Content available at: https://www.ipinnovative.com/open-access-journals

IP International Journal of Periodontology and Implantology

Journal homepage: https://www.ijpi.in/

Review Article

Optimizing peri-implant health: The crucial role of soft tissue condition in bone regenerative procedures

Bhargav Kuchu[1], Jeevan B S[2], Sunny Mavi[3], Jamalpur Karthik Raj[4], Preeti Kale[5]*

[1]*Dept. of Oral and Maxillofacial Surgery, SVS Institute of Dental Sciences, Mahabubnagar, Telangana, India*
[2]*Dept. of Oral and Maxillofacial Surgery, Sri Rajiv Gandhi College of Dental Sciences, Bangalore, Karnataka, India*
[3]*Dept. of Periodontics, Sudha Rustagi College of Dental Sciences & Research, Faridabad, Haryana, India*
[4]*Dept. of Oral and Maxillofacial Surgery, Government Dental College and Hospital, Hyderabad, Telangana, India*
[5]*Dept. of Periodontology, Rural Dental College, Loni, Maharashtra, India*

ARTICLE INFO

Article history:
Received 16-03-2024
Accepted 29-04-2024
Available online 10-07-2024

Keywords:
Peri-implant health
Soft tissue condition
Bone regeneration
Dental implants

ABSTRACT

Peri-implant health is paramount for the long-term success of dental implants. While bone regeneration techniques have been extensively studied and employed to ensure implant stability, the significance of soft tissue condition in this context is increasingly recognized. This review article explores the intricate interplay between soft tissue dynamics and bone regenerative procedures in the pursuit of optimal peri-implant health. Soft tissue condition around dental implants plays a multifaceted role in supporting long-term stability and functionality. Adequate soft tissue thickness, contour, and attachment are crucial for maintaining a healthy peri-implant environment and preventing complications such as peri-implantitis and mucosal recession. Furthermore, soft tissue quality influences the outcomes of bone regeneration procedures by affecting vascularization, wound healing, and tissue integration. Various strategies have been proposed to enhance soft tissue condition in conjunction with bone regenerative techniques. Through a comprehensive review of existing literature, this article aims to elucidate the pivotal role of soft tissue condition in bone regenerative procedures and its implications for long-term peri-implant health. Insights gained from this review will inform clinicians and researchers in devising effective strategies to enhance soft tissue quality and ensure the success and longevity of dental implant therapy.

1. Introduction

Dental implants have revolutionized the field of restorative dentistry, offering patients a reliable and long-term solution for replacing missing teeth. The success and longevity of dental implants hinge not only on osseointegration but also on the health of the surrounding peri-implant tissues. Peri-implant health, encompassing both soft tissue and bone integrity, is essential for ensuring the stability and functionality of dental implants over time.[1]

While significant attention has been directed towards optimizing bone regeneration techniques to support implant osseointegration, the importance of soft tissue condition in this context has garnered increasing recognition. Soft tissue dynamics around dental implants play a pivotal role in maintaining a healthy peri-implant environment and preventing complications such as peri-implantitis, mucosal recession, and implant failure.[2–4]

This review article delves into the intricate relationship between soft tissue condition and bone regenerative procedures in the pursuit of optimal peri-implant health. We aim to explore the multifaceted role of soft tissues in supporting long-term implant stability and functionality,

* *Corresponding author*.
E-mail address: preetikale20jan@gmail.com (P. Kale).

https://doi.org/10.18231/j.ijpi.2024.015

shedding light on the synergistic interactions between soft tissue quality and bone regeneration. Understanding the structure and function of soft tissues around dental implants lays the foundation for comprehending their role in supporting implant success. Adequate soft tissue thickness, contour, and attachment are essential for facilitating optimal wound healing, vascularization, and tissue integration following bone augmentation around dental implants.[5]

Various strategies aimed at enhancing soft tissue quality in conjunction with bone regeneration techniques. From the utilization of barrier membranes and soft tissue grafts to the application of growth factors and tissue engineering approaches, a plethora of interventions have been proposed to optimize soft tissue condition and promote peri-implant health.[6]

By synthesizing findings from existing literature, this review aims to provide clinicians and researchers with a comprehensive understanding of the critical role played by soft tissue condition in bone regenerative procedures for dental implants. Insights gleaned from this review will inform the development of evidence-based treatment protocols aimed at maximizing peri-implant health and ensuring the long-term success of dental implant therapy.

2. Importance of the Peri-Implant Keratinized Mucosa for Bone Regenerative Procedures and to Maintain Peri-Implant Health

The presence of keratinized mucosa around dental implants plays a crucial role in supporting both bone regenerative procedures and long-term peri-implant health. Keratinized mucosa refers to the specialized oral mucosa characterized by a keratinized epithelial layer, which provides unique advantages in the peri-implant environment.[7]

It has been widely noted that tissue deficiencies such as horizontal and vertical bone defects are often associated to lack of soft tissue quality and quantity.15 Consequently, especially in challenging cases, both soft and hard tissue augmentation procedures are necessary to foster a proper site for prosthetically driven implant placement. Soft tissue augmentation can be performed either to increase the keratinized mucosa width (KMW), in order to facilitate oral hygiene procedures, or to increase mucosal thickness (MT), in order to establish a proper peri-implant tissue volume.[8]

One of the primary functions of keratinized mucosa is to provide mechanical protection and resilience to the underlying soft tissues, including the peri-implant bone. This protective barrier helps withstand mechanical trauma from masticatory forces, oral hygiene practices, and other external factors. In the context of bone regenerative procedures, a sufficient amount of keratinized mucosa facilitates better wound healing and minimizes the risk of soft tissue dehiscence or recession, which can compromise the outcomes of bone grafting or augmentation procedures.[9,10]

Moreover, keratinized mucosa contributes to peri-implant health by reducing the susceptibility to inflammation and peri-implant diseases such as peri-implantitis. The keratinized epithelium provides a more resilient barrier against microbial invasion and chemical irritants compared to non-keratinized mucosa. By maintaining a healthy peri-implant environment, keratinized mucosa helps preserve the stability and longevity of dental implants.

Additionally, the presence of keratinized mucosa has been associated with improved soft tissue attachment and stability around dental implants. This enhanced soft tissue support facilitates better adaptation of peri-implant tissues to the implant surface, promoting a harmonious integration of soft and hard tissues. During bone regenerative procedures, the presence of keratinized mucosa may enhance the predictability of soft tissue outcomes and promote favorable tissue maturation around the implant site.[11]

3. Strategies to Enhance Soft Tissue Condition in Conjunction with Bone Regenerative Techniques

Enhancing soft tissue condition in conjunction with bone regenerative techniques is essential for promoting optimal peri-implant health and long-term success of dental implants. Several strategies can be employed to achieve this goal:

3.1. Soft tissue augmentation

Soft tissue grafting techniques, such as connective tissue grafts or free gingival grafts, can be utilized to augment deficient or inadequate soft tissue around dental implants. These grafts can increase the volume and thickness of peri-implant soft tissues, improving tissue contour and stability.[12]

4. Types of Soft Tissue Grafts

4.1. Connective tissue graft (CTG)

This is the most commonly used graft for soft tissue augmentation around dental implants. It involves harvesting a subepithelial layer of connective tissue, usually from the palate, and transplanting it to the recipient site around the implant.[13]

4.2. Free gingival graft (FGG)

In this technique, a piece of gingival tissue, including the epithelium and underlying connective tissue, is harvested from the donor site and transferred to the recipient site. FGG is often used to increase the width of keratinized mucosa around dental implants.

4.3. Allografts and Xenografts

These graft materials derived from human or animal sources may be used as alternatives to autogenous tissue grafts. They offer the advantage of avoiding a donor site surgery but may have variable outcomes. [14]

4.4. Surgical procedure

Recipient Site Preparation: The recipient site around the dental implant is prepared by creating a flap or making a small incision to access the underlying soft tissue. Graft Harvesting: If an autogenous graft (e.g., CTG or FGG) is used, tissue is harvested from the donor site, typically the palate, using a surgical blade or a specialized tissue harvesting instrument. Graft Placement: The harvested graft is then secured in place at the recipient site using sutures or tissue adhesive. Care is taken to ensure proper adaptation and stabilization of the graft. Suture Placement: Sutures are placed to stabilize the graft and promote wound healing. Depending on the technique and graft size, various suture patterns may be used. Postoperative Care: Patients are provided with postoperative instructions, including oral hygiene measures, dietary restrictions, and medications to manage discomfort and prevent infection. [15]

4.5. Healing and outcome

Initial Healing: Following soft tissue augmentation, the graft undergoes a process of revascularization and integration with the surrounding tissues. Patients may experience some swelling, discomfort, and temporary changes in the appearance of the soft tissues during the initial healing phase. Long-term Outcome: Over time, the augmented soft tissues mature and adapt to the implant surface, resulting in improved tissue contour, stability, and aesthetics. Regular follow-up appointments allow for monitoring of healing progress and assessment of treatment outcomes.

4.6. Barrier membranes

Guided bone regeneration (GBR) procedures often involve the use of barrier membranes to protect the bone graft and promote tissue regeneration. Selecting membranes with properties conducive to soft tissue integration can enhance soft tissue healing and stability. Resorbable membranes may offer advantages by avoiding the need for a second surgical intervention for membrane removal. [16]

4.7. Growth factors

Growth factors, such as platelet-rich plasma (PRP) or platelet-rich fibrin (PRF), can be used to stimulate tissue regeneration and wound healing around dental implants. These bioactive substances can enhance soft tissue healing, vascularization, and cellular proliferation, leading to improved soft tissue quality. [17]

4.8. Tissue engineering

Tissue engineering approaches involve the fabrication of biomimetic scaffolds seeded with cells and growth factors to regenerate functional soft tissues around dental implants. Engineered constructs can mimic the extracellular matrix and support cell proliferation, differentiation, and tissue integration, leading to enhanced soft tissue formation. [18]

4.9. Proper implant positioning

Optimal implant placement and angulation are essential for ensuring adequate soft tissue support and esthetic outcomes. Placing implants subcrestally or slightly subgingivally can help preserve keratinized mucosa and prevent soft tissue recession.

4.10. Comprehensive treatment planning

A thorough assessment of soft tissue characteristics, including quantity, quality, and contour, should be performed during treatment planning. Incorporating soft tissue management techniques into the overall treatment plan can help address any deficiencies and optimize peri-implant soft tissue condition. [19]

4.11. Maintenance of oral hygiene

Educating patients about the importance of oral hygiene and regular maintenance visits is crucial for preserving peri-implant soft tissue health. Proper oral hygiene practices can prevent inflammation, infection, and peri-implant diseases, promoting favorable soft tissue outcomes. [20]

5. Conclusion

In conclusion, soft tissue augmentation techniques play a crucial role in optimizing peri-implant soft tissue health and ensuring the long-term success of dental implants. By addressing deficiencies in soft tissue volume, thickness, and quality, these procedures contribute to improved esthetics, stability, and function around dental implants. Overall, soft tissue augmentation represents an important component of comprehensive implant therapy, contributing to the preservation of peri-implant health and the long-term stability of dental implants. Continued research and advancements in soft tissue management techniques will further refine and improve the outcomes of soft tissue augmentation procedures in implant dentistry, ultimately benefiting patients and clinicians alike.

6. Source of Funding

None.

7. Conflict of Interest

None.

References

1. Buser D, Weber HP, Donath K, Fiorellini JP, Paquette DW, Williams RC, et al. Soft tissue reactions to non-submerged unloaded titanium implants in beagle dogs. *J Periodontol*. 1992;63(3):225–35.
2. Cosyn J, Eghbali A, Hermans A, Vervaeke S, De Bruyn H, Cleymaet R, et al. A 5-year prospective study on single immediate implants in the aesthetic zone. *J Clin Periodontol*. 2016;43:702–9.
3. Sanz M, Lindhe J, Alcaraz J, Sanz-Sánchez I, Cecchinato D, Ferrus J, et al. A prospective, randomized-controlled clinical trial to evaluate bone preservation using implants with different geometry placed into extraction sockets in the maxilla. *Clin Oral Implants Res*. 2010;21(1):13–21.
4. Wennström JL, Bengazi F, Lekholm U. The influence of the masticatory mucosa on the peri-implant soft tissue condition. *Clin Oral Implants Res*. 1994;5(3):1–8.
5. Zitzmann NU, Abrahamsson I, Berglundh T, Lindhe J. Soft tissue reactions to plaque formation at implant abutments with different surface topography. An experimental study in dogs. *J Clin Periodontol*. 2002;29(5):456–61.
6. Rasperini G, Acunzo R, Cannalire P, Farronato D, Consonni D, Silvestri M, et al. Crestal bone changes at teeth and implants in periodontally healthy and periodontally compromised patients. A 10-year comparative case-series study. *J Periodontol*. 2014;85(6):795–9.
7. Covani U, Marconcini S, Galassini G, Cornelini R, Santini S. Bacterial plaque colonization around dental implant surfaces. *Implant Dent*. 2003;12(4):318–25.
8. Tonetti MS, Pini-Prato G, Cortellini P. Effect of cigarette smoking on periodontal healing following GTR in infrabony defects. A preliminary retrospective study. *J Clin Periodontol*. 1995;22(3):229–34.
9. Jung RE, Fenner N, Hämmerle CH, Zitzmann NU. Long-term outcome of implants placed with guided bone regeneration (GBR) using resorbable and non-resorbable membranes after 12-14 years. *Clin Oral Implants Res*. 2013;24(10):1065–73.
10. Botticelli D, Berglundh T, Lindhe J. Hard-tissue alterations following immediate implant placement in extraction sites. *J Clin Periodontol*. 2004;31(10):820–8.
11. Roos-Jansåker AM, Lindahl C, Renvert H, Renvert S. Nine- to fourteen-year follow-up of implant treatment. Part II: presence of peri-implant lesions. *J Clin Periodontol*. 2006;33(4):290–5.
12. Lang NP, Wilson TG, Corbet EF. Biological complications with dental implants: their prevention, diagnosis and treatment. *Clin Oral Implants Res*. 2000;11(1):146–55.
13. Weng D, Nagata MJ, Bell M, Bosco AF, De Melo L, Richter EJ, et al. Immediate and delayed implantation for complete restoration of the jaw with a fixed prosthesis. A retrospective comparison of 18 cases. *Clin Oral Implants Res*. 2004;15(4):414–22.
14. Esposito M, Grusovin MG, Felice P, Karatzopoulos G, Worthington HV, Coulthard P, et al. The efficacy of horizontal and vertical bone augmentation procedures for dental implants–a Cochrane systematic review. *Eur J Oral Implantol*. 2009;2(3):167–84.
15. Araújo MG, Lindhe J. Dimensional ridge alterations following tooth extraction. An experimental study in the dog. *J Clin Periodontol*. 2005;32(2):212–8.
16. Zucchelli G, Stefanini M, Ganz S, Mazzotti C, Mounssif I. Coronally advanced flap with different designs in the treatment of gingival recessions: A comparative controlled randomized clinical trial. *Int J Periodontics Restorative Dent*. 2016;36(3):319–24.
17. Hammerle CH, Chen ST, Wilson T. Consensus statements and recommended clinical procedures regarding surgical techniques. *Int J Oral Maxillofac Implants*. 2004;19:26–8.
18. Quirynen M, De Soete M, Van Steenberghe D. Infectious risks for oral implants: a review of the literature. *Clin Oral Implants Res*. 2002;13(1):1–19.
19. Hammerle CH, Jung RE, Yaman D, Lang NP. Ridge augmentation by applying bioresorbable membranes and deproteinized bovine bone mineral: a report of twelve consecutive cases. *Clin Oral Implants Res*. 2008;19(6):19–25.
20. Lindeboom JA, Tjiook Y, Kroon FH. Immediate placement of implants in periapical infected sites: a prospective randomized study in 50 patients. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. 2006;101(6):705–10.

Author biography

Bhargav Kuchu, Assistant Professor

Jeevan B S, 3rd Year Post Graduate

Sunny Mavi, Reader

Jamalpur Karthik Raj, Senior Resident

Preeti Kale, Assistant Professor

Cite this article: Kuchu B, Jeevan B S, Mavi S, Raj JK, Kale P. Optimizing peri-implant health: The crucial role of soft tissue condition in bone regenerative procedures. *IP Int J Periodontol Implantol* 2024;9(2):68-71.