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Failed Implants and Surviving Implants- A Review

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ABSTRACT: Long-term treatment success is impacted by dental implant failure, which is a major concern in contemporary implantology. The difficulty of failed implants to acquire or sustain osseointegration is a defining characteristic, frequently brought on by mechanical issues, severe bone loss, or infection. However, Even when there are minimal side effects like mild bone loss or soft tissue irritation, surviving implants stay in place and continue to function. Despite difficulties in preserving ideal peri-implant health, surviving implants, in contrast to failed implants, continue to function as planned. A number of factors, including as inadequate osseointegration, peri-implantitis, implant overload, or systemic diseases, can lead to implant failure. Finding the cause of failure requires the use of diagnostic techniques such radiography, clinical exams (such as probing depth and mobility tests), and microbiological sampling. Early identification and a customized treatment plan are essential for the successful management of failed implants. To avoid implant failure and guarantee long-term implant survival, routine monitoring and the application of cutting-edge diagnostic procedures are essential. In order to shed light on the clinical ramifications and treatment procedures of both failed and surviving dental implants, this review article will examine their causes, diagnostic techniques, and management approaches.

I. FAILED IMPLANTS

A failed dental implant is one that, even after the healing phase, either fails to Osseo integrate (integrate into the bone) or starts to exhibit symptoms of problems that eventually cause it to fail. This may happen months or even years after installation, or it may happen soon after placement. [1]

1. Implant Failure Stages: Early and late failure stages can be used to classify implant failure:
A) Early Failure: This happens before osseointegration can take place, soon after the implant is inserted. Usually, it occurs in the first three to six months following placement. Trauma, surgical complications, or infection are among the causes.

B. Late Failure: This happens when the implant loses stability after successfully integrating into the bone. Bone resorption, mechanical overload, and peri-implantitis (inflammation of the tissues around the implant) are among the causes. [1]

Depending on the stage, several signs and symptoms of implant failure may appear.
Typical traits consist of:
Discomfort or Pain: Prolonged discomfort, particularly while pressing or chewing on the implant site, may be a sign of implant failure. Implant mobility: If the implant feels loose or moves when touched, it can be a sign of failure. Instability results from the loss of osseointegration in a failed implant.

Infection or Swelling: Infection or peri-implantitis may be indicated by swelling, redness, or pus surrounding the implant site.

Bone Loss: A reduction in bone density surrounding the implant on X-rays or CBCT scans indicates a failure in either bone resorption or osseointegration.

Bleeding or pus discharge: This can originate from the gums around the implant and is a blatant indication of infection.

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Radiographic Changes: When an implant fails, radiographs may reveal increased peri-implant space, darkening bone surrounding the threads, or bone loss surrounding the implant.

Identifying Failed Implants
A clinical and radiographic evaluation are necessary to diagnose a failed implant: [2-4]

Clinical Assessment:
Examine for symptoms of infection, discomfort, and movement. The stability of the implant can be assessed by lightly tapping it or applying pressure.

Radiographic Imaging: To evaluate implant integration and identify bone resorption, X-rays and CBCT (Cone Beam CT) scans are crucial.
Failure is indicated by any obvious radiolucency (darkness surrounding the implant) or by the absence of bone contact with the implant threads.

Microbiological Examinations:
Microbiological testing can assist in identifying the pathogens causing peri-implantitis or other infections if an infection is suspected.

Depth of Peri-Implant Probing:
If there is bleeding or pus discharge and the probing depth is greater than 5 mm, it may be a sign of peri-implantitis or osseointegration issues.

Handling Implant Failure
Depending on the reason and timing of the failure, many therapy options are available if a diagnosis is made:
Early Failure: Before a new implant is inserted, the site may need more time to heal, and the implant is usually removed.

Late Failure: In certain situations, the implant may be saved by procedures including cleaning, bone grafting, or the use of antibiotics or other therapies to treat peri-implantitis. Otherwise, it might be necessary to remove the implant.

II. HOW TO HANDLE THE STAGE OF A FAILED IMPLANT

Restoring function to the damaged area, addressing the root cause of the failure, and averting additional issues are all part of managing a failed dental implant. The underlying reason, such as infection, trauma, or overload, and whether the failure happens early (before osseointegration) or late (after osseointegration) determine the management strategy. [5-9]

1. Management of Early Implant Failure: Shortly after implantation, before the implant has completely fused with the bone, early failure happens. Surgical problems, infection, inadequate bone volume, or high loading may be the causes. The following are part of management:
a) Implant Removal Indications: Within the first three to six months, the implant is judged to be uncomfortable, loose, or non-functional.

Procedure: Surgery is used to remove the implant. To reduce harm to the surrounding bone and tissue, careful attention is required.

b) Reimplantation Site Preparation: Grafting may be necessary at the removal site to guarantee sufficient bone for a replacement implant. Among the options are:
Bone Grafting: To increase bone volume, autografts, allografts, or synthetic bone graft materials can be utilized.
Guided Bone Regeneration (GBR): This method stops soft tissue growth into the bone defect and encourages the production of new bone by using barrier membranes.
Wait Time: Wait times of three to six months or more before reimplantation may be required, depending on the graft material and the healing process.

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c) Steer clear of the cause of failure: To avoid recurrence, the cause of failure (such as inadequate bone density, infection, or surgical technique) must be found and treated. It could be necessary to reevaluate the patient's general health, bone health, and dental hygiene practices.

2. Management of Late Implant Failure

Late failure happens when the implant fails after it has first integrated due to problems including peri-implantitis, mechanical overload, or systemic health difficulties.

Controlling Peri-Implantitis

Treatment without surgery: Using ultrasonic equipment and antiseptic treatments, the implant surface and soft tissues are debrided as part of the first treatment of peri-implantitis.

Antibiotics: In the event of an infection, systemic antibiotics may be recommended.

Laser Therapy: To eliminate microorganisms from the implant site and encourage healing, laser-assisted treatment may be utilized.

Surgical Intervention: Surgical intervention may be required if non-surgical approaches are unsuccessful. This may include:

Flap Surgery: Direct access to the implant for debridement and cleaning is made possible by flap surgeries. Guided tissue regeneration (GTR) or bone grafting may be required in cases of severe bone loss.

Resection: In severe situations, it can be necessary to remove the implant and carry out bone regeneration.

Failure by Mechanical Means

Excessive Loading: Modifications to the occlusion or the application of a splint may be required if the implant is exposed to excessive forces (caused by bruxism or occlusal overload).
Implant Abutment Adjustment: To lessen the strain on the bone, this may entail changing the angulation or design of the implant.
Prosthesis restoration: In order to better uniformly distribute the forces, the restoration may need to be modified.

Management of Bone Loss

Bone Grafting: Bone grafting treatments are utilized to restore the bone structure in cases of bone loss surrounding a late-stage failed implant.
Soft Tissue Management: Preserving function and appearance can be achieved by treating gingival recession or soft tissue loss surrounding the implant.
Extraction of Implants
The implant needs to be taken out if it cannot be saved. The surrounding bone is preserved, just like in early failure. Following sufficient healing and bone volume restoration, a replacement implant may be inserted.

3. Preventive measures and general management

Patient Education: Implant failure can be avoided by teaching patients about maintaining good dental hygiene, abstaining from smoking, and controlling risk factors (such as diabetes and bruxism).

Frequent Monitoring: To evaluate the implant's condition, identify infection symptoms, or track bone loss early, routine follow-ups are crucial.

Occlusal Management: Maintaining appropriate occlusion will help avoid mechanical failure, especially in patients who have parafunctional habits like grinding.

Systemic Health Assessment: The chance of failure can be decreased by managing systemic problems such as immunocompromised states, osteoporosis, or uncontrolled diabetes.

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III. DIAGNOSTIC PROCEDURES TO DETERMINE FAILED IMPLANTS

The stage of a failed dental implant can be assessed using a variety of diagnostic techniques and procedures. These tests assist in evaluating the stability of the implant, identifying the necessity for corrective action, and spotting early indicators of problems including infection, peri-implantitis, or mechanical failure. The primary examinations and diagnostic instruments used to look for failed implants are listed below: [10-13]

1. Clinical Assessment

To find indications of implant failure, a comprehensive clinical assessment is required:

Test of Implant Mobility: A failing implant frequently shows signs of loosening or movement. The implant can be physically moved or softly tapped to verify this. It indicates early failure or a lack of osseointegration if the implant is unstable and moves.

Probing the peri-implant: Finding infection or bone loss might be aided by measuring the depth of the probing surrounding the implant. Peri-implantitis, a prevalent cause of late implant failure, is indicated by probing depths more than 5 mm and the presence of pus or blood.

Pain or Discomfort: If the patient experiences ongoing pain, it may be a sign that their implant is failing.

2. Imaging via Radiography

Radiographs are essential for identifying implant failure, particularly when peri-implantitis or bone loss is present.

Intraoral X-rays: An infection, peri-implant radiolucency (dark region surrounding the implant), or bone loss can all be seen on standard 2D X-rays. Failure is indicated by a decrease in bone density or height surrounding the implant.

Cone Beam Computed Tomography (CBCT): This 3D imaging method offers fine-grained views of implant location, bone volume, and any structural alterations. It can assist in determining the degree of bone loss, implant stability, and potential infection and is more accurate than conventional X-rays.

Periapical Radiographs: These are typically taken to check for any changes in the bone structure surrounding the implant. Darkening around the implant threads, especially if it extends into the bone, is indicative of potential failure.

3. Peri-Implant Sulcus Fluid Test

The presence of peri-implant sulcus fluid (PISF) can be tested as an indicator of peri-implant disease. Increased levels of PISF may suggest inflammation or infection around the implant, which can lead to failure if untreated.

Testing Method: Special strips are used to collect fluid from the peri-implant sulcus. Elevated levels of biomarkers like cytokines, prostaglandins, or MMPs (matrix metalloproteinases) are indicative of peri-implantitis or bone resorption.

4. Implant Stability Measurement

Implant stability can be quantitatively assessed using resonance frequency analysis (RFA) or periotest.

Resonance Frequency Analysis (RFA): This method uses a vibrating probe to assess the stiffness of the implant and surrounding bone, giving a numerical value (ISQ - Implant Stability Quotient). A low ISQ value indicates poor implant stability, which may be a sign of failure, while a higher value suggests good integration.

Periotest: This test uses an electronic probe that measures the damping effect as the implant is tapped. A low score indicates that the implant has low stability and may be failing.

5. Microbiological Testing

If infection is suspected as a cause of implant failure, microbiological tests can help identify pathogens around the implant.

Subgingival Bacterial Culture: This test identifies specific bacteria associated with peri-implantitis (e.g., Porphyromonas gingivalis, Aggregatibacter actinomycetemcomitans). A higher bacterial load or the presence of pathogenic species can suggest that infection is contributing to implant failure.

DNA Probing or PCR (Polymerase Chain Reaction): This molecular method can detect bacterial DNA at the implant site, even when the bacterial load is low. It is more sensitive than traditional culture methods.

6. Bone Density Testing

Bone density around the implant site can be evaluated using dual-energy X-ray absorptiometry (DXA) or CT imaging to assess bone loss.

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CT or CBCT Scans: These scans provide high-resolution 3D imaging to assess bone quality and volume around the implant. Significant bone loss around the implant can indicate that the implant is failing or has failed.

7. Histological Examination (in severe cases)

Histological analysis of the surrounding tissue can be carried out in situations where implant failure necessitates implant removal. At the microscopic level, this technique can assist in determining the degree of bone resorption, infection, or inflammation. The histology of the bone surrounding failed implants may reveal fibrous tissue rather than the anticipated bone integration, which would be a sign of failure.

Clinical evaluation, radiographic analysis, and specialist testing such as microbiological assessments and resonance frequency analysis are all part of the multifactorial diagnosis of failed implants. Clinicians can precisely determine the stage of failure, the underlying reason, and the best course of treatment by combining various diagnostic tools.

IV. CLASSIFICATIONS OF FAILED IMPLANTS

The different phases and forms of dental implant failure have been divided into a number of categories. By determining the root causes and the course of failure, these classifications assist physicians in diagnosing and treating failed implants. Some commonly accepted categories of unsuccessful implants are listed below.[14,15]

1. Grouping Considering the Time of Failure

Depending on when the failure happens—during the early healing phase or after the implant has been operational for a while—it might be classified as an implant failure.

a) Early Implant Failure (Primary Failure): This type of failure happens in the first three to six months following implant implantation, prior to osseointegration. Causes include overload during the healing process, infection, trauma, poor bone quality, and incorrect implant placement. Signs include pain, difficulty to integrate into the bone, infection, lack of bone development surrounding the implant, and implant movement.

b) Late Implant Failure (Secondary Failure): This type of failure happens after the implant has osseointegrated and operated normally for a while, usually six months. Causes include implant fracture, mechanical overload, peri-implantitis, and systemic diseases that impact bone health.

Indications: After a period of successful operation, progressive bone loss, pain, infection, or implant movement.

2. Classification Based on Causes of Failure

The causes of implant failures can also be used to categorize them. This classification aids in identifying the best management and treatment approaches.

a) Failure of the Biologic

Inflammation of the soft tissues around the implant, known as peri-implantitis, frequently results in bone loss. Following osseointegration, this is among the most frequent reasons for failure. Signs include bone loss seen on radiographs, extensive peri-implant pockets, and bleeding upon probing. Treatment options include surgical flap operations, bone grafting, antibiotic medication, and non-surgical debridement.

Infection: This could happen as part of peri-implantitis or another bacterial infection, or it could happen during the first healing period. Signs include redness, swelling, pus discharge, and pain near the implant.

Treatment options include surgical cleaning, antibiotics, and occasionally implant removal if the infection does not go away.

b). Mechanical Failure:

Overload Failure: This can lead to implant loosening or fracture when the implant or surrounding bone is subjected to extreme stresses. Signs include fracture of the implant body, abutment loosening, or implant movement. Treatment options include occlusal splints, occlusion adjustments, or implant replacement in cases of significant damage. Although uncommon, implant fractures can occur when there is excessive force, low quality materials, or significant stress on the implant. Signs include pain or malfunction and difficulty correctly reattaching the prosthesis. Treatment: The broken implant is taken out and replaced.

c).Biomechanical Failure

Inadequate Bone Volume: Either bone resorption following initial integration or insufficient bone volume for implant implantation. Signs include inadequate anchoring and bone loss surrounding the implant.

Treatment options include sinus lifts, bone grafting, or removal and replacement using modified surgical techniques. [7,15]

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3. Classification Based on Clinical Presentation (Peri-Implant Disease Classification)

The biological component of failed implants, especially those that experience peri-implant illnesses, is specifically addressed by this classification.

a) Definition of Peri-Implant Mucositis: Inflammation of the soft tissue around the implant without bone loss. Signs include redness, swelling, and bleeding when prodded, although radiographs show little bone loss. Treatment consists of careful cleaning, monitoring, and plaque reduction.

b) Peri-Implantitis: An inflammatory process that damages the bone and soft tissue surrounding the implant and causes bone loss. Signs include bone loss on radiography, bleeding, deep probing depths, and even the development of an abscess. Treatment options include antibiotics, non-surgical therapy (such as scaling and root planing), potential surgical re-entry for debridement, or bone grafting in extreme circumstances.[16]

4. Categorization according to Implant Design and Position

Failure may occasionally be linked to problems with implant design or placement:

a) Implant Misplacement: Failure brought on by improper implant placement during surgery.

Signs: If the implant is positioned incorrectly, it may result in occlusal problems, aesthetic concerns, or inadequate bone for a successful integration. Treatment consists of bone grafting, reimplantation, and removal of the incorrectly positioned implant.

b) Implant Overload: Failure brought on by an excessive amount of occlusal force applied to the implant.

Signs include discomfort when chewing or unusual restoration wear. Treatment options include modifying the occlusion, redesigning the prosthesis, or applying splints to lessen stresses. [17,18]

5. Radiographic Classification of Implant Failure (Bone Loss)

One of the most important markers of implant failure is the degree of bone loss surrounding the implant, which can be used to classify implant failure.

a) Failure Type 1: No Bone Loss

Description: There is no bone loss and the implant stays completely integrated.

Indication: If monitoring does not reveal improvement, there may be a future failure.

b) Type 2 Failure:

a)Less than 50% Bone Loss

Description: The area surrounding the implant experiences very little bone loss.

Indication: Peri-implantitis in its early stages, which is typically curable with conservative therapy.

b) Severe Bone Loss (more than 50%)

Type 3 Failure

Description: Implant instability due to extensive bone loss. Sign: Severe peri-implantitis that may necessitate implant removal and grafting. [19]

Clinicians can identify the stage, reason, and required action by classifying implant failure. Effective diagnosis and treatment are guided by the classification schemes, which cover biological causes such as peri-implantitis, mechanical and biomechanical variables, and early or late failure. Better management and long-term success for dental implants are ensured by understanding these classes.

V. PROTOCOL FOR TREATING FAILED IMPLANTS

The origin, timing, and stage of failure all influence the course of treatment for failed dental implants. Management usually entails locating and resolving the underlying problem, stabilizing the implant site, and regaining function, regardless of whether the failure occurred early (before to osseointegration) or late (post-osseointegration). A thorough treatment approach for failed implants is provided below, along with reading recommendations.

1. Primary Failure, or early implant failure

Before osseointegration is completely accomplished, which often happens in the first three to six months following placement, early failure takes arise. Early failure can be caused by surgical errors, low bone quality, infection, or implant overload.

Protocol for Treatment: [9,14]

a) Indications for Implant Removal: To avoid more issues, the implant should be removed if it is movable or if there is a lack of osseointegration.

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Procedure: To prevent harm to the surrounding bone, the implant must be carefully removed. A surgical procedure utilizing trephines or a bone tapping technique can be required if the implant cannot be removed without causing bone damage.

a) Setting Up the Site

Bone volume and quality should be assessed at the location following implant removal. Before reimplantation, bone grafting can be required to rebuild the bone.

Grafting options include:

Autografts (bones taken from the patient). Donor bone allografts and animal-derived bone xenografts

Bone Grafts Synthetic (biocompatible materials). Increased bone volume and the best possible reimplantation environment can be achieved with grafting materials.

b) Reimplantation Timing: Depending on the grafting material and the site's healing response, reimplantation is usually carried out three to six months following the first healing time.

Consideration: To prevent recurrence, a thorough reevaluation of the cause of failure should be carried out.

2. Late Implant Failure (Secondary Failure)

After the implant has first Osseo integrated, late failure happens when it gradually fails, usually as a result of peri-implantitis, mechanical overload, or systemic health difficulties.

Protocol for Treatment:

a) Non-Surgical Management of Peri-Implantitis Indications: Non-surgical treatment may be enough if the implant is stable and there is only mild bone loss or inflammation (usually peri-implant mucositis or early peri-implantitis).

Actions to take:

Debridement by mechanical means: The implant surface can be cleaned of biofilm, calculus, and plaque with hand tools or ultrasonic scalers.

Antimicrobial Therapy: To manage bacterial infections, provide systemic or local antibiotics. The implant site may be directly treated with gel containing antibiotics or rinsed with chlorhexidine.

Laser Therapy: Studies have demonstrated the effectiveness of laser-assisted implant surface decontamination in lowering bacterial load and accelerating tissue recovery.

b) Surgical Management of Advanced Peri-Implantitis Indications: Surgery can be required if there is a substantial loss of bone or if the non-surgical method is ineffective.

Steps: Flap Surgery: To reach the implant surface and surrounding bone, a mucoperiosteal flap is raised. This enables the implant to be thoroughly cleaned and debrided.

Bone Grafting: To restore bone volume surrounding the implant in cases of severe bone loss, bone grafting—autografts, allografts, or synthetic materials—may be necessary.

Guided Bone Regeneration (GBR): This method stops soft tissue from growing into the defect by using barrier membranes to encourage bone development.

c) Management of Implant Overload Indications: The occlusion must be modified if it is suspected that excessive occlusal forces are causing implant loosening or mechanical failure.

Actions to take:

Occlusal Adjustment: Improving the location of the implant or lowering excessive occlusal forces.

Occlusal Splints: To avoid putting undue strain on the implant, patients with bruxism or clenching tendencies may utilize occlusal splints or night guards.

Implant Abutment Modification: A redesign can be required if the design of the implant abutment is causing overload.

d) Indications for Implant Removal and Replacement: Removal may be necessary if the implant is unstable, cracked, or has been seriously harmed by infection or mechanical failure.

Steps: Implant Removal: Following the removal of the unsuccessful implant, the surrounding bone should be examined for any damage.

Bone Regeneration: Before reimplantation, bone grafting can be necessary to restore bone volume.

Reimplantation: A replacement implant may be inserted following adequate recovery, which usually takes three to six months. [7,15]

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3. Additional Management Protocols

a) Systemic Health Assessment Indications: Immunocompromised states, smoking, osteoporosis, and uncontrolled diabetes are examples of systemic illnesses that can raise the risk of implant failure.

Management: Before beginning any implant-related therapy, it can be beneficial to optimize the patient's overall health (managing diabetes, quitting smoking, etc.).

a) Follow-up Indications and Patient Education: Continuous patient education is essential for the long-term success of implants.

Management: Patients should get instruction on preventing tobacco use, practicing proper dental hygiene, and controlling risk factors including bruxism. It is advised to have follow-ups every three to six months after implant placement in order to look for any early indications of failure. [19]

The treatment protocol for managing failed implants involves a comprehensive approach, including removal and site preparation for reimplantation in early failures, and non-surgical or surgical intervention for late-stage failures. By addressing the underlying cause of failure—whether biological, mechanical, or systemic—the clinician can improve the chances of success for future implant attempts. Regular monitoring and proper management of patient health are critical for long-term implant success.

B. Surviving implants:

Characteristics and Definition of Surviving Implants

Dental implants that continue to be intact and functional over time are referred to as "surviving implants." Implant survival generally refers to implants that remain in the patient's mouth, whether or not they are operating at their best, as opposed to success, which describes implants that operate well and without issues. Even if an implant has had problems such bone loss, peri-implantitis, or other problems, it is still regarded as a "survival" provided it has not been removed because of failure.

Properties of Implants That Survive:

Existence in the Mandible: Whether or not a survival implant is completely functional, it is still in place. The main difference between failure and survival is this.

Consistency: The surrounding bone may still be able to sustain the implant, which is neither loose nor movable. Even if there is some bone loss, the implant could not exhibit symptoms of osseointegration failure.

Bone Loss Signs: Survival implants may exhibit signs of bone loss, but not to the point where they need to be removed. As long as it's not too bad, some bone loss around an implant may be okay.

Implant Functionality: If there is minimal inflammation or minor problems, like peri-implantitis, the implant may still function, although it may not be at its best.

No Persistent Infection: The implant has not progressed to the point where infection or inflammation results in substantial bone loss or implant failure, despite the possibility of early infection symptoms (such as moderate peri-implantitis).[8,12]

How to Determine an Implant's Survival Stage:

To make sure the implant is still viable over the long run, a mix of clinical and radiographic examinations is used to determine implant survival. Usually, the following actions are taken:[7,14,15,19]

1. Clinical Assessment

Implant Mobility: Examine the implant for any unusual looseness or mobility. An implant that remains immobile is a reliable sign of survival.

Soft Tissue Condition: Look for indications of pus, edema, redness, or inflammation in the soft tissues around you. Although mild gingival irritation could be a sign of peri-implant mucositis, if the inflammation is managed, the implant might still be viable.

Inquire if the patient is experiencing any pain, discomfort, or changes in their bite. The implant is probably at the survival stage if the patient is not exhibiting any symptoms.

2. Radiographic Evaluation of Bone Loss: To determine whether there has been a considerable loss of bone, measure the levels of bone surrounding the implant using periapical radiography or Cone Beam Computed Tomography (CBCT). For implant survival, moderate bone loss (less than 50%) can still be acceptable, but more significant loss might be a sign of failure.

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Check to see if the implant is still osseointegrated correctly. Failure may be indicated by radiolucencies surrounding the implant or by a lack of osseointegration.
Peri-Implantitis: If peri-implantitis is detected early (minimal bone loss, localized infection), the implant may still be able to be kept, although this needs to be carefully watched.

3. Occlusal Function Occlusion and Prosthesis Fit: Verify that the implant provides sufficient support for the prosthesis. An implant is still operating well if the prosthesis is in good working order and shows no symptoms of loosening or unusual wear.

4. Soft Tissue Attachment: Verify that there are no indications of overload, such as implant fracture or abutment loosening.
One key sign of survival is the existence of healthy mucosal tissue surrounding the implant. It is not appropriate for the mucosa to exhibit symptoms of recession or severe inflammation.

Classification of Surviving Implants
Although there isn't a single classification for "survival" implants, the stages can be divided into groups according to clinical observations and the development of certain problems:[7,9,11,15,20]
1. Phase 1: Sound Implant
Qualities: No indications of inflammation or infection. The implant is operating as planned, and bone levels are steady.
Treatment: Consistent observation and upkeep of personal hygiene.

2. Stage 2: Mild Mucositis or Peri-Implantitis
Qualities: Early indicators of infection or inflammation include blood when prodded or a small loss of bone (less than 2 mm). No movement or severe pain.
Treatment options include improved dental hygiene, antibiotic therapy, and non-surgical debridement. routine follow-ups.

3. Moderate Bone Loss in Stage Three
Features include soft tissue inflammation, moderate movement, and a 2–4 mm loss of bone. The implant may still work, but it needs to be closely watched.
Treatment: Additional debridement, perhaps in conjunction with laser therapy or antibiotics as an adjuvant. In certain situations, bone grafting may be required.

4. Stage 4: Severe Peri-Implantitis Features: Deep pockets, implant movement, and severe bone loss (>4 mm). Even if the implant is still there, its functionality is impaired.
Treatment: Surgery, which could involve directed tissue regeneration, bone grafting, or re-entry for cleaning. Removal can be required in some circumstances.
Implants that stay in the patient's mouth even when they aren't working completely are known as survival implants. The ability of a survival implant to be stable and intact in the face of minimal side effects, including little inflammation or bone loss, is its primary feature. To determine the survival stage and take prompt action to correct problems before they become failures, routine monitoring through clinical examinations and radiographic evaluations is crucial.

VI. MAINTENANCE FOR SURVIVING IMPLANTS

The continuous care and observation necessary to guarantee that the implant is stable and functional for the duration of its life is referred to as the maintenance phase for survival implants. This stage is essential for the implant's long-term success and aids in avoiding issues including implant failure, bone loss, and peri-implantitis. Both at-home care by the patient and professional care from the dentist are necessary for effective maintenance. The following are essential elements of the surviving implant maintenance phase:[6,7,9,15]

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1. Consistent Radiographic and Clinical Monitoring

Clinical Assessment:

Regularity: During the first year following implantation, implants should be checked more often, with visits occurring every three to six months. If no problems develop, this should be done once a year after that.

Soft Tissue Health: Look for indications of edema, redness, or inflammation in the mucosal tissue around the implant. Pocket formation or bleeding on probing (BOP) could be signs of peri-implant mucositis or peri-implantitis.

Implant Mobility: Look for any indications of implant mobility, since this may point to bone loss or a loss of osseointegration.

Prosthesis Function and Occlusion: Examine the occlusion to make sure the prosthesis (bridge, crown, etc.) fits correctly and isn't putting undue strain on the implant.

Monitoring of Radiography: Frequency: To check for bone loss surrounding the implant and assess its stability, radiographs should be obtained at regular intervals (every 1-2 years).

Evaluation of Bone Levels: Assess variations in the bone levels surrounding the implant, keeping an eye out for any indications of aberrant bone resorption or peri-implantitis.

Finding the First Issues: More severe issues and implant failure can be prevented with early diagnosis of infection or bone loss.

2. Expert Debridement and Cleaning

Scaling and polishing: To get rid of plaque, calculus, and biofilm that may have built up around the implant and in the peri-implant sulcus, professional cleaning should be performed at routine maintenance visits. In order to prevent implant surface damage, ultrasonic scalers are frequently utilized.

Ultrasonic and Hand Instrumentation: To prevent scratching or injuring the implant surface, which can lead to the buildup of biofilm, specialized tools like titanium scalers and ultrasonic equipment should be utilized to clean the area surrounding implants.

Evaluation of Peri-Implant Tissue: Assess the condition of the tissues surrounding the implant and search for any indications of infection or inflammation, as these could point to the need for further care.

3. Patient Instructions for At-Home Dental Hygiene: To ensure the best possible oral hygiene around the implant, patients should be instructed in appropriate brushing and flossing methods. It is advised to use soft-bristled brushes and non-abrasive toothpaste to prevent harming the implant surface and soft tissue.

Interdental Cleaning: To avoid plaque accumulation in difficult-to-reach places, clean the area surrounding the implant using dental floss, interdental brushes, or specialized tools (such as a soft pick or rubber tip).

Electric Toothbrush: To better clean the region surrounding the implant, it is advised to use an electric toothbrush with a soft head.

Rinses and Antimicrobial Agents: To lessen germs around the implant and avoid infection, patients may be administered antimicrobial mouth rinses (such as chlorhexidine) for brief use, particularly after cleaning.

Quitting Smoking: Smoking increases the chance of implant failure and related issues such peri-implantitis. To extend the life of implants, patients should be counseled to stop smoking or, at the absolute least, cut back.

4. Handling Diseases Around Implants

Early Peri-Implantitis Detection and Treatment: Non-surgical techniques include mechanical debridement, scaling, and the application of local antimicrobial medications are typically the first line of treatment for peri-implantitis, which is defined as inflammation and infection surrounding the implant.

Surgical Interventions: To secure the implant and replace lost bone in more severe situations, surgical procedures such flap surgery, bone grafting, or guided bone regeneration may be required.

Frequent Monitoring: To identify any indications of disease before it worsens, it is essential to continuously check the peri-implant tissues and bone levels.

5. Resolving Issues with Function

Implant Overload: Patients who grind their teeth may need to have their occlusion adjusted, or a night guard may be suggested, if there are indications of implant overload, such as abutment loosening or wear on the prosthesis.

Occlusal Adjustment: To lessen excessive stresses on the implant, bite modifications may be necessary when occlusal problems are preventing the implant or prosthesis from operating at its best.

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6. Regular Reassessment

Reassessing Systemic Health: Implant survival may be impacted by systemic conditions such as immunological diseases, diabetes, or osteoporosis. To make sure that any medical issues that can affect the implant's success are properly addressed, routine health examinations should be carried out.

Maintenance of Prosthetics: Make that the prosthesis (crown, bridge, etc.) is kept in good condition and replace any worn-out or broken parts.

For dental implants to last a long time and continue to operate, the maintenance phase is essential. The risk of problems like peri-implantitis and bone loss can be considerably decreased with regular expert treatment combined with efficient at-home maintenance. A effective maintenance program is built on the foundation of soft tissue management, routine clinical and radiological monitoring, and home care education.

Classifications of Surviving Implants:

Classifying surviving dental implants is crucial for knowing their health, evaluating their condition over time, and choosing the best course of action. A number of classifications and systems have been put up to group implants according to their radiological and clinical characteristics. The functional state of the implant, the condition of the surrounding tissues (peri-implant tissues), and the degree of bone loss are usually the main factors considered in these classifications.

1. Zarb and Albrektsson Categorization (1987): [20]

This categorization separates successful implants from unsuccessful ones and offers a foundation for comprehending implant survival.

Survival: Implants that stay in situ in spite of issues including inflammation, infection, or bone loss. Although they could need maintenance, they might still be operational.

Success: Implants that not only stay in situ but also perform at their best with minimal bone loss and healthy surrounding tissues.

Failure: Implants that haven't worked because of problems like mobility, infection, or significant bone loss. Usually, these implants are taken out.

2. Classification of Peri-Implant Diseases (Zitzmann and Berglundh, 2008): [21]

The stages of peri-implantitis, which can develop in implants that are still functional, are identified by this classification, which focuses on the tissues around the implant.

A healthy implant has no surrounding bone loss or inflammation.

The peri-implant Mucositis: A slight inflammation of the soft tissues surrounding the implant that does not result in a substantial loss of bone.

Peri-implantitis: Inflammation of the tissues around the implant, accompanied by bone loss. This can be classified as mild, moderate, or severe depending on the degree of bone loss.

3. The European Association for Osseointegration's (EAO) 2007 Consensus Report: [22]

This classification provides a framework for classifying implants according to tissue stability and health, with an emphasis on the detection and management of peri-implant disorders.

Use a Healthy Implant The peri-plant Tissues: Stable bone levels and no indications of inflammation.

Use a Peri-implant with the implant Mucositis: inflammation of soft tissues without bone loss.

Peri-implantitis: Loss of bone surrounding the implant, with or without inflammation of the soft tissues.

4. The Implant Success Misch Classification [19]

The Misch classification emphasizes the implant's long-term durability, particularly in relation to implant function and bone loss.

Class I (Ideal): Class II (Compromised): Some bone loss (less than 50%), but still stable and functioning implant; no problems, stable bone levels, pain or inflammation, and complete functionality.

Class III (Failed): Significant pain, mobility, or bone loss (>50%) that results in implant failure.

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5. The Buser Classification for Implant Survival and Peri-Implantitis: [23]

This peri-implantitis-specific classification system groups implants according to the degree of bone loss and tissue health. Its main application is in the evaluation of implants exhibiting symptoms of peri-implant disorders.

Type 1: Healthy Implants: Normal bone levels and no peri-implant disease.

Type 2: Mild Peri-Implantitis: No discomfort or movement, less than 2 mm of bone loss.

Type 3: Moderate Peri-Implantitis: minor mobility, inflammation, and bone loss of 2-4 mm.

Type 4: Severe Peri-Implantitis: notable soft tissue inflammation, implant movement, and bone loss greater than 4 mm.

6. Functional Performance-Based Implant Classifications (Olate et al., 2017): [24]

The functional status of the implant and its relationship to prosthetic function and patient satisfaction form the basis of this classification.

Class A (Successful Implant): Perfect bone levels, soft tissue health, and complete functionality without any issues.

Class B (Functional Implant): These are implants that work but have modest side effects, like mild peri-implantitis or moderate bone loss. Class C (Non-Functional Implant): These are implants that have serious side effects, like infection, severe bone loss, or prosthesis loosening.

There are several ways to evaluate surviving implants according to their function, health, and peri-implant tissue characteristics. With variations based on bone loss, inflammation, and general implant function, the most popular classification is on implant survival. These categories are essential for directing clinical judgment, identifying the need for treatment, and evaluating the long-term viability of dental implants.

Diagnostic procedures to examine the Surviving implants

A number of diagnostic procedures and clinical assessments are used to evaluate surviving dental implants in order to make sure they continue to be stable, functional, and healthy. These examinations aid in the detection of any possible side effects, including implant movement, peri-implantitis, and bone loss. The most popular tests for determining the condition of surviving implants are listed below: [21]

1. Clinical Assessment

a. Visual Examination

The goal is to evaluate the overall condition of the tissues around the implant, including the gums. There may be indications of infection or inflammation (redness, swelling, blood on probing).

Things to Verify: intact mucosal tissue around the implant, healthy peri-implant tissues, and no pus or discharge.

b. Feeling

The goal is to look for indications of implant or surrounding tissue movement, discomfort, or soreness.

What to Look for: Any anomalies, implant movement, and soft tissue health.

c.Bleeding on Probing (BOP): This technique is used to determine whether inflammation is present in the tissues surrounding implants. An indication of peri-implant mucositis or peri-implantitis is bleeding upon probing.

What to Check: If bleeding occurs when the peri-implant sulcus is gently probed.

2. Evaluation of Radiography

Assessing the quantity of bone surrounding the implant and looking for bone loss are the goals of periapical radiographs, or X-rays. Over time, routine radiographs aid in implant monitoring.

Check for bone loss, peri-implant radiolucency, and bone levels surrounding the implant. A issue, like peri-implantitis, may be indicated if bone levels drop by more than 2 mm.

b. The goal of Cone Beam Computed Tomography (CBCT) is to provide 3D imaging that can more precisely assess surrounding structures, implant location, and bone levels. It is especially helpful for identifying early indications of problems or bone loss that might not be apparent on 2D radiographs.

Things to look for include bone volume, the implant's closeness to anatomical features, and a 3D assessment of any peri-implantitis or bone loss. [25]

3. Mobility Test for Implants

The goal is to determine whether the implant is completely incorporated into the bone and whether it is stable. Mobility is a sign that the implant is unstable and may require removal or more care. [16]

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What to Check: Using finger pressure or an implant mobility testing tool (like Periotest), look for any indications of implant mobility.
Clinical Use: Significant implant mobility (greater than 1 mm, for example) indicates a failure of osseointegration, which can be brought on by overload, infection, or bone loss.
The goal is to determine whether there are any indications of inflammation or infection by measuring the depth of the peri-implant sulcus, or the area around the implant.
What to Look for: Infection is often indicated by probing depths larger than 4-5 mm, but severe peri-implantitis is indicated by depths greater than 6 mm.
Clinical Application: The state of the peri-implant tissues can be clearly determined by the depth of probing and the presence of blood on probing (BOP).[7]
F. Schwarz and associates (2014). Therapy of peri-implantitis without surgery. Clinical Periodontology Journal.

4. Assessment of Implant Abutment and Prosthetic, assess for Loosening of the Prosthesis
The goal is to verify that the crown or bridge that is affixed to the implant is firmly secured.
What to Check: Verify that the prosthesis and implant abutment are securely fastened. Loosening could be a sign of insufficient torque or mechanical failure during placement.
Occlusal Assessment
The goal is to assess how well the implant fits the patient's bite.
What to Check: Make that the prosthesis is not overloaded because this might lead to implant damage or mechanical failure. [18]

5. Electrical and Thermal Examinations
Use: In certain situations, used to assess the health of the surrounding bone and tissue. Although they are less frequently utilized in standard implant evaluations, these tests might be performed in certain circumstances.
What to Check: These tests could be useful in determining how well the implant is responding to temperature changes or electrical conductivity. They are not, however, accepted assays for regular survival evaluation.

6. Microbial and Saliva Sampling (to Detect Peri-Implantitis)
Finding any bacterial activity surrounding the implant is the goal, particularly when peri-implantitis is suspected.
Things to Verify: If necessary, microbial culture tests can direct antibiotic treatment by identifying bacteria surrounding the implant. [14]
M. Esposito and associates (2006). the efficiency of dental implants in patients with impaired periodontal health. Journal of Oral Implantology in Europe.

VII. CONCLUSION

Dental implants require meticulous, routine monitoring that combines functional testing, radiographic assessments, and clinical examinations to ensure their longevity. The most widely used tests to evaluate the health and longevity of implants include peri-implant probing, clinical probing, mobility assessments, and radiography, particularly CBCT. These assessments are crucial for identifying early warning indications of problems or failure so that prompt action can be taken to maintain implant performance.

REFERENCES

1.Liran Levin. DEALING WITH DENTAL IMPLANT FAILURES. J Appl Oral Sci. 2008 Jun;16(3):171–175.
2.Esposito, M., Grusovin, M. G., & Willings, M. (2006). The effectiveness of dental implants in periodontally compromised patients. European Journal of Oral Implantology.
3.Zitzmann, N. U., & Berglundh, T. (2008). Definition and classification of peri-implant diseases. Journal of Clinical Periodontology, 35(8), 287–291.
4.Schwarz, F., & Rüter, A. (2007). Peri-implantitis: Pathogenesis, diagnosis, and treatment. European Journal of Oral Sciences, 115(1), 94-104.
5.Esposito, M., Grusovin, M. G., & Willings, M. (2006). The effectiveness of dental implants in periodontally compromised patients. European Journal of Oral Implantology.

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6.Zitzmann, N. U., & Berglundh, T. (2008). Definition and classification of peri-implant diseases. Journal of Clinical Periodontology, 35(8), 287–291.
7.Schwarz, F., & Rüter, A. (2007). Peri-implantitis: Pathogenesis, diagnosis, and treatment. European Journal of Oral Sciences, 115(1), 94-104.
8.Van der Weijden, F., & Slot, D. E. (2011). Peri-implantitis: A review of the literature. Journal of Clinical Periodontology, 38(3), 177-188.
9.Albrektsson, T., & Johansson, C. (2003). Osteointegration and its long-term implications. Journal of Prosthodontics, 12(2), 155-160.
10.Pancherz, H., et al. (2008). Cone beam computed tomography in implantology. Journal of Clinical Oral Implantology.
11.Schwarz, F., et al. (2007). The microbiology of peri-implant diseases. Journal of Periodontology.
12.Zuffetti, F., et al. (2008). Evaluation of implant stability and resonance frequency analysis in clinical practice. Journal of Clinical Periodontology.
13.Kampf, G., et al. (2014). Diagnostic tools for peri-implant diseases. Clinical Implant Dentistry and Related Research.
14.Esposito, M., et al. (2006). Interventions for replacing missing teeth: dental implants. Cochrane Database of Systematic Reviews.
15.Zitzmann, N. U., & Berglundh, T. (2008). Definition and classification of peri-implant diseases. Journal of Clinical Periodontology.
16.Johansson, C., and T. Albrektsson (2003). The long-term effects of osteointegration. Prosthodontics Journal, 12(2), 155-160.
17.Ong, M. M., & Coelho, P. G. (2014). Dental implants: A review of techniques for imaging the jawbone. Journal of Prosthetic Dentistry.
18.Misch, C. E., & Dietsh, F. (2010). Implant dentistry: A practical approach. Elsevier.
19.Van der Weijden, F., & Slot, D. E. (2011). Peri-implantitis: A review of the literature. Journal of Clinical Periodontology, 38(3), 177-188.
20.Zarb, G. A., and T. Albrektsson (1987). Clinical importance of current interpretations of the osseointegrated response. The International Journal of Maxillofacial and Oral Implants.
21.Berglundh, T., and N. U. Zitzmann (2008). Peri-implant diseases: definition and classification. Clinical Periodontology Journal, 35(8), 287–291.
22.Grusovin, M. G., Esposito, M., & Willings, M. (2007). A comprehensive analysis of the literature on the efficacy of dental implants in patients with impaired periodontal health. Journal of Oral Implantology in Europe.
23.D. Buser and associates (2000). stability of the maxillary osseointegrated dental implant throughout the long term. Clinical Dental Implants and Associated Studies.
24.Olate, S., et al. (2017). Implant survival and success: A review of definitions and contemporary methods. Journal of Oral Implantology.
25.Slot, D. E., and Van der Weijden, F. (2011). A review of the literature on peri-implantitis. Clinical Periodontology Journal, 38(3), 177–188.

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