

Key Local and Surgical Factors Related to Implant Failure



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KEYWORDS

- Local factors • Implant failure • Dental implants

KEY POINTS

- Clinicians should critically evaluate the patient's oral hygiene, compliance, motivation, and risk factors before suggesting dental implant treatment.
- Achieving primary stability is important for successful implant placement.
- Host-related factors, operative-related factors, and implant-related factors may influence the outcome of implant treatment and should be thoroughly evaluated during treatment planning.
- Practitioners treating patients with systemic metabolic disorders, such as diabetes or osteoporosis, those undergoing radiation therapy, and those who smoke, should follow a 2-staged approach for optimal implant outcome.

INTRODUCTION

The clinical effectiveness of the osseointegration concept introduced by Brånemark and colleagues¹ in the 1960s has revolutionized the clinical practice of dentistry. Dental implants are now the preferred line of treatment for the replacement of missing teeth. Additionally, implant-supported full-mouth prostheses are a good treatment option for patients who are completely edentulous, achieving a comprehensive and functional oral rehabilitation.² Although endosseous implants have a predictable outcome and long-term success, they sometimes fail. Several clinical studies have recognized risk factors that may lead to implant failure.^{3,4} Implant failures are categorized as primary (early), when the body is unable to establish osseointegration, or secondary (late), when the body is unable to maintain the achieved osseointegration and a breakdown process results.⁵ Implant failures also are classified on the basis of

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the time of prosthesis placement; in this classification, early implant failure usually occurs before the prosthesis is placed, and late implant failure is associated with functional loading after the placement of the prosthesis. Because there are no known noninvasive methods for evaluating the extent of osseointegration, the factors associated with both early and late failures may coexist for a particular implant. Additionally, these factors can be difficult to interpret individually. In a retrospective study, Friberg and colleagues⁶ followed 4641 Brånemark dental implants from stage 1 surgery to the completion of the prosthetic restoration. They found that maximal fixtures failed for completely edentulous maxillae with poor bone quality. They also found that some fixtures were not mobile at the abutment connections but were mobile just before the prosthesis was placed.⁶ The reason that the fixture gave a false impression of initial stability was that, although the surgeon embedded the implants tightly into the bone, the bone in which the fixture was embedded was remodeled by resorption during the progression of the healing phase. Thus, implant mobility was evident, and the implant failed. Several local and systemic factors, such as lack of primary stability, surgical trauma, and existing periodontal infection, may play an important role in hindering the normal process of bone healing around implants and can subsequently lead to early implant failure. On the other hand, provisional overload and microbially induced peri-implant diseases are associated with late implant failure.

The process of osseointegration between the host's bone tissue and the implant is the key to the success of the implant. The term *osseointegration* has several definitions. Albrektsson and colleagues⁷ defined it as "a direct structural and functional connection between bone and the surface of a load-bearing implant." Brånemark¹ definition, which is based on macroscopic and microscopic biology from a medical point of view, is "close approximation of new and reformed bone and the fixture together with surface irregularities so that there is no interposition of connective or fibrous tissue at light microscopic level. Thus, a direct structural and functional connection, capable to carrying normal physiologic loads without extensive deformation and initiation of rejection."

OUTCOME OF THE DENTAL IMPLANT: SUCCESS OR FAILURE

Several reports have evaluated the successful outcome of dental implants. The term *success* means attainment of the desired aims. The criteria for successful implants proposed by Albrektsson and colleagues⁸ were based on clinical and radiographic evidence of osseointegration, and this criterion is presently most widely accepted. Furthermore, several additions to the criteria of Albrektsson and colleagues⁸ have been recently proposed for evaluating successful implants: these additions include clinical function, esthetics, patient satisfaction, radiographic evidence of minimal bone loss, stability of the prosthesis, absence of peri-implant soft tissue infection, and lack of implant mobility and pain.⁸⁻¹⁰ If an implant does not meet all of the criteria for a successful implant, it is instead considered a surviving implant.

On the other hand, implant failure occurs when an implant fails to achieve its function. Usually, failure to attain osseointegration is considered an implant failure. A failed implant must usually be removed. Esposito and colleagues¹¹ established 4 categories of implant failure based on the osseointegration concept. The first category, biological failure, includes early or primary failure (before loading) and late or secondary failure (after loading). Early or primary failure occurs when osseointegration is not achieved during the initial normal bone-healing process. Late or secondary failure occurs when achieved osseointegration is not sustained. The second category, mechanical

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