

Implant Failures: A Review

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Abstract

Dental implants are currently regarded as viable solutions to lost teeth, notwithstanding the possibility of failure. Implant placement is a very technique-sensitive process that necessitates extensive knowledge as well as an experienced implantologist. Despite consistently high success rates, implant failure can occur, necessitating prompt removal. To enhance the treatment success with dental implants, the etiology and variables related with implant failures should be considered. Such knowledge is required for designing effective treatment and preventative methods. This article is intended to provide insight into many aspects of dental implant failures.

Keywords: Implants, Implant failure, Peri implantitis.

INTRODUCTION

The introduction of dental implants has lessened the constraints of traditional prosthetic modalities. Implantology has evolved from an unpredictable art to a well-founded clinical science as a hyperspecialized treatment method. The reliability of this treatment approach has revolutionized edentulous patients' rehabilitative alternatives.

Dental implant is a prosthetic device made of alloplastic material(s) implanted into the oral tissues beneath the mucosal or/and periosteal layer, and on/or within the bone to provide retention and support for a fixed or removable dental prosthesis; a substance placed into or/and on the jaw bone to support a fixed or removable dental prosthesis (Glossary of Prosthodontic Terms-8).^[1]

An implant is made up of an implant body that is inserted within the bone and an implant screw that is placed on the superior surface of the body and to which the healing cap is linked. Implants are inserted into the bone in either a one-stage or two-stage procedure. Abutments are placed above the implant body to keep the prosthesis in place.

Implant failure is defined as the condition of implant performance that, when measured quantitatively, falls below an acceptable level. Despite numerous precautions and surgical expertise, implant failures do occur due to a variety of causes.^[2]

This article's goal is to look into the many causes of implant failure by focusing on the various classifications that are presented from time to time. Implant failure is caused by

a variety of factors, including peri-implantitis, a lack of osseointegration, and implant fracture. Other possible causes include surgical trauma, micro motion, and overloading.

RISK FACTORS OF IMPLANT FAILURE

Although implant treatment is highly successful and predictable, some risk factors may reduce the success rates leading to a higher risk for implant failure for individuals.^[3]

Dentist-related risk factors

Pre-operative factors

There is no obvious link between dental implant failure and irradiated patients.^[4] The primary issue with irradiated individuals is decreased salivary flow, an increased risk of infection due to decreased blood flow, and the chance of osteoradionecrosis. Radiation complications begin when the dose exceeds 64Gy. Complications are to be expected if it does not exceed the limit.^[5,6]

Peroperative factors

There are various factors which lead to implant failure during implant placement

- Severe angulations
- Lack of initial stabilization

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- Impaired healing
- Overheating the bone
- Minimal space between the implants
- Placing implant in immature bone
- Placement in infected socket

Post-operative factors

Implant failure may be due to improper design and guidance of the crown. Peri-implant bone fractures and implant fractures are caused by occlusal forces.

Implant-related risk factors

The use of bioincompatible implant materials causes implant failure due to unfavorable host tissue reactions.^[7]

Host-related factors (Figure 1)

Local risk factors are as follows:

- Bone quality and quantity
- Irradiated bone
- Biomechanical occlusal loading
- Smoking as a risk factor for implant failure
- Para-functional Habits and bruxism

Systemic factors are as follows:

- Diabetes mellitus
- Osteoporosis
- Medication
- Age

CAUSES OF IMPLANT FAILURES

Failure of implant has a multifactorial etiology. Several causes are implicated which lead to the ultimate failure of the implant.

Early failure (intraoperative or within 3 months)

According to etiology

- Implant selection: Improper implant type or bone type, length and diameter of the implant, surface impurity, and surface roughness
- Surgical placement: Off axis placement, lack of initial stabilization, overheating of bone, minimal space between implants, and contamination of implants during placement



Figure 1: Factors affecting dental implants

- Restorative problems: Improper design, occlusal scheme, improper fit, and excessive
- Loading and implant fractures.

Due to personnel responsible

- Dental expertise: oral surgeon, prosthodontist, and periodontist
- Laboratory technician: improper design of prosthesis.

According to failure mode

- Lack of osseointegration.

Due to biological causes

- Peri-implantitis.

Late failure (post-operative after 3 months)

According to etiology

- Host factors: Systemic factors diabetes, arthritis, obesity, and osteoporosis
- Tissue abuse: Smoking, parafunctional habits, and alcoholism
- Radiotherapy.

Due to personnel responsible

- Patient: Inadequate post-operative maintenance.

According to failure mode

- Functional and psychological problems.

Due to biological causes

- Infections: retrograde peri-implantitis, due to traumatic occlusion, overloading.^[8]

CLASSIFICATION OF IMPLANT FAILURE

Various authors have classified implant failures depending on several criteria.

Rosenberg *et al.*^[9] classified implant failures as follows:

- Infectious failure
- Traumatic failure

Esposito *et al.*^[9,10] classified implants according to the osseointegration concept biological

- Mechanical
- Iatrogenic

Inadequate patient education

Truhlar^[11] classified failures as

Early failures

- That occur within weeks to few months after placement
- Caused by factors that can interfere with normal healing processes or by an altered healing response.

Late failure

- Failure that arise from pathologic processes that involve a previously osseointegrated implant.

According to the procedure, it is classified as follows:

1. Surgical failure
2. Prosthetic failure.^[12]

El Askary *et al.*^[5] have divided the failures into seven categories.

According to etiology

Failures due to host factors

- Medical status – Osteoporosis and other bone diseases; uncontrolled diabetes
- Habits – Smoking and parafunctional habits.
- Oral status – Poor home care, juvenile, and rapidly progressive periodontitis, irradiation therapy.

Restorative problems

Excessive cantilever, pier abutments, no passive fit, improper fit of the abutment, improper prosthetic design, improper occlusal scheme, bending moments, connecting implants to natural dentition, premature loading, and excessive torquing.^[9]

Surgical placement

- Off axis placement (severe angulation.)
- Lack of initial stabilization
- Impaired healing and infection due to improper flap design or others
- Overheating the bone and exerting too much pressure
- Minimal space between implants
- Placing the implant in immature bone grafted sites
- Placement of the implant in an infected socket or a pathologic lesion
- Contamination of the implant body before insertion.

Implant selection

- Improper implant type in improper bone type
- Length of the implant (too short, crown-implant ratio unfavorable)
- Diameter of the implant.

According to timing of failure

- Before Stage II (after surgery)
- At Stage II (With healing head and or abutment insertion)
- After restoration.

According to origin of infection

- Peri-implantitis (infective process and bacterial origin) (Figure 2)
- Retrograde peri-implantitis (traumatic occlusion origin, non-infective, forces off the long axis, premature, or excessive loading).

According to condition of failure: (Clinical and radiographic status)

- Ailing implants
- Failing implants
- Failed implants
- Surviving implants.

According to responsible personnel

- Dentist (oral surgeon, prosthodontist, and periodontist)
- Dental hygienist
- Laboratory technician
- Patient.

According to failure mode

- Lack of osseointegration (usually mobility)
- Unacceptable esthetics (Figure 3)
- Functional problems
- Psychological problems.

According to supporting tissue type

- Soft-tissue problems (lack of keratinized tissues, inflammation, etc.)
- Bone loss (Radiographic changes, etc.)
- Both soft tissue and bone loss.

WARNING SIGNS OF IMPLANT FAILURES

1. Connecting screw loosening^[13]
2. Connecting screw fracture (Figure 4)
3. Gingival bleeding and enlargement
4. Purulent exudates from large pockets
5. Pain
6. Fracture prosthetic component
7. Angular bone loss noted radiographically
8. Long-standing infection and soft-tissue sloughing during the healing period of first stage surgery.^[14]



Figure 2: Peri-implantitis



Figure 3: Unacceptable esthetics

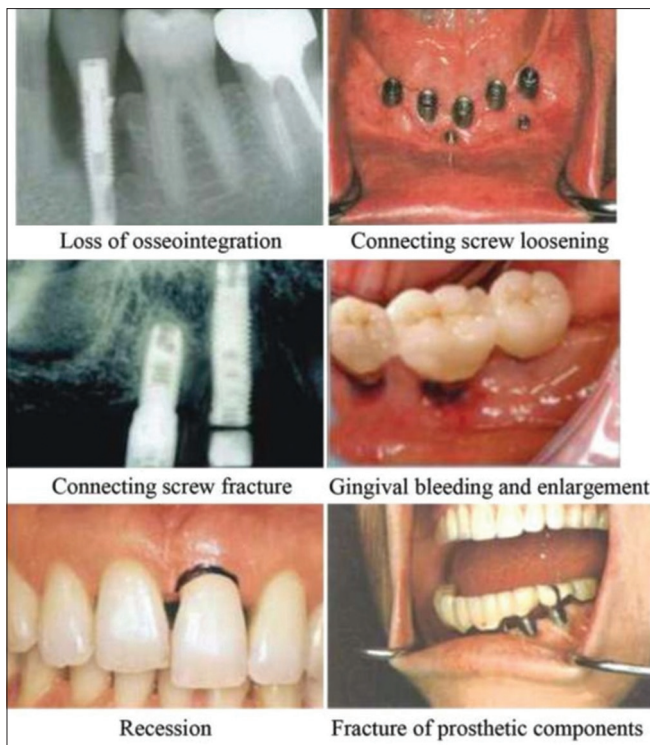


Figure 4: Warning signs of implant failure

EVALUATIONS OF IMPLANT FAILURE

Although it is possible to distinguish between a successful and a failed implant, identifying failing implants remains difficult. Esposito *et al.* addressed the factors used clinically to evaluate implant status.^[10] The following is the most prevalent diagnostic criteria defined for implant failures (failed implants).

Clinical signs of early infection

Swelling, fistulas, suppuration, early/late mucosal dehiscences, and osteomyelitis are the most common problems noticed during the healing phase (3–9 months), indicating implant failure.

Discomfort or sensitivity

Pain or discomfort is the first sign which indicates an implant failure and is often associated with mobility.

Clinically distinct movement

Mobility is the cardinal sign of implant failure.¹⁰ Several different types of mobility have been recognized as:

Rotation mobility, lateral or horizontal mobility, and axial or vertical mobility.^[15]

Dull sound at percussion

A subdued sound on percussion is indicative of soft-tissue encapsulation. A clear crystallization sound indicates successful osseointegration.^[10]

Bleeding on probing

Bleeding on probing has been used to assess peri-implant tissue conditions. However, new findings indicate that it cannot be

utilized to distinguish between a healthy and pathological peri-implant state, and there is no scientific evidence to support it.

Radiographic signs of failure

There can be two well-distinct radiographic pictures in implant failure.

- First is a thin perfixtural radiolucency surrounding the entire implant. This suggests the absence of a direct bone-implant contact and possibly a loss of stability
- Second being an increased marginal bone loss. When a suspected perfixtural radiolucency or excessive marginal bone loss
- According to Albrektsson *et al.*, marginal bone loss of 1.5 mm during the 1st year and <0.2 mm yearly can be considered as success criteria.^[16,17] A thin perfixtural radiolucency encompassing the entire implant, together with increased marginal bone loss and the absence of a direct bone-implant contact, suggests a loss of stability, and greater marginal bone loss indicates a failed implant.^[18]

STAGES OF IMPLANT FAILURES

Many causes of implant failure have been investigated. Implant failure can occur at any time during treatment and later when the implant is in use. Hence, depending on the timing of the failure, it might be

- Before Stage II (after surgery)
- At Stage II (with healing head and/or abutment insertion)
- After restoration.^[5]

Before stage II

It frequently happens as a result of implant misplacement, which is when the implant is placed in an infected socket, pathological lesion, or immature bone that has already been augmented, or when a contaminated implant is placed in the osteotomy, infection, or soft-tissue complications.

The failing dental implant may resemble an exfoliating fixture with purulent exudates. In this case, it starts with the exposure of the cover screw, which, when palpated with a light touch of a probe on top of the screw, displays a sinking or damping movement caused by the fibrous tissues and infection around the fixture. It may end with fixture exfoliation in 10 days to 2 months from the time of fixture placement.^[5]

At stage II

Implants can fail during the second stage of surgery, during healing or head insertion, during the abutment connection, or before to prosthesis placement. This could be the result of excessive torquing during the abutment connection when placed into grafted bone. It is most probably caused by insufficient bone contact surface area with the implant, as well as poor fixture surface treatment.^[19]

A contaminated implant may remain inactive until torque is applied to the cover screw. The implant then comes out due to a lack of integration, which can occur as a result of the implant

being placed in a large osteotomy, the implant being loaded before the specified time, or traumatic implant implantation. It cannot be termed an early failure because it occurred too late.

After restoration

This is the most particular time for a failure to occur. It begins with the loading of an integrated implant and progresses until the point of failure discovery. Occlusal trauma is the most common cause. It has its own set of clinical symptoms called as peri implantitis.

TREATMENT STRATEGIES

Treatment options vary depending on the cause. Non-surgical and surgical treatment procedures are the two primary categories of treatment strategies.

Non-surgical treatment

When occlusal biochemical forces are considered as an etiological factor, the occlusal is first analyzed, and any occlusal interference, if present, should be addressed. The fit of the prosthesis and the abutment should also be examined and modified as needed. When plaque and microbes are thought to be etiological contributors, thorough debridement is the preferred treatment. It has been proposed that hyperplastic peri-implant tissues be debrided locally with hand or ultrasonic plastic devices.

Metallic instruments are avoided to limit surface damage and roughening, which can promote plaque adhesion. Furthermore, the use of antibacterial mouth rinses in conjunction with mechanical therapy improved the prognosis of such mucositis lesions. To improve clinical outcomes, chemical disinfectants such as hydrogen peroxide and chlorhexidine digluconate were utilized in addition to mechanical debridement.

Surgical treatment

In the instances, when the disease is unstable after proper non-surgical treatment, the clinician should reevaluate the situation and, if necessary, consider surgical treatment. The surgical treatment consists of elevating a mucoperiosteal flap and removing the peri-implant inflammatory granulation tissue.

The following surgical exposure of the contaminated implant surface, mechanical, chemical, or photodynamic methods, as well as combinations of the three, can be employed to try to eradicate infection, resolve inflammation, and make the surface suitable for bone regeneration and re-osseointegration.

The goal of the regenerative technique is to fill the osseous deficiency around the implant while also improving soft-tissue quality. Autogenous bone, allogenic decalcified freeze-dried bone, xenogenic bone mineral, phytogenic calcium carbonate, and hydroxyapatite are all examples of bone minerals.

Peri-implant maintenance

Regular evaluation of implants and their surrounding tissues and prostheses; occlusal examination; review and reinforcement of oral hygiene; removal of plaque and calculus;

treatment of disease or repair of prostheses, as needed; and implementation of customized preventive measures should be among the maintenance principles. Clinical factors such as peri-implant hemorrhage, periodontal probing depth, and the presence of periodontitis were linked to an increased chance of developing peri-implantitis.

DISCUSSION

The failure of the implant is multifaceted. Many things might often come together to cause the implant to fail. Identifying the cause is necessary not just to cure the current ailment but also as a learning experience for future treatments. Avoiding situations that predispose to poor outcomes, selecting cases with ideal surgical and prosthetic circumstances, and avoiding complex clinical challenges can significantly increase favorable outcome results.

Failures, without a doubt, are stepping stones to success, but only until their causes are identified and their occurrence is avoided. As a result, to give the next branch of dentistry a new horizon, every clinician must understand how and why failures occur, as well as how best we may prevent them.

CONCLUSION

Many things might often come together to cause the implant to fail. Proper data collection, patient Feedback, and an accurate diagnostic tool will aid in determining the cause of failure. If regular check-ups are performed, early intervention is always possible. The identification of possible etiologic variables influences the treatment strategy for problems and failing implants. • Once a diagnosis has been established and potential etiologic factors have been identified, the causative agent should be eliminated and treatment should begin as soon as possible.

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