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# Supportive Periodontal Therapy: Hand instruments vs ultrasonic vs AirFlow—a literature update

The German S3 guideline “Treatment of Stage I–III Periodontitis” is the implementation of the S3 guideline “Treatment of Stage I–III Periodontitis” of the European Federation of Periodontology (EFP) (AWMF register number: 083–043 dated: December 2020. Valid until: November 2025). Section 7 deals with the topic of “Clinical Recommendations” for “Supportive Periodontal Care”. The aim of supportive periodontal care or therapy is to limit the rate of tooth loss and to stabilize or improve the periodontal situation.

It has been found that there remains a high risk of a relapse or progression after completion of active periodontal therapy. Patients require professional supportive periodontal therapy (SPT) that is adapted to their individual needs. This includes a combination of preventive and therapeutic measures that are performed at different intervals (from 3 months to a maximum of 12 months). These professional interventions require a structured recall system. The structured recall system should include monitoring of systemic and periodontal health, reinforcement of oral hygiene instructions, and encouragement of patients to continuously control risk factors as well as professional mechanical plaque removal (PMPR) and localized subgingival instrumentation at residual pockets. Along with repeated oral hygiene instructions adapted specifically for each patient, PMPR is an important component of SPT. Homecare measures are discussed in detail in the guideline. PMPR is only briefly mentioned as supragingival instrumentation to remove biofilm/calculus/debris. It is performed using hand or mechanical instruments (“conventional procedure”). “A procedure is considered to be subgingival instrumentation if it thoroughly removes biofilm and subgingival calculus from the root surface while protecting the body’s tissues as much as possible.”

Answers to the questions of the structure of the systematic recall process protocol, what tools should be included in the instrumentation (PMPR, subgingival instrumentation) and what should be the gold standard are not provided. The answers to these questions are of great importance for daily clinical practice.

## SPT: structured recall

According to the S3 guideline, the structured recall should include monitoring of systemic and periodontal health, oral hygiene instructions, patient motivation, continuous control of risk factors, professional mechanical plaque removal (PMPR), and localized subgingival instrumentation at residual pockets.

The modern recall protocol of Guided Biofilm Therapy (GBT), which was introduced in 2016 by EMS, Nyon, Switzerland, in collaboration with clinicians and university professors as an update to the recall session developed by Axelsson/Lindhe (1), includes all the requirements of the S3 guideline. By definition, GBT is a risk-oriented, evidence-based, systematic, modular, individual, universally applicable prevention and treatment protocol. GBT can be applied in all patients, even those with complex oral and general health issues, and in all age groups (Fig. 1).

## The meaning of the individual terms of the GBT definition:

- Orientation based on the risk of disease: Medical history, diagnostic findings, age-specific risk determination, diagnosis, and, derived from this, targeted (“guided”) systematic prevention and therapy.
- Evidence-based: All partial steps are evidence-based.
- Systematic prevention and therapy: A basic procedure is specified. The practitioner is led (“guided”) systematically through the protocol in eight steps.
- Modular: There are no time constraints for the individual steps as in the “pie model” according to Axelsson/Lindhe. The practitioner decides which modules are specifically used (“guided”) and how much time is used for the modules.
- Customized: Both home and professional interventions must be customized to the patient (participation).
- Universal: Prevention and therapy concept that can be applied to all oral and general health “cases”, even complex ones, and across all age groups.

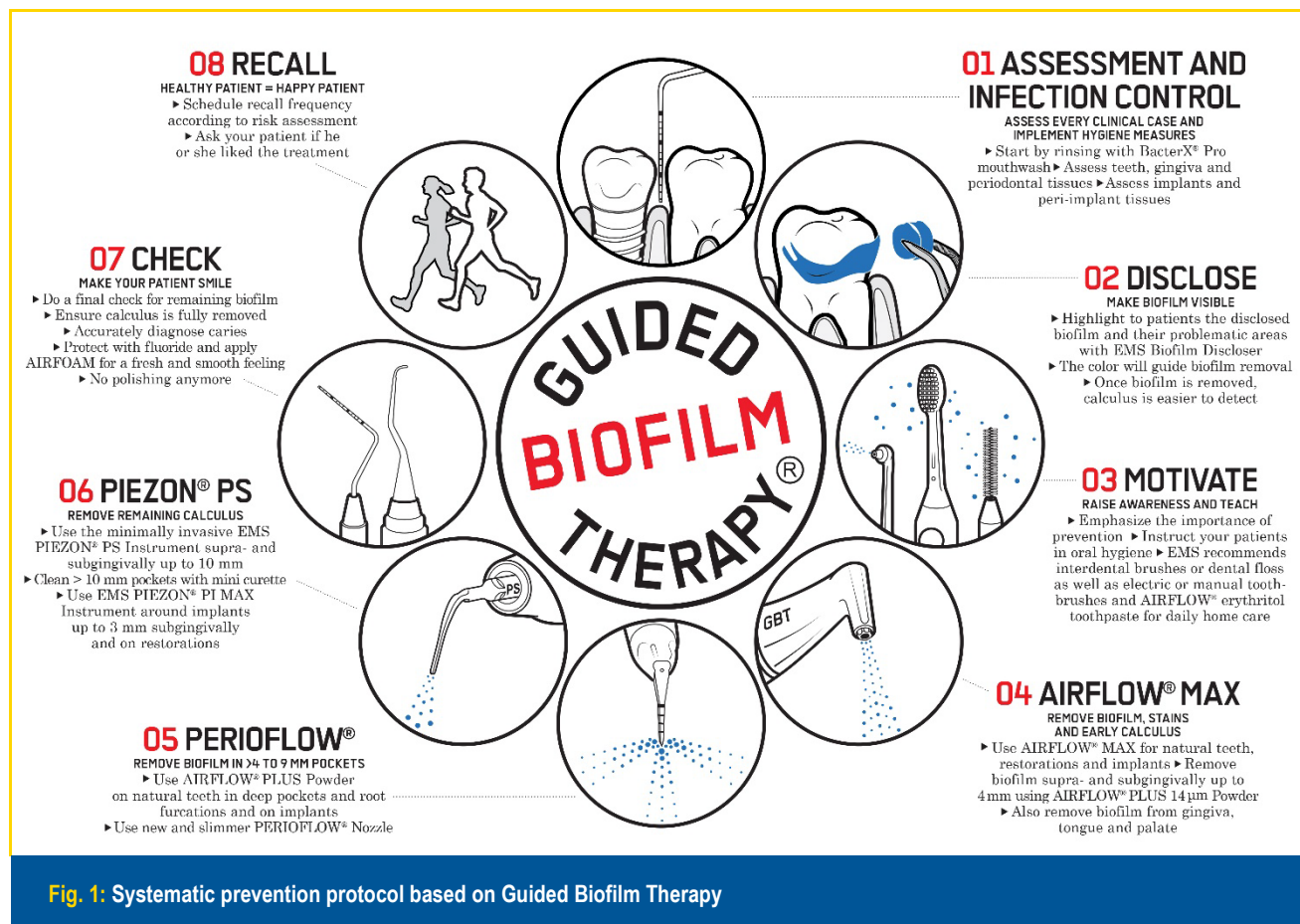


Fig. 1: Systematic prevention protocol based on Guided Biofilm Therapy

In summary, GBT includes all the steps required by the S3 guideline. For many years GBT has also satisfied all the requirements of modern oral prevention (4P and 1E derived from modern Industry 4.0):

- Predictive
- Preventive
- Personalized
- Participatory
- Ethical, because the profits of dental practices should be achieved by the health and not disease of the patients.

**SPT: Supragingival, subgingival instrumentation for biofilm and calculus management**

Today, the "Ecological plaque hypothesis according to Marsh" (2) is accepted worldwide as the etiology of the most important oral diseases. An essential component of supportive periodontal therapy is professional mechanical plaque removal (PMPR) (targeted supragingival biofilm/calculus management) and target subgingival cleaning (subgingival biofilm/calculus management).

It is very surprising that there are no clear statements in the S3 guideline about the tools required for this important part of SPT. Particularly in this area, providing a "clear guideline" would be extremely beneficial for clinicians. Professional biofilm management can be carried out by chemical and mechanical means or a combination of both. Professional mechanical management of supragingival biofilm and calculus (PMPR) and subgingival instrumentation can be performed with hand instruments (HI) such as scalers and curettes, mechanical aids such as sonic scalers (AS) and ultrasonic scalers (US) as well as with powder-water-jet devices (Air-Polishing / AirFlowing®) and "Rubber Cup Polishing" (RCP). The terms Air-Polishing (AP) and AirFlowing® (AF) are often used synonymously, but they differ considerably and must be distinguished from each other: Both systems work according to the same principle of powder-water-jet technology.

Like AirFlowing, Air-Polishing is a procedure used to remove soft deposits (biofilm/plaque) and discoloration on natural teeth and implants. For Air-Polishing, different devices from various manufacturers (table-top devices, hand-held devices) together with different powders can be used. A continuous flow of powder is not ensured and the flow of the powder-water mixture is turbulent. On the other hand, AirFlowing® is a technically, physically, and chemically coordinated system (Airflow Prophylaxis Master, Airflow or Perioflow handpiece, minimally invasive erythritol-based Airflow Plus powder) that is the only device that works with a constant and regulated powder flow rate and laminar flow (3) (Fig. 2).

■ **Keywords:** Biofilm, prevention, guidelines, periodontitis, recall ■



**Fig. 2:** Application of the AirFlow handpiece Max

## Effective supragingival biofilm removal

In the past, professional supragingival prevention focused mainly on the use of hand instruments and *classic polishing (Rubber Cup Polishing, RCP)*. These instruments are not very effective for biofilm management and lead to unnecessary loss of tooth structure and damage to the soft tissue. Hand instruments such as scalers and curettes are unsuitable for supragingival biofilm management. Scientific literature is not needed to confirm this. All that is needed is to conduct a small experiment. Disclosing the supragingival biofilm and then attempting to remove the stained biofilm with hand instruments confirms that this is a laborious and highly ineffective undertaking.

## Aids and effectiveness

Modern aids (powder-water-jet devices, ultrasonic devices) that are now available not only enable efficient management of biofilm and calculus but also make the preservation of substance and the comfort of patients and practitioners the focus of the treatment.

The values for *Aggregatibacter actinomycetemcomitans* were significantly lower when Perioflow technology was used. Pain was also reported as being significantly less for the Perioflow technology, leading

Groundbreaking in this context was a 2013 paper by Chetrus et al. (4), aimed at determining the most effective and easiest way to diagnose and remove biofilm. The conclusion was that “the most effective and easiest way to visualize biofilm is by disclosure because biofilm is difficult to see with the naked eye.” Almost 100% of the supragingival biofilm is removed using AP/AF® compared to only about 80% using RCP. More recent literature demonstrates even more clearly that AF® is superior to all other aids in targeted, effective biofilm removal. The results in the paper by Wolgin et al. 2021 (5) state: AF® achieves significantly better results in supragingival biofilm removal than RCP. This applies to both anterior and posterior teeth. Arefnia et al. (6) summarized as follows their results for cleaning enamel in a comparison of hand instruments, piezoceramic ultrasound, AF®, RCP, and combinations of all aids: “The best deep cleaning on enamel is achieved with AF® alone.” In summary, AF® in combination with ultrasonic aids (e.g., EMS PiezonNo-Pain/PS®) is superior to hand instruments as well as traditional polishing with rotary instruments, rubber polishers, brushes, and polishing paste (RCP).

This means that a maximum of 0.05 mm (50 µm) should be removed each year. In other words, at four maintenance sessions per year, a maximum of 12.5 µm of dentin/cementum may be removed in each session. Based on the

## Effective subgingival biofilm removal

S3 guideline “Subgingival instrumentation”, dated October 2019 DG-PARO: “There is no doubt that subgingival instrumentation is the standard for tackling causal infection and inflammation in periodontitis.”

## Aids and effectiveness

Sulcular biofilm can only be removed to a limited degree, if at all, with RCP. Subgingival biofilm removal is not possible. In contrast, the work of Petersilka et al. 2003 (7, 8) demonstrated that the application of AP with a low-abrasive powder (glycine) in moderate pockets resulted in a significantly greater reduction in the amount of subgingival bacteria than with hand instruments. Müller et al. 2014 (9) were able to demonstrate the advantages of Perioflow technology versus ultrasound technology for residual pockets ≥ 4 mm in maintenance therapy. The clinical parameters and bacterial counts were substantially identical.

## Aids and patient comfort

Wennström et al. (32) already demonstrated in 2005 that the same clinical results are achieved in non-surgical periodontitis therapy compared to the

patients to prefer Perioflow to ultrasound.

#### Summary:

Professional subgingival biofilm removal forms an essential part of non-surgical periodontitis therapy. Subgingival biofilm management is not possible with RCP. Precise separation into supragingival and subgingival/sulcular is not possible and not needed with modern aids and their combinations.

#### SPT and aids

In recent years there have been eight reviews published on the topic of SPT and AP/AF® as the sole therapy or as an adjuvant therapy as well as in comparison to the use of the aid in SPT (HI vs US vs AP/AF®) (10–17). The results are largely identical and can be summarized as follows: There are only slight differences in the clinical and microbiological parameters when using the various aids. AP/AF® is a safer, faster, gentler, and more comfortable option compared to SRP/HI and US.

Some more recent randomized controlled trials (RCTs) on the subject of SPT and the aids used also confirm the results of the systematic reviews (18–22): The clinical parameters improve in all groups (HI, US, AP/AF®), only slight or no differences are seen when comparing microbiological parameters, and AF® was significantly better for the comfort of patients and preservation of substance in all studies.

#### Aids and substance preservation

In 1997 Flemmig postulated that a loss of substance of more than 0.5 mm cementum/dentin over ten years is clinically unacceptable for maintenance therapy.

work by Ritz et al. (23) conducted in 1991, a contact force of 100 p with a magnetostrictive ultrasonic scaler leads to an average substance loss of 11.6 µm after 12 working strokes. This value lies exactly within the range of the maximum that may be ablated in one session. When using a sonic scaler and the same working conditions, the value is 93.5 µm. This is double the maximum value that should be lost in a year. When using a curette (500 p contact pressure), the substance loss is 108.9 µm and therefore also well above the proposed limit. Other studies (24, 25) also confirm that the order for the substance loss is always the same. Curettes exhibit the highest loss of substance, followed by sonic scalers, ultrasonic scalers, and powder-water-jet devices. The same picture is also evident when these aids are applied to the gingiva (26). As early as 1984 Badersten et al. (27, 28, 29) summarized their study results as follows: Hand instrumentation in pockets up to 4 mm leads to attachment loss, and loss of substance is very often accompanied by tooth hypersensitivity.

Substance preservation must also be the aim for restoration materials.

Reinhart et al. 2022: RCP (Cleanic prophylaxis paste from Kerr, Switzerland) caused significantly higher wear from composite, ceramic, and gold compared to erythritol powder with AirFlowing® (EPAF®). AIR-FLOW® PLUS powder (EMS, Switzerland) can be used for cleaning teeth with permanent restorations without any concerns (30). Zotter et al. 2022 concluded that Airflow® Plus powder is indicated for all materials tested (adult human dentin, deciduous enamel, amalgam, nano-hybrid composite, flowable composite, zirconia, titanium, metal-reinforced glass ionomer cement, feldspar ceramic, glass ceramic, and hybrid ceramic) (31).

classical approach (scaling root planing with hand instruments) versus piezoceramic ultrasonic scaler (PUS). For PUS the treatment time was only one-third, the anesthetic consumption was only 40%, and patient comfort was considerably better.

Aslund et al. (33) compared curettes and Piezon in non-surgical periodontitis therapy in terms of pain and cervical hypersensitivity. The clinical parameters improved to an equal degree in both groups. Significantly less hypersensitivity occurred after one, four, and eight weeks with the use of PUS.

The greatest comfort level for patients is achieved with the use of Airflow technology compared to all other aids. Patients experience less pain and discomfort during prevention and non-surgical periodontal therapy when Airflow technology (AF) is used compared to ultrasonic devices and hand instruments. This is demonstrated in a very large number of scientific papers. By way of example: 2015 Simon CJ: AF has the best patient comfort; 2017 Sultan DA et al.: AF is superior to the conventional treatment approach in terms of patient comfort, safety, and time required; 2018 Divinic-Resnik et al.: There are further benefits for patient comfort and time required; 2020 Vouros I: GBT is preferred by patients; 2021 Fu JHF: AF has the best patient comfort (23, 34–37).

#### Summary

SPT plays a very important role in periodontal therapy. Regular SPT helps patients with treated periodontitis to stabilize their periodontal situation and limit the rate of tooth loss.





**Fig. 3:** Application of Piezon/PS

Successful integration of SPT into routine clinical practice requires a structured recall system such as that offered by GBT. Along with oral hygiene instructions and motivation of the patient, professional mechanical plaque removal (PMPR) and localized subgingival instrumentation at residual pockets are a critical component of the structured recall system.

Even though the S3 guideline does not provide any detailed recommendations for a structured recall system and aids for professional mechanical plaque removal (PMPR) and for localized subgingival instrumentation, whether from a supposed flaw or a lack of evidence, it would be very helpful for routine clinical practice to include appropriate instructions and recommendations.

More recent literature shows that Air-Flowing combined with US (particularly with piezoelectric ultrasound / Piezon-NoPain®/PS) in SPT can stabilize the periodontal situation.

## References:

The extensive list of references for this article is available on our website [www.prophylaxe-impuls.de](http://www.prophylaxe-impuls.de).

While for decades the focus was solely on the effectiveness of biofilm and calculus management, these days the preservation of substance and the comfort of both patient and practitioner are increasingly taking center stage. Biofilm and calculus management in prevention and initial and maintenance therapy (SPT) must now be conducted painlessly and in a manner that preserves substance (see the requirements of the S3 guideline). If this is successful, then the recall adherence rate will increase significantly. With this harm-benefit analysis, which is not taken into account in the S3 guideline, the Air-Flowing system / PUS has all the advantages (Fig. 3). The long-term success of periodontal therapy is closely related to adherence by patients. Painless SPT that preserves substance is the key to a low drop-out rate for SPT.

Another important point for successful integration of SPT into routine clinical practice is the learning curve associated with the various aids. Again, there are benefits associated with the Air-Flowing system / PUS. Skilled dental professionals should choose simple methods and instruments that align with their skills and preferences.

In summary, I would like to quote C.D. Naylor (136 research studies with 9,566 citations) in regard to the S3 guideline:

“There is also a certain irony that we most likely can access quick and simple rules of thumb if we learn to understand the cognitive processes of those outstanding doctors who invariably make excellent decisions without identifiably adhering to the canon of evidence-based medicine ...”

## Conflict of interests

In the interests of transparency, Dr. Klaus-Dieter Bastendorf would like to declare that he is a member of the “Scientific Board” of EMS Electro Medical Systems S.A., 1260 Nyon, Switzerland. Furthermore, he is active as a speaker on behalf of EMS and receives fees for his services.

There is no conflict of interests for Dr. Nadine Strafela-Bastendorf. pi

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