**Subgingival debridement: end point, methods and how often?**

For figures, tables and references we refer the reader to the original paper.

Subgingival debridement is the part of nonsurgical therapy which aims to remove the biofilm without intentionally removing the cementum or subgingival calculus. The objective of this review was to describe the end point of this therapy, the different methods used and how often it should be carried out. The literature shows that several methods are currently available for subgingival debridement, namely hand instrumentation, (ultra)sonic instrumentation, laser, photodynamic therapy and air-polishing. None of these methods seems superior to any other regarding clinical benefits or microbiological differences. However, less treatment discomfort is reported using laser, photodynamic therapy or air-polishing compared with hand- and/or (ultra)sonic instrumentation. Subgingival debridement can be carried out when, during supportive periodontal therapy, pockets of 5 mm or deeper are detected.

Periodontal disease was described for the first time in the second half of the 19th century by Dr John Riggs, who called it Riggs disease [[26, 67](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0026)]. At that time, the gold standard for periodontal therapy consisted of gingival resection. However, Riggs, who was an opponent of periodontal surgery, promoted the concept of prophylaxis and reported his method of nonsurgical periodontal therapy in a paper in 1876 [[67](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0067)]. Nonsurgical therapy still remains an important part of periodontal therapy.

Instrumentation of the periodontal pockets is one of the most important procedures carried out during nonsurgical therapy. A plethora of terms has been used to describe periodontal instrumentation, of which ‘debridement’ is only one. These terms are often used interchangeably, which makes interpretation of the term ‘debridement’ difficult. For the purpose of this review and in accordance with the definition proposed during the first European Workshop on Periodontology, subgingival debridement was defined as the gentle mechanical subgingival instrumentation carried out to disrupt and/or remove the acquired biofilm [[46](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0046)]. As such, subgingival debridement can be part of initial cause-related therapy, surgical therapy, as well as supportive periodontal therapy. This review will focus on treatments that can be implemented by dentists after initial therapy for mechanically disrupting and/or remove subgingival microbial communities.

The semantic problem

During the first European Workshop on Periodontology, it was described that root surface instrumentation (performed to restore the biocompatibility of periodontally diseased root surfaces) consists of three separate components [[46](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0046)]: subgingival debridement, subgingival scaling and root planing [[46](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0046)]. According to these definitions, the aim of subgingival debridement is the removal or the disruption of the subgingival biofilm. Subgingival scaling is, identically to its supragingival counterpart, directed toward removing subgingival calculus. Root planing refers to the removal of contaminated cementum. In theory, these three steps are well defined, but clinically it is difficult to separate them. As a result, it is inevitable that they show some degree of overlap.

According to Drisko in 2001 [[28](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0028)], the term ‘debridement’ was pioneered by Smart and coworkers in 1990 [[89](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0089)]. It was introduced to describe the conservative instrumentation of root surfaces with an ultrasonic scaler, in which light pressure was applied for a short period of time and use of overlapping strokes was ensured [[89](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0089)]. However, Smart and coworkers were not the first to bring up the term ‘debridement’. Before the 1990s, ‘root debridement’ was already a term frequently used in different articles [[7-9, 20, 58, 69, 78](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0007)]. In none of these articles was the term ‘root debridement’ described in detail, although one can assume that it was used as a synonym for ‘scaling and root planing’. For example, Badersten and coworkers [[7](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0007)] described the result of root debridement as ‘adequately debrided and planed root surfaces’. In 1994, subgingival debridement was defined during the first European Workshop on Periodontology as part of nonsurgical therapy. According to the consensus definition, with ‘debridement’ one aims to remove the subgingival biofilm by gentle instrumentation, without intentionally removing the cementum or subgingival calculus [[46](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0046)].

However, even after introducing this consensus definition in 1994, the term subgingival debridement is often used more broadly. Some authors continue to use ‘debridement’ interchangeably with ‘scaling and root planing’, while others consider calculus removal a result of debridement [[11, 24, 29, 30, 38, 40, 44, 45, 52, 71, 94](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0011)]. This idea is in accordance with the definition of the Medical Subject Headings term ‘periodontal debridement’, which is defined as:

… removal or disruption of dental deposits and plaque-retentive dental calculus from tooth surfaces and within the periodontal pocket space without deliberate removal of cementum as done in root planing and often in dental scaling. The goal is to conserve dental cementum to help maintain or re-establish a healthy periodontal environment and eliminate periodontitis by using light instrumentation strokes and nonsurgical techniques.

According to Heitz-Mayfield & Lang [[40](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0040)], a possible explanation for the ambiguous use of the term debridement can be found in a shift in thinking over the past decades. In the 1970s and 1980s, the method of treating periodontally involved root surfaces was to remove the periodontally involved cementum by means of intensive root planing [[15, 25](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0015)]. Since the 1990s, the need to remove cementum as key to a successful periodontal treatment has been challenged. What is now understood as root planing is thus different from what root planing meant 30 years ago. To date, it does not involve aggressive removal of cementum [[40, 47](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0040)]. This change in the understanding and way of thinking has certainly contributed to the mixed use of the terminology scaling, root planing and debridement.

Consequently, the different interpretations of the term ‘subgingival debridement’ in the available literature have made the search for articles about this topic extremely complicated. On the one hand, when using ‘debridement’ as a search term in electronic databases (PubMed MEDLINE, Cochrane) the majority of the search results deal with root planing studies. On the other hand, many studies dealing with subgingival debridement use synonyms such as subgingival curettage, professional tooth cleaning, maintenance scaling, subgingival instrumentation, routine scaling and polishing. This made reviewing the existing information challenging. As mentioned above, subgingival debridement is understood (regardless of how the authors named the treatment) as the gentle mechanical subgingival instrumentation for disrupting and/or removing the acquired biofilm, without intentionally removing cementum.

The role of debridement in periodontal therapy

Subgingival debridement, as defined during the first European Workshop on Periodontology, can be a part of cause-related therapy, surgical therapy, as well as supportive periodontal therapy. During initial, cause-related therapy, the supragingival and subgingival biofilm and calculus are mechanically removed by a combination of debridement, scaling and root planing. Nonsurgical therapy is addressed in other chapters of this volume of Periodontology 2000, namely by Cobb [[21](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0021)], Graziani et al. [[34](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0034)], McCracken et al. [[62](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0062)] and Slots [[88](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0088)], and will not be discussed in detail in this paper.

Debridement can also be part of surgical therapy when, during flap surgery, soft microbial deposits are removed from the root surfaces under direct view. Although there is a clear rationale for performing debridement during periodontal flap surgery, to the best knowledge of the authors, the significance of debridement during flap surgery has barely been investigated. At best, Nyman and coworkers [[70](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0070)] demonstrated, in a split-mouth study, that scaling and root planing during flap surgery versus debridement leads to a comparable improvement in periodontal health. In a split-mouth study in 11 patients, two quadrants were carefully scaled and planed after flap elevation in order to remove all soft and hard deposits, as well as all cementum. In the contralateral quadrants, after flap elevation, the roots were only polished (using rubber cups, interdental rubber tips and a polishing paste). After 1 year, the same improvement in periodontal health (based on gingival index, bleeding on probing and probing pocket depth) was found. In view of the paucity of data, determining the effect of debridement during periodontal surgery was not within the scope of this review.

Subgingival debridement is also an important part of supportive periodontal therapy. The goal of supportive periodontal therapy is to prevent disease progression in patients with periodontitis that has previously been treated [[18, 22](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0018)]. Although the use of subgingival debridement in supportive periodontal therapy is common practice, the scientific evidence to support its effectiveness is poor [[91](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0091)]. It is also important not to regard subgingival debridement as a stand-alone action. It cannot be performed without removing the supragingival biofilm and calculus [[30](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0030)]. Subgingival debridement should be seen as one of the components of mechanical instrumentation during supportive periodontal therapy. In addition, oral hygiene (re-)instruction also forms a significant part of supportive periodontal therapy [[91, 94](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0091)]. With these points in mind, the aim of this review was to describe the role of subgingival debridement in supportive periodontal therapy.

The available techniques

Hand instrumentation

Hand instruments have been the gold standard for many years in performing a debridement. These instruments are composed of a handle, a shank and a blade. The blade is the working part of the instrument and needs to be correctly and frequently sharpened to deliver the required effect. Based on different designs of the blade, the instruments are categorized as curettes, sickles, hoes or files. Curettes are the instruments most commonly used and can be applied for supra- and subgingival debridement. They are mostly double-ended with mirror-turned blades. The blade has two curved cutting edges that are joined by a rounded toe. Sickles and hoes are mainly used for supragingival debridement. Sickles present either a curved or a straight blade with two cutting edges and are sometimes used subgingivally at tooth sites with shallow pockets. The blade of the hoes can be positioned at four (mesial, distal, vestibular and palatal/lingual) different inclinations in relation to the shank and has only one cutting edge bevelled at a 45° angle. Files are sometimes used for smoothing root surfaces that contain stubborn deposits. The use of hand instruments is considered to be physically more demanding for the clinician and more time consuming than use of sonic and ultrasonic instruments. However, subgingival debridement with hand instruments is considered the treatment of choice because it allows a good tactile sensation and control over the instrument. It is believed that the technique should be mastered by every clinician who practices periodontal therapy [[63](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0063)].

(Ultra)sonic instrumentation

Around 1960, the first sonic, and later ultrasonic, instruments became available and have become a common alternative or addition to hand instruments. The main difference from hand instruments is that power-driven instruments are used with water cooling that is passed over the tip to reduce frictional heating [[54](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0054)]. The vibration may also generate cavitation within the water which could assist in the cleaning process. The difference between sonic instruments and ultrasonic instruments is to be found in the frequencies of vibration. Sonic devices are driven by air pressure to create mechanical vibration, and the frequencies range from 2,000 to 6,000 Hz [[33, 85](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0033)]. Ultrasonic devices convert electrical current into mechanical energy in the form of high-frequency vibrations, ranging from 18,000 to 45,000 Hz. There are three types of ultrasonic instruments: magnetostrictive scalers; piezoelectric scalers; and the Vector system. The main difference between the first two is the pattern of vibration at the tip; the magnetostrictive scaler has an elliptical pattern while the piezoelectric scaler has a linear pattern. The Vector system has a different cooling method, namely a water-based medium containing polishing particles of various sizes dependent on the therapeutic indication [[35, 84](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0035)]. Power-driven instruments are easier to use and may debride teeth significantly faster than hand instruments [[92](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0092)].

A systematic review on the clinical effectiveness of hand instruments compared with powered instruments reported no difference in the effectiveness of subgingival debridement using ultrasonic, sonic or hand instruments in the treatment of single- rooted teeth. However, power-driven instruments are easier to use and subgingival debridement may be completed in a shorter time with ultrasonic and sonic instruments [[92](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0092)].

Laser and photodynamic therapy

The use of lasers in the treatment of periodontal disease was introduced in the early 1990s and its application in subgingival debridement has also been reported. An ablative laser device produces coherent electromagnetic radiation, characterized by a well-defined wavelength and a low divergence of the radiation beam. Laser therapy is reported to have bactericidal and detoxification effects and to be capable of removing biofilms [[42](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0042)]. CO2 lasers seem to be less effective for root debridement, and potential thermal damage in the periodontal pocket and surrounding tissues has been reported [[4](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0004)]. Neodymium-doped yttrium aluminium garnet (Nd:YAG) and diode lasers have been described to have quite good bactericidal and soft-tissue debridement properties [[4](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0004)]. However, they always have to be used in combination with mechanical instrumentation. Because of less-effective removal of deposits, as well as the considerable thermal damage on the root surface that they might produce, these lasers cannot be used as a replacement for mechanical instruments in root debridement procedures [[42](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0042)]. The most promising laser for debridement seems to be the erbium-doped yttrium aluminum garnet (Er:YAG) laser, which is capable of effectively removing biofilm and calculus. The energy produced by an Er:YAG laser is absorbed by water and organic components. This will raise the temperature and convert water into vapor, thereby increasing the internal pressure within the deposits. Because of this expansion, the deposit can detach from the root surface. The Er:YAG laser also has a high bactericidal effect against periodontal bacteria at a low energy level [[3, 32](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0003)]. It has the potential to ablate the root surface and remove toxins diffused into the root cementum with minimal loss of tooth substance [[51, 97](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0051)]. However, there is still limited evidence to support laser therapy for subgingival debridement alone or in association with classical debridement [[1](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0001)].

Photodynamic therapy has also been tested in clinical studies as an adjunctive debridement method, especially during maintenance therapy. Photodynamic therapy is based on the principle that a photosensitizer binds to the target cells and is activated through light of a certain wavelength. In turn, singlet oxygen and other reactive agents are produced, which are extremely toxic to certain cells and bacteria [[27, 86](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0027)].

Air-polishing

The application of air-polishing has been suggested as a treatment approach for subgingival debridement. The ability of a jet of air, powder and water to remove biofilm relies on a combination of cutting, fatigue and brittle fracture of the various materials. To produce the abrasive slurry of particles, the powder inside the powder chamber is stirred up by pressurized air. This is then transported to the tip of the air-polishing nozzle by airflow and is mixed with water [[73](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0073)]. Sodium bicarbonate air-polishing devices have been used since the 1980s in periodontal therapy. They have been demonstrated to be safe and efficient for removing supragingival plaque [[10, 41, 50](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0010)]. However, they are not suitable for use subgingivally because of significant root-substance removal and damage during application [[6](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0006)]. To overcome this problem, low-abrasive glycine powder air-polishing has been introduced. However, for calculus removal or initial therapy, hand instruments or oscillating scalers are still the instruments of choice [[31](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0031)].

Immediate end point

Theoretically, the immediate end point of subgingival debridement is disruption and/or removal of biofilm so that a root surface is obtained that is biologically acceptable for the (re)attachment of periodontal tissues [[26, 28](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0026)]. To date, it is not known exactly to what extent, either quantitatively or qualitatively, oral biofilms are compatible with healthy periodontal conditions. As a result, the clinical end point of debridement is a biofilm-free surface that is achieved by removing all detectable biofilm from the root surfaces [[5](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0005)]. This end point cannot, in contrast to scaling and root planing, be measured based on the smoothness of the root surface. Although reattachment, after scaling and root planing, on subgingival calculus and any remaining biofilm has been described in the literature [[74](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0074)], removal of all subgingival calculus and leaving a smooth root surface is still the clinical end point for scaling and root planing. It can be assumed that patients who participate in a supportive periodontal therapy program already have smooth roots. As subgingival calculus develops very slowly, unlike supragingival calculus, it is not expected to be found in patients participating in a supportive periodontal therapy program [[5](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0005)]. A proposed end point of debridement is therefore an empty curette [[5](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0005)].

To study the efficiency of subgingival debridement and to compare the available methods, an estimation of the amount of residual biofilm is necessary [[74](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0074)]. To our knowledge, in contrast to the different studies focusing on efficacy of calculus removal [[59, 77](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0059)], only a few dealing with plaque-removal efficiency are available. These studies all examined biofilm removal in patients with active periodontal disease. Chan and coworkers [[17](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0017)] found that the percentage apical plaque border (calculated by comparing the total length of apical plaque border with the total length of connective tissue attachment) is significantly different between instrumented surfaces and control surfaces. Kocher and coworkers [[47](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0047)] also showed that debridement leads to statistically significant less plaque subgingivally than when root surfaces were left untreated. Additionally, they found that curettes left significantly less plaque (1.9%) than the other debridement methods studied, including sonic (5.4%) and ultrasonic (5.4%) scalers.

Long-term effects

As described above, the immediate end point of debridement is removal of the subgingival biofilm. However, in the long term, this is only a surrogate end point to evaluate the efficiency of debridement in supportive periodontal therapy. The true goal is maintaining a stable periodontium by preventing the recurrence and progression of periodontal disease. This can be evaluated based on the changes in probing pocket depth, attachment level and ultimately tooth loss. To evaluate the specific role of subgingival debridement in supportive periodontal therapy, the ideal comparison would be supportive periodontal therapy, with and without subgingival debridement. A systematic review with this aim was written in 2002 by Heasman and coworkers [[38](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0038)]. They evaluated the effectiveness of supragingival prophylaxis versus subgingival debridement during supportive periodontal therapy in patients with previously treated chronic periodontitis. Based on 11 articles, it was concluded that no firm recommendations for clinical practice could be made. However, the best available evidence at that moment seemed to indicate that clinical outcomes at 12 months were comparable between supragingival prophylaxis and subgingival debridement.

Solely one paper has directly compared coronal scaling only with coronal scaling plus adjunctive subgingival debridement. Jenkins and coworkers [[43](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0043)] included patients who were in the supportive periodontal therapy phase of treatment and had at least four pockets of 4 mm or deeper. The subjects were randomly assigned to coronal scaling only or coronal scaling plus subgingival debridement, both at 3-month intervals (baseline, and 3, 6 and 9 months). In the subgingival debridement group, care was taken to clean the entire root surface using overlapping strokes, but also avoiding, as far as possible, trauma to the base of the pocket. After 12 months, the data of 31 patients were analyzed. For the group that received coronal scaling only, the mean pocket depth reduction was 0.65 ± 0.14 mm and the mean attachment loss was 0.20 ± 0.18 mm. For the group that received coronal scaling plus subgingival debridement, the mean pocket depth reduction was 0.45 ± 0.18 mm and the mean attachment loss was 0.11 ± 0.20 mm. No statistically significant differences were detected between the two treatment groups at any time point. However, one should bear in mind that these values were calculated after excluding sites with the largest attachment loss in both groups. When a site in a patient of the coronal scaling group exhibited attachment loss of 2 mm or more compared with baseline values, subgingival scaling was carried out. These sites were excluded from the analyses, together with similar loser sites form the subgingival scaling group.

To our knowledge this is still the only study available that compares supportive periodontal therapy with and without subgingival debridement. However, there are several studies available that describe the effect of subgingival debridement on remaining deep pockets during supportive periodontal therapy. The most recent papers studying different methods of subgingival debridement and reporting clinical and/or microbiological outcomes are summarized in Table [1](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-tbl-0001). The effect of subgingival debridement on probing pocket depth, microbiological parameters and tooth loss is discussed in detail below.

Table 1. Summary of studies examining different methods of subgingival debridement with at least 1 week of follow-up

Probing pocket depth

All methods for subgingival debridement (hand instruments, [ultra]sonic therapy, laser, photodynamic therapy and air-abrasion) seem to reduce the probing pocket depths of deep pockets significantly [[13, 14, 18, 23, 36, 37, 48, 51, 57, 64-66, 68, 75, 76, 83, 87, 95](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0013)] compared with baseline values. The use of hand instruments and/or (ultra)sonic instruments seem to give pocket reduction similar to that achieved using a laser, photodynamic therapy or air-abrasion [[13, 14, 18, 23, 36, 37, 48, 51, 57, 64-66, 68, 75, 76, 83, 87, 95](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0013)]. All articles comparing laser therapy or air-abrasion with hand instrumentation and/or (ultra)sonic instrumentation showed comparable pocket depth reductions between the techniques examined [[36, 37, 51, 66, 68, 79, 87, 95](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0036)]. The data from studies comparing photodynamic therapy with hand- and/or (ultra)sonic instrumentation are more ambiguous. Five out of eight studies did not show a difference in pocket probing depth reduction [[14, 18, 48, 57, 83](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0014)], whereas three did show statistically significantly more pocket probing depth reduction when using photodynamic therapy compared with hand instrumentation and/or (ultra)sonic instrumentation [[12, 23, 65](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0012)].

Microbiological differences

For the papers describing the effect of debridement on microbiological parameters, a general trend can be detected. Immediately after debridement there is a significant decrease in the number of periodontal pathogens [[64, 90](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0064)]. After some time, the microbiota seem to regrow to the same load and composition as before the subgingival debridement [[14, 66, 83, 90, 95](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0014)]. In contrast, some studies did not find any effect of subgingival debridement on bacterial load [[65, 79](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0065)].

The specific recovery rate of the periodontal pathogens after debridement is not clear. Two weeks after debridement, both a significant decrease in the number of periodontal pathogens [[14](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0014)] and a rebound effect were detected [[95](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0095)]. The available literature seems to indicate that the microbiological effect is lost 1–2 months after debridement. Tomasi and coworkers [[90](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0090)] detected a significant impact on the ‘red-complex bacteria’ (Porphyromonas gingivalis, Treponema denticola and Tannerella forsythia) 2 days after laser or ultrasonic debridement. A tendency for relapse was, however, seen for these species of bacteria after 1 month. Rühling and coworkers [[83](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0083)] found that immediately after treatment the bacterial counts were reduced by about 30–40%, but returned to baseline values after 3 months. Two weeks after debridement, Cappuyns and coworkers [[14](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0014)] found that the detection frequencies of the red-complex bacteria were significantly lower compared with the detection frequencies at baseline. After 2 and 6 months, these differences were no longer significant. Wennström and coworkers [[95](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0095)] identified a reduced number of periodontitis-associated bacteria immediately after both air-polishing and ultrasonic debridement, as well as at day 2. At day 14, the number of periodontitis-associated bacteria had recovered to pretreatment levels.

The microbiological outcomes are not influenced by the method of subgingival debridement. Most studies did not find intergroup differences regarding the main periodontopathogens and total bacterial load [[18, 51, 65, 79, 83, 90, 95](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0018)]. For some specific bacteria, a difference in occurrence could be detected; however, no trend was discovered. A short-term follow-up study found smaller numbers of Aggregatibacter actinomycetemcomitans in patients who underwent photodynamic therapy than in those treated with curettes and an ultrasonic debridement [[23](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0023)]. Other authors showed greater reduction in the number of Eikenella corrodens and Capnocytophaga species following photodynamic therapy than sonic scaling at 3–6 months post-treatment. Petersilka and coworkers [[75](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0075)] found that air-polishing resulted in a significantly greater reduction in the numbers of subgingival bacteria than did hand instrumentation.

Tooth loss

To our knowledge, there are no studies available linking subgingival debridement and tooth loss. A possible reason for this can be the relatively short follow-up period of studies examining subgingival debridement (from 1 week to 1 year). Tooth loss is, of course, a slow process for which longer follow-up periods are necessary. However, based on the available literature on tooth loss and supportive periodontal therapy, one can assume that traditional supragingival oral hygiene alone is not sufficient to control attachment loss. Subgingival debridement thus might play an important role in maintaining teeth [[1](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0001)].

Several authors have pointed out that tooth loss is inversely proportional to the frequency of supportive periodontal therapy [[1, 55](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0001)]. More than 30 years ago, Wilson and coworkers [[96](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0096)] retrospectively surveyed 162 periodontal maintenance patients regarding tooth loss in the previous 5 years. The patients were divided into two groups: patients who complied with the suggested maintenance schedule; and patients with an erratic compliance. Of the compliant group, none of the patients had lost any teeth. All teeth were lost in the patients from the erratic group. The less frequently that the patient attended the maintenance visits, the more likely he or she was to lose teeth.

After analyzing the predictors of tooth loss during long-term periodontal maintenance, Chambrone and coworkers [[16](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0016)] concluded that overall, long-term periodontal maintenance maintained periodontal health and prevented tooth loss in most patients. More recently, Trombelli and coworkers [[91](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0091)] showed that the level of patient adherence to supportive periodontal therapy impacted significantly on tooth loss. In patients undergoing routine professional mechanical plaque removal, the weighted mean yearly rate of tooth loss was 0.15 ± 0.14 after a follow-up of 5 years and 0.09 ± 0.08 after a follow-up of 12–14 years. This means that the mean rate of tooth loss was below 0.1 tooth per year after 5 up to 14 years of follow-up. People strictly attending a supportive periodontal therapy program, for whom subgingival debridement can be carried out when deemed necessary, have less risk of losing teeth than people not attending a supportive periodontal therapy program, in whom one can assume that subgingival debridement is not carried out in a ‘timely’ manner.

Patient experience

None of the studies stated that subgingival debridement was experienced as being painful, as such, by the patients. However, it seems that some techniques for subgingival debridement are reported as being less comfortable than others. Less treatment discomfort is reported when comparing laser therapy with conventional therapy [[79, 90](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0079)]. Accordingly, air-polishing is described as being significantly more comfortable and less painful than conventional instrumentation [[64, 66, 75, 76, 95](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0064)]. The most frequently reported side effect of air-polishing was that some of the subjects felt sensitivity to cold during this treatment [[64, 66](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0064)].

Debridement: how often?

Subgingival debridement is an important part of supportive periodontal therapy, in addition to an update of the medical and dental history, supragingival biofilm and calculus removal and oral hygiene reinforcement. As there are no studies available with particular focus on how often debridement should be performed, one could try to deduce this from the time interval between different supportive periodontal therapy sessions. The most commonly reported time interval between different supportive periodontal therapy appointments is 3 months [[22](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0022)]. This is based on the plethora of studies using quarterly intervals as part of the study protocol [[61, 81](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0061)]. However, there is no strong evidence regarding the efficacy and safety of different time intervals for supportive periodontal therapy [[56, 82, 93](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0056)]. The few studies exploring different supportive periodontal therapy frequencies could not show any clinically significant differences between various supportive periodontal therapy frequencies ranging from 1 month to up to longer than 1 year [[56, 82, 93](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0056)]. Moreover, it does not seem plausible that another round of instrumentation with the same instruments and technique can augment the effectiveness in areas not reached during the first instrumentation [[49](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0049)]. Anderson and coworkers [[2](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0002)] examined the effectiveness of calculus removal between a single or three consecutive episodes of scaling and root planing within 48 h. In 15 patients, one tooth was subjected to a single episode of scaling and root planing, while another was additionally instrumented after 24 and 48 h. A single episode of scaling and root planing was as effective as three in removing calculus. In 1984, Badersten and coworkers [[9](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0009)] examined the effect of a single instrumentation versus repeated instrumentation. They selected 13 patients with severely advanced periodontal disease. One side of the mouth was instrumented once; in the other side of the mouth, the instrumentation was repeated after 3 and 6 months. However, up to 24 months after the first instrumentation, no differences in bleeding on probing and probing pocket depth could be noted. One has to be extremely careful when interpreting these data because they seem to contradict the previously mentioned data on the effect of compliance and erratic compliance to supportive periodontal therapy. As mentioned before, supportive periodontal therapy encompasses much more than merely debridement. It might be that in patients with suboptimal oral hygiene, repeated debridement as part of the supportive periodontal therapy is effective, but in patients with optimal oral hygiene, its effect is negligible. One has to realize that in most studies, the oral hygiene levels are kept optimal as a result of repeated oral hygiene reinforcement, thereby reducing the impact of repeated subgingival debridement. As a clinician, one has to strive for optimal oral hygiene; however, in practice, this is sometimes not achievable as a result of motivational or dexterity issues, or in patients with learning difficulties or physical disabilities. Unfortunately, there is currently no study available that compares the impact of frequency of debridement or supportive periodontal therapy in patients with good oral hygiene versus patients with erratic or suboptimal oral hygiene. Therefore, the present scientific evidence does not allow a specific or the ideal frequency of supportive periodontal therapy or debridement to be determined. Additionally, it is important to realize that there is a need for individual tailored supportive periodontal therapy intervals according to the needs of the patient, which are often not taken into consideration in studies looking at intervals of supportive periodontal therapy or debridement frequency. In order to overcome this problem, clinicians can use the periodontal risk calculator or periodontal risk assessment [[53, 72](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0053)] to decide on patient-specific supportive periodontal therapy intervals. These tools do not rely solely on probing pocket depth for determining the ideal supportive periodontal therapy frequency. They use a combination of variables and additional risk factors, such as age, smoking history, bone loss and genetic factors, to propose a supportive periodontal therapy interval.

Although subgingival debridement is part of supportive periodontal therapy, this does not mean that subgingival debridement is mandatory at every supportive periodontal therapy visit. Subgingival debridement may only be recommended when the pockets are ≥ 5 mm, given that residual pockets of ≥ 5 mm are predictive for further attachment and tooth loss [[19, 39, 60, 80](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0019)]. Moreover, subgingival debridement of pockets < 4 mm is not recommended as this might induce attachment loss. Additionally, the idea of repeated subgingival debridement is challenged because it is not clear if the benefit of disturbing the microbiota outweighs the traumatic effect [[49, 51](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0049)]. It has been suggested that repeated instrumentation can lead to removal of tooth substance, which can cause tooth sensitivity and an ‘hour glass appearance’ at the root–crown interface [[51, 61](http://onlinelibrary.wiley.com/doi/10.1111/prd.12204/full#prd12204-bib-0051)].

Concluding remarks

Subgingival debridement is a treatment frequently performed by clinicians. It is part of different phases of periodontal therapy, but it is specifically used in supportive periodontal therapy. To our surprise, the effect of subgingival debridement is less described in the dental literature than anticipated. An additional difficulty in finding relevant literature was the use of the term ‘debridement’. This term is often used much more broadly than how it was defined, during the first European Workshop on Periodontology, as the gentle mechanical subgingival instrumentation to disrupt and/or remove the acquired biofilm. Therefore, is it difficult to make well-evidenced statements on the use of debridement in supportive periodontal therapy.

Based on the available evidence and opinion of the authors, well-executed scaling and root planing, together with an optimal level of oral hygiene, are the cornerstones of initial cause-related therapy. These therapeutic interventions should result in a reduction of periodontal inflammation and, among others, a reduction in probing pocket depth below 5 mm. Unfortunately, residual pockets might remain, even after a well-executed initial nonsurgical therapy. Depending on several parameters, surgical regenerative, resective or reattachment techniques are the treatment of choice to deal with these residual deepened sites. There is ample evidence that shows the effectiveness of these surgical techniques to treat residual pockets. However, even after surgery, residual pockets may remain or re-emerge. Additionally, patients with residual pockets might not be willing to undergo surgery or the level of oral hygiene might not allow surgical therapy. In these cases, subgingival debridement is an option, although it is unclear if repeated subgingival debridement is effective in patients with optimal oral hygiene. At present, hand instruments and (ultra)sonic instruments are still considered the instruments of choice for subgingival debridement. The good tactility and manual control of hand instruments favor their use. However, it takes less time to perform the debridement with (ultra)sonic instruments. Laser, photodynamic therapy and air-polishing can be applied during supportive therapy as debridement tools to remove biofilm in a less aggressive manner. None of these more novel techniques seem to be superior – clinically or microbiologically – to conventional instrumentation. Their only clear advantage is that they seem to result in less treatment discomfort for patients and might be less aggressive on the root surface. All techniques mentioned significantly reduced the pocket probing depth. Microbiologically, they only seem to have a temporary result on periodontitis-associated bacteria; however, after some months, this effect was no longer detectable. It is not clear how often we should perform subgingival debridement. From a practical point of view, debridement frequency might be similar to supportive periodontal therapy frequency, which ranges from every 3 months to once a year. Although there are still a number of uncertainties on the role of debridement in supportive periodontal therapy to treat residual deep pockets, one should realise that not performing debridement in deep pockets during supportive periodontal therapy might be seen as supervised neglect.