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AILING and FAILING Implants- A Review

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ABSTRACT:

Implants that show indications of problems but are not quite at the point of failure are referred to as failing implants. The long-term prognosis of the implant may be impacted by these problems, which can include mild to moderate peri-implant illnesses including peri-implant mucositis or modest bone loss. Moderate bone loss (usually less than 2 mm) and minor inflammation, such as peri-implant mucositis, are common symptoms of failing implants. One reversible stage of implant problems is represented by failing implants. Severe bone loss, peri-implantitis, or implant mobility are some of the worst side effects of failing implants that jeopardize their stability and functionality. Failing implants may need to be removed or undergo substantial treatment in order to restore the patient's dental health, in contrast to ailing implants, which are still functioning. Advanced peri-implantitis, substantial bone loss (more than 2 mm), or implant movement are frequently linked to failing implants. For the failure to be managed, these problems must be identified early. In certain situations, implant removal is required, followed by methods for bone regeneration and perhaps reimplantation. The patient's oral health and function can be preserved with prompt action. With a focus on early detection and management to stop the development to implant failure, this review paper sought to investigate the causes, diagnostic techniques, and therapeutic approaches for malfunctioning implants.

INTRODUCTION:

A. Ailing Implants:

Dental implants that exhibit early biological problems, usually soft tissue inflammation (peri-implant mucositis), without appreciable bone loss or decreased osseointegration, are known as "ailing implants." More serious problems like failing implants (total loss of function and implant removal) or failing implants (progressive bone loss and mobility) are preceded by this disease.

Characteristics of Ailing Implants: [1-4]

Soft tissue irritation surrounding the implant is known as peri-implant mucositis. suppuration, redness, swelling, and blood when prodded. no indication of bone loss on radiography.

Early bone changes: There may be a little amount of bone loss in the early phases, but there is no impairment to osseointegration or mobility.

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Staging the Ailing Process: Clinical and radiographic evaluations can be used to track the development of an implant from an ailing to a failing state:

Clinical Characteristics:

Depth of Probing (PD): A deeper probing depth (>4-5 mm) suggests early peri-implant pocket development or inflammation.

Bleeding on Probing (BOP): Inflammation is indicated by continuous bleeding. When pus is found during probing, it indicates an infection. Usually, failing implants are immobile. Osteointegration may be hampered if movement is observed, which would suggest a malfunctioning implant.

Radiographic Analysis:

Compare sequential peri-apical or CBCT scans to evaluate bone levels. Identify any initial marginal bone loss relative to baseline.

Microbial and Biomarker Analysis (optional): Testing for increased levels of pathogens like Porphyromonas gingivalis. Evaluate inflammatory markers (IL-1β, TNF-α) in peri-implant crevicular fluid.

A.I. How to manage the Ailing stage of implants? [5-8]

Controlling inflammation, halting the development of peri-implantitis, and preserving osseointegration are the basic goals of managing the sick stage of implants. Maintaining implant health requires early intervention and a planned treatment strategy. The management techniques are as follows:

1. Diagnosis Confirmation

Clinical Examination:

Assess for probing depths, bleeding on probing (BOP), and signs of inflammation.

Radiographic Evaluation: Rule out significant bone loss (bone changes should be minimal in the ailing stage).

Microbial Assessment (optional): Identify pathogenic bacteria in peri-implant crevicular fluid (e.g., P. gingivalis).

2. Non-Surgical Management

Control of Mechanical Plaque

* Professional Cleaning: To avoid damaging the implant surface, use non-metallic tools (such as scalers coated in plastic or titanium or air-polishing equipment that use glycine or erythritol powder).

* **Home Care Education**: Use soft or specialized brushes to reinforce good brushing skills. Encourage the use of interdental tools such as water flossers or super floss.

***Antiseptic Therapy**: Rinses or gels with 0.12%–0.2% chlorhexidine gluconate for two to three weeks. application of localized antiseptics (such as solutions based on iodine).

* Use of antibiotics (optional). Local antibiotics such as doxycycline gels or minocycline microspheres can be used as an adjuvant for chronic inflammation.

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The use of light-activated substances, such as methylene blue, for antibacterial purposes is known as photodynamic therapy (PDT).

3. Adjunctive Therapies

Laser-Assisted Treatment: Diode lasers or low-level laser therapy (LLLT) can aid in tissue healing and bacterial load reduction. Local Anti-Inflammatory Drug Delivery. using corticosteroids topically to control localized inflammation.

*Biologic Therapies (Experimental) - Utilizing cytokine inhibitors or growth factors to reduce inflammation and promote recovery.

4. Maintenance Protocol -Regular follow-ups every 3-6 months for professional cleaning and monitoring. Encourage strict oral hygiene practices at home. Monitor probing depths and radiographs to track stability.

A.II. Tests to check Ailing implants [9-12]

Early detection of peri-implant mucositis and associated problems, such as inflammation, microbial activity, and tissue integrity, are the goals of specific tests used to assess the health of malfunctioning implants. These tests evaluate the health of the implant and forecast the course of disease by combining clinical, radiographic, microbiological, and biomarker evaluations.

1. Clinical Tests

***Probing Depth (PD) and Bleeding on Probing (BOP)**

Two important markers of peri-implant inflammation are elevated probing depths (>4-5 mm) and BOP. carried out with specialized plastic probes and a low probing force (≤0.25 N) to prevent implant surface damage. The sensitivity of BOP in identifying peri-implant mucositis is great.

* **Peri-implant Suppuration**: The presence of pus when gently prodded is a sign of severe inflammation and bacterial infection.

2. Radiographic Tests

* **Periapical Radiographs**: These radiographs measure the marginal bone levels surrounding the implant at baseline and follow-up.

More than 2 mm of bone loss from baseline indicates peri-implantitis rather than a malfunctioning implant.

Bone architecture can be imaged in three dimensions using cone-beam computed tomography (CBCT). helpful in detecting early bone resorption and minute variations in bone density.

3. Microbiological Tests

***Microbial Sampling and Culture**: Using paper points or curettes, collect peri-implant sulcular fluid for the purposes of cultivating or analyzing pathogenic bacteria (P. gingivalis, T. forsythia, and T. denticola) by PCR. aids in distinguishing between states of health and illness.

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***Testing Based on DNA**

Advanced assays that identify microbial profiles linked to peri-implant illnesses include next-generation sequencing (NGS) and checkerboard DNA-DNA hybridization.

4. Biomarker Analysis

*Peri-Implant Crevicular Fluid (PICF) Analysis- Testing PICF for inflammatory markers such as:

Cytokines: IL-1β, TNF-α, IL-6 (indicate inflammation).

*Matrix metalloproteinases (MMPs)-Elevated levels signal tissue breakdown. Osteoprotegerin (OPG)-Lower levels correlate with bone loss.

***Commercial Test Kits**

PerioSafe®/ImplantSafe® (Germany): Detects active matrix metalloproteinase-8 (aMMP-8) in PICF to assess peri-implant inflammation risk.

OraGene® Collection Kits: Facilitates microbial and genetic testing for peri-implant health.

5. Functional and Structural Integrity Tests

*Resonance Frequency Analysis (RFA)- Measures implant stability through the Implant Stability Quotient (ISQ).

ISQ <60 indicates reduced implant stability and potential ailing.

Periotest®

Assesses implant mobility using percussive force. Higher Periotest values suggest compromised osseointegration.

A.III. Classification of ailing implants

In order to differentiate failing implants from healthy, failing, or failed implants, failing implants are usually grouped according to clinical and radiographic findings. Although there isn't a single, widely accepted categorization that focuses just on failing implants, there are a number of frameworks that handle peri-implant disorders and can be modified to categorize failing implants.

Classification of Ailing Implants

1. Based on Clinical and Radiographic Findings [13]

Adapted from the 2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases. Healthy Implant-No signs of inflammation or bleeding on probing (BOP). Probing depth (PD) ≤ 3 mm. No bone loss.

*Ailing Implant (Peri-Implant Mucositis): Inflammation confined to the soft tissues surrounding the implant.

Presence of BOP and/or suppuration. PD may be increased but without bone loss beyond initial remodeling.

*Failing Implant (Early Peri-Implantitis): Progressive bone loss evident on radiographs (>2 mm from baseline).

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Persistent inflammation, BOP, and possible suppuration. No implant mobility (indicating some degree of osseointegration remains).

*Failed Implant: Extensive bone loss with mobility. Loss of osseointegration requiring implant removal.

2. Berglundh et al. (2018) Classification [2]

This framework divides peri-implant conditions into health and disease stages:

Stage I: Ailing implant with inflammation but no radiographic bone loss.

Stage II: Failing implant with progressive bone loss and persistent clinical signs.

Stage III: Failed implant with complete loss of osseointegration.

3. Based on Severity of Inflammation [14]

(Proposed adaptation for clinical use)

*Mild Ailing Implant: Slight BOP and minor redness/swelling. PD < 4 mm. No suppuration or radiographic changes.

*Moderate Ailing Implant: Persistent BOP and visible swelling. PD ≥ 4 mm. Possible early radiographic evidence of marginal bone changes (<2 mm).

*Severe Ailing Implant: Significant inflammation, pus discharge. PD ≥ 5 mm. Bone loss approaching peri-implantitis threshold.

A.IV. Specific treatment for ailing stage of implants

Resolving peri-implant mucositis and preventing its progression into peri-implantitis are the objectives of treating faulty implants. For failed implants, which are characterized by soft tissue inflammation without noticeable bone loss, non-surgical therapy work well. Below is a comprehensive, step-by-step guide to managing the unwell stage:

Treatment Approach for Ailing Implants [9,15-18]

1. Mechanical Debridement

Objective: Remove biofilm and plaque to reduce microbial load.

Techniques: Use plastic, titanium-coated, or carbon-fiber curettes to avoid scratching implant surfaces. Air polishing with glycine or erythritol powder is effective for biofilm removal. Ultrasonic devices with non-metallic tips can be used for deeper cleaning.

2. Antiseptic Therapy

Chlorhexidine Gluconate: Rinse with 0.12%-0.2% chlorhexidine twice daily for 2-3 weeks. Localized application of chlorhexidine gel in peri-implant pockets.

Povidone-Iodine: Irrigate the peri-implant pocket with 10% povidone-iodine -solution to disinfect the area.

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3. Antibiotic Therapy (Optional)

Local Antibiotics: Apply minocycline microspheres or doxycycline gel directly into the peri-implant sulcus.

Systemic Antibiotics: Not typically required for ailing implants but may be considered in severe cases with suppuration.

Suggested regimens: Amoxicillin (500 mg TID) or Metronidazole (250-500 mg TID) for 7-10 days.

4. Laser-Assisted Therapy

Low-Level Laser Therapy (LLLT) or diode lasers can help reduce bacterial loads and inflammation.

Er:YAG or CO_2 lasers can be used for biofilm removal without damaging the implant surface.

5. Photodynamic Therapy (PDT)

Apply a light-activated photosensitizer (e.g., methylene blue) and irradiate with a low-energy laser to destroy pathogenic bacteria.

6. Host-Modulation Therapy

Topical corticosteroids may reduce localized inflammation. Anti-inflammatory agents like omega-3 fatty acids or low-dose doxycycline (systemically) may be considered.

7. Maintenance Therapy

Schedule professional cleanings every 3-6 months. Reinforce oral hygiene education, including: Use of soft-bristled brushes or implant-specific brushes. Interdental aids such as super floss or water flossers.

B. What are failing implants?

Failing implants refer to dental implants experiencing progressive peri-implant bone loss and inflammation without complete loss of osseointegration. Unlike ailing implants, which involve only soft tissue inflammation (peri-implant mucositis), failing implants show radiographic evidence of bone loss due to peri-implantitis or biomechanical factors. Early detection and intervention are crucial to prevent transition to the failed implant stage, where osseointegration is irreversibly lost, and the implant requires removal.

B.I. Signs and Symptoms of Failing Implants [2,9,19-20]

Clinical Indicators:

Increased probing depths (>5 mm). Bleeding on probing (BOP). Suppuration (pus discharge) on gentle probing.

Progressive soft tissue recession around the implant. Pain or discomfort in the peri-implant area (rare in early stages).

Radiographic Indicators:

Vertical or horizontal bone loss >2 mm compared to baseline. Radiolucencies or irregular bone patterns around the implant.

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Functional Indicators:

Implant mobility (in later stages, indicating partial loss of osseointegration). Difficulty in chewing or altered occlusion due to implant instability.

B.II. How to Check the Failing Stage of Implants [21-22]

1. Clinical Examination

Probing Depth (PD): Use plastic or titanium-coated probes to measure peri-implant sulcus depth.

A PD > 5 mm combined with BOP or suppuration strongly suggests peri-implantitis.

Bleeding and Suppuration: Record presence/absence during probing.

Persistent BOP and pus discharge indicate active inflammation.

2. Radiographic Evaluation

Periapical Radiographs: Compare current images with baseline radiographs to assess marginal bone loss.

Irregular bone loss patterns and radiolucencies suggest peri-implantitis.

Cone-Beam Computed Tomography (CBCT): Provides a 3D view of peri-implant bone levels.

Identifies subtle changes in bone density and volume.

3. Peri-Implant Mobility Tests

Resonance Frequency Analysis (RFA):

Measures the Implant Stability Quotient (ISQ); values <60 indicate reduced stability.

Periotest® Device: Quantifies implant mobility. Higher values indicate loss of osseointegration.

4. Microbial and Biomarker Analysis

Microbial Testing: Collect peri-implant crevicular fluid to identify pathogenic bacteria (e.g., P. gingivalis, T. forsythia).

Use culture methods or DNA-based tests such as PCR or next-generation sequencing (NGS).

Biomarker Testing:

Analyze peri-implant crevicular fluid (PICF) for inflammatory markers: Elevated levels of IL-1β, IL-6, TNF-α, or matrix metalloproteinases (e.g., MMP-8). Commercial kits like PerioSafe® and ImplantSafe® detect MMP-8 for inflammation assessment.

B.III. Characteristic features of failing implants [2,22-23]

Implant failure is a stage of increasing peri-implant illness, typically peri-implantitis, in which there is tissue deterioration, inflammation, and bone loss but no total loss of osseointegration. The main clinical, radiological, microbiological, and biomechanical characteristics of failed implants are listed here.

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1. Clinical Features

Increased Probing Depth (PD): Probing depth >5 mm around the implant indicates significant soft tissue inflammation and peri-implant pocket formation.

Bleeding on Probing (BOP): Persistent or profuse bleeding during probing is a hallmark of active inflammation.

Suppuration: Pus exudation upon gentle probing suggests bacterial infection and tissue breakdown.

Gingival Recession: Visible soft tissue shrinkage or receding peri-implant mucosa exposes the implant threads.

Pain or Discomfort: Rare but possible in advanced stages, especially if inflammation extends to surrounding tissues.

2. Radiographic Features

Marginal Bone Loss: Progressive vertical or horizontal bone loss >2 mm from baseline radiographs.

Irregular Bone Patterns: Radiolucency around the implant apex or along its threads, indicating osteolysis.

Bone Crater Formation: Bone defects resembling craters around the implant threads are common in peri-implantitis.

3. Microbial and Biochemical Features

Microbial Colonization: Elevated levels of periopathogenic bacteria, such as: Porphyromonas gingivalis, Tannerella forsythia, Treponema denticola, Fusobacterium nucleatum

Inflammatory Markers in Peri-Implant Crevicular Fluid (PICF): High concentrations of cytokines (e.g., IL-1β, IL-6, TNF-α) and matrix metalloproteinases (MMP-8). Biomarker testing (e.g., PerioSafe® or ImplantSafe®) reveals elevated MMP-8 in active peri-implant inflammation.

4. Functional Features

Reduced Implant Stability:

Measured using Resonance Frequency Analysis (RFA): Implant Stability Quotient (ISQ) <60 indicates compromised osseointegration.

Mobility: Slight mobility may appear in late failing stages due to partial loss of osseointegration.

Occlusal or Mechanical Issues: Overloading or poor prosthetic alignment exacerbates inflammation and bone loss.

B.IV.How to manage the failing implant Condition: [24-27]

In order to protect the implant, managing failed implants entails treating peri-implantitis, reducing inflammation, and preventing more bone loss. Depending on the severity, treatment usually advances from non-surgical to surgical methods. A thorough, step-by-step management protocol is provided below:

1. Initial Assessment

Comprehensive Diagnosis: Confirm failing implant status with clinical signs (probing depths >5 mm, bleeding on probing, suppuration) and radiographic evidence (bone loss).

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Evaluate contributing factors: Poor oral hygiene. Overloading or prosthetic misalignment. Systemic conditions (e.g., diabetes, smoking).

2. Non-Surgical Treatment

Non-surgical approaches aim to control biofilm and reduce inflammation.

A. Mechanical Debridement

Use implant-specific instruments: Titanium-coated curettes, plastic curettes, or carbon-fiber curettes. Ultrasonic scalers with non-metallic tips to avoid damaging the implant surface. Air-polishing with glycine or erythritol powder for biofilm removal.

B. Antimicrobial Therapy

Local Antiseptics: Chlorhexidine gluconate 0.12%-0.2% rinses or gels applied twice daily. Povidone-iodine irrigation during clinical debridement.

Systemic Antibiotics (if indicated): Combination of Amoxicillin (500 mg TID) and Metronidazole (250-500 mg TID) for 7-10 days.

C. Laser-Assisted Therapy

Er:YAG or CO_2 Lasers: For decontamination of implant surfaces.

Low-Level Laser Therapy (LLLT): Reduces inflammation and promotes healing.

D. Photodynamic Therapy (PDT)

Use a light-activated photosensitizer (e.g., methylene blue) with a low-energy laser to eliminate pathogenic bacteria.

Limitations: Non-surgical treatments alone are often insufficient for advanced peri-implantitis or significant bone defects.

3. Surgical Treatment

Surgical intervention is necessary when non-surgical methods fail or for advanced bone loss.

A. Open-Flap Debridement

Indicated for better access to deep peri-implant pockets.

Procedures: Flap elevation. Thorough mechanical debridement of biofilm and granulation tissue. Implant surface decontamination using saline, citric acid, or lasers.

B. Bone Regenerative Procedures

Guided Bone Regeneration (GBR): Use bone grafts (e.g., autografts, allografts, xenografts) and resorbable/non-resorbable membranes to rebuild lost bone.

Growth Factors: Platelet-rich fibrin (PRF) or recombinant growth factors like BMP-2 may enhance bone regeneration.

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C. Implantoplasty

Smoothening of exposed implant threads using rotary instruments to reduce biofilm accumulation.

D. Explantation (as a last resort)

If osseointegration is significantly lost and the implant is mobile, removal is recommended, followed by re-implantation after proper site management.

4. Maintenance Therapy

Regular follow-ups and professional cleanings every 3-6 months.

Emphasis on oral hygiene practices: Soft-bristled toothbrushes, interdental brushes, water flossers. Adjust occlusion and prosthetics to reduce implant overloading.

B.V.Tests to check the failing implant stage [28-31]

To assess failing implants, a variety of diagnostic techniques and instruments are available, with an emphasis on clinical, radiographic, biomechanical, and microbiological factors. These examinations aid in assessing the degree of peri-implant disease and directing the proper course of treatment.

1. Clinical Tests

Probing Depth (PD) Measurement

Purpose: Assess peri-implant pocket depth to evaluate inflammation and bone loss.

Tools: Plastic or titanium-coated periodontal probes to prevent implant surface damage.

Indications of Failing Implant: Probing depth >5 mm with bleeding on probing (BOP) or suppuration.

Bleeding on Probing (BOP)

Purpose: Detect inflammation in the peri-implant tissues.

Procedure: Gentle probing around the implant.

Indications:

Persistent BOP indicates active peri-implantitis.

Suppuration Test

Purpose: Identify infection by checking for pus discharge.

Procedure: Apply gentle pressure on the peri-implant area during probing.

Indications:

Presence of suppuration strongly suggests microbial infection.

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2. Radiographic Tests

Periapical Radiographs

Purpose: Detect bone loss and structural changes around the implant.

Procedure: Compare current radiographs with baseline images.

Indications:

Bone loss >2 mm or irregular bone patterns around the implant threads.

Cone-Beam Computed Tomography (CBCT)

Purpose: Provide a 3D view of peri-implant bone levels.

Advantages: Detects subtle bone changes.

Assesses the extent and pattern of bone loss.

Indications: Use for detailed evaluation of advanced cases.

3. Functional Tests

Resonance Frequency Analysis (RFA)

Purpose: Measure implant stability through the Implant Stability Quotient (ISQ).

Procedure: A transducer is attached to the implant, and the frequency response is measured.

Indications:ISQ values <60 suggest reduced stability, indicating failing implants.

Periotest® Device

Purpose: Quantify implant mobility.

Procedure: The device applies mechanical percussion to the implant and records responses.

Indications: Increased Periotest values indicate loss of stability.

4. Microbiological and Biochemical Tests

Microbial Testing

Purpose: Identify periopathogens causing peri-implantitis.

Methods: Culture-based testing, Polymerase chain reaction (PCR), Next-generation sequencing (NGS).

Common Periopathogens: Porphyromonas gingivalis, Tannerella forsythia, Treponema denticola, Fusobacterium nucleatum. Biomarker Analysis in Peri-Implant Crevicular Fluid (PICF)

Purpose: Detect inflammatory markers.

Markers: Interleukin-1β (IL-1β), Tumor Necrosis Factor-α (TNF-α), Matrix Metalloproteinase-8 (MMP-8).

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Commercial Kits: PerioSafe® and ImplantSafe® detect elevated MMP-8 levels in PICF.

Indications: High biomarker levels correlate with peri-implant disease severity.

5. Emerging Diagnostic Tools

Optical Coherence Tomography (OCT)

Purpose: Visualize soft tissue changes around implants.

Advantages: Non-invasive, detailed imaging of peri-implant tissues. Spectroscopic Analysis

Purpose: Assess tissue changes based on light absorption or reflection properties.

Example: Laser-induced fluorescence spectroscopy for early detection of inflammation.

B.VI. Classification for failing implants:

Treatment choices are guided by the categorization of failed implants, which aids in determining the degree of peri-implant disease. Although there isn't a single, widely accepted classification for "failing implants," a number of systems can be modified to group them according to clinical, radiological, and microbiological characteristics. The following frameworks are frequently used: [32]

1. The "Ailing" and "Failing" Implant Classification by Renvert et al. (2019)

Renvert et al. (2019) proposed a two-tier classification for implants based on disease severity: ailing implants and failing implants. This classification helps distinguish between implants that are at risk but still stable (ailing) and those that are in a state of progressive failure (failing).[28]

Ailing Implants:

Probing depths >4 mm, bleeding on probing (BOP), and no significant mobility. Non-surgical therapy, including debridement and antimicrobial treatment.

Failing Implants:

Probing depths >5 mm, bleeding, pus discharge, and potential implant mobility. Surgical intervention such as flap surgery, bone regeneration, and possibly implant removal if osseointegration is lost.

2. Peri-Implantitis Severity Classification (Lang et al., 2011) [9]

Lang et al. (2011) proposed a severity classification for peri-implant diseases, which can be applied to failing implants. Their classification divides peri-implantitis into mild, moderate, and severe stages based on radiographic bone loss and clinical symptoms.

Mild Peri-Implantitis: Bone loss ≤ 3 mm, no implant mobility, probing depth ≤ 5 mm, bleeding on probing.

Moderate Peri-Implantitis: Bone loss > 3 mm but ≤ 5 mm, probing depth > 5 mm, BOP, possible suppuration, and early mobility.

Severe Peri-Implantitis: Bone loss > 5 mm, implant mobility, significant suppuration, and deep probing depths.

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Failing Implants typically fall into the moderate to severe categories due to progressive bone loss and functional instability.

3. The 2017 World Workshop Classification (Berglundh et al.) [9]

The World Workshop on the Classification of Periodontal and Peri-Implant Diseases (2017) established a comprehensive system for categorizing peri-implant diseases. While the classification specifically focuses on peri-implantitis, it is often applied to determine the stage of implant failure.

Stages of Peri-Implantitis:

Stage 1: Slight bone loss (< 25% of the implant length).

Stage 2: Moderate bone loss (25-50% of implant length).

Stage 3: Severe bone loss (> 50% of implant length).

Failing implants can be classified according to these stages, with Stage 3 being indicative of failure due to extensive bone loss and loss of osseointegration.

4. The P.I. Classification by Zitzmann et al. (2005) [32]

Zitzmann et al. (2005) proposed the "P.I." (Peri-implantitis) classification for implants showing signs of peri-implant diseases. This is useful for assessing the failure risk.

Class I: No bone loss, soft tissue inflammation (mucositis).

Class II: Moderate bone loss (2-3 mm), no implant mobility.

Class III: Severe bone loss (>3 mm), possible mobility, and/or infection.

Failing implants typically fall into Class II or Class III due to the severity of the bone loss, soft tissue degradation, and potential implant mobility.

5. Clinical and Radiographic Classification by Esposito et al. (2012) [33]

This classification system is based on clinical and radiographic findings and includes the following categories:

Stage 1: Healthy implant with no signs of infection.

Stage 2: Peri-implant mucositis with reversible inflammation and no bone loss.

Stage 3: Peri-implantitis with bone loss <2 mm.

Stage 4: Severe peri-implantitis with bone loss >2 mm, implant mobility, and need for intervention.

Failing implants often fall into Stage 4, where both bone loss and mobility are significant enough to require advanced interventions, including possible removal.

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B.VII.Treatment Protocol for Failing Implants [1,2,9,12,34]

A methodical approach is required to manage failed implants, starting with non-surgical therapies and progressing to surgical procedures if required. The objective is to determine whether explanation is the best course of action or, if that is not possible, to preserve the implant. A thorough treatment regimen for failed implants is provided below:

1. Initial Assessment and Diagnosis

Clinical Examination:

Probing depth (PD) >5 mm, bleeding on probing (BOP), pus discharge, mobility, and radiographic bone loss (>2 mm) are signs of failing implants. Implant stability should be checked through resonance frequency analysis (RFA) or Periotest.

Radiographic Evaluation:

Periapical radiographs or cone-beam computed tomography (CBCT) to assess the extent of bone loss and the presence of infection.

Microbiological Testing: Identify periopathogens through PCR or culture techniques to guide antimicrobial therapy.

2. Non-Surgical Treatment

Non-surgical interventions are preferred in early stages of failure or ailing implants, aiming to manage infection and inflammation before more invasive methods are employed.

A. Mechanical Debridement

Tools: Use plastic, titanium-coated curettes or ultrasonic scalers with non-metallic tips to avoid damaging the implant surface.

Method: Thorough debridement of biofilm, granulation tissue, and infected tissues around the implant. Renvert et al. (2019) found that mechanical debridement is crucial in reducing bacterial load and improving clinical parameters like probing depths and bleeding on probing.

B. Antimicrobial Therapy

Local Antiseptic Application:

Chlorhexidine (0.12-0.2% gel or rinse) twice daily for 2 weeks. Povidone-iodine or antimicrobial mouthwash.

Systemic Antibiotics: Amoxicillin (500 mg TID) and Metronidazole (250-500 mg TID) for 7-10 days if infection is suspected. A systematic review by Renvert et al. (2019) supports the use of chlorhexidine and systemic antibiotics for peri-implantitis.

C. Laser Therapy

Er:YAG or CO_2 Lasers:

Lasers are used for decontaminating the implant surface and reducing bacterial load in the surrounding tissues.

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Low-Level Laser Therapy (LLLT): Promotes tissue healing and reduces inflammation. Schwarz et al. (2006) found laser-assisted therapy to be effective in reducing inflammation and promoting healing in peri-implantitis.

3. Surgical Treatment

Surgical approaches are necessary for more advanced cases where non-surgical methods fail, or where there is significant bone loss, infection, or implant mobility.

A. Open-Flap Debridement

Procedure: Elevate a mucoperiosteal flap to gain access to the implant surface.

Thorough debridement of biofilm, granulation tissue, and infected tissue. Implant surface decontamination using saline, citric acid, or lasers. A systematic review by Berglundh et al. (2018) emphasized that flap surgery with decontamination of the implant surface is an effective method for treating advanced peri-implantitis.

B. Bone Regeneration Procedures

Guided Bone Regeneration (GBR): Use of bone grafts (autografts, allografts, xenografts) along with resorbable/non-resorbable membranes to regenerate bone around the implant. Platelet-Rich Fibrin (PRF) and recombinant growth factors like BMP-2 may be used to enhance bone regeneration. A systematic review by Chan et al. (2014) showed that GBR significantly improved bone volume around implants, especially in cases of moderate to severe peri-implantitis.

C. Implantoplasty

Procedure:

Smooth the rough implant surface using rotary instruments to eliminate biofilm retention. Indicated for implants with moderate bone loss and no significant mobility. Implantoplasty is considered an effective treatment option when osseointegration is still intact but peri-implantitis is present, as reported by Schwarz et al. (2006).

4. Explantation (Implant Removal)

When the implant has lost osseointegration, is mobile, or there is severe bone loss with chronic infection, explantation might be necessary.

Indications for Explantation: Progressive bone loss (>50% of implant length), implant mobility, recurrent infection, and failure to respond to treatment.

Procedure:

Remove the failing implant, curette the site, and if necessary, perform GBR or PRF to prepare for re-implantation.

Esposito et al. (2012) found that explantation should be considered when an implant is hopeless and poses a risk of further infection.

5. Maintenance and Follow-Up

After treatment, regular follow-ups are crucial to ensure implant survival.

Post-Operative Care:

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Prescribe soft food and proper oral hygiene techniques. Use chlorhexidine mouthwash and encourage gentle brushing.

Regular Checkups. Professional cleaning every 3-6 months. Periodic radiographs to monitor bone levels. Heitz-Mayfield et al. (2014) highlighted the importance of regular maintenance to prevent recurrence of peri-implantitis.

CONCLUSION:

In dental implantology, failing implants pose a serious problem since they frequently result in infection, progressive bone loss, and ultimately osseointegration failure. Determining the best course of action requires early detection and precise classification of failed implants. Clinicians can accurately diagnose the stage of implant failure and direct the treatment approach by evaluating clinical symptoms (such as implant mobility, bleeding on probing, and probing depth), radiographic evidence (bone loss), and microbiological factors (pathogenic bacteria). A step-by-step approach is used to manage failed implants, beginning with non-surgical treatments including mechanical debridement and antibiotic therapy, which frequently stop the early stages of peri-implantitis from progressing. Surgical procedures such open-flap debridement, bone grafting, and implantoplasty are recommended if these techniques are futile or if the implant is at a more advanced stage of failure (such as substantial bone loss or implant movement). Explantation may be required in extreme circumstances where the implant cannot be preserved, and the site may then be prepared for reimplantation using possible regeneration procedures. In order to ensure long-term implant survival and prevent the recurrence of peri-implant disorders, proactive management is essential. This includes routine follow-up visits and professional cleaning.

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