Periodontal disease, as evidenced by the ground-breaking studies of Loe et al. and Page, refers to a group of infectious diseases of the periodontium, which are characterised by the destruction of the periodontal tissue, including the periodontal ligament, root cementum, alveolar bone and gingiva. Marginal periodontitis is an opportunistic infection (Fig. 2) that is caused by a Gram-negative anaerobic range of bacteria and results in chronic inflammation of the periodontal tissue.

The progressive loss of periodontal tissue and attachment is observed as a consequence of the persistent inflammation. Based on epidemiological studies (Fig. 2), the prevalence of chronic marginal periodontitis in the population over the age of 35 in Germany is approximately 40–45%. Approximately 55% of this age group suffers from a moderately severe and approximately 21% from a severe form of periodontitis. Moderately severe (approx. 15%) and severe (approx. 1%) forms of periodontitis have been observed even in 15-year-old adolescents. In the case of elderly people, almost in two out of ten adults, inflammatory and destructive changes (moderately severe/severe) to the periodontal tissue can be observed.

Causative therapy can prevent the progress of the disease. Therefore, the mechanical supragingival and subgingival removal of calculus and plaque is the primary objective of conservative periodontal therapy, which is aimed at destroying the subgingival biofilm and minimising the periodontal pathogenic bacteria. Bacterial biofilms and endotoxins can be removed from the root surfaces effectively by scaling and root planing, for which manual, sonic, or ultrasonic scaling instruments are employed. According to research, the use of mechanical scaling systems has become established because they make cleaning of the root surfaces easier, result in less fatigue and are more efficient for the dental treatment team.

In addition to the decontamination processes already described, the intention in this case study is to illustrate the effectiveness of an innovative method for biofilm removal—low-abrasion air-polishing technology employed by systems such as the AIR-N-GO PERIO instrument specifically for working directly in the periodontal pocket, is the result of cutting-edge technology in computational fluid dynamics. The adjacent anatomical structures are not irritated and thorough removal of the subgingival biofilm from the root surface reduces marginal inflammation. The initial results presented in this article are part of a clinically and microbiologically controlled and randomised long-term study of the comparative effectiveness of low-abrasion, sonically assisted air-polishing systems and ultrasonically assisted methods within the scope of conservative periodontal therapy.

Clinical study
Fifteen patients who had chronic marginal periodontitis at baseline were treated and re-examined over a period of three months. The clinical and microbiological parameters were recorded pretreatment, immediately after clinical intervention (microbiological analysis only), after six weeks and after three months (Table 1).

After the preparative treatment had been carried out successfully and the patients had received a verbal and written explanation, those included in the study provided an informed consent and written declaration in accordance with the Declaration of Helsinki (following amendment by the 41st World Medical Assembly, Hong Kong, September 1989).

All patients were involved in preparative treatment after the initial examination. They received oral hygiene instruction and professional supragingival debridement as necessary. Depending on the patient, the first phase of the preparative treatment covered a period of at least three and at most five weeks (three to five air-polishing treatments). Instruments had to have a Pi score of approximately 1 within this period.

The preparative treatment included supragingival scaling and polishing of the tooth surfaces using the AIR-N-GO SUPRA air polisher (Fig. 4). This air polisher works with a mixed jet of air and water, added to which is a cleaning powder that has been specially developed to be minimally traumatic to delicate mucosal tissue. The powder’s rounded microstructure and the fineness of the calcium carbonate-based microbeads protect the tooth enamel, and enable gentle and effective cleaning of the tooth surfaces. Moreover, the spray reaches areas that are difficult to access, such as tight interproximal spaces.

The probing pocket depth (PPD), clinical attachment level (CAL), bleeding on probing (BOP) and gingival recession (GR) were selected as the clinical variables. Bacteriological analysis of the study teeth was performed prior to the basic examination, immediately after therapeutic intervention, and six weeks and three months after the conservative periodontal therapy, by selectively detecting the periodontal pathogenic marker bacteria using gene probe binding (hybridisation).

Subgingival sampling (Figs. 3a & b) was carried out using sterile paper points according to Slots. The paper point was inserted down to the base of the pocket, left there for 10 seconds, removed without initiating bleeding and then placed immediately in the tube provided for the test. The samples were
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pooled for the patients examined.

Microbiological tests, such as the IAI PadoTest 4·5 of the Institute for Applied Immunology in Switzerland used in our study, employ small, synthetic DNA molecules complementary to the ribosomal RNA molecules as probes in order to analyse bacteria (such as Aggregatibacter actinomycetemcomitans (Aa), Tannerella forsythia (Tf), Peptostreptococcus gingivalis (Pg), Trepomonas denticola (Td)). Furthermore, the total bacterial load (TBL) is a good indicator of periodontal infection. For patient typing, we used the classification system (cluster) also developed by the Institute for Applied Immunology as the IAI PadoTest 4·5 of the Institute for Applied Immunology (osseo.org). This system (cluster) also developed by the Institute for Applied Immunology as the IAI PadoTest 4·5 of the Institute for Applied Immunology (osseo.org).

### Results

#### Demographic data

All the participants (n = 15; 56.6% of the patients were female and 43.4% were male) remained in the study for the entire observation period of three months; therefore, there was no change in the number of teeth investigated. The proportion of smokers included in the study was 35.3%. All the patients were examined in accordance with the study protocol.

#### Clinical parameters

The AIR-N-GO PERIO group (Table 2) showed an average gain in CAL six weeks post-treatment of 0.30 ± 0.04 mm for the periodontium treated (mean reduction in PPD of 0.50 ± 0.02 mm) and for areas on the microbiological study teeth a gain of 0.37 ± 0.01 mm (mean reduction in PPD of 1.85 ± 0.06 mm). After three months, the AIR-N-GO PERIO group showed a greater gain in CAL for the periodontium treated of 2.13 ± 0.04 mm (mean reduction in PPD of 0.50 ± 0.05 mm) and for areas on the microbiological study teeth a gain of 2.13 ± 0.14 mm (mean reduction in PPD of 1.54 ± 0.05 mm). Table 3 shows BOP and GR for all the study periods. In the AIR-N-GO PERIO group, the improvement in BOP (compared with baseline) after six weeks and three months was statistically significant (p < 0.01). The slight increase in GR compared with baseline reflects the improved inflammatory situation of the marginal periodontium after AIR-N-GO PERIO therapy.

**Table 5: Effect of the AIR-N-GO PERIO system on bacterial prevalence (in million pathogens/ml of sulcus fluid).**

<table>
<thead>
<tr>
<th>Species</th>
<th>Baseline (x 10^6)</th>
<th>Immediately post-treatment (x 10^6)</th>
<th>After 6 weeks (x 10^6)</th>
<th>After 3 months (x 10^6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aa</td>
<td>0.37 ± 0.10</td>
<td>2.13 ± 0.03</td>
<td>2.13 ± 0.04</td>
<td>2.13 ± 0.04</td>
</tr>
<tr>
<td>Tf</td>
<td>1.67 ± 0.15</td>
<td>2.13 ± 0.03</td>
<td>2.13 ± 0.04</td>
<td>2.13 ± 0.04</td>
</tr>
<tr>
<td>Tf</td>
<td>1.92 ± 0.20</td>
<td>2.13 ± 0.03</td>
<td>2.13 ± 0.04</td>
<td>2.13 ± 0.04</td>
</tr>
<tr>
<td>TBL</td>
<td>87.21 ± 42.81</td>
<td>55.21 ± 28.69</td>
<td>55.21 ± 28.69</td>
<td>55.21 ± 28.69</td>
</tr>
</tbody>
</table>

**Table 4: Microbiological results.**

The results for the four periodontal marker bacteria—Aa, Tf, Pg, and Td—and the total number of marker bacteria (TBL) were recorded. The microbiological results are summarised in Table 4. As an exhibited the lowest concentration at baseline (0.05 ± 0.05) of all the species investigated. Six weeks post-treatment the concentration of the bacteria had reduced to 0; and three months post-treatment it had almost reached the baseline values again (0.03 ± 0.08 ± 10^6). The three other species (Pg, Tf, and Td) reached concentrations at this time of 0.28 × 10^6, 0.18 × 10^6, respectively. The microbiological situation three months post-treatment showed the colonisation of all four bacteria to be at a lower level than at baseline.

Pg and Tf were at an even lower level at this time than immediately post-treatment. Only Aa showed rudimentary re-colonisation at three months after the elimination after six weeks, with an increase to 0.05 ± 10^6. Pg had reduced to 0.28 ± 10^6 at three months, which signifies a mean elimination of 84% compared with baseline. Tf exhibited a reduction to 0.20 ± 10^6, which corresponds with a mean elimination of 59% compared with baseline.

**Microbiological profile**

Microbiological analysis of the pooled samples, based on data not detailed here, after initial examination showed that 57% of the samples contained Aa; 85%, Pg; 51%, Tf; 91%, Td; and 89%, Td. The proportion of contaminated pockets decreased immediately post-treatment and increased again after six weeks, but in the third month, without but returning to the baseline values.

Pg exhibited the greatest prevalence of all the species of bacteria at each point. The bacterium was detected in 40% of pockets at baseline, in 20% immediately post-treatment, in 55.5% after six weeks and in 6.6% in the third month after AIR-N-GO PERIO therapy.

Tf occurred in 60% of pockets at baseline. Post-treatment, the species was only found in 50% of pockets immediately post-treatment, in 60% in the sixth week and in 56.6% after three months.

Td was detected in 61.75% of all pockets pretreatment. Immediately after therapeutic intervention the prevalence of the species decreased (50%), and in the sixth week post-treatment increased again only slightly (56.6%). With an incidence of 60% after three months, Td almost reached the baseline values and therefore almost complete recolonisation occurred in the periodontal pockets examined.

The similarly high percentage of pockets in which the species of the red complex (Pg, Tf, and Td) were detected was striking. Pg, Tf, and Td together colonised 72.7% of all pockets prior to treatment. The prevalence of the complex became lower immediately post-treatment (55.5%) and rose again in the third month post-treatment (47.2%). At each point in the study, a combination of the four bacteria was found in most of the pockets (55.1% of pockets at baseline, 20.8% and 28.8% of pockets immediately post-treatment and after six weeks) irrespective of the form of therapy used. The proportion of pockets including only one species of bacteria increased in the third month.

**Conclusion**

The effect on obligate pathogenic bacteria such as Aa, Pg, and Tf, which are the most difficult to control in therapy, is very promising. However, it must be noted that this is a reduction in the marker bacteria, not the required elimination of the obligate pathogenic bacteria. Therefore, it is concluded that a better long-term outcome can be achieved after classic periodontal therapy using the low-abrasion, sonically assisted air-polishing system. [This article first appeared in ZWP Zahnärztliche Weiterbildung Praxis 9/2012 and can be viewed online.](http://www.zwp-92.de/issue2012_09/)

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