



## HISTOLOGICAL PERSPECTIVES ON DENTAL IMPLANT FAILURE: A CASE REPORT AND ANALYSIS OF PERI-IMPLANT BONE HISTOLOGY

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### ABSTRACT

Peri-implant bone histology plays a crucial role in understanding the mechanisms underlying implant failure. This article presents a case report of a failed dental implant in a 72-year-old male patient, with a focus on the histological evaluation of the peri-implant bone. The patient underwent an All-in-4 implant-based denture treatment plan, which initially showed promising results but later resulted in implant failure. A trephine core biopsy was performed to assess the histology of the failed implant site and determine the



cause of failure at the microscopic level. Histological analysis revealed the presence of graft material acting as a scaffold, surrounded by dense fibrosis and chronic inflammatory infiltrate. These findings indicate a failure of osseointegration and suggest possible causes for implant failure, such as inadequate tissue integration and host response. Factors contributing to implant failure, including occlusal overload, peri-implantitis, and systemic conditions, were discussed in the context of the case. Understanding the histological changes associated with implant failure is crucial for improving treatment outcomes and developing preventive strategies. Preoperative assessment, including evaluation of bone density and identification of systemic risk factors, is essential for successful implant placement. Retrieval and histological analysis of failed implants provide valuable insights into tissue responses and areas for improvement in implant design and surgical techniques. This case report highlights the significance of peri-implant bone histology in diagnosing and managing implant failure, with implications for enhancing implant success rates and patient care in implant dentistry. Further research in this field will contribute to advancements in implantology and the development of evidence-based protocols for implant treatment.

**KEYWORDS:** Dental implant failure; Peri implant bone histology; osseointegration and implant failure; Trephine core biopsy in implant failure; Peri-implantitis and implant failure; Bone density and implant success.



## PERSPECTIVAS HISTOLÓGICAS DEL FRACASO DE LOS IMPLANTES DENTALES: INFORME DE UN CASO Y ANÁLISIS DE LA HISTOLOGÍA ÓSEA PERIIMPLANTARIA

### RESUMEN

La histología ósea periimplantaria desempeña un papel crucial en la comprensión de los mecanismos subyacentes al fracaso del implante. En este artículo se presenta un caso clínico de fracaso de un implante dental en un paciente varón de 72 años, centrándose en la evaluación histológica del hueso periimplantario. El paciente se sometió a un plan de tratamiento de prótesis implantosoportada All-in-4, que mostraron inicialmente resultados prometedores, pero posteriormente provocaron el fracaso del implante. Se realizó una biopsia para evaluar la histología de la zona del implante fracasado y determinar la causa del fracaso a nivel microscópico. El análisis histológico reveló la presencia de material de injerto que actuaba como andamio, rodeado de fibrosis densa e infiltrado inflamatorio crónico. Estos hallazgos indican un fracaso de la osteointegración y sugieren posibles causas del fracaso del implante, como una integración tisular inadecuada y una respuesta del huésped. Factores que contribuyen al fracaso de los implantes, como la sobrecarga oclusal, la periimplantitis y las sistémicas. Comprender los cambios histológicos asociados al fracaso de los implantes es crucial para mejorar los resultados del tratamiento y desarrollar estrategias preventivas. La evaluación preoperatoria, incluida la densidad ósea y la identificación de factores de riesgo sistémicos, es esencial para La recuperación y el análisis histológico de los implantes fracasados aportan información valiosa sobre la



respuesta de los tejidos y las áreas de mejora del diseño de los implantes y las técnicas quirúrgicas. Este caso clínico pone de relieve la importancia de la histología ósea periimplantaria en el diagnóstico y la gestión del fracaso de los implantes, con implicaciones para el tratamiento de la enfermedad, diagnóstico y tratamiento del fracaso de los implantes, con implicaciones para mejorar las tasas de éxito de los implantes y la atención al paciente en implantología. La investigación en este campo contribuirá a los avances en implantología y al desarrollo de protocolos basados en pruebas para el tratamiento implantológico.

**PALABRAS CLAVE:** Fracaso del implante dental; Histología ósea periimplantaria; osteointegración y fracaso del implante; Biopsia de núcleo de trefina en el fracaso del implante; Peri-implantitis y fracaso de los implantes; Densidad ósea y éxito de los implantes.

## INTRODUCTION

Dental Implants are considered to be one of the best replacements to missing teeth. Its use has increased globally because of better prognosis. However, the success of dental implant depends upon various factors; including clinical as well as host factors. The host factors comprise of local and systemic factors, for example, bone

density, bone volume, peri-implant soft tissue and osteoporosis, diabetes, hormonal metabolism, respectively. Also, integration of implant with bone (osseointegration) plays a crucial role in success or failure of implant. Osseointegration in simple terms is "the formation of a direct interface between an implant and bone, without intervening

soft tissue”. The healing process around an implant is same as that which occurs in normal primary bone. Titanium dental Implant osseointegration takes place by healing process in three stage process including osteo-phyllic phase, osteo-conductive phase, osteo-adaptive phase.

Lack of osseointegration leads to failure of implants. Therefore, in the present article, we will be discussing about a case of failed implant with emphasis on histology of peri-implant bone.

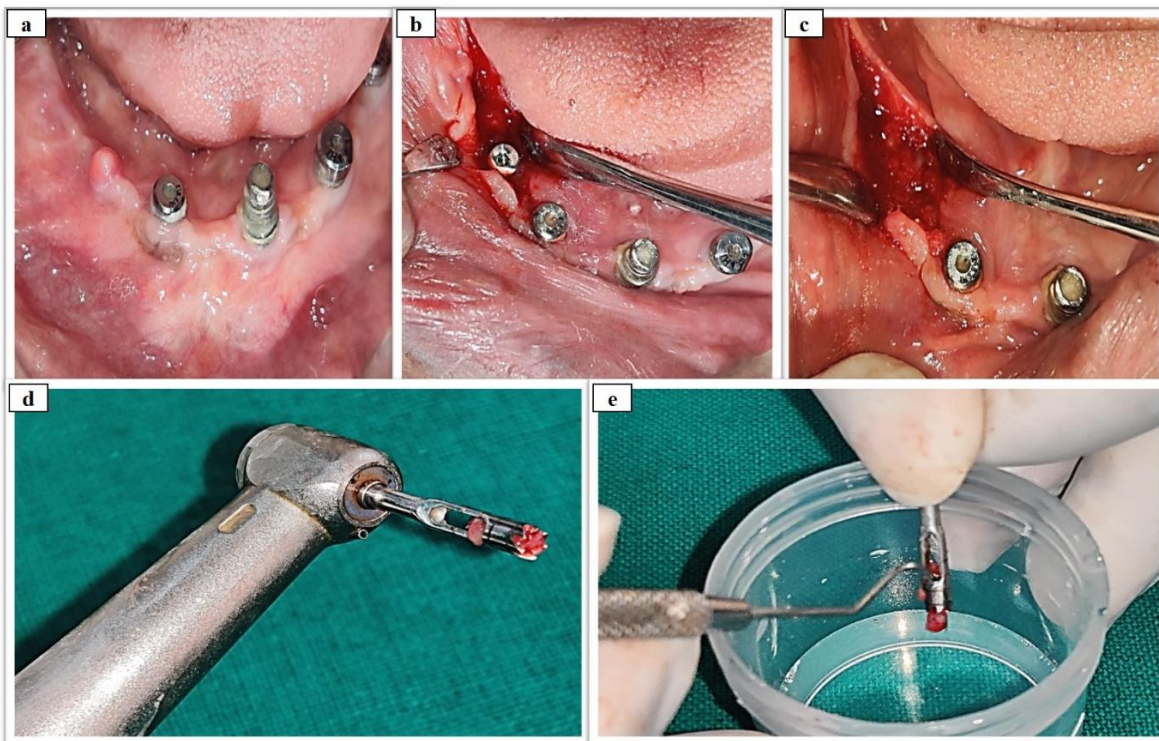


FIGURE 1: a- gingival abscess at the site of dental implant; b- incision and flap reflection; c- failed implant removed; d&e- trephine core biopsy obtained from implant site for histological evaluation.

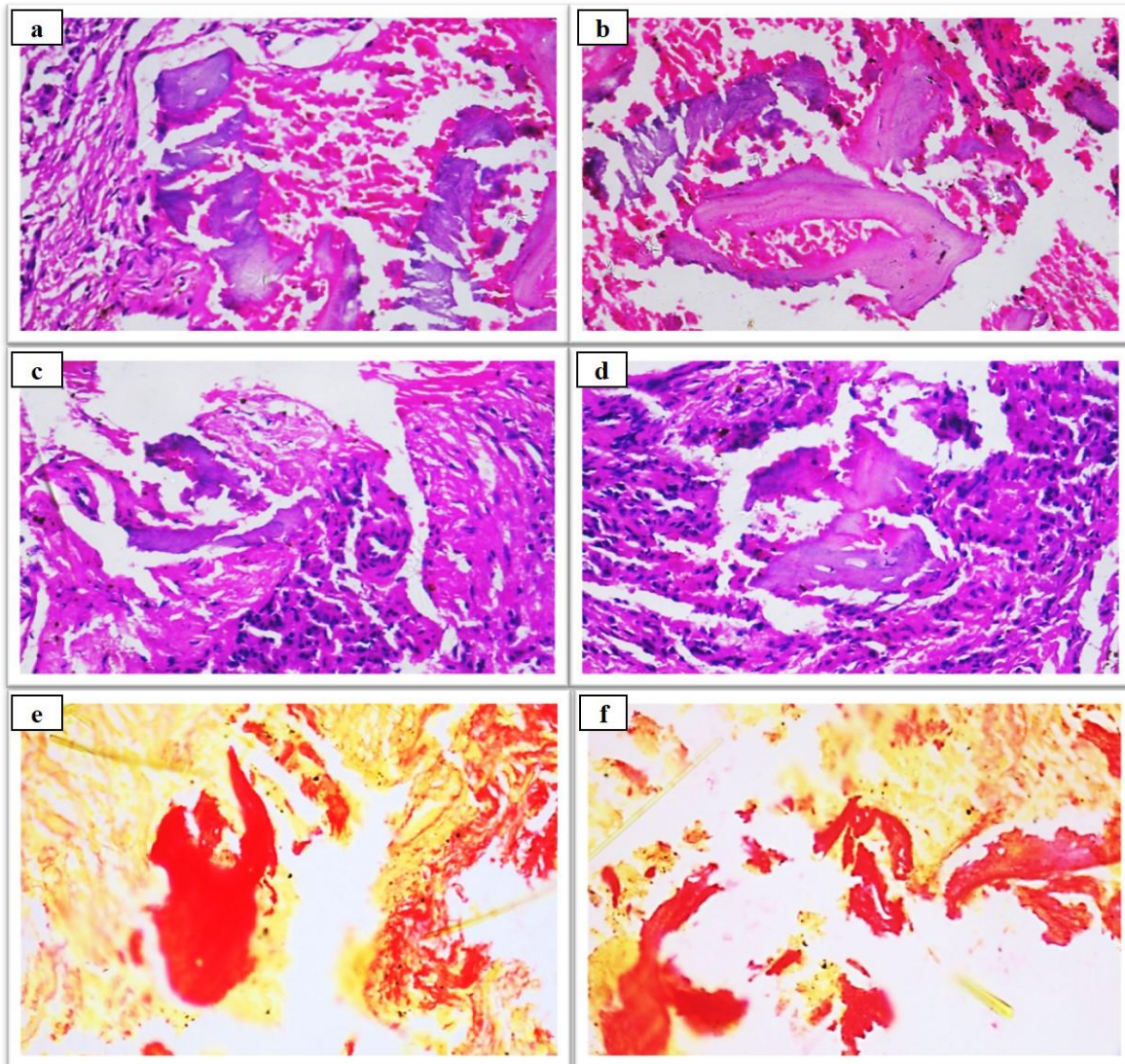


FIGURE 2: a- photomicrograph showing scaffold of graft material seen as a basophilic material; b- photomicrograph showing mature bone formation in the vicinity of graft material; c- photomicrograph showing remnants of graft material surrounded by dense fibrosis and granulation tissue; d- dense chronic inflammation surrounding the remnant graft material; e & f- Van geison stain showing graft material in yellow and bone in orange.



## Case Report

A 72 year old male patient reported with a chief complain of missing teeth. After a thorough intra-oral examination, a treatment plan of All-in-4 implant based denture was planned. CBCT was done to evaluate the bone density for implant placement.

Further, follow up was done wherein it was observed that, one of the implants failed in the 3rd quadrant. After a month, another implant was placed at a different site in the same quadrant, along with bone graft (Novabone). (Fig. 1a-c) Within a week, the patient returned with a complain of mobility of the implant, which was further evaluated followed by retrieval of implant. Also, a trephine core biopsy was obtained from the implant site, after implant retrieval, and stored into 10% formalin solution, to assess the histology of the site as well as to determine the cause of failure at the microscopic level. (Fig. 1d-e)

Decalcification of the tissue was done followed by tissue processing and

hematoxylin & eosin staining, which further showed graft material present as a scaffold and surrounded by dense fibrosis as well as dense chronic inflammatory infiltrate. (Fig. 2a-d) Histochemical evaluation was also done which included Van Gieson stain in order to accurately differentiate between bone and graft material. (Fig. 2e-f)

## Discussion

Osseointegration signifies a highly dynamic physiological process, and the peri-implant osseous tissue enhances its structure and organization which reflects multiple remodelled areas of the bone. 5 Retrieving the dental implants due to their failure and further histological analysis of the retrieved implant is essential to understand the causative mechanisms of failed implants.<sup>6</sup> The destructive effect of occlusal overload on bone-implant interface may give rise to marginal bone loss. Moreover, defects in the bone occur due to microfractures but without any inflammatory response. In a study done by Uribe et al., the histology showed



presence of fibrous connective tissue with little inflammation, which was inconsistent to the present study where there was dense chronic inflammatory response along with dense fibrosis.<sup>7</sup> Peri-implantitis and associated inflammatory osteolysis acclaim that the residual bone in the peri-implant region, could accumulate the functional load and is accordingly modeled and reinforced to develop into cortical bone.<sup>8</sup>

Failed implant clinically manifests with increasing probing depths, suppuration or bleeding when probed, and progressive bone loss. It is no more osseointegrated or might have never achieved osseointegration.

Peri-implant radiolucency could be appreciated radiographically caused by encapsulation of fibrous tissue around the implant.<sup>9</sup>

Several studies have associated the role of local and systemic factors in the long-term success of dental implants, however, some common concerning factors might also include disturbance in the stability of oral implants after the abutment

placement process and occlusal loading.<sup>10</sup> Peri-implantitis tends to be mediated chiefly by the endotoxins from gram-negative bacteria and the host response around the implant site. Adequate apical osseointegration, might be an indicating factor for compromised dental implants which represent as peri-implantitis to endure thorough debridement and be contamination-free before Guided Bone Regeneration (GBR) treatment.<sup>9</sup>

GBR might be achieved successfully with various types of membranes and grafting materials carried out by decontaminated implant surface before regenerative therapy. Recovery of implant should be considered as an important component of clinical practice, but is generally ignored. It prevents failure of implants and prosthetics, if a clinician is well-versed and follows the regulations of decontamination, biomodification, and guided tissue regeneration.<sup>9</sup>





The histological evaluation of peri-implant bone in a failed implant provides valuable insights into the underlying causes of implant failure. In the case presented, the histology revealed the presence of graft material as a scaffold surrounded by dense fibrosis and a chronic inflammatory infiltrate. This finding suggests a possible failure of osseointegration and highlights the importance of assessing the host response and tissue integration when evaluating implant success.

Understanding the factors contributing to implant failure is crucial for improving treatment outcomes and developing preventive strategies. Local factors such as occlusal overload and peri-implantitis, as well as systemic factors like bone density and metabolic disorders, can significantly influence implant stability and osseointegration. Therefore, comprehensive preoperative assessment, including evaluation of bone density and identification of systemic risk factors, is

essential for successful implant placement.

Furthermore, the retrieval and histological analysis of failed implants provide an opportunity to study the tissue response and identify potential areas for improvement in implant design, surface modifications, and surgical techniques. By gaining a deeper understanding of the histological changes associated with implant failure, clinicians can refine their treatment protocols and enhance long-term implant success rates.

In conclusion, the histological examination of peri-implant bone in a failed implant offers valuable insights into the underlying mechanisms of implant failure. This knowledge can aid in improving treatment strategies, enhancing osseointegration, and ultimately, achieving better outcomes in dental implantology. Further research in this field will contribute to the ongoing advancements and innovations in implant



dentistry, leading to improved patient care and satisfaction.

## REFERENCIAS

1. Alghamdi HS, Jansen JA. The development and future of dental implants. *Dent. Mater. J.* 2020, 39, 167–72.
2. Ducommun J, El Kholy K, Rahman L, Schimmel M, Chappuis V, Buser D. Analysis of trends in implant therapy at a surgical specialty clinic: Patient pool, indications, surgical procedures, and rate of early failures—A 15-year retrospective analysis. *Clin. Oral Implant. Res.* 2019, 30, 1097–1106.
3. Parithimarkalaignan S, & Padmanabhan TV. Osseointegration: An Update. *The Journal of Indian Prosthodontic Society.* 2013; 13(1), 2–6.
4. Albrektsson T & Johansson C. Osteoinduction, osteoconduction and osseointegration. *European Spine Journal.* 2001; 10(0), S96–S101.
5. Margherita Tumedei , Adriano Piattelli, Marco Degidi , Carlo Mangano and Giovanna Iezzi. A Narrative Review of the Histological and Histomorphometrical Evaluation of the Peri-Implant Bone in Loaded and Unloaded Dental Implants. A 30-Year Experience (1988–2018) *Int. J. Environ. Res. Public Health* 2020, 17, 2088
6. Tumedei M, Piattelli A, Degidi M, Mangano C, Iezzi G. A Narrative Review of the Histological and Histomorphometrical Evaluation of the Peri-Implant Bone in Loaded and Unloaded Dental Implants. A 30-Year Experience (1988-2018). *Int J Environ Res Public Health.* 2020 Mar 21;17(6):2088.
7. Uribe R, Peñarrocha M, Sanchis JM, García O. Marginal peri-implantitis due to occlusal overload. A case report. *Med Oral.* 2004 Mar-Apr;9(2):160-2, 159-60.
8. Galárraga-Vinueza ME, Tangl S, Bianchini M, Magini R, Obreja K,



Gruber R, Schwarz F. Histological characteristics of advanced peri-implantitis bone defects in humans. *Int J Implant Dent.* 2020 Mar 25;6(1):12.

9. Triplett RG, Andrews JA, Hallmon WW. Management of peri-implantitis. *Oral Maxillofac Surg Clin North Am.* 2003 Feb;15(1):129-38.

10. Shibli JA, Aguiar KC, Melo L, Ferrari DS, D'Avila S, Iezzi G, Piattelli A. Histologic analysis of human peri-implant bone in type 1 osteoporosis. *J Oral Implantol.* 2008;34(1):12-6.