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TwinLight® Protocol and AutoSWEEPS Photoacoustic Irrigation for Periodontal Treatment – Split Mouth Case Report

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ABSTRACT

Periodontal diseases remain a major challenge in modern dentistry, affecting the supporting tissues of teeth and implants.

The TwinLight® laser protocol has shown strong clinical efficacy, and recent evidence suggests that cavitation-based methods may further enhance outcomes. This case report compares the standard TwinLight® protocol to a modified approach incorporating AutoSWEEPS photoacoustic irrigation. Both sides of the mouth received identical Nd:YAG laser steps, while the left side used Er:YAG AutoSWEEPS irrigation instead of MSP direct ablation.

Results showed a reduction in the number of sites with probing depths ≥4 mm from 39 sites to 1 site and a drop in bleeding on probing from 72% to 11%, with better outcomes on the AutoSWEEPS-treated side. These findings support the added benefit of photoacoustic cavitation in periodontal therapy.

Key words: Periodontal treatment TwinLight® SWEEPS.

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I. INTRODUCTION

Periodontal disease is among the most rapidly growing concerns in modern dentistry. It affects the supporting structures of both natural teeth and implants, leading to systemic inflammation and potential teeth loss. While traditional treatment methods have been effective to some extent, they often fall short in fully addressing deep-seated infections and removing biofilm from hard-to-reach areas.[1] In recent years, advancements in laser-assisted treatments, particularly the TwinLight® protocol utilizing Er:YAG and Nd:YAG lasers, have significantly improved treatment outcomes.[2] Additionally, recent studies indicate that cavitation-based treatment can be integrated into periodontal therapy as well, making it a promising new approach.[3]

a) The Role of Laser Technology in Periodontology

Lasers have transformed periodontology by offering precise, effective, and less invasive treatment options. The TwinLight® protocol incorporates two of dentistry's most effective laser wavelengths, Er:YAG and Nd:YAG, in a synergistic approach to enhance treatment success and accelerate healing.

Er:YAG Laser: This laser effectively removes microbial biofilm and calculus from root surfaces, promotes gingival fibroblast proliferation, and significantly reduces microbial presence in periodontal pockets. It is particularly useful in removing granulation tissue from the alveolar bone and ensuring decontamination of the affected area.

Nd:YAG Laser: With deep tissue penetration, superior coagulation capabilities, and selective bacterial elimination, this laser is highly effective in removing diseased pocket-lining epithelium, aiding in wound healing, and enhancing biostimulation for better tissue regeneration.

The combination of these two wavelengths provides a comprehensive and efficient method for managing periodontal disease, reducing infection risks, and promoting faster tissue recovery.

b) Minimally Invasive TwinLight® Periodontal Treatment Protocol

The TwinLight® protocol follows a step-by-step process designed to maximize efficacy while ensuring patient comfort and safety.

- *Nd:YAG Laser Application*: Removes diseased epithelial lining of the periodontal pocket, creating better access to the root surface and eliminating inflamed tissue.
- *Er:YAG Laser Application*: Thoroughly removes microbial biofilm and calculus from the root surface, ensuring effective cleaning of hard-to-reach areas.
- *Nd:YAG Laser Disinfection and Coagulation*: Further disinfects the pocket, promotes stable fibrin clot

formation, and encourages optimal healing conditions.
- *Nd:YAG Photobiomodulation (Optional)*: Enhances healing and tissue regeneration, promoting long-term stability and reducing recurrence.

c) Challenges and Innovations in Biofilm Removal

One of the major unresolved challenges in dentistry is biofilm removal from hard to reach areas.[1] In literature and in daily clinical use, photoacoustic cavitation for biofilm removal is used. Unlike direct laser ablation, which requires direct illumination of the target area, photoacoustic cavitation allows biofilm removal from hard-to-reach areas at a distance from the laser tip. Laser-induced cavitation creates rapid fluid movement, triggering a reduction in fluid pressure that effectively disrupts biofilm in deep pockets. This method has been highly successful in endodontic treatments where complex root canal anatomy prevents mechanical cleaning.[4]

While aggressive irrigants like EDTA and NaOCl are commonly used in endodontics, they are not suitable for periodontal and peri-implant treatments due to their cytotoxic effects.

Preliminary studies indicate that cavitation-based treatments can be adapted for periodontal therapy, making it a promising future approach.[5]

MATERIALS AND METHODS

A 43-year-old medically fit, non-smoking female presented with generalized gingival bleeding (Fig.1). Radiographic and clinical assessment with periodontal pocket probing revealed stage III periodontitis. In the upper jaw, 39 of 72 probing sites were measured with a depth ≥ 4 mm (Fig. 2).

Figure 1: Initial situation

All details regarding the diagnosis and treatment were discussed with the patient, and informed consent was obtained. In this case, a split-mouth comparison was performed between the standard TwinLight® protocol on the right side and a modified version on the left side. In the latter, AutoSWEEPS irrigation (20 mJ, 15 Hz) was used instead of MSP direct ablation during the second step. The Nd:YAG steps were identical on both sides of the mouth.

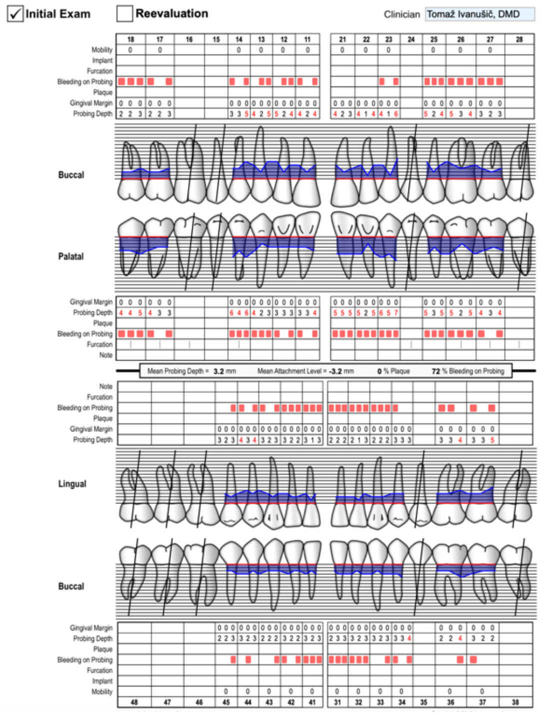

Figure 2: Periodontal chart of initial examination

After administration of the local anesthetic agent, the ultrasound scaler (EMS, Piezon) was used for removal of supragingival plaque and calculus. Then a Nd:YAG laser (Fotona LightWalker AT-S) with settings of MSP pulse mode, 20 Hz, and 2 W power was used for periodontal pocket sterilization and decontamination for 30 seconds per tooth (Fig. 3). The R21-C3 handpiece with 320 µm fiber was used and inclined 5-15° to the long axis of the tooth.

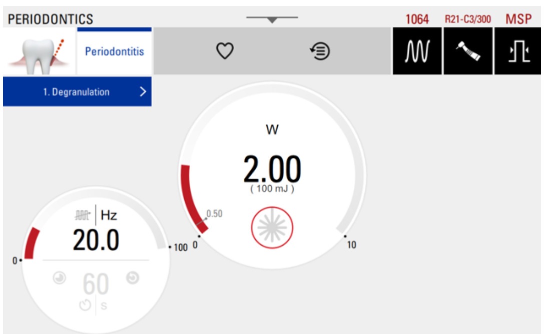

Figure 3: Settings used for periodontal pocket sterilization and decontamination

The next step was removal of subgingival plaque, granulation and calculus on the right side with Er:YAG laser (Fotona LightWalker AT-S) with water cooling in contact mode. The laser settings were MSP pulse (micro-short pulse, duration 100 µs), 50 mJ, 40 Hz with a Flat-SWEEPS400 fiber tip (Fig. 4). The laser was used 60 seconds per tooth and the tip was inclined 10-20° to the long axis of the tooth in constant motion scanning the pocket wall.

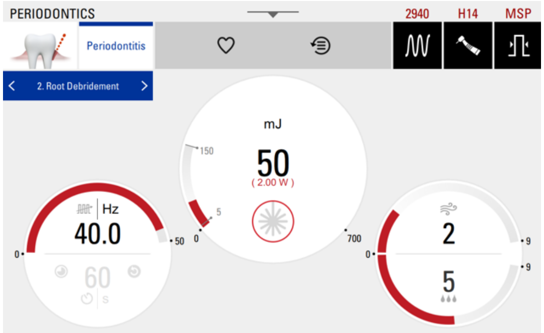

Figure 4: Settings used for subgingival plaque, granulation and calculus removal on the right side

On left side of the mouth we applied AutoSWEEPS, 40 mJ (2x20 mJ), 15 Hz, water on 5, air off (Fig. 5). The operator hand movement was the same as on the right side.

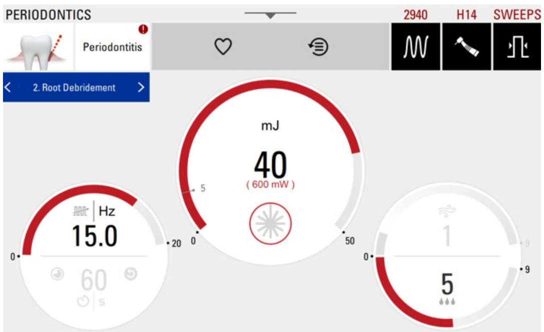

Figure 5: Settings used for subgingival plaque, granulation and calculus removal on the left side

For final decontamination and stabilization of the fibrin clot, the Nd:YAG laser (VLP, 20 Hz, 4 W) was applied again (Fig. 6). The laser fiber tip was inserted into the periodontal pocket at 1 mm less than the value obtained through the probing procedure. The tip was held parallel to the long axis of the tooth, activated and kept in constant motion scanning the pocket wall until a stable fibrin clot was achieved.

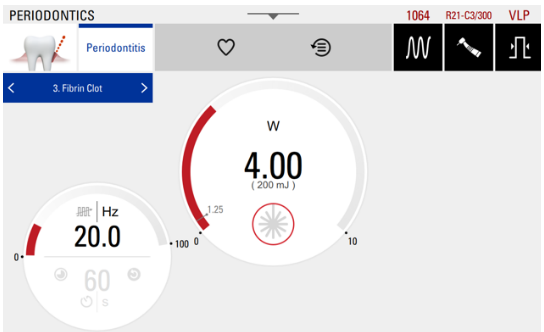

Figure 6: Settings used for final decontamination and stabilization of the fibrin clot

At the end of appointment, the patient was instructed on how to perform hygiene at home.

After 3 months periodontal probing was performed again.

RESULTS

The number of probing sites with depth ≥ 4 mm was reduced from 39 to 1 (Fig. 7). On the right side where TwinLight was used there were 18 probing sites with depth ≥ 4 mm at baseline with 1 still remaining after treatment. On the left site where AutoSWEEPS was used there were 21 such sites at baseline with none remaining after treatment.

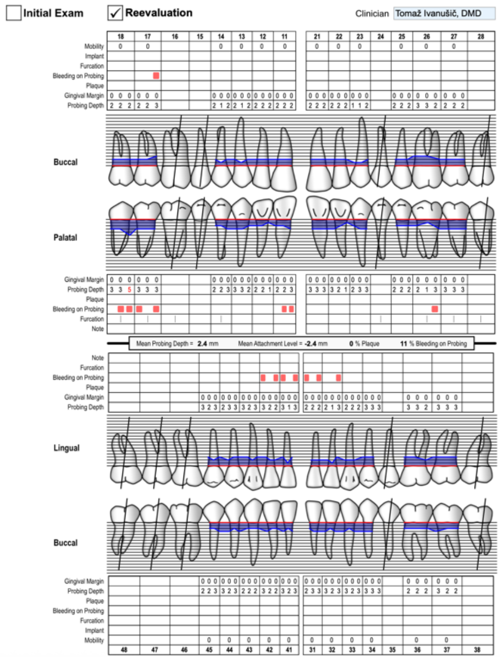

Figure 7: Reevaluation periodontal chart

Bleeding on probing was reduced from 72% to 11%. Better improvement was noted on the left side of the mouth, where the AutoSWEEPS modality was applied. Bleeding on probing on the right side was reduced from 71.2% to 16.7% and on the left side from 73.6% to 5.6%.


Figure 8: Clinical situation after periodontal treatment and a few new composite fillings

No adverse effects related to the laser irradiation were reported. Healing was uneventful and without complications (Fig. 8).

After periodontal treatment, we changed some older failing composite fillings and fixed carious lesions.

DISCUSSION

The combination of Nd:YAG and Er:YAG laser treatment as an adjunct to conventional non-surgical periodontal therapy has demonstrated significant benefits in improving periodontal treatment outcomes. The TwinLight® periodontal procedure, which integrates both laser modalities, is a well-established and effective approach for the management of periodontal disease.

Recent protocol modifications—specifically the substitution of the second step with AutoSWEEPS photoacoustic cavitation—have shown promising potential to further enhance clinical efficacy. AutoSWEEPS technology appears to perform optimally when the irrigating water is not mixed with pressurized air. However, achieving effective water delivery into periodontal pockets without the assistance of air pressure can be particularly challenging in the upper jaw. In such cases, manual irrigation using a syringe may serve as a practical and effective alternative.

These laser-based therapies offer a minimally invasive alternative, promoting faster recovery and reducing post-operative discomfort.

CONCLUSIONS

The incorporation of AutoSWEEPS photoacoustic cavitation in the treatment of periodontal disease has shown promising potential to further enhance clinical outcomes. However, additional studies are needed to determine the optimal treatment parameters.

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