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Diagnosis and non-surgical treatment of peri-implant diseases and maintenance care of patients with dental implants – Consensus report of working group 3

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Abstract: The following consensus report is based on four background reviews. The frequency of maintenance visits is based on patient risk indicators, homecare compliance and prosthetic design. Generally, a 6-month visit interval or shorter is preferred. At these visits, peri-implant probing, assessment of bleeding on probing and, if warranted, a radiographic examination is performed. Diagnosis of peri-implant mucositis requires: (i) bleeding or suppuration on gentle probing with or without increased probing depth compared with previous examinations; and (ii) no bone loss beyond crestal bone level changes resulting from initial bone remodelling. Diagnosis of peri-implantitis requires: (i) bleeding and/or suppuration on gentle probing; (ii) an increased probing depth compared with previous examinations; and (iii) bone loss beyond crestal bone level changes resulting from initial bone remodelling. If diagnosis of disease is established, the inflammation should be resolved. Non-surgical therapy is always the first choice. Access and motivation for optimal oral hygiene are key. The patient should have a course of mechanical therapy and, if a smoker, be encouraged not to smoke. Non-surgical mechanical therapy and oral hygiene reinforcement are useful in treating peri-implant mucositis. Power-driven subgingival air-polishing devices, Er: YAG lasers, metal curettes or ultrasonic curettes with or without plastic sleeves can be used to treat peri-implantitis. Such treatment usually provides clinical improvements such as reduced bleeding tendency, and in some cases a pocket-depth reduction of ≤ 1 mm. In advanced cases, however, complete resolution of the disease is unlikely.

Key words: *Peri-implant diseases, peri-implantitis, peri-implant mucositis, non-surgical therapy, maintenance, supportive care*

INTRODUCTION

Dental implants have long been used to replace missing teeth. Initially, it was believed that the possible drawbacks of dental implant treatment were minimal if the implants were fully integrated into the bone. Over the years, however, it has become clear that biological complications frequently occur. Biological complications associated with dental implants are mostly infections induced by a bacterial biofilm, resulting in an inflammatory response in the soft tissues and bone surrounding implants. The inflammatory lesions located in the soft tissues have been referred to as peri-implant mucositis. If the inflammatory response progresses further and results in a loss of the bone beyond the initial bone remodelling, it is referred to as peri-implantitis[1,2].

The prevalence of peri-implant mucositis has, in a recent systematic review, been reported in the range of 19%–65% and the prevalence of peri-implantitis in the range of 1%–47%[3]. The wide range may be dependent on the different patient populations investigated in the studies included in the review, but it may also reflect differences in diagnostic criteria. In a paper using different levels of severity, a substantial variance in disease prevalence was highlighted[4]. The differences in criteria used to characterise peri-implant

diseases in different studies were also highlighted in two systematic reviews[3,5].

Such discrepancies in diagnostic criteria pose a problem when the true prevalence of disease is to be investigated. In 2017, a world workshop was organised by the American Academy of Periodontology and the European Federation of Periodontology to, among other things, develop a classification of peri-implant health and disease to be used in the future[6,7].

When the clinician has diagnosed peri-implant mucositis or peri-implantitis, and has also decided to keep the implant, many different factors and parameters have to be considered before a treatment plan is constructed and treatment begins.

The task of this working group was to answer critical questions related to the diagnosis of peri-implant health and disease, the treatment planning and non-surgical treatment of peri-implant diseases, and maintenance care of patients supported with dental implants. The answers to the questions are based on four position papers[8–11] presented at the FDI consensus meeting on peri-implantitis in May 2018.

The first position paper describes the diagnosis of peri-implant diseases[8]. It concludes that although peri-implant mucositis and peri-implantitis are plaque-induced diseases in the majority of cases, other conditions resembling the clinical appearance of peri-implantitis may initially be non-plaque induced and infected by the microflora at a later stage. These include bone loss in conjunction with implant fractures or mal-implant positioning, other technical problems, bone loss due to overheating, and excess cementum. The new classifications of peri-implant mucositis and peri-implantitis are based on a position paper[6] and the consensus report following the World Workshop of Periodontology in Chicago[7]. It was pointed out that baseline clinical registrations and radiographs are essential for the diagnosis.

In the second position paper[2], treatment planning strategies for peri-implant diseases are described. Irrespective of whether the biofilm is the primary cause of all peri-implant diseases or if the infection is established at a second stage, resolving inflammation to maintain clinically healthy and stable conditions is vital. Accordingly, treatment of both peri-implant mucositis and peri-implantitis should focus on infection control, i.e. removal of hard and soft tissue deposits from the implant surface, adjustment of the supra-structure if needed, and instructing the patient to perform adequate home care. Non-surgical therapy should always be completed before any surgical intervention is attempted to allow for an evaluation of the efficacy of the non-surgical treatment and to assess the patient's ability and willingness to perform effective oral hygiene measures[9].

The third position paper addressed the non-surgical therapy of peri-implant mucositis and peri-implantitis[10]. Non-surgical treatment of peri-implantitis usually provides clinical improvements in reducing bleeding tendency and in some cases pocket reduction. It was stated that several recent studies had reported different combination therapies that may enhance the outcome of non-surgical treatment, and that early diagnosis, detection and intervention remain the key to managing peri-implantitis.

The fourth position paper focused on maintenance therapy of patients supported with dental implants[11]. It was concluded that patient compliance with the recommended peri-implant maintenance regimen is essential in the prevention of biological complications, and that compliers had fewer peri-implantitis conditions.

SUMMARY STATEMENTS IN THE AREAS OF DIAGNOSIS, TREATMENT PLANNING, NON-SURGICAL THERAPY AND MAINTENANCE CARE, AS DEVELOPED BY WORKING GROUP 3 DURING THE FDI CONSENSUS MEETING

Diagnosis of peri-implant diseases

Peri-implant diseases and other conditions are composed of plaque-induced (e.g. peri-implant mucositis and/or peri-implantitis) as well as non-plaque-associated conditions, such as implant mucosal recession, mucosa hyperplasia, lesions due to trauma and other non-specific clinical conditions. The diagnoses of these plaque- and non-plaque-associated peri-implant diseases are mainly dependent on whether there is a plaque-induced active infection (e.g. bleeding on probing, exudate/suppuration, radiographic bone loss and increasing probing pocket depth).

How to define and diagnose peri-implant health, peri-implant mucositis and peri-implantitis

Diagnosis of peri-implant health requires:
- no clinical signs of inflammation;
- no bleeding and suppuration on gentle probing;
- no increase in probing depth compared with previous examinations;
- no bone loss beyond crestal bone level changes resulting from initial bone remodelling.

Diagnosis of peri-implant mucositis requires:
- bleeding and/or suppuration on gentle probing with or without increased probing depth compared with previous examinations;
- no bone loss beyond crestal bone level changes resulting from initial bone remodelling.

Diagnosis of peri-implantitis requires:
- bleeding and/or suppuration on gentle probing;
- increased probing depth compared with previous examinations;
- bone loss beyond crestal bone level changes resulting from initial bone remodelling.

If data from prior examinations are not available, diagnosis of peri-implantitis can be based on the combination of:

- bleeding and/or suppuration on gentle probing;
- probing depths of ≥ 6 mm;
- bone levels ≥ 3 mm apical of the most coronal portion of the intra-osseous part of the implant.

What are the tools for the diagnosis of peri-implant mucositis or peri-implantitis?

A periodontal probe is a necessary clinical tool for monitoring the condition of the peri-implant tissues.

Probing measurements are influenced by the extent of inflammation, probing force used, implant location in the oral cavity, prosthetic contour, and by differences in shape, increments and material (e.g. plastic, stainless steel) of the probe used. Because plastic probes are flexible, it is likely that deeper probing depths may be registered using plastic probes compared with stainless steel probes. It is therefore necessary to always use the same type of probes across different examinations. The initial probing measurements should be obtained at the time of loading. If probing is not possible, the prosthetic reconstruction should be removed and adjusted.

Bone loss at dental implants in function is evaluated by analysis from radiographs. Long-cone parallel radiographic projection techniques are recommended to assess interproximal crestal bone level changes periodically.

The presence of bleeding on probing suggests soft tissue inflammation, and is a required clinical parameter to distinguish between peri-implant health and peri-implant mucositis or peri-implantitis. Early detection of inflammation around the implant is essential to prevent peri-implant mucositis and peri-implantitis.

The treatment plan for peri-implant diseases

The objective of peri-implant mucositis treatment is to resolve the inflammation by controlling the infection and creating maintainable healthy peri-implant conditions. If the inflammation is generalised around both natural teeth and implants, then the primary issues to investigate are inadequate oral hygiene and smoking habits. The clinician should also examine the prosthetic supra-structure for mis-fitting components or for design flaws that do not allow access for optimal oral hygiene. The patient should be instructed in oral hygiene procedures and scheduled to have a course of mechanical therapy, start attending regular maintenance visits, and be provided with smoking cessation support. Irrespective of the treatment, effective plaque control by the patient is paramount for success. If inflammation persists following many maintenance visits, regardless of low plaque scores, further investigations addressing the patient's general health may be warranted, and the supra-structure might need to be modified or replaced.

When inflammation is present only around one or more implants and the restorations are cemented, the dentist should investigate the presence of residual cement in the peri-implant pocket. If cement is present, it should be removed. If removal of the supra-structure is not possible, then surgical intervention should be considered to facilitate cement removal.

What is the treatment plan for peri-implantitis?

If clinical and radiographic examination identifies an implant for which treatment is irrational, removal of the implant is indicated.

If the clinician decides to retain the implant, treatment should primarily focus on controlling the infection. Non-surgical therapy should always be the first step as this allows the clinician time to evaluate the healing response of the tissues and the patient's ability to perform effective oral hygiene measures. Mechanical therapy can be supplemented with locally delivered antibiotics. Non-surgical treatment in combination with adequate oral hygiene may be sufficient to control the infection without any further surgical intervention. Most of the time, however, surgical therapy is necessary as it allows for proper access to the implant surface for mechanical debridement and chemical decontamination. Surgical approaches usually include access surgery, resective surgery or a regenerative procedure. The choice of which method to use is mostly dependent on the defect type and the position of the implant in the oral cavity. Mechanical and chemical decontamination of the exposed implant surface with or without bone recontouring is essential as it creates a healthy environment that allows for healing. When the bone morphology is such that it can support a grafting material, regenerative treatment modalities can be implemented. If the patient is a smoker, regenerative therapy is often not advisable. Maintenance is of paramount importance, and susceptible individuals should be examined regularly and provided with the appropriate supportive treatment. It has been demonstrated that when oral hygiene is maintained at proper levels following treatment, the initial defect fill can be sustained over time.

Non-surgical treatment of peri-implantitis

What is the effectiveness of non-surgical treatment for peri-implant mucositis and peri-implantitis?

Conventional non-surgical mechanical therapy in conjunction with oral hygiene reinforcement is the standard treatment for peri-implant mucositis. This

treatment will result in an average of 0.5–1.0 mm pocket depth reduction and 15%–40% reduction in bleeding on probing. Non-surgical treatment of peri-implantitis (e.g. mechanical debridement alone) usually provides clinical improvements in reduced bleeding tendency (20%–50%) and in some cases pocket reduction (≤1 mm). However, in advanced cases, complete resolution of the disease is unlikely.

What mechanical instruments should we use for the treatment of peri-implant mucositis and peri-implantitis?

Power-driven air-polishing devices, Er: YAG lasers, metal (e.g. titanium) curettes, and ultrasonic curettes with the plastic sleeve can be used to clean the peri-implant mucositis-/peri-implantitis-affected implants.

What is the effectiveness of non-surgical treatment for peri-implantitis?

Non-surgical treatment of peri-implantitis (e.g. mechanical debridement alone) usually provides clinical improvements in reducing bleeding tendency (20%–50%) and in some cases pocket reduction (≤ 1 mm). However, in advanced cases, complete resolution of the disease is unlikely.

What is the benefit of using adjunctive therapies such as antimicrobial, antiseptic, laser and probiotic therapies for the treatment of peri-implant mucositis and peri-implantitis?

The additional use of adjunctive therapies (such as antiseptic, antibiotic, antimicrobial, laser-assisted and probiotic therapies) provides only minimal clinical improvements in bleeding tendency and pocket reduction. Early detection and intervention of the disease remain key for higher success. Quality non-surgical treatment, including addressing all contributing factors and adjunctive measures, should precede surgical procedures for better assessment, treatment outcome and patient compliance.

When should non-surgical therapy be attempted? Should non-surgical therapy always precede the surgical treatment of peri-implantitis?

Even though non-surgical therapy may not resolve advanced cases, it is mandatory that a phase of preparatory non-surgical treatment should precede a surgical intervention. This preparatory phase performed before surgery allows for oral hygiene improvement and possible resolution of disease infection by itself. In cases showing signs of disease following initial non-surgical treatment, surgical treatment should be considered.

When should the implant-supported restoration be removed?

When fixed implant-supported restorations impede proper diagnosis or oral hygiene access, the restoration must be removed or recontoured. When non-surgical treatment of peri-implant mucositis/peri-implantitis has failed to resolve the infection, clinicians are advised to remove the superstructure to obtain access for cleaning and to modify the prosthesis if needed.

Maintenance care

Once the patient has been treated for peri-implant mucositis, an assessment of the resolution of the disease should be made. The treating clinician should set a peri-implant maintenance interval based on individual patient risk indicators, patient homecare compliance and prosthetic design. A recall interval of 6 months or less is recommended.

What diagnostic and treatment modality should be included in the maintenance visits?

- During a maintenance visit, a diagnostic assessment should include peri-implant probing, assessment of bleeding on probing, and a radiographic examination if warranted.
- An oral hygiene assessment and instruction of patient-administered plaque control is required.
- Mechanical instrumentation of implant sites to remove biofilm is mandatory.

What home care procedures and products could be recommended to patients with dental implants?

- Both manual and powered toothbrushes are deemed useful in improving and maintaining peri-implant soft tissue health. It is up to the treating oral healthcare provider to adjust oral hygiene recommendations based on patient ability and compliance.
- Both interdental brushes and dental floss have shown to be effective in maintaining peri-implant health. If rough implant surfaces are exposed, caution should be exercised in the use of dental floss.
- 0.3% triclosan-containing toothpaste is effective when used in the maintenance of dental implants.
- Based on the current evidence for patient-administered interventions, the use of antiseptic mouthwashes or gels has not been shown to have additional beneficial effects in the long term.

What is the efficacy of professionally administered mechanical treatment in the maintenance care of dental implants?

Professionally administered mechanical therapy is efficacious in maintaining healthy conditions around dental implants. It has been demonstrated that a peri-implant maintenance protocol every 6 months can maintain a stable peri-implant attachment in the majority of the cases.

What is the current level of evidence that supportive periodontal therapy is effective in achieving the prevention of tissue disease occurrence around dental implants?

Professionally administered implant maintenance therapy is effective in long-term peri-implant maintenance. Patient compliance with individually tailored supportive periodontal therapy is crucial in the long-term prevention of peri-implant mucositis and peri-implantitis.

Do professionally administered antimicrobials provide added benefit for the maintenance of dental implants?

There is currently no substantial evidence to support the use of professionally administered antimicrobials.

CONCLUSIONS

- The patient's oral hygiene measures are crucial in maintaining healthy conditions around dental implants.
- Patients with dental implants should be monitored regularly.
- Peri-implant probing, assessment of bleeding on probing and, if warranted, a radiographic examination are vital factors to be considered at a maintenance visit.
- The prosthetic construction should be checked to allow access for optimal oral hygiene.
- Patients who smoke should be offered a smoking cessation programme.
- Diagnosis of peri-implant mucositis requires: (i) bleeding and/or suppuration on gentle probing with or without increased probing depth compared with previous examinations; and (ii) no bone loss beyond crestal bone level changes resulting from initial bone remodelling.
- Diagnosis of peri-implantitis requires: (i) bleeding and/or suppuration on gentle probing; (ii) an increased probing depth compared with previous examinations; and (iii) bone loss beyond crestal bone level changes resulting from initial bone remodelling.
- If disease is diagnosed, non-surgical therapy is always the first-choice intervention.
- Non-surgical mechanical therapy and oral hygiene measures are useful in treating peri-implant mucositis.
- Non-surgical treatment of peri-implantitis usually provides clinical improvements, but may not be sufficient to treat advanced cases.
- If the condition is resolved by non-surgical therapy, the patient should be placed on a supportive maintenance programme.
- If disease remains after non-surgical therapy, surgical interventions should be considered.

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Conflict of interest

The authors have no conflicts of interest to declare.

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