

Periodontology

1. Principles Pertinent to the Evaluation Criteria

Periodontology deals with the structure and function of the tooth-supporting tissues including the tissues which support oral implants. It comprises the diagnostic and therapeutic measures for prevention and treatment of diseases of the periodontium and the periimplant tissues. It also involves the long-term care of the patients for the purpose of the prevention of reinfections.

Periodontitis is a local inflammatory disease caused by bacteria, which destroys the tooth-supporting tissues (periodontal fiber apparatus and alveolar supporting bone). Periodontitis is widespread and in mild or moderate forms affects close to 50% of the population. About 5% to 15% suffer from severe forms. In adults, periodontitis is one of the main causes of tooth loss. Periodontitis can compromise general health and is associated with systemic diseases, in particular diabetes and cardiovascular diseases.

By far the most frequent form is chronic periodontitis (ChP). Clinically it manifests itself chiefly in the second period of life and therefore was previously referred to as adult periodontitis. Less common forms are aggressive periodontitis (AgP), periodontitis as a manifestation of a systemic disease, and the necrotizing periodontitis forms (necrotizing ulcerative gingivitis, NUG; necrotizing ulcerative periodontitis, NUP). The localized AgP (also referred to as juvenile periodontitis) mainly affects the permanent first molars and incisors. In Switzerland it is diagnosed in about every thousandth adolescent at the age of 18 years.

The tissues surrounding oral implants can be affected by diseases similar to periodontitis. The superficial inflammation of the mucosa is called periimplant mucositis; if deeper layers including the bone (resorption) are involved, it is referred to as periimplantitis.

Although various acquired and hereditary factors have been associated with the development and progression of periodontal diseases and periimplant infections, deposits of major amounts of bacteria on tooth and implant surfaces are regarded as their main cause. From a microbiological point of view these deposits constitute complex, structured biofilms referred to as plaque. The plaque-related local inflammation of the gingiva or mucosa is regarded as the basis for the development of periodontitis or periimplantitis. For the prevention of these diseases, hindering the accumulation of structured bacterial deposits therefore plays a crucial role. Smoking increases the risk of periodontitis and periimplantitis and affects the degree of severity of both diseases. Quitting smoking therefore is also an important part of the prevention of periodontal and periimplant diseases.

Treatment is indicated when tissues exhibit inflammatory symptoms. The primary objective is the elimination of the bacterial infection through a complete removal of all bacterial deposits and their retention sites. This causal therapy which should establish clean and well cleanable conditions of oral hygiene does not only comprise the services of the therapist, but to a considerable extent also requires the active collaboration of the patient. Learning of an efficient cleaning method which enables the patient to hinder in the long term the new formation of plaque on all hard oral surfaces is an integral component of periodontal and periimplantitis therapy. A professional mechanical cleaning of all afflicted tooth surfaces in-

cluding scaling and root planing can suffice to initiate the recovery of the periodontal tissues. Frequently, however, additional measures, particularly the administration of systemic antibiotics and/or surgical interventions, are indicated. The stability of the treatment result in the long term depends on the following three key factors: the patient has good oral hygiene, they receive regular professional aftercare, and they do not smoke. The professional support of the patient by the dentist, the dental hygienist, and the prophylaxis personnel is essential.

Diagnosics

Objectives of Periodontal Diagnostics

- In the population: identification of individuals in need of treatment (diseased or at increased risk of disease)
- In individuals requiring treatment: gathering of information necessary to plan and perform an individually optimal treatment and to control its success

The primary pathognomonic clinical signs of periodontitis and periimplantitis are: pocket formation, local inflammation (mainly bleeding on probing and/or suppuration), and loss of tooth- or implant-supporting tissues (periodontal fiber apparatus, alveolar and jaw bone, respectively). Recessions as well as increased mobility or changes in position of teeth can be present. For the differential diagnosis further information is necessary. This particularly includes information from the medical history (diseases, therapies, medications), the dental history (previous therapy, subjective course), and the family history (occurrence of the disease in other family members) as well as tooth vitality.

The Periodontal Basic Examination (PBE)

The objective of the PBE is to identify periodontal treatment needs and in positive cases to define the further diagnostic measures. The PBE is carried out using a graduated periodontal probe with a tip diameter of 0.4–0.5 mm. Every tooth and every implant is probed at two sites. However, only teeth or implants exhibiting pocket depths above 4 mm or suppuration on probing are recorded. Further recorded are definite furcation involvement and possibly discovered clinical abnormalities such as clearly elevated tooth mobility or mucogingival problems. The PBE is a part of the general dental routine examination. Bitewing and other radiographs should always be checked with regard to marginal bone loss as well.

The Periodontal Chart

If the PBE suggests treatment needs, a complete periodontal chart is created with the goal to obtain all information necessary to plan and carry out an individually optimal treatment. This documentation is also the prerequisite for the later assessment of the treatment success.

The periodontal chart is prepared using a graduated probe. Probing depths are measured and recorded at not less than four sites in single-rooted teeth and implants, and at six sites in molars. Thereafter the occurrence of bleeding on probing, possible suppuration, and tooth mobility is recorded. In multirouted teeth the entrance of the furcation is probed and an eventual furcation involvement is noted. The clinical status is supplemented with a radiographic examination. An X-ray of every tooth or implant exhibiting clinical signs of pathology or an unclear condition (e.g. a negative vitality test) is desirable. However, the radiographic assessment of the bone level is only of verifying significance.

Microbiological examinations and tests for the assessment of the host response impart welcome additional information in certain cases. The benefit of such tests depends on the already existing insights and the treatment options. Investigations lacking a potential benefit for the patient have to be avoided.

Treatment of Periodontitis

Non-Surgical Treatment

Since periodontitis primarily is caused by bacteria, the most important element of the cause-related therapy consists in the elimination of these bacteria. The mechanical removal of bacterial deposits reduces the inflammation in all forms of periodontitis. Due to a tightening of the periodontal tissues, the periodontal probe at a given force can penetrate less far between the tooth and the soft tissues. In clinical practice, this is interpreted as a pocket reduction and attachment gain.

Based on well-documented studies, it is recommended to normally proceed with the following steps: after the explanation of the findings and the motivation of the patient for an individually adapted oral hygiene, a supragingival tooth cleaning is performed. Dental calculus, plaque retaining elements, and obstacles to oral hygiene are eliminated. As appropriate, teeth unworthy of preservation are removed and other urgent preparatory dental treatments are carried out. These measures are followed by the instruction and practice of an adequate oral hygiene method (toothbrush, interdental cleaning method, further auxiliaries) with the goal to enable the patient to keep more than 80% of all tooth surfaces free from plaque. A clarification on the consequences of tobacco consumption and other influenceable risk factors is an integral component. If these operations are accomplished and the goal of an adequate oral hygiene is achieved, a thorough root planing down to the fundus of the pocket is performed using appropriate instruments. The perfect mechanical depuration of all bacterially contaminated tooth surfaces and good oral hygiene are the crucial factors for the success of every periodontal treatment. A periodontitis of mild to medium severity in most instances can be treated without surgical interventions. If severe periodontal cases exhibiting multiple deep pockets are initially treated by means of a thorough root planing and systemic antibiotics (amoxicillin and metronidazole), the need for an additional periodontal-surgical therapy can be reduced. A non-surgical treatment in many cases is sufficient; it should not only be regarded as a preparation for surgical interventions.

Three to six months after the completion of the subgingival instrumentation the initial treatment plan should be adjusted based on a clinical reevaluation of the periodontal findings. Residual pockets with probing depths over 4 mm exhibiting bleeding on probing or suppuration and an unfavorable root anatomy hampering optimal oral hygiene are regarded as indications for further therapy.

Surgical Interventions

Surgical interventions can be necessary to further reduce pockets or remove residual dental calculus, for the treatment of furcations, for guided tissue regeneration or other regenerative measures as well as in certain cases for an adjustment of the soft tissue and/or bone morphology, e.g. to facilitate adequate oral hygiene or prosthodontic measures. Good oral hygiene of the patient as well as the consideration of the tobacco consumption is presupposed. In the absence of an imperative indication an antibiotic prophylaxis is renounced.

Treatment of Periimplant Infections

The point related to the therapy of periimplant infections is that bacterial biofilms, possibly also other deposits (e.g. rests of cement), have to be removed from macroscopically and microscopically intensely structured implant surfaces. Since a non-surgical therapy in many cases is insufficient, a subsequent surgical approach is to be recommended in order to gain direct access to the contaminated surfaces. Various procedures differing in regard to the surgical approach, the method of surface cleaning, the application of antimicrobial means, and additional measures have been proposed. The relative benefits of specific elements of the therapy as well as the success in the long term unfortunately are incompletely documented thus far.

Treatment Outcomes

Upon completion of the treatment the following goals should be accomplished:

- Substantial plaque reduction
- Absent pyorrhea from the sulcus
- Healthy gingiva, significant reduction of bleeding on probing (BOP)
- In principle, reduction of probing depths below 5 mm; minimal persistence of isolated probing depths above 4 mm
- No hard concretions on the root surface
- Absence of obstacles for the removal of plaque (excess material along margins of fillings and crowns)
- No increase in tooth mobility
- Ensured collaboration of the patient and participation in the recall

Post-Therapeutic Care

The long-term success of a periodontal treatment depends to a lesser extent on the treatment modality than on the post-therapeutic care. The objective of this care is the preservation of oral health, i.e. the maintenance of the integrity of the periodontal tissues and the teeth through prevention of new infections and the early countering of reinfections in residual pockets.

Also after the treatment of periimplant problems regular checks should be performed in order to recognize possible new or reinfections as early as possible.

The recall system in the practice necessitates a specific organization which enables to fix regular appointments of treated patients. An efficient implementation mostly requires the assignment of trained auxiliary personnel. Depending on the risk, recall appointments take place every three to twelve months and comprise:

- New collection of necessary findings
- Specific information and motivation of the patient
- Removal of plaque and calculus
- Specific therapy in case of re- and new infections
- Application of local medications
- Fixing of the next recall visit depending on the risk of the patient

Quality Guidelines

Quality management in periodontal care comprises four treatment stages, after whose completion the practitioner can evaluate their performance and the attained result. In particular, such a reevaluation serves as the basis for the potential selection of further therapeutic steps. The four stages to be assessed are diagnostics, non-surgical therapy, surgical therapy, and post-therapeutic care. At that, the evaluation of the patient collaboration (compliance) as the fifth quality aspect is of pivotal significance. Thus it is self-evident that in a patient featuring a compliance of the quality level C for their collaboration, hardly a level A or even A+ can be attained for all treatment stages. The successful periodontal care depends on the collaboration of the patient.

The deeper the pockets are prior to treatment and the more supporting tissue has already been destroyed, the more difficult it can be to reach an ideal treatment goal. In advanced cases, the objective to eliminate all pockets deeper than 4 mm cannot always be readily achieved. Although residual pockets constitute a risk for a reinfection, the persistence of a probing depth above 4 mm alone is not a sufficient reason for an extraction or another radical intervention. Since teeth exhibiting residual pockets with good care can also remain stable, the potential benefit of every resective intervention must clearly outweigh the damage caused by the sacrifice of additional periodontal or dental hard tissues.

The sixth aspect of the quality guidelines indicates the standards for the periodontal condition of the dentition. This, so to speak, corresponds to the description of a treatment objective which could be strived for by means of a successful treatment. Therefore, the description of the tissues is to be related to the assessment of the services rendered, whereby the collaboration of the patient should be taken into account as well. Periodontal care is thus not evaluated using a single set of evaluation criteria, but rather in phases using one to three quality aspects, each. If periodontal care comes in addition to another dental treatment, the quality criteria of the other treatment have to be applied as well.

2. Evaluation Criteria for the Quality Levels A+ to C

	DIAGNOSTICS	NON-SURGICAL THERAPY	PERIODONTAL-SURGICAL THERAPY
A+	Based on a PBE, the necessary parameters of investigation were selected individually and collected specifically. The findings are documented in a visually descriptive manner and are suited for the patient instruction.	The specific professional root treatment eliminates all existing bacterial deposits while removing most minimal amounts of hard tissues and avoiding macroscopic damage to tooth surfaces. A further surgical therapy is necessary only at isolated sites exhibiting severe or complex findings. Influenceable risk factors were eliminated.	The objectives were accomplished with minimal unwanted side effects. The patient in all respects is satisfied with the outcome.
A	The PBE is part of the general dental routine examination. In individuals requiring treatment, all anamnestic, clinical, and radiographic information is gathered which is necessary for planning and performing an individually optimal treatment and for monitoring its success.	Complete but largely undifferentiated elimination of soft and calcified bacterial deposits; the treatment results in a gradual reduction of probing depths and in a significant decline in the number of pockets >4 mm which bleed upon probing. Tooth surfaces are damaged only slightly. The removal of hard tissues is small. The dentition permits a perfect oral hygiene. Influenceable risk factors (e.g. tobacco consumption) were reduced.	The objectives of the periodontal-surgical therapy were accomplished. The conditions for a regular efficient elimination of hard and soft deposits were created. Sites difficult to clean persist only selectively. Esthetic losses or hypersensitive tooth necks are present but bearable. Altogether the patient is satisfied with the outcome.
B	The PBE is not performed routinely. Individuals in need of treatment are examined unsystematically or incompletely. The documentation is incomplete. Investigations lacking a potential benefit for the patient are made.	Incomplete elimination of bacterial deposits; the treatment results in moderate loss of hard tissues and minor damage to the tooth surface. A perfect oral hygiene is hampered by isolated obstacles. Tobacco smoking and other risk factors were not reduced substantially.	The objectives of the periodontal-surgical therapy to create favorable conditions for plaque removal and to reduce probing depths were not completely accomplished. Efforts and gain are disproportionate. Altogether the patient is not satisfied with the outcome.
C	No attention is paid for the periodontal condition. No documentation of the condition is made, although therapeutic procedures had already occurred. The emergency situation is regarded as an exception.	Clearly visible soft and calcified bacterial deposits were not eliminated. Inappropriate instrumentation results in marked hard tissue loss and damage to the tooth surface. Bleeding gingiva and deep periodontal pockets were ignored. Coarse iatrogenic or constitutional obstacles make a perfect oral hygiene impossible. Tobacco smoking and other risk factors were ignored.	No attempt was made to achieve a high degree of freedom from plaque and a substantial freedom from gingival inflammation prior to the periodontal-surgical intervention. Inappropriately performed periodontal-surgical measures result in damage to the periodontium, the morphology of the gingiva, and/or the dental hard tissues. Execution of periodontal-surgical interventions without being able to provide a recall program.

	POST-THERAPEUTIC CARE	COLLABORATION OF THE PATIENT (COMPLIANCE)	TREATMENT OBJECTIVES
A+	The practice provides an individually adapted, cost-effective recall to every patient. Specifically trained assistants support the hygiene efforts of the patients. The focus is on diagnostics, recurring therapeutic measures take place in a site-specific and tissue-sparing manner. They are confined to a minimum.	The patient wishes to have their periodontal condition monitored at regular intervals. They would like to understand their problems in full detail. The patient regularly performs a perfect oral hygiene with the skill necessary to avoid damage to the gingiva and dental hard tissues. The patient takes care that regular recall appointments can be satisfied. The patient is a non-smoker or successfully weaned from smoking.	<ul style="list-style-type: none"> ■ No pockets >4 mm with frequent bleeding on probing ■ Minimal, sporadic occurrence of bleeding on probing ■ No open furcations which exhibit signs of inflammation and are not amenable to oral hygiene ■ No visible hard or soft deposits ■ Esthetically satisfactory periodontal conditions ■ Individually optimal occlusion ■ The patient is a non-smoker or successfully weaned from smoking.
A	Relevant diagnostics are carried out regularly. Gingival, periodontal, and hard tissue lesions are purposefully treated using adequate measures.	The patient is ready to undergo a periodontal examination; they try to understand the problems and they are willing to comply with a prescribed oral hygiene program and regularly arranged recall appointments. However, the hygiene program of the patient due to external reasons – both private and occupational – cannot always be satisfied. The patient is only a slight smoker (≤10 cigarettes per day).	<ul style="list-style-type: none"> ■ No pockets >4 mm which regularly bleed on probing ■ No probing depths >5 mm ■ No discharge of pus ■ Only few sites bleed on probing ■ Furcations which are either closed or open and cleanable ■ Only few sites with visible hard or soft deposits ■ Freedom from pain ■ Stable occlusion ■ The patient has reduced smoking.
B	At the request of the patient the practice provides a recall. Diagnostics are carried out at irregular intervals. Obvious lesions are adequately treated.	The patient is little interested in understanding the periodontal problems. They would like the dental hygienist or the dentist to solve the problems without their help. The patient is a smoker (11–19 cigarettes per day).	<ul style="list-style-type: none"> ■ Isolated pockets >4 mm regularly bleed on probing ■ Attachment level and pocket depths not stable everywhere ■ Discharge of pus at isolated sites ■ Several sites bleed on probing ■ Non-accessible/-cleanable furcations ■ Several sites with visible hard or soft deposits ■ Occasionally pain ■ Slightly impaired, correctable occlusion
C	No recall is provided. Lesions, if at all, are treated at the most in acute cases.	Refusal of the patient to acknowledge the periodontal problems, even if their existence is obvious. Missing willingness of the patient to undergo treatment, except in an emergency. The patient is a heavy smoker (≥20 cigarettes per day).	<ul style="list-style-type: none"> ■ Multiple sites exhibiting discharge of pus ■ Recurring abscess formation ■ Crude neglect of oral hygiene ■ Generalized bleeding on probing ■ Progressive significant loss of attachment at several sites ■ Persistence of occlusal disorders compromising function

3. Explanatory Notes

Standard protocol for the treatment of chronic or aggressive periodontitis

1. Diagnostics

MEDICAL HISTORY	<ul style="list-style-type: none"> ▪ Requests and subjective complaints, course and previous treatments ▪ General state of health and medical treatments ▪ Periodontal risk factors (smoking, stress, family history etc.)
CLINICAL EXAMINATION	<ul style="list-style-type: none"> ▪ Full mouth plaque score (PS, presence of plaque yes/no on four surfaces per tooth) ▪ Probing depth (PD), recession, bleeding on probing (four or six sites per tooth) ▪ Furcation involvement, suppuration, tooth mobility, vitality test ▪ Plaque retention elements (defective restorations, carious lesions etc.)
IMAGING	X-ray of every tooth exhibiting clinical signs of pathology
CASE PRESENTATION AND MOTIVATION	<ul style="list-style-type: none"> ▪ Explanation of the findings and the planned treatment ▪ Motivation for oral hygiene and reduction of modifiable risks (e.g. smoking)

2. Non-Surgical Treatment

PRETREATMENT	<ul style="list-style-type: none"> ▪ Supragingival tooth cleaning (using ultrasound or hand instruments) ▪ Elimination of plaque retention elements and obstacles for oral hygiene ▪ Extraction of teeth not worthy of preservation ▪ Urgent or preparatory dental treatments
INSTRUCTION OF ORAL HYGIENE	Instruction and practice of an adequate oral hygiene method (toothbrush, method of interdental cleaning, additional auxiliaries)
MONITORING OF ORAL HYGIENE	<ul style="list-style-type: none"> ▪ PS assessment several days after the instruction ▪ If PS is insufficient, remotivation, further instruction, and practice of oral hygiene ▪ Repetition of this step until a good level of oral hygiene is achieved
SCALING AND ROOT PLANING	Thorough root planing down to the pocket fundus using ultrasound and hand curettes (e.g. Gracey curettes) carried out in one session or several appointments in quick succession
CHEMICAL PLAQUE CONTROL	Antimicrobial mouthrinse for about two weeks (e.g. 0.2% chlorhexidine)
ANTIBIOTICS	In cases exhibiting multiple deep pockets which otherwise presumably would have to be treated further using a surgical approach, systemic antibiotics (in particular amoxicillin and metronidazole p.o.) can be indicated.

3. Aftercare and Reevaluation (after 1, 3, and 6 months)

MONITORING OF ORAL HYGIENE	<ul style="list-style-type: none"> ■ PS assessment ■ If PS is insufficient, remotivation, further instruction, and practice of oral hygiene
DEBRIDEMENT	<ul style="list-style-type: none"> ■ Supragingival tooth cleaning, if necessary ■ Reevaluation
AFTER 3–6 MONTHS	PD, recession, and bleeding on probing, suppuration, furcation involvement

4. Periodontal–Surgical Therapy (depending on the findings of the reevaluation)

CAUSE-RELATED MEASURES	Creation of a surgical access for root planing at sites which non-surgically were difficult to reach (e.g. deep pockets, open furcations) or for a reduction of pockets
REGENERATIVE THERAPY	<p>Pivotal for the success of additional regenerative measures is the morphology of the defect.</p> <ul style="list-style-type: none"> ■ Enamel matrix proteins ■ Guided tissue regeneration ■ Bone augmentation
FURTHER MEASURES	<p>After completion of the periodontal therapy, in conditions free from inflammation:</p> <ul style="list-style-type: none"> ■ Preprosthetic measures (e.g. crown lengthening) ■ Esthetically indicated supplementary treatments ■ Placing of implants ■ Other

5. Post–Therapeutic Care

CLINICAL EXAMINATION	PD, recession and bleeding on probing, suppuration, furcation involvement
IMAGING	Evaluation of the treatment success, as a rule not before the end of one year (in unclear situations maybe earlier)
ORAL HYGIENE	Remotivation, further instruction, and practice of oral hygiene if necessary
MAINTENANCE THERAPY	<ul style="list-style-type: none"> ■ Supragingival tooth cleaning if necessary ■ Specific countering of reinfections using suitable local measures (e.g. instrumentation of sites exhibiting increased probing depths, new loss of clinical attachment, bleeding on probing, suppuration)

4. References

Axelsson P, Nystrom B, Lindhe J: The long-term effect of a plaque control program on tooth mortality, caries and periodontal disease in adults. Results after 30 years of maintenance. *J Clin Periodontol* 31: 749–757 (2004).

Pihlstrom B L, Michalowicz B S, Johnson N W: Periodontal diseases. *Lancet* 366: 1809–1820 (2005).

Warnakulasuriya S, Dietrich T, Bornstein M M, Casals Peidró E, Preshaw P M, Walter C, Wennström J L, Bergström J: Oral health risks of tobacco use and effects of cessation. *Int Dent J* 60: 7–30 (2010).

Mombelli A, Décaillet F, Almaglouth A, Wick P, Cionca N: Effiziente, minimal-invasive Parodontitistherapie. Ein evidenzbasiertes Behandlungskonzept. *Rev Mens Suisse Odontostomatol* 121: 145–157 (2011).

Herrera D, Alonso B, León R, Roldán S, Sanz M: Antimicrobial therapy in periodontitis: the use of systemic antimicrobials against the subgingival biofilm. *J Clin Periodontol* 35 (Suppl): 45–66 (2008).

Walter C, Weiger R, Zitzmann N U: Periodontal surgery in furcation-involved maxillary molars revisited. An introduction of guidelines for comprehensive treatment. *Clin Oral Investig* 15: 9–20 (2011).

5. Authors of the Guidelines Periodontology

Authors of this edition:
 Andrea Mombelli, Geneva
 Jürg Schmid, Ilanz
 Clemens Walter, Basel
 Anton Wetzel, St–Gall

Authors of the first edition (1999):
 Markus Grassi, Niklaus P. Lang,
 Barbara Lehmann, Andrea Mombelli,
 Jürg Schmid