Association of Dental Implantology

ADI GUIDELINES

On Peri-implant Monitoring and Maintenance

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Scope of the Problem:

During the last two decades implant treatment has become a part of mainstream dentistry as a predictable modality for replacing missing teeth. Nevertheless, most of the evidence supporting this predictability is based on **survival statistics**, which use **"presence or absence"** of implants as an **end-point** outcome measure. The survival rates, unfortunately, do not account for the slowly progressing, on-going biological problems such as **peri-implant diseases**. Long-term biological complications arising from peri-implant infection and inflammation result in progressive crestal bone loss (CBL), which places the implant **at risk** of being lost. Although the technical and mechanical complications have been reduced up to a certain extent due to advances in implant technology and design, there is still no clarity on how to manage biological complications around implants. History of periodontal disease, satisfactory plaque control, patient susceptibility, smoking, compliance and availability of adequate professional supportive therapies are important issues affecting implant patients. Monitoring and maintaining implants in function satisfactorily is therefore one of the biggest challenges that the implant team faces. The whole implant team; the implant surgeon, restoring dentist, the general dental practitioner, the hygienist/therapist, as well as the patient (by being compliant) all have individual responsibilities and duty of care in this respect.

These guidelines are produced as a summary of ADI's Expert Panel Consensus meeting, held on 19th November 2012 in London, on the management of peri-implant diseases. The guidelines are not prescriptive protocols but good practice recommendations based on expert opinion informed by best available current evidence on the subject. Nevertheless, clinicians are strongly advised to seek up-to-date information and opinion from different sources when managing patients.

Introduction:

A cause-effect relationship has been demonstrated between dental plaque and peri-implant diseases (Mombelli et al, 2007). Reversible inflammation affecting the peri-implant soft tissues without any bony involvement is known as **peri-implant mucositis**. When this leads to crestal bone loss it is referred to as **peri-implantitis**, which is irreversible. Both conditions have similarities, respectively, to gingivitis and periodontitis in pathogenesis (Okayasu and Wang, 2011) but the disease progression might be faster around implants due to physiological differences in connective tissue morphology (Lang and Berglund, 2011).

It has been demonstrated that high level of implant success requires meticulous peri-implant maintenance and plaque control to keep the supporting tissues healthy (Wenstrom et al. 2005). This normally involves more than a customary visit every three months for a scale and polish. A professional periodontal and peri-implant maintenance programme should be instigated meticulously, with periodic documentation of clinical parameters and treatment end-points such as bleeding (BOP) and peri-implant pocketing (PPD) and stability of crestal bone levels (CBL). The supportive maintenance therapy should be individualised according to each patient's clinical requirements with full recording of all clinical parameters to facilitate a clear risk management strategy.

Table 1: Aetiology of Peri-implant Diseases (PID):

Host Susceptibility
History of periodontal/peri-implant disease (strong evidence)
Genetic susceptibility (insufficient evidence)
Systemic disease/medical co-morbidities (e.g. uncontrolled diabetes, immunosuppression, radiotherapy) (insufficient evidence)
Prosthetic Design
Impassive fit (insufficient evidence)
Poor access for plaque control (good evidence)
Occlusal trauma or adverse loading conditions (inconclusive evidence)
Implant Design
Surface and/or geometry (inconclusive evidence)
Excessive stress concentration at Bone Implant Interface (mostly preclinical evidence)
Increased risk of plaque adhesion or retention (e.g. exposed endosteal implant surface)
Type of abutment connection (inconclusive evidence)
Patient Factors
Poor plaque control (strong evidence)
Smoking (strong evidence)
Bone quality and quantity (mostly preclinical evidence)
Iatrogenic Factors (dentist/surgeon related)
Surgical trauma (mechanical damage)
Implant malpositioning
Extrusion of excess luting cement*

This table summarises the biological and mechanical causative and predisposing factors that have been implicated in PID (see references) (Adapted from Heitz-Mayfield et al 2008).

* Cementitis is caused by extrusion of luting cement acting as plaque retention between the abutment and implant shoulder leading to peri-implant inflammation, fistula formation, discharge or bleeding. If untreated, this could also progress into deep seated infection with crestal bone loss. The use of radiopaque luting cements and satisfactory removal of all excess material after cementation is essential to eliminate cementitis.

Monitoring:

Following the completion of treatment, the patient should be instructed on adequate home care and plaque control measures focusing on inter-dental cleaning with inter-proximal brushes. The patient should also be enrolled in an individually designed supportive periodontal therapy (SPT) and infection control program according to their specific risk assessment profile (Donos et al 2012). The objective is to prevent development or recurrence of infection around the natural dentition and the implants. The following regime of SPT is recommended:

Periodic Examination:

A routine examination (3, 6 or 12 monthly intervals) is recommended depending on severity of the case and presence of risk factors for disease development or progression (Donos et al 2012).

The purpose of the peri-implant examination should be:

a) To determine the health of peri-implant tissues and to identify any potential problems early. The following periodontal indices should be evaluated: bleeding on probing (BOP), probing depths (PD), and presence of plaque, suppuration or mobility.

b) To check crestal bone levels in relation to a known reference point (e.g. implant shoulder). A baseline radiograph serves as a reference and is repeated as and when indicated by clinical circumstances and parameters including patient susceptibility.

c) To reassess and reinforce plaque control/smoking cessation

d) To check the stability of underlying medical conditions (e.g. diabetes)

e) To check occlusal integration and harmony, identify occlusal trauma and associated wear and tear

f) To check removable prostheses and need for relining

g) To check and reinforce patient's oral hygiene technique and home-care

Professional plaque control measures including oral hygiene reinforcement and subgingival/mucosal instrumentation should be performed as indicated every 3-6 months with ultrasonic and hand instruments specially modified for titanium surfaces.

Clinical and Radiological Diagnostic Parameters:

1) Radiographs:

A baseline radiograph is recommended at the time of implant loading to determine alveolar bone levels after the completion of the initial adaptive bone remodelling phase (Lang and Berglundh, 2011). The panoramic radiograph is not generally suitable to visualise peri-implant bone levels consistently. The baseline periapical radiograph is to serve as the reference from which future bone changes and progression of peri-implant disease could be determined. The radiograph should be repeated after the first year in function to check the stability of peri-implant bone support or when clinical parameters indicate disease. The frequency of subsequent radiological investigations should be dictated by individual clinical parameters. Presence of high (BoP) scores and PD ≥5mm are indications for further radiographic examination for bone margin evaluation and determination of further treatment needs (Donos et al, 2012).

2) Probing:

Studies have shown no harm in routine peri-implant probing. Therefore, probing is recommended as a subjective index of monitoring the condition of the peri-implant soft tissues (Lang et al 2002 and 2004). Presence of exudate, bleeding (BOP) or swelling should be noted together with peri-implant pocket depth (PPD) measurements. The key parameter for diagnosis of peri-implant mucositis is BOP with gentle probing (<0.25N) (Lang and Berglundh, 2011), using ideally a calibrated metal or a plastic probe. Contrary to earlier concerns, this will **not** damage the tissues or the implant surface if carried out with light digital pressure.

The following periodontal indices to assess the presence or absence of peri-implant diseases (e.g. mucositis or peri-implantitis), should be evaluated periodically:

1. Plaque index (PI)
2. Bleeding on probing (BOP) (e.g. "spontaneous": "on probing" or "30s after probing")
3. The peri-implant probing depth (when possible using 6-point charting)
4. Presence of discharge, exudate, sinus or a fistula

Table 2: Limitations of Probing:

Probing is essential for diagnosis of peri-implant disease. However, probing may be limited by:
Contour of prostheses
Depth of the implant shoulder
Design of implant shoulder/abutments

3) Mobility:

Implant mobility should be checked for all free-standing implant restorations whenever possible as radiographs are not always diagnostic of a deterioration in osseointegration. A percussion test is often all that is needed to detect absence of mobility. However, it is inadvisable to disconnect a fixed prosthesis to check on individual implant mobility unless clinical signs and symptoms strongly suggest loss of osseointegration. Removal of abutments/restorations could disturb the equilibrium within the implant-abutment-soft tissue junction. Use of resonance frequency analysis (RFA), although a poor indicator of implant failure, has been shown to be a reliable test of implant stability and therefore could be used to document initial implant stability and integration. However, routine removal of restorations to document implant stability is not recommended.

Table 3: Peri-implant Mucositis: Disease outcome: reversible

Signs and symptoms (S&S)	
Bleeding on probing	Discharge or suppuration
Increased PD	Pain or tenderness and/or fistula
Swelling	**Diagnostic criteria:** no radiological sign of CBL

Table 4: Peri-implantitis: Disease outcome: irreversible

Signs and symptoms (S&S)	
Bleeding on probing	Fistula
Increased PD	Discharge or suppuration
Swelling	**Diagnostic criteria:** radiological sign of CBL
Pain or tenderness	

Table 5: Diagnosis of Peri-implant Diseases (PID):

To clinically diagnose the presence of peri-implant diseases the following should be evaluated:
Probing (using a light force <0.25N): Increase in PPD (from a fixed reference point) indicates loss of attachment. Enables a clinical diagnosis of peri-implantitis.
BOP: Indicates inflammation. Diagnostic of peri-implant mucositis
Periapical radiography: Crestal bone loss confirms the diagnosis of peri-implantitis. Continual CBL indicates Implant at Risk (IaR)
Other S&S: Exudate; swelling and pain

Interpretation of Results:

a) **Radiographs:** the presence of peri-implant radiolucency or crestal bone loss is checked using the implant shoulder as a reference point. Distance between implant threads could be used to calculate the magnification factor when estimating bone loss. Baseline radiographs are used as a reference to compare stability of crestal bone support.

b) **Probing:** (a calibrated periodontal probe) (<0.25N) is recommended. Probe using 6-point pocket charting when possible with a fixed reference point (e.g. crown margin). Record presence or absence of bleeding (BOP or 30s delayed), plaque accumulation, peri-implant pocket depth (mm) (PPD) and any suppuration. BPE score of teeth/implants should be noted at each recall visit. Full mouth periodontal charting once a year or as clinically deemed necessary (e.g especially when BPE >3 or 4). Deeper pockets harbour pathogenic bacteria, therefore pocket reduction and improved plaque control should be an initial objective of peri-implant maintenance.

c) **Bleeding on probing:** diagnostic of peri-implant mucositis. However false positives are possible if more than gentle pressure is exerted which could force the tip of the probe to penetrate circularly oriented weak fibres.

d) **Other S&S:** Hyperplasia/fistula/exudate/pain.

Management and Individualised Supportive Therapy:

Duty of Care and Patient/Clinician Responsibilities:

Long-term success of implant treatment is multifactorial and primarily depends on satisfactory maintenance of health of peri-implant tissues. However, certain predisposition to peri-implant disease should be recognised and addressed during long-term maintenance of patients particularly with higher susceptibility. In this respect the dental team including the practitioner and the hygienist/therapist who are responsible for routine maintenance of the implant patient should be fully aware of their duty of care, not only in documenting the baseline clinical parameters of the health of peri-implant tissues but also in continuing to monitor these periodically during maintenance. Moreover, the implant patient should be fully educated on the effect of dental plaque on the long-term success of implants. Patients who present with higher risk or susceptibility (diabetes, smokers, history of periodontal disease) should be fully made aware of the implications of the risks and their need for systematic professional maintenance. Patients should be educated on their own responsibilities regarding the correct oral hygiene and home-care techniques. Clinicians are also required to screen their implant cases by periodic auditing of outcomes based on their implant log books.

Routine Maintenance:

The overall objectives of routine implant maintenance are similar to that of periodontal maintenance: establish presence of health or disease and offer supportive maintenance to improve plaque removal and oral hygiene. Implants should be cleaned subgingivally with gentle pressure using (preferably) titanium scalers. The use of plastic instruments are not recommended as these have been shown to be less efficient in removing subgingival plaque off implant surfaces.

Table 6: Professional Cleaning Instruments and Devices:

Different levels of evidence – none considered state of the art.		
Titanium hand scalers	Air abrasive device	Lasers

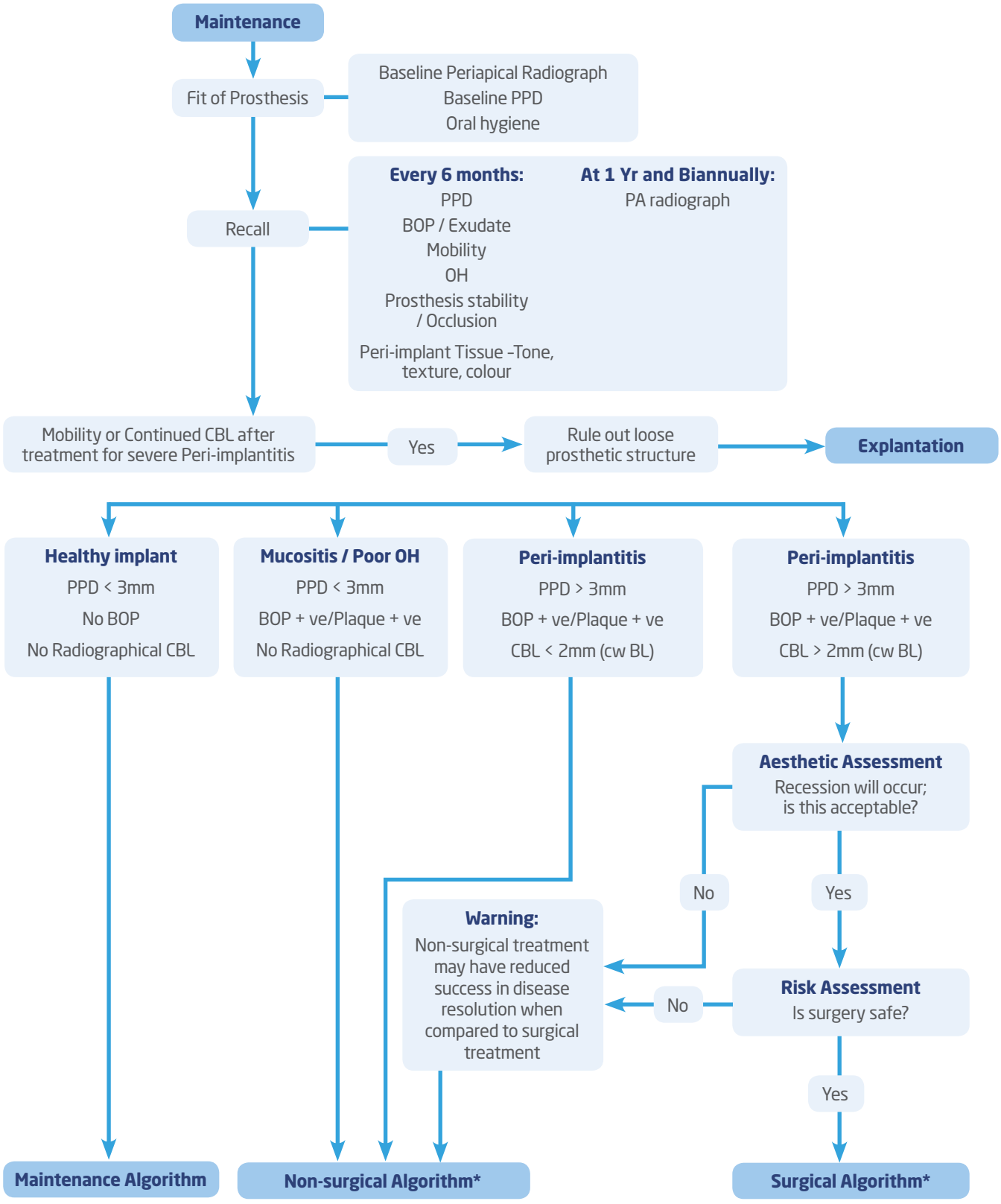
Consider recommending an antiseptic mouthwash such as Corsodyl, Delmopinol or essential oil mouthwash to control bacterial invasion. (Chlorhexidine must not be used at the same time as toothpaste, it should be used about 30 minutes afterwards otherwise there are interactions and decreased activity). Review to evaluate improvement in plaque control and to ensure full resolution. If untreated, peri-implant mucositis could lead to deeper pocketing and loss of peri-implant crestal bone.

Table 7: Recommended Home Cleaning Devices

Different levels of evidence – none considered state of the art.		
Dental floss	Interdental brushes	Chlorhexidine, essential oils, or Delmopinol (weak evidence)

See next page:

Maintenance Algorithm:



* Please refer to the ADI Guidelines on the Management of Peri-implant Diseases for these algorithms.

Long-term Monitoring and Outcome Measures:

Studies have identified certain risk factors and co-morbidities that may affect the pathogenesis and progression of peri-implant diseases. These include radiotherapy, uncontrolled diabetes, susceptibility to periodontal disease, bruxism and smoking. Although for some of these conditions the evidence is insufficient or inconclusive, these risk factors should be carefully monitored and managed in patients with dental implants. Diabetic control should be checked using HB1Ac tests at least annually and patients should be counselled to discontinue smoking. Meticulous plaque control and control of occlusal harmony becomes more critical in patients who are susceptible to PID.

Documentation of Long-term Monitoring of Implants:

- Records of individualised supportive therapy plan and recall attendance
- Periodontal indices
- Baseline and serial radiographs
- Restorative parameters and function
- Technical problems
- Mechanical problems with abutments/screws etc
- Crestal bone support and maintenance of osseointegration
- General patient satisfaction including aesthetics

Success and Survival Criteria:

In absence of an objective test, implant success should be documented using surrogate outcome measures or treatment end-points such as pain, BOP, PD and crestal bone loss (CBL). Survival statistics simply report on the presence or absence of an implant at the time of evaluation and do not take into consideration the health of the peri-implant tissues, thus a failing implant with gross bone loss could be reported as "surviving". It is mandatory for the clinicians in charge of implant patient's maintenance to monitor and document implant outcome periodically and meticulously using the above-mentioned parameters in order to manage emerging problems in a timely fashion.

We suggest the following classification of implant success or failure:

Table 8: Definition of Implant Success and Failure:

Success	Failing
Stable marginal bone levels after an initial crestal bone loss of < 1.5mm No BOP PD < 4 mm No mobility Good plaque control (FMPI < 20%)	< 50% progressive bone loss which has not stabilised Deep pocketing BOP Less than ideal PC Pain Exudates/discharge
At Risk	**Failed**
Initial bone loss of < 4mm but bone loss has been stabilised PD < 5mm No BOP immediate or delayed PI less than ideal	Deep pocketing Discharge BOP Mobility Lost or about to be lost

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