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Comparative Evaluation of Clinical Outcomes Following Guided Biofilm Therapy and Conventional SRP in Periodontitis Patients: A Split-Mouth Clinical Study

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Abstract

Objective: To compare the clinical outcomes of Guided Biofilm therapy and conventional SRP in periodontitis patients.

Materials & Methods: In two sessions, the patients received periodontal therapy. Quadrants I and IV as well as II and III were randomized to receive GBT or SRP therapy at the start of the first session. At baseline, six weeks (T1), and three months (T2) following treatment, periodontal measures were gathered. The experimental locations (pocket probing depth [PPD] >4 and <10 mm) that became closed pockets (PPD ≤ 4 mm bleeding on probing [BOP] negative) at T1 and T2 were the main outcome. PPD, recession, clinical attachment level, BOP, and changes in the plaque index at the experimental sites and throughout therapy were secondary outcomes.

Results: Both treatment procedures resulted in significant reductions in clinical parameters—BOP, PPD and relative attachment level.

Conclusion: The application of the GBT protocol can be considered equally efficient [i] compared with the conventional SRP approach in terms of biofilm removal from supragingival and subgingival regions of teeth.

Keywords: Guided Biofilm Therapy**,** Periodontitis, Periodontal, Debridement, Dental Scaling, Root Planning.

Introduction

The most effective nonsurgical treatment for periodontal disease is still scaling and root planing (SRP), which is done with both manual and ultrasonic tools. Both hard deposits and non-mineralized biofilm can be removed using a wide range of tools. Nevertheless, there are several restrictions for efficient, subgingival biofilm breakup [2]. Closing periodontal pockets is the main

outcome of the therapy, which attempts to restore health to the diminished periodontium. Pocket probing depth (PPD) ≤ 4 mm and the lack of bleeding on probing (BOP) if PPD = 4 mm are indicators of a closed periodontal pocket[3]. In addition to the traditional usage of hand devices like curettes, sonic scalers that run on air pressure or ultrasonic scalers have long been commonplace. Conventional polishing with spinning tools and polishing paste has long been available for the selective removal of non-mineralized biofilm, but it is only effective in supragingival regions. As the need to remove "infected cementum" has been long disproven[2], a shift from SRP to the more conservative root surface debridement has been recommended, involving the predominant use of delicate ultrasonic tips instead of manual instrumentation. Ultrasonic debridement can provide the same clinical resolution of disease obtained via traditional root planning[2]. Consequently, the creation of air polishing devices with low abrasive particles was seen as a paradigm change in biofilm control because it can be applied both supra- and subgingivally[2]. A few years ago, EMS (Electro Medical Systems S.A., Nyon, Switzerland) unveiled Guided Biofilm Therapy (GBT), a novel treatment approach that methodically blends additional interventions (such as the use of plaque elevators) with an air-abrasive device that uses erythritol powder and ultrasonic scalers [2]. Air polishing seems to be especially time efficient during maintenance of residual pockets: a short 5-second application of subgingival air polishing can achieve the same clinical result as 1.4 minutes of ultrasonic scaling[2]. The aim of the present randomized controlled clinical trial is to compare the clinical results of GBT protocol with traditional SRP patients with stages II and III of periodontitis.

Materials & Methods

The present study was a single-blinded, randomized, split-mouth, controlled clinical trial including 25 patients with stage II and stage III Periodontitis. Patients exhibiting at least one tooth with a probing pocket depth of 4-6mm in any teeth from incisor to second molar on either side of the oral cavity will be selected. Patient with systemic disease such as diabetes, hypertension or respiratory disease such as chronic obstructive pulmonary disease and asthma or pregnant or lactating women were excluded from the study. Patients who were allergic to chlorhexidine or erythritol were also excluded from the study. All participants signed a written informed consent before the beginning of the study.

Two quadrants were selected from each patient and allotted to experimental and control groups. Experimental group quadrant received GBT and control group quadrant received conventional SRP. Clinical parameters like PPD, CAL and BOP (modified sulcus bleeding index) were recorded at baseline and after 4 weeks.

According the recommendations of a systematic periodontal treatment[2], at baseline, all patients received center-standard instructions on individual oral hygiene and PMPR. Specifically, patients were instructed on the proper use of a toothbrush (case-by-case decision: manual toothbrush or oscillating-rotating toothbrush) twice daily, and in the use of interdental brushes with adapted sizes for each interdental space. Subgingival instrumentation was usually performed under local anesthesia (SOPIRA® Citocartin® (Active ingredient: Articaine), Kulzer GmbH, Hanau, Germany), unless the patient explicitly refused local anesthesia; these cases were documented for the statistical analysis of the patients' perception of pain. Other treatments directly affecting the treatment outcome, such as adjunctive use of antibiotics or antibacterial agents, were not performed

by the practitioner during/after NSPT or by the patients at home.

Quadrants randomized for GBT protocol received the following treatment:

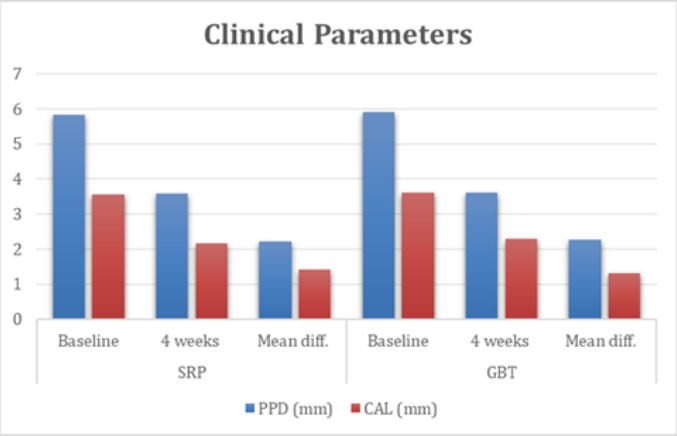
- Plaque coloring all teeth to determine plaque levels and to guide or optimize biofilm removal.
- Removal of supra-gingival non-mineralized plaque using air polishing with erythritol powder.
- Tooth surfaces requiring treatment (PPD ≥ 4 mm) were instrumented with an ultrasonic scaler with a slime-line tip (PERIO SLIM PIEZON PS, EMS, Nyon, Switzerland) throughout the randomized quadrant, including the removal of supragingival calculus.
- Removal of non-mineralized biofilm in the supra- and subgingival areas were performed with erythritol powder (PLUS® powder, EMS, Nyon, Switzerland). It should be noted, that independent the depth of PPD no nozzle handpiece was utilized to prevent emphysemas in NSPT according the manufactory recommendations.

Results and statistical analysis

Table 1:

	SRP			GBT		
	Baseline	4 weeks	Mean Diff.	Baseline	4 weeks	Mean Diff.
PPD (mm)	5.82	3.59	2.23	5.90	3.62	2.28
CAL (mm)	3.57	2.16	1.41	3.62	2.3	1.32
BOP	2.73	1.07	1.66	2.81	1.10	1.71

Graph 1:



Statistical analysis was performed using SPSS Statistics 24 software (IBM, Chicago, IL, USA) for multilevel statistical analysis at tooth surface level, tooth level, and patient level.

Discussion

This clinical study was designed to determine possible differences in clinical outcome when conventional subgingival instrumentation with hand/ powered instruments and rotating rubber cups were used compared with the GBT approach during NSPT of patients with stage II-III periodontitis. Both, GBT and conventional treatment protocol, resulted in significant improvement of all periodontal parameters surveyed. If we take into account the body of research regarding the effectiveness of periodontal nonsurgical therapy, the results are overwhelmingly good. Wennström et al. (2005)[2] examined the effectiveness of a novel full-mouth ultrasonic debridement technique versus conventional quadrant SRP in individuals with periodontitis. SRP obtained a 66% pocket closure at the 3-month reexamination, whereas ultrasonic debridement obtained a 58% pocket closure. After six months, the proportion rose to 77 and 74%, respectively. The pocket closure in the present study also resulted higher than the weighted mean pocket closure estimated by a systematic review by Suvan et al (2020)[2] on the subgingival instrumentation

(manual/sonic/ultrasonic) for the treatment of periodontitis, calculated at 74% at 6/8 months after the treatment. One explanation could be that the review's studies were heterogeneous, with different instruments, designs and technologies, protocols, and instrument combinations that could have resulted in different clinical outcomes. Additionally, the research under consideration did not consistently record the "pocket closure" characteristic. Our findings highlight that while integrating and utilizing many NSPT devices necessitates more involved education and training, it also enables the practitioner to choose the best instrument for various indications or treatment scenarios. For instance, air-powder devices reduce damage to surrounding soft tissue even if they lack tactile sense[2]. Although the results of other studies comparing the use of the air-polishing method during the phases of periodontal treatment were comparable and all demonstrated an improvement in clinical parameters, there was no discernible clinical advantage to the air-polishing approach overall. However, due to the wide range of materials and techniques utilized in these investigations, a highly detailed comparison is challenging[2,3]. In comparison to hand instrumentation, Flemmig et al.[2] observed a considerable decrease in subgingival biofilm and a favorable change in the microbiota following the application of air-polishing (glycine-based) on the mucosa throughout the mouth and in periodontal pockets. More hard and soft deposits may have been eliminated from both groups in our study by using mechanical equipment than by using only human instrumentation.

No side effects of air-polishing were observed (e.g., swelling, or emphysema) and the pain perception of the patients under local anesthesia in both treatment groups.

Limitations of the study

Notwithstanding the present RCT's strength, a number of limitations must be noted. (1) There is a greater chance of a carryover effect even if the split-mouth design with therapy assigned by quadrant removes interindividual heterogeneity (smoking status, oral hygiene) in clinical outcomes[2]. The exclusion of patients with COPD will have reduced the number of participants even COPD and periodontitis share similar confounders e.g. smoking[3] and both are associated with each other[2]. However, using airflow devices to prevent wheezing and bronchospasm is contraindicated for patients with COPD, asthma, bronchial asthma, etc., according to treatment guidelines for our department's dentistry curriculum. The exclusion of patients who had systemic conditions that required antibiotic prophylaxis or who were allergic to test product constituents (such as erythritol or chlorhexidine) must also be read as a selection bias. Last but not least, pre-graduate students controlled variables including patient compliance and self-performed dental hygiene in accordance with the guidelines of the first periodontal therapy stage. Individual treatment outcomes will be impacted by low plaque scores or slight changes, which is why a split-mouth design and randomization were used to reduce this impact. All things considered, additional clinical research using a parallel design and a bigger cohort will assist to elucidate these problems and enable the examination of additional factors, like alterations in the microbiota.

Conclusion

The application of the GBT protocol can be considered equally efficient compared with the conventional SRP approach in terms of biofilm removal from supragingival and subgingival regions of teeth. Further clinical studies with a parallel design and even larger cohort are required to assess the results of this study.

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