JOURNAL OF INTERNATIONAL CRISIS AND RISK COMMUNICATION RESEARCH
ISSN: 2576-0017
2024, VOL 7, NO S8

Outcomes of Dental Implant in Cases with Generalized Aggressive Periodontitis

Saadah Abdullah Almutairi[1], Rasha Maseer Alotaibi[2], Dalal fahad Almutairy[3], Habiba marzoq alrawili[2], Abdulaziz Abdulrazaq alanazi[4], Huda abdulhadi almushiti[4], Majedah Mohammed Almoukaliy[4], Sarah mohysine almuwallad[5], Sara mohammd ALjuraid[4], Manal Fahd Awad Al-Otaibi[4], Ayman Sameer Alotaibi[6], Ibtihal Abdulrahman Al-Baydani[7], Abdulmajeed Atallah Alanazi[8]

1. Dental Hygienist, Riyadh specialised Dental Center, Riyadh, KSA
2. Dental Assistant, Prince Abdullah bin Abdulaziz bin Musaed Specialized Dental Center, Arar, KSA
3. Dental assistant, Al Dhahi Health Center, Al-Qassim, Buraidah, KSA
4. Dental assistant, Riyadh specialised Dental Center, Riyadh, KSA
5. Dental assistant, Primary health care center in Al Murabba, Riyadh, KSA
6. Resident dentist, Branch of the Ministry of Health in the Riyadh region, KSA
7. Dental Assistant, Al-Hanakiyah Health Center, Al-Hanakiyah, KSA
8. Dental Technology, Eradah Hospital and Mental Health in Al-Qurayyat, Al-Jouf Health Cluster, KSA

.

ABSTRACT

Generalized aggressive periodontitis (GAgP) poses significant challenges in dental practice due to its rapid onset and severe impact on oral health, notably leading to extensive periodontal tissue destruction. Traditional restorative techniques often prove inadequate for this patient population, raising concerns about the viability of dental implants in such complex cases. As advancements in implant technology continue to evolve, the integration of dental implants has emerged as a promising restorative option for patients with GAgP. This study aims to systematically investigate the long-term outcomes associated with dental implants in individuals

diagnosed with GAgP, focusing on critical parameters such as implant survival rates, peri-implant bone health, soft tissue conditions, and overall patient satisfaction. A comprehensive approach that encompasses thorough clinical evaluations and patientreported outcomes will be employed to shed light on the feasibility and effectiveness of dental implants within this challenging demographic. The research further explores the role of pre-implant periodontal therapy, examining how comprehensive management of periodontal disease prior to surgical intervention can influence implant success. Additionally, the study assesses the outcomes related to varying types of dental implant systems and surface treatments. Innovations such as hydrophilic and surface-modified implants are explored concerning their osseointegration potential in compromised conditions associated with GAgP. Challenges faced in assessing periodontal status, ensuring proper immune response, and managing post-surgical maintenance are also critically analyzed, as these factors are known to significantly influence patient outcomes. Ultimately, this study intends to fill existing gaps in the literature regarding the performance of dental implants in patients with GAgP, providing clinicians with evidence-based insights that can inform treatment protocols and improve patient care strategies. By bridging the divide between periodontal therapy and implant dentistry, the findings of this research are expected to contribute meaningfully to the ongoing discourse on innovative approaches to managing aggressive periodontal conditions while enhancing the quality of patient care.

KEYWORDS: Agrressive periodontitis, Dental implants, Dental implantation.

1. Introduction

Generalized aggressive periodontitis (GAgP) is a severe form of periodontal disease characterized by rapid attachment loss, bone destruction, and the potential for tooth mobility and loss. It primarily affects adolescents and young adults, underscoring an urgent need for effective management strategies among this population [1]. The pathophysiology of GAgP involves complex interactions between microbial pathogens, the host immune response, and genetic predispositions. Patients diagnosed with GAgP often present with significant periodontal tissue destruction, making traditional dental restorative options complicated. Consequently, there is an increasing interest in the role of dental implants as a viable treatment alternative for patients suffering from this aggressive form of periodontitis [2].

The integration of dental implants into the oral cavity represents a transformative advancement in restorative dentistry, providing a functional and aesthetic solution for tooth replacement. However, the presence of chronic inflammation and compromised bone quality in GAgP patients raises concerns over the long-term stability and survival rates of such implants. While existing literature has explored the outcomes of dental implants in various contexts, there remains a gap in specific research focused on individuals with generalized aggressive periodontitis. Understanding the clinical outcomes in this patient group is crucial for establishing evidence-based protocols,

enhancing patient education, and fostering multidisciplinary collaboration among dental professionals [3].

This study aims to investigate the outcomes of dental implants placed in patients diagnosed with generalized aggressive periodontitis, assessing parameters such as implant survival rates, marginal bone loss, soft tissue health, and overall patient satisfaction over time. By examining these factors, we seek to determine the feasibility and effectiveness of dental implants in this challenging patient demographic. Furthermore, this research will contribute to the existing body of knowledge regarding the management of periodontal disease and its implications for implant dentistry [4].

Through a comprehensive literature review and a robust methodological approach involving clinical evaluations and patient-reported outcomes, this study will provide essential insights into the long-term success rates of dental implants in individuals with GAgP. As the field of dentistry continues to evolve, it is imperative that clinicians remain up-to-date with the latest evidence to inform their practice and optimize treatment outcomes for patients facing the challenges posed by aggressive periodontal diseases. Ultimately, this study endeavors to bridge the gap between periodontal therapy and implant dentistry, guiding future research and clinical methodologies in the management of patients with generalized aggressive periodontitis and paving the way for innovative approaches to oral health care [5].

Objectives:

The main objectives of this study are to:

1. Evaluate the long-term survival rates of dental implants.
2. Investigate the outcomes related to peri-implant soft tissue health.
3. Analyze the impact of periodontal treatment prior to implant placement on the outcomes of dental implants.
4. Compare the outcomes of different types of dental implant systems and surface treatments Implant Placement Protocol

The successful placement of dental implants in patients with generalized aggressive periodontitis requires a meticulously constructed protocol that addresses the unique challenges posed by this condition. GAgP is characterized by rapid attachment loss and bone resorption, which can complicate implant integration and stability. Consequently, the implant placement protocol must not only accommodate the general principles of implantology but also specifically address the periodontal health of the patient [6].

The first step in the implant placement protocol is a comprehensive assessment of the patient's periodontal status. This involves a thorough clinical examination, including

probing depths, attachment loss, and mucosal health. Radiographic evaluation is critical as well, providing invaluable information on bone quality and quantity, as well as identifying any areas of active disease. The presence of periimplant pathogens should also be assessed, as these biological factors can adversely affect osseointegration. Patients' medical histories should be reviewed to account for any systemic conditions or medications that may impact healing or increase the risk of complications [7].

Once a thorough assessment has been completed, the next step is to develop a personalized treatment plan. Due to the aggressive nature of GAgP, it may be necessary to implement periodontal therapy prior to implant placement. This can involve therapeutic modalities such as scaling, root planing, and sometimes periodontal surgery, aiming to reduce inflammation and stabilize the periodontal tissues. In cases where significant bone loss has occurred, the use of bone grafting materials may be indicated to augment the alveolar ridge prior to surgical intervention [8].

When implant placement is deemed viable, the surgical protocol should also be tailored to accommodate the patient's specific needs. The selection of implant type and size is paramount, as implants that are too small or inappropriate for the anatomical site may not achieve sufficient mechanical stability. Moreover, a guided surgical approach can be instrumental in achieving optimal implant positioning and angulation, minimizing damage to remaining periodontal tissues. The use of immediate or delayed loading protocols should be based on the individual patient context, with considerations given to initial stability, bone quality, and periodontal response [9].

Intraoperatively, meticulous attention to asepsis and surgical technique is crucial, as the risk of infection is notably elevated in patients with GAgP. The use of appropriate antiseptics and the maintenance of a sterile field can mitigate this risk. Additionally, post-operative care is essential, involving the prescription of antibiotics and anti-inflammatory medications to manage discomfort and reduce the potential for infection. The patient must be educated on post-surgical self-care, emphasizing the importance of oral hygiene and regular follow-ups to monitor healing and implant stability [10].

After implant placement, a regular monitoring protocol should be established. This involves clinical and radiographic evaluations at predetermined intervals to ensure proper osseointegration and to detect any signs of peri-implantitis or other complications early. The role of supportive periodontal therapy cannot be overstressed, as these patients may require enhanced maintenance protocols to sustain both peri-implant and periodontal health [11].

Implant Survival Rates:

The implant survival rates in individuals diagnosed with GAgP tend to be reported lower than those in periodontally healthy populations. This discrepancy is partly due to the aggressive nature of GAgP, characterized by rapid bone loss and a pronounced inflammatory response, which can compromise the osseointegration process—the

critical phase where the implant fuses with the surrounding bone. Research indicates that, in a controlled clinical setting, the five-year survival rate of implants placed in patients with GAgP ranges from approximately 85% to 95% [12]. Furthermore, complications such as peri-implantitis and implant failure are not uncommon, occurring at a greater frequency than in non-periodontitis subjects. This necessitates scrupulous treatment planning and a thorough understanding of the disease's impact on peri-implant tissues [13].

Factors that substantially influence implant survival rates among GAgP patients include the severity of the periodontal disease at the time of implant placement, the meticulousness of oral hygiene protocols implemented post-operatively, and the selection of appropriate surgical and restorative techniques [14]. For instance, employing a staged approach that addresses any active periodontal disease before the implant placement can markedly improve the predictability and longevity of the dental implants. Preoperative periodontal therapy is crucial as it serves to stabilize the periodontal condition and engage the patient in a comprehensive maintenance plan, which is vital in mitigating infection risks post-implantation. Moreover, additional systemic factors such as smoking, diabetes, and other comorbidities can significantly affect consistent outcomes. These systemic health considerations must be carefully evaluated, as they can predispose individuals to higher rates of implant failure and complications. Additionally, the choice of implant surface characteristics plays an essential role; rougher surfaces may integrate more effectively within osteoporotic alveolar bone, which is often seen in compromised periodontal cases. The interaction between biocompatibility, implant design, and the local microenvironment in the presence of periodontal pathology also deserves attention [15].

It is also essential to emphasize the importance of regular follow-up and maintenance care for patients with implants in the context of GAgP. Continuous monitoring allows for early intervention in the case of developing peri-implant diseases, which can crucially affect implant longevity. Educational components aimed at enhancing patients' awareness regarding optimal oral hygiene practices are vital. Successful long-term outcomes are significantly associated with the patient's commitment to maintaining periodontal health, including more frequent dental visits and adherence to peri-implant maintenance protocols [16].

Impact of periodontal treatment prior to implant placement:

The management of patients with generalized aggressive periodontitis presents a unique set of challenges, particularly when considering the placement of dental implants. Prior to the introduction of implants into such patients' treatment plans, comprehensive periodontal therapy is essential. This therapy serves multiple functions, including controlling the existing periodontal disease, improving the periodontal status, and ultimately enhancing the outcomes of subsequent implant placement [17]. The aim of periodontal treatment in these instances is to achieve periodontal health,

which is crucial for the success of any implant placement since the presence of active periodontal disease can lead to implant failure or complications such as peri-implantitis. If periodontal health has been achieved, the next stage involves considering the timing of implant placement. Different schools of thought exist regarding immediate versus delayed implant placement following periodontal therapy in GAgP patients. Immediate placement may be possible under certain conditions; however, many clinicians advocate for a period of healing and reevaluation after intensive periodontal therapy before proceeding with implants [18]. Studies have indicated that patients who undergo extensive periodontal treatment before receiving implants exhibit better outcomes regarding bone integration and reduced rates of complications when compared to those who have not received such therapy. Moreover, the role of biocompatible materials and planning surgical techniques in conjunction with successful periodontal management cannot be overstated. The selection of implants that can integrate well within the host's bone structure and soft tissues adds to the overall success probability. An additional consideration is the type of prosthetic restoration planned post-implant placement, which also needs to factor in the patient's oral hygiene capacity and their understanding of maintenance measures necessary post-treatment [19].

Outcomes of different types of dental implant systems and surface treatments in patients with generalized aggressive periodontitis:

Several types of dental implant systems are available on the market, each designed with specific features that may enhance osseointegration, especially in compromised periodontal conditions. Standard titanium implants have been widely used for their biocompatibility and proven success rates. However, innovations in implant design, such as the incorporation of surface treatments that increase surface roughness, have emerged to improve primary stability and facilitate better bone healing. Surface coatings, such as hydroxyapatite (HA), have gained attention for their ability to promote cell adhesion and proliferation, which are critical in the presence of challenging periodontal conditions [20]. Numerous studies have investigated the outcomes of different implant systems and their respective surface treatments in patients with generalized aggressive periodontitis. For instance, implants with a moderately rough surface have shown superior outcomes compared to smoothsurfaced implants, notably in terms of earlier bone-to-implant contact and improved biomechanical stability [21]. This is particularly vital in patients with a history of aggressive periodontal disease, as enhanced initial stability can mitigate the risk of early implant failure due to insufficient osseointegration.

Recent advancements also include the use of surface modifications such as titanium plasma spray and anodization, which have demonstrated enhanced bone integration properties. These modifications encourage osteoconduction and may benefit patients suffering from systemic conditions that hinder bone healing. It has been noted that such advanced surface treatments can lead to decreased healing times and improved clinical outcomes in patients with a significant periodontal history. As a result, the

adoption of these advanced implant systems can provide a more favorable prognosis for implant placement in the context of generalized aggressive periodontitis [22].

Another important aspect to consider is the role of adjunctive therapies. In patients with a history of aggressive periodontal disease, a multidimensional approach involving periodontal treatment prior to implant placement can significantly improve outcomes. The stabilization of periodontal disease through scaling and root planing, combined with the use of systemic or local antibiotics, may enhance the healing environment for dental implants. Studies have indicated that preemptive periodontal therapy not only minimizes the risk of peri-implantitis but also increases the success rates of implants placed in previously affected sites [23].

Furthermore, the influence of bone quality and quantity cannot be overlooked in evaluating implant outcomes in this patient population. Bone grafting techniques may be necessary in instances of significant defect or lack of bone support due to the periodontitis. Several types of graft materials, including autografts, allografts, and synthetic materials, can be employed to augment bone volume prior to implant placement, resulting in a more predictable integration process. Each material presents its own set of resorption rates and osteoconductive properties, which may impact the ultimate success of the dental implant [24].

Complications and Challenges:

One of the primary challenges faced by clinicians is the assessment of the periodontal status of patients with GAP. This condition is characterized by rapid attachment loss and bone destruction, which can severely compromise the integrity of the alveolar bone—an essential factor for the success of dental implants [25]. The pre-existing bone loss may limit the available bone volume, complicating the procedures for implant placement and potentially predisposing the site to further complications, such as implant failure or peri-implantitis [26]. Another major concern is the management of the immune response in patients with generalized aggressive periodontitis. These individuals may present with altered immune responses that can affect not only the healing process post-implant placement but also the long-term outcomes of the implants. The modified host response may result in an increased likelihood of microbial invasion and subsequent infection, making the surgical area more susceptible to complications such as peri-implant mucositis and peri-implantitis. These inflammatory conditions can jeopardize the longevity of the implants and require diligent monitoring and maintenance to preemptively address any signs of deterioration. Additionally, the systemic health of patients with GAP can further complicate implant procedures [27]. Many of these patients may have comorbidities such as diabetes, which can influence healing and increase the risk of infection. Diabetics are often prone to complications because of their impaired wound healing and altered inflammatory responses. As such, a multidisciplinary approach may be

required, involving collaboration with medical professionals to optimize the overall health of the patient before proceeding with oral surgical interventions [28].

Bone quality is another critical factor that can influence the outcomes in patients with GAP. Many of these patients may present with reduced bone density due to the aggressive nature of their periodontal disease. This lack of adequate bone can necessitate the use of bone grafting procedures, which introduce additional variables into the treatment plan. The choice of graft materials and techniques could affect healing times and integration of the implant with the surrounding bone. Moreover, the presence of residual periodontal disease can contribute to a worsening bone condition, requiring careful surgical planning and perhaps multiple surgical interventions to ensure a successful outcome [29].

Post-surgical maintenance is pivotal in managing complications associated with dental implants in patients with GAP. Following the placement of implants, rigorous oral hygiene practices and regular follow-ups are crucial to monitor for any early signs of peri-implant disease. Supportive periodontal therapy, including professional cleanings and patient education on maintaining optimal oral hygiene, plays a vital role in the long-term success of implants in this patient population. The inherent challenges posed by aggressive periodontitis necessitate frequent reevaluation of both the patient and the implant's condition, making ongoing commitment by both the clinician and the patient essential [30].

2. Conclusion:

In conclusion, this study underscores the complexities and challenges of managing dental implants in patients with generalized aggressive periodontitis (GAgP). Our findings highlight the critical importance of thorough preoperative periodontal therapy, which plays a pivotal role in enhancing implant outcomes by stabilizing the periodontal condition before any surgical intervention. Although the survival rates of implants in this demographic present a stark contrast to those in periodontally healthy individuals, with rates ranging from approximately 85% to 95%, the integration of advanced implant systems and innovative surface treatments shows promise for improving clinical outcomes. The ongoing assessment of soft tissue health and vigilant monitoring for complications such as peri-implantitis will be essential for ensuring the long-term success of implants in these patients.

References

American Academy of Periodontology. Parameter on aggressive periodontitis. J Periodontol. 2000;71:867–869. doi: 10.1902/jop.2000.71.5-S.867. [DOI] [PubMed] [Google Scholar]

Sachdeo A, Haffajee AD, Socransky SS. Biofilms in the edentulous oral cavity. J Prosthodont. 2008;17:348–356. doi: 10.1111/j.1532-849X.2008.00301.x. [DOI] [PubMed] [Google Scholar]

.De Boever AL, De Boever JA. Early colonization of non-submerged dental implants in patients with a history of advanced aggressive periodontitis. Clin Oral Implants Res. 2006;17:8–17. doi: 10.1111/j.1600-0501.2005.01175.x. [DOI] [PubMed] [Google Scholar]

Quirynen M, Vogels R, Peeters W, van Steenberghe D, Naert I, Haffajee A. Dynamics of initial subgingival colonization of 'pristine' peri-implant pockets. Clin Oral Implants Res. 2006;17:25–37. doi: 10.1111/j.1600-0501.2005.01194.x. [DOI] [PubMed] [Google Scholar]

Bullon P, Fioroni M, Goteri G, Rubini C, Battino M. Immunohistochemical analysis of soft tissues in implants with healthy and peri-implantitis condition, and aggressive periodontitis. Clin Oral Implants Res. 2004;15:553–559. doi: 10.1111/j.1600-0501.2004.01072.x. [DOI] [PubMed] [Google Scholar]

van der Weijden GA, van Bemmel KM, Renvert S. Implant therapy in partially edentulous, periodontally compromised patients: a review. J Clin Periodontol. 2005;32:506–511. doi: 10.1111/j.1600051X.2005.00708.x. [DOI] [PubMed] [Google Scholar]

Schou S, Holmstrup P, Worthington HV, Esposito M. Outcome of implant therapy in patients with previous tooth loss due to periodontitis. Clin Oral Implants Res. 2006;17:104–123. doi: 10.1111/j.1600-0501.2006.01347.x. [DOI] [PubMed] [Google Scholar]

Klokkevold PR, Han TJ. How do smoking, diabetes, and periodontitis affect outcomes of implant treatment? Int J Oral Maxillofac Implants. 2007;22:173–202. [PubMed] [Google Scholar]

Karoussis IK, Kotsovilis S, Fourmousis I. A comprehensive and critical review of dental implant prognosis in periodontally compromised partially edentulous patients. Clin Oral Implants Res. 2007;18:669–679. doi: 10.1111/j.1600-0501.2007.01406.x. [DOI] [PubMed] [Google Scholar]

Schou S. Implant treatment in periodontitis-susceptible patients: a systematic review. J Oral Rehabil. 2008;35:9–22. doi: 10.1111/j.1365-2842.2007.01830.x. [DOI] [PubMed] [Google Scholar]

Al-Zahrani MS. Implant therapy in aggressive periodontitis patients: a systematic review and clinical implications. Quintessence Int. 2008;39:211–215. [PubMed] [Google Scholar]

Mengel R, Lehmann KM, Metke W, Wolf J, Flores-de-Jacoby L. A telescopic crown concept for the restoration of partially edentulous patients with aggressive generalized periodontitis: two case reports. Int J Periodontics Restorative Dent. 2002;22:129–137. [PubMed] [Google Scholar]

Wu AY, Chee W. Implant-supported reconstruction in a patient with generalized aggressive periodontitis. J Periodontol. 2007;78:777–782. doi: 10.1902/jop.2007.060281. [DOI] [PubMed] [Google Scholar]

Hoffmann O, Beaumont C, Zafiropoulos GG. Combined periodontal and implant treatment of a case of aggressive periodontitis. J Oral Implantol. 2007;33:288–292. doi: 10.1563/1548-1336(2007)33[288:CPAITO]2.0.CO;2. [DOI] [PubMed] [Google Scholar]

Hong JS, Yeo IS, Kim SH, Lee JB, Han JS, Yang JH. Implants and all-ceramic restorations in a patient treated for aggressive periodontitis: a case report. J Adv Prosthodont. 2010;2:97–101. doi: 10.4047/jap.2010.2.3.97. [DOI] [PMC free article] [PubMed] [Google Scholar]

Huh YH, Shin HJ, Kim DG, Park CJ, Cho LR. Full mouth fixed implant rehabilitation in a patient with generalized aggressive periodontitis. J Adv Prosthodont. 2010;2:154–159. doi: 10.4047/jap.2010.2.4.154. [DOI] [PMC free article] [PubMed] [Google Scholar]

Bidra AS, Shaqman M. Treatment planning and sequence for implant therapy in a young adult with generalized aggressive periodontitis. J Oral Implantol. 2012;38:405–415. doi: 10.1563/AAID-JOI-D10-00118. [DOI] [PubMed] [Google Scholar]

Kehl M, Swierkot K, Mengel R. Three-dimensional measurement of bone loss at implants in patients with periodontal disease. J Periodontol. 2011;82:689–699. doi: 10.1902/jop.2010.100318. [DOI] [PubMed] [Google Scholar]

Mengel R, Flores-de-Jacoby L. Implants in patients treated for generalized aggressive and chronic periodontitis: a 3-year prospective longitudinal study. J Periodontol. 2005;76:534–543. doi: 10.1902/jop.2005.76.4.534. [DOI] [PubMed] [Google Scholar]

Mengel R, Flores-de-Jacoby L. Implants in regenerated bone in patients treated for generalized aggressive periodontitis: a prospective longitudinal study. Int J Periodontics Restorative Dent. 2005;25:331–341. [PubMed] [Google Scholar]

Mengel R, Kreuzer G, Lehmann KM, Flores-de-Jacoby L. A telescopic crown concept for the restoration of partially edentulous patients with aggressive generalized periodontitis: a 3-year prospective longitudinal study. Int J Periodontics Restorative Dent. 2007;27:231–239. [PubMed] [Google Scholar]

De Boever AL, Quirynen M, Coucke W, Theuniers G, De Boever JA. Clinical and radiographic study of implant treatment outcome in periodontally susceptible and non-susceptible patients: a prospective

long-term study. Clin Oral Implants Res. 2009;20:1341–1350. doi: 10.1111/j.16000501.2009.01750.x. [DOI] [PubMed] [Google Scholar]

Mengel R, Behle M, Flores-de-Jacoby L. Osseointegrated implants in subjects treated for generalized aggressive periodontitis: 10-year results of a prospective, long-term cohort study. J Periodontol. 2007;78:2229–2237. doi: 10.1902/jop.2007.070201. [DOI] [PubMed] [Google Scholar]

Swierkot K, Lottholz P, Flores-de-Jacoby L, Mengel R. Mucositis, peri-implantitis, implant success, and survival of implants in patients with treated generalized aggressive periodontitis: 3- to 16-year results of a prospective long-term cohort study. J Periodontol. 2012;83:1213–1225. doi: 10.1902/jop.2012.110603. [DOI] [PubMed] [Google Scholar]

Strietzel FP, Reichart PA, Kale A, Kulkarni M, Wegner B, Küchler I. Smoking interferes with the prognosis of dental implant treatment: a systematic review and meta-analysis. J Clin Periodontol. 2007;34:523–544. doi: 10.1111/j.1600-051X.2007.01083.x. [DOI] [PubMed] [Google Scholar]

Lindquist LW, Carlsson GE, Jemt T. Association between marginal bone loss around osseointegrated mandibular implants and smoking habits: a 10-year follow-up study. J Dent Res. 1997;76:1667–1674. doi: 10.1177/00220345970760100801. [DOI] [PubMed] [Google Scholar]

Schwartz-Arad D, Samet N, Samet N, Mamlider A. Smoking and complications of endosseous dental implants. J Periodontol. 2002;73:153–157. doi: 10.1902/jop.2002.73.2.153. [DOI] [PubMed] [Google Scholar]

Karoussis IK, Salvi GE, Heitz-Mayfield LJ, Brägger U, Hämmerle CH, Lang NP. Long-term implant prognosis in patients with and without a history of chronic periodontitis: a 10-year prospective cohort study of the ITI Dental Implant System. Clin Oral Implants Res. 2003;14:329–339. doi: 10.1034/j.1600-0501.000.00934.x. [DOI] [PubMed] [Google Scholar]

.Roos-Jansåker AM, Renvert H, Lindahl C, Renvert S. Nine- to fourteen-year follow-up of implant treatment. Part III: factors associated with peri-implant lesions. J Clin Periodontol. 2006;33:296–301. doi: 10.1111/j.1600-051X.2006.00908.x. [DOI] [PubMed] [Google Scholar]

Bain CA, Weng D, Meltzer A, Kohles SS, Stach RM. A meta-analysis evaluating the risk for implant failure in patients who smoke. Compend Contin Educ Dent. 2002;23:695–699. [PubMed] [Google Scholar]