *J Musculoskelet Neuronal Interact.* 2020;20(3):347–71.
- [19] Hart NH, Nimphius S, Rantalainen T, Ireland A, Siafarikas A, Newton RU. Mechanical basis of bone strength: influence of bone material, bone structure and muscle action. *J Musculoskelet Neuronal Interact.* 2017;17(3):114–39.
- [20] Wall M, Butler D, El Haj A, Bodle JC, Loba EG, Banes AJ. Key developments that impacted the field of mechanobiology and mechanotransduction. *J Orthop Res.* 2018;36(2):605–19. doi: 10.1002/jor.23707.
- [21] Amengual-Peñañiel L, Brañes-Aroca M, Marchesani-Carrasco F, Jara-Sepúlveda MC, Parada-Pozas L, Cartes-Velásquez R. Coupling between osseointegration and mechanotransduction to maintain foreign body equilibrium in the long-term: a comprehensive overview. *J Clin Med.* 2019;8(2):139. doi: 10.3390/jcm8020139.
- [22] Argentati C, Morena F, Tortorella I, Cifaldi S, Di Fazio N, Sestili P, et al. Insight into mechanobiology: how stem cells feel mechanical forces and orchestrate biological functions. *Int J Mol Sci.* 2019;20(21):5337. doi: 10.3390/ijms20215337.
- [23] Colecipiccolo LS, Magalhães PHV, Martinez MMA, Cota LOM, Lima RPE, Pessoa LFS, et al. Comparative analysis of a conventional cantilever abutment and innovative double abutment in dental implant prosthesis: a finite element analysis study. *Biomed Eng Adv.* 2025;9:100151. doi: 10.1016/j.bea.2025.1000151.
- [24] Perwez P, Sachdeva S, Krishna M. Implant abutment: a vital link in the success of implant restoration. *Int J Health Sci Res.* 2024;14(5):319–25. doi: 10.52403/ijhsr.20240541.