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Efficacy of Subgingival Air Polishing in Patients with Aggressive Periodontitis

SUMMARY

***Background**: Aggressive periodontitis is one of the most severe forms of periodontal disease, resulting in the destruction of junctional epithelium and alveolar bone around teeth in a very short period of time. The early diagnosis of aggressive periodontitis and timely therapy is of outmost importance in controlling the progress of the disease.*

Application of the techniques of subgingival air polishing of periodontal pockets (pflow) with glycine powder has contributed to reduce damage to the root surface of the teeth and surrounding soft tissue.

***Aim**: The goal of this paper was to determine the effectiveness of two different types of subgingival air polishing therapy for the periodontal tissue status at the patients with aggressive periodontitis*

***Methods and materials**: the study included 46 patients of both sexes diagnosed with aggressive peridontitis. The patients were divided into two groups: test group (PFLOW), and control group (sonic SRP). The size of the destruction of periodontal tissue was estimated by CAL and assessment of oral hygiene and gingival inflammation was performed using FMPS and FMBS.*

***Results**: Monitored indexes values in both groups were reduced.*

***Conclusion**: Subgingival air polishing showed equally good results as the SRP, while pflow was more advantageous with respect to patients acceptability, time usability and safety for the soft tissue.*

Key words: Periodontal disease, Aggressive periodontitis, Therapeutic approach, Subgingival airpolishing.

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Introduction

Diseases of the periodontium include inflammatory and destructive changes in the entire support system of the tooth. Such changes occur as a response of the host to the bacteria present in the dentogingival junction[1].

Generalized aggressive periodontitis is the most severe but not too frequent a form of the disease. The prevalence of this form of periodontitis significantly varies between countries and depends on one's ethnicity[2,3,4]. The factors that may lead to aggressive periodontitis are numerous: above all, poor dental hygiene which leads to a build-up of oral bacteria forming a dental film[5,6]. Another significant factor causing this form of periodontitis is a compromised *immune system. Some authors argue that aggressive periodontitis is a result of a diminished immune response to biofilm antigens. Patients with aggressive periodontitis have a disorder concerning the function of neutrophil granulocytes and monocytes*[7].

Since a number of factors appear as the causes of the disease, the therapy itself is very complex. Therapeutic procedures should start immediately upon diagnosing aggressive periodontitis as well as other forms of the disease in the supporting tissues, but the treatment outcome is very unpredictable[8].

Given that there is a genetic predisposition and impairment of the immune response in persons suffering from aggressive periodontitis, reducing or even disabling the defense of periodontal tissues from bacteria, the treatment of aggressive periodontitis also includes antibiotics, which gives this disease its specificity[9,10,11].

The main therapeutic procedure in treating periodontal diseases is the removal of the biofilm formed in both the supragingival and subgingival area. Periodontal pockets are treated with various instruments designed to be relatively easy to use in both the supragingival and subgingival area. Technological advancements have introduced novelties in therapy in managing a diseased periodontium[12].

A new approach in treating periodontal pockets is the subgingival air polishing of the root surfaces. The air polishing method applied on root surfaces means applying fine particles of powders to the root surface. The procedure itself removes the biofilm and other soft deposits as well as stains from the root surface using a stream of compressed air, water and particles of glycine powder. This air polishing technique is performed using a special nozzle (Figure 1)[13] improving the mixing of water and air with the powder, while preventing soft tissue emphysema. The nozzle thus designed provides access to the periodontal pockets measuring up to 5 mm. The new approach is that subgingival air polishing increases the dentist's efficacy and improves the patient's comfort[14].

Figure 1. Subgingival air polishing with special nozzle[13]

Aggressive periodontitis is a severe disease of the periodontium; a timely diagnosis and taking of the necessary therapeutic measures is crucial to slowing down or delaying a premature tooth loss. The objective of this study was to define the clinical efficacy of a new therapy for periodontal pockets and indicate the amount of destruction of periodontal tissues in smokers and non-smokers.

Materials and Methods

A total of 46 individuals (28 females and 18 males) aged between 25 and 47, mean age 34,7±5,7 with aggressive periodontitis were included in the study. The subjects were selected according to the criteria defined for diagnosing aggressive periodontitis established by the American Academy of Periodontology[15].

Both smokers and non-smokers were included in the study. The non-smokers included both non-smokers and ex smokers, while smokers group also included subjects smoking one cigarette a day. The selected subjects had good general health and had not taken any antibiotics in the previous six months.

All subjects were thoroughly informed of the procedures required for the study and only those who gave a written consent confirming they would take a part of their own free will were selected.

At the first appointment, the subjects were asked to provide their full medical/dental history, had a dental exam and their dental X-rays analysed individually. To assess the level of oral hygiene and gingivitis the following indexes were used: plaque index- Full Mouth Plaque Score (FMPS) and gingival bleeding index- Full Mouth Bleeding Score (FMBS);

FMPS and FMBS were recorded as the percentage of tooth surface with supragingival plaque or bleeding within 15 seconds after probing gingival sulcus or periodontal pocket[16].

To assess the state of the deeper structures of periodontal tissues, pocket depth was measured with a periodontal probe (PP), while the severity of periodontal tissue destruction was assessed by measuring the clinical attachment level (CAL). CAL is the distance between the base of the pocket and the cementoenamel junction expressed in mm[17]. The patients were examined under an artificial light while seated in a dental chair, using a mouth mirror. The required indexes were measured using the periodontal probe *PCP-UNC 15®*, *Hu-Friedy*, *Chicago*, IL, *USA*. *The required parameters were entered in a standard chart according to a predefined formula.*

During the initial stage, upon the exam, possible supragingival calculus formations were removed. The subjects were then divided into two groups.

In the first group of subjects (SRP group), dental biofilm was removed from periodontal pockets using an air scaler (SONICflex quick 2008 L, KaVo, Biberach, Germany) and scaler tips 5A, 60°, 61°, and 62°. After this, the final polishing of accessible root surfaces was done using rubber-cup polishers.

Subgingival air polishing of root surfaces was performed on the second group of subjects (PFLOW, periodontal flow). Air polishing involves projecting a jet of compressed air, water and glycine powder onto the root, using a specially designed nozzle (EMS Air-Flow Master). Each root surface area is air-polished for 4 or 5 seconds.

The same pocket treatment was performed in the following four appointments. The subjects took care of their oral hygiene at home according to our instructions. Thirty minutes after brushing the teeth, they rinsed their mouth with 0.12% chlorhexidine digluconate (Curasept

ADS 212, Curaden, Kriens, Switzerland) two times daily. Upon the completion of the fourth appointment, they were prescribed antibiotic therapy including *Amoxicillin 500mg* capsules and Metronidazole 400mg tablets three times daily for 7 days, according to the recommendations of the German Society of Periodontology[18].

Follow-up checks were performed 6 to 8 weeks after the first appointment, ending the re-assessment of periodontal tissues.

The second stage came three months after the start of therapy. All the aforementioned measurements were repeated. The obtained results showed whether any kind of further therapy was necessary.

Statistical Analysis

A Student's *t*-test for paired samples was used to compare the observations before therapy and 3 months after therapy (if the observations followed a normal distribution). Statistically significant were assumed the values of $p< 0.05$. *IBM SPSS Statistics 19.0; MS Office Word 2010* and *MS Office Excel 2010* was the software used for the statistical analysis, as well as the result tables and diagrams.

Results

FMPS index for the group of patients treated with PFLOW showed statistically significant reduction of mean, from 44.38 at baseline to 15.86 after 3 months of therapy. FMPS index for the group of patients treated with SRP also showed statistically significant reduction of mean, from 44.84 at baseline to 15.2 after 3 months of therapy (Table 1).

Tabele 1. FMPS (Full Mouth Plaque Score) per treatment procedures

FMPS index		PFLOW		SRP	
		0	3	0	3
Number of participans		21	21	25	25
Arithmetic mean		44,38	15,86	44,84	15,20
Standard deviation		25,48	10,77	24,22	6,86
Standard error of arithmetic mean		5,56	2,35	4,84	1,37
95% confidence interval	Donja granica	33,48	11,25	35,35	12,51
	Gornja granica	55,28	20,46	54,33	17,89
Minimum		10,0	4,0	11,0	2,0
First qurtile-Q1		24,0	7,0	21,0	10,0
Median-Q2		39,0	14,0	45,0	16,0
Third quartile-Q3		69,0	21,0	63,0	21,0
Maximum		81,0	49,0	88,0	30,0
Student t-test for paired samples					
p<0,001					

FMBS index for the group of patients treated with PFLOW showed statistically significant reduction of mean, from 45.57 at baseline to 14.62 after 3 months of therapy. FMBS index for the group of patients treated with SRP also showed statistically significant reduction of mean, from 45.96 at baseline to 16.04 after 3 months of therapy (Table 2).

Tabele 2. FMBS (Full Mouth Bleeding Score) per treatment procedures

FMBS index		PFLOW		SRP	
		0	3	0	3
Number of participans		21	21	25	25
Arithmetic mean		45,57	14,62	45,96	16,04
Standard deviation		22,24	9,39	21,08	8,89
Standard error of arithmetic mean		4,85	2,05	4,22	1,78
95% confidence interval	Donja granica	36,06	10,60	37,7	12,56
	Gornja granica	55,08	18,63	54,22	19,52
Minimum		15,0	1,0	9,0	2,0
First qurtile-Q1		28,0	7,0	34,0	9,0
Median-Q2		44,0	14,0	40,0	17,0
Third quartile-Q3		59,0	20,0	60,0	21,0
Maximum		92,0	36,0	87,0	37,0
Student t-test for paired samples					
p<0,001					

CAL values for the group of patients treated with PFLOW showed statistically significant reduction of mean, from 3.6 at baseline to 2.81 after 3 months of therapy. CAL values for the group of patients treated with SRP also showed statistically significant reduction of mean, from 3.81 at baseline to 2.85 after 3 months of therapy (Table 3).

Tabele 3. CAL (Clinical Attachment Level) per treatment procedures

CAL		FLOW		SRP	
		0	3	0	3
Number of participans		21	21	25	25
Arithmetic mean		3,60	2,81	3,81	2,85
Standard deviation		0,91	0,57	0,65	0,47
Standard error of arithmetic mean		0,20	0,12	0,13	0,09
95% confidence interval	Donja granica	3,21	2,57	3,56	2,66
	Gornja granica	3,99	3,05	4,07	3,03
Minimum		2,4	2,1	2,9	2,1
First qurtile-Q1		3,1	2,3	3,4	2,5
Median-Q2		3,4	2,8	3,7	2,8
Third quartile-Q3		4,0	3,0	4,3	3,1
Maximum		5,6	4,1	5,4	4,1
Student t-test for paired samples					
p<0,001					

CAL values for the group of non smoking patients showed statistically significant reduction of mean, from 3.47 at baseline to 2.67 after 3 months of therapy. CAL values for the group of smoking patients showed statistically significant reduction of mean, from 4.01 at baseline to 3.02 after 3 months of therapy (Table 4).

Tabele 4. CAL (Clinical Attachment Level) according to smoking status

CAL		non smokers		smokers	
		0	3	0	3
Number of participans		25	25	21	21
Arithmetic mean		3,47	2,67	4,01	3,02
Standard deviation		0,65	0,46	0,83	0,51
Standard error of arithmetic mean		0,13	0,09	0,18	0,11
95% confidence interval	Donja granica	3,21	2,49	3,65	2,81
	Gornja granica	3,72	2,85	4,36	3,24
Minimum		2,4	2,1	2,7	2,2
First qurtile-Q1		3,1	2,3	3,4	2,7
Median-Q2		3,4	2,7	3,8	3,0
Third quartile-Q3		3,9	2,9	4,6	3,2
Maximum		5,0	4,1	5,6	4,1
Student t-test for paired samples					
p<0,001					

Discussion

Periodontal disease is widespread. Gingivitis occurs in a large part of the world population, over 90% has some type of gingival inflammation[19]. Worldwide, advanced periodontitis is the 6th most frequent disease. Therefore, 2% of young population has this type of disease, while the percentages in adult population go from 5% to 20% [20]. Data for this area of Bosnia and Herzegovina (Banja Luka and the surroundings) are unknown, therefore this study will contribute in gathering partial insight into understanding the state of periodontal tissue health in the local population.

In this study we compared the classical treatment for this disease, periodontal scaling and root planning, with the new treatment of periodontal pockets such is air polishing. We used dichotomous indexes FMPS and FMBS to evaluate the gingival tissue health, oral hygiene and gingival inflammation. CAL index was used to evaluate the degree of destruction of periodontal tissue. The efficiency of the described procedures was established monitoring the aforementioned indexes.

Comparing the FMPS index before and after treatment, we noted a decrease in the value in both PFLOW and SRP groups. Comparing these two methods of gingival pocket treatment Tomasi and his assistants came to the similar results, where, at the end of the treatment, the value of this index was significantly reduced[21].

FMBS index is used to evaluate the oral hygiene. There were two groups of patients, one treated with PFLOW and the other with SRP, and both shown statistically significant decrease of FMBS index in comparison to the values registered before the treatment. The values observed are in accordance with the values reported by other researches[16,22,23].

Measured clinical attachment level (CAL) index before any treatment is 3.71, which indicates significant destruction of periodontal tissue in patients with aggressive periodontitis. Measured value of CAL in the group of patients treated with PFLOW before the treatment was 3.6, and after 3 months of treatment, was reduced to 2.81. Based on this we can observe that the new treatment contributed to stopping further destruction of periodontal tissue.

CAL index in control group of patients that underwent a treatment with sonic scaling and root planning showed a reduction of the value, indicating that the periodontal disease is kept under control. Other studies conducted shown that any of the treatments for treating periodontal pocket in patients with aggressive periodontitis leads to stopping the further destruction of periodontal tissue[24].

Other authors have pointed out, that monitoring parameters of gingival inflammation and CAL index of periodontal tissue destruction shows PFLOW technique can be considered as a successful replacement for existing mechanical sonic root planning and scaling, as it results in successful removal of subgingival biofilm, consequently leading to stopping the further destruction of periodontal tissue[25].

Smoking has been well documented as a significant risk factor for aggressive periodontitis[26]. Smokers with initial signs of periodontitis show higher alveolar bone destruction and much faster loss of clinical attachment than non-smokers with aggressive periodontitis[27].

Non-smokers have in average 3.47 of clinical attachment level, while smokers average in 4.01, which is 0.54 higher. This is a statistically significant difference, meaning that the destruction of periodontal tissue in patients with generalized form of aggressive periodontitis is much larger with smokers than non-smokers. The average clinical attachment level after 3-month treatment in non-smokers was 2.67, which was 0.36 less than the level exhibited by smokers. This statistically significant

difference indicates that, regardless of treatment applied, the size of the periodontal tissue destruction in aggressive periodontitis remains higher with smokers. Periodontal tissue in non- smokers with aggressive periodontitis responds better to any of the two used in this study treatments than the one in smokers[28]. Other researches using the same treatments confirmed the results of this research[29].

Therefore, based on the results of this study, as well as the results obtained through other related studies, patients need to be informed about smoking effects on periodontal tissue. Cigarette smoking leads to significantly larger periodontal tissue destruction. We are obliged to inform patients about this effect and encourage them to momentarily quit smoking.

Conclusions

While sub-gingival air polishing showed equally good results as the SRP, PFLOW was more advantageous with respect to acceptability to patients, time usability and safety for the soft tissue.

The size of the periodontal tissue destruction in smokers is significantly larger than in non-smokers, while treatment methods used in this study have equally successful effects with both smokers and non-smokers.

As both treatments applied in this study, as well as antimicrobial treatment, lead to successful reduction in observed clinical parameters, a therapist has to choose the most feasible therapy that suits the needs of patient in question.

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