

## ORIGINAL RESEARCH



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# Comparative oral health outcomes before and after periodontitis treatment: Scaling and root planning alone versus Nd: YAG Laser Assisted New Attachment Procedure.

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## Abstract

**Introduction:** Periodontitis is a multifactorial condition that impacts the support tissues of the teeth. The purpose of the research was to correlate the results obtained in the treatment of patients with at least stage II periodontitis by scaling and root planing alone (SRP), or by the laser-assisted new attachment procedure (LANAP), and to assess the outcomes and patients' perceptions regarding the influence of these therapies on their quality of life by using The Oral Health Impact Profile-14 (OHIP-14) questionnaire.

**Materials and methods:** The oral cavities of 15 patients were divided into quadrants, and, according to the inclusion and exclusion criteria, two quadrants were allocated to one of the groups after the effectuated therapy: SRP or LANAP. The patient's periodontal status (VPI, PPD, BOP, and CAL) was assessed and filed in a periodontal chart at baseline and 6 weeks after the implementation of the treatments, along with the OHIP-14 questionnaire. SRP was conducted for the first group of patients, in the selected quadrant and in the two remaining quadrants that were not included in the study. The LANAP protocol was applied to the quadrant belonging to the second group (LANAP) using a 1064 nm Nd: YAG laser (Lightwalker AT-S, Fotona®, Slovenia).

**Results:** The results showed that both noninvasive treatments are effective in diminishing VPI, PPD, BOP, and CAL in periodontal patients, and the scores obtained 6 weeks after the end of the periodontal treatments determined the improvement of the patient's perception in the questionnaire.

**Conclusion:** Both the association of the Nd: YAG laser with scaling and root planing (LANAP) and SRP alone provided safe and efficient outcomes, resulting in high levels of satisfaction among patients at 6 weeks after treatment.

**Keywords:** periodontitis, SRP, LANAP, OHIP-14 questionnaire.

## Introduction

Periodontitis is a multifactorial disease in which the surrounding tissues and the bone support of the teeth are affected. The periodontal tissues are bleeding and sometimes painful. In advanced cases, tooth mobility or even tooth loss can occur [1,2]. It can be caused by various factors, like aggressive infection, chronic inflammation, and diminished healing [2,3]. The inflammation of periodontal tissues occurs in periodontal diseases and is interconnected to plaque and calculus accumulation [2,4].

A report by the Centers for Disease Control and Prevention (CDC) appraises that the incidence of periodontal disease in the United States is 47.2% in adults aged 30 years and over, which can present oral manifestations of this disease [5]. This disease rises with age, reaching 70.1% in adults 65 years and over, but young individuals can also be affected by the harmful effects of periodontal disease [6]. The

significant risk factors for the evolution of periodontal conditions are represented by poor oral hygiene and tobacco use [7].

The most demanding problems in the therapy of periodontal conditions are represented by the decrease of infectious and inflammatory processes and the cessation of tissue destruction [8,9]. For these, it is necessary to thoroughly acknowledge disease characteristics and personalized therapies [10]. This goal can be achieved by removing plaque, subgingival calculus and the biofilm layer to obtain a clean and polished dental surface with no retention of dental plaque and calculus [11,12].

Scaling and root planing (SRP) is a therapeutic procedure used in the treatment of periodontal conditions [12,13]. Lasers are used in dentistry to treat multiple conditions, including periodontal diseases, as a nonsurgical option [14-16].

LANAP is a modern alternative to conventional periodontal treatment. The described benefits of LANAP include better access to the root surfaces, predictable hemostasis, and widened patient acceptance (without conventional surgical flaps and sutures) [17,18]. The objectively determinable variables for a correct diagnosis and evaluation of periodontal conditions are represented by plaque index (VPI), bleeding on probing (BOP), periodontal probing depth (PPD), and clinical attachment level (CAL), or bone level (BL) [19].

The treatment for patients with periodontal conditions is generally made without knowing their subjective perceptions or how their daily lives were affected by the therapy [20].

The Oral Health Impact Profile-14 (OHIP-14), is a shorter form of Oral Health Impact Profile (OHIP), planned to evaluate the patients' perceptiveness regarding the influence on their quality of life regarding their oral conditions, and the applied therapies [21]. OHIP-14, as a unidimensional instrument, presents 14 questions with answers, which are estimated on a scale (where 1 = never, and 5 = very often). These are utilized to specify the level of various oral health conditions of the patients. A lower score means better oral health [22].

Despite the actual use of the LANAP protocol, limited studies show the oral health profile outcomes, patient compliance, and timeliness of healing [17].

The objective of this survey was to evaluate the oral health profile of patients affected with at least stage II periodontitis, before and after the implementation of specific periodontal therapies represented by SRP alone or LANAP.

## Material and methods

Table 1. Inclusion criteria

Age of patients of at least 18 years who wanted to take part in the study and signed the informed consent;

The presence of at least 12 natural teeth on the dental arches, located in the four quadrants;

Patients who had at least two teeth affected by periodontitis, with periodontal pockets at least 4 mm deep on one of the six tooth surfaces;

The research was concluded by applying the ethical principles of good clinical practice and those of the World Medical Association of Helsinki (WMA) regarding the Ethical Principles for Medical Research Involving Human Subjects. The study has been approved by the Ethics Committee of George Emil Palade University of Medicine, Pharmacy, Science, and Technology of Târgu Mureș, Romania, no. 750, on February 18th, 2020.

All of the patients involved were briefed concerning the demands of the survey. The selected patients voluntarily accepted the specifications of the program. The study phases, including monitoring, were described to all selected subjects. Written informed consent and the use of data for research-based reasons were signed by all participants.

The research was accomplished in the George Emil Palade University of Medicine, Pharmacy, Science, and Technology of Târgu Mureș Dental Medicine Faculty's Integrated Dental Center and Dentaltop Dental Clinic in Târgu Mureș from February 2020 through October 2022, with a gap due to the circumstances of the COVID-19 pandemic.

Eligibility was assessed through anamnesis, clinical examinations, and orthopantomography. The anamneses involved questions concerning any allergies, habits (nutritional, parafunctional, bruxism, vicious, including smoking), and acute or chronic illnesses.

Selection of patients: at least two teeth located in different quadrants and showing more than 4 mm of periodontal pocket depth. 15 selected patients (seven females and eight males) were aged between 36 and 67 ( $51.5 \pm 15.5$ ). The inclusion criteria are shown in Table 1 and the exclusion criteria are shown in Table 2.

Patients rehabilitated or that require fixed prosthetic restorations;

Patients with bone resorption observed clinically and radiologically;

Patients with a good state of health that allows dental therapy and monitoring.

Table 2. Exclusion criteria

Patients who have experienced periodontal therapy during the last 12 months;

Patients that followed systemic/local antibiotic therapy during the last 6 months;

Systemic conditions that would change the results of the therapies (type I and II diabetes, HBV, HCV, haematological disorders, cancer, immune deficiencies, epilepsy);

Pregnancy or breastfeeding;

Teeth with extraction indication;

Refusal or inability to follow the protocol of the study.

Clinical protocol: consultation, documentation of the periodontal variables in the periodontal chart, radiographic examinations; the first determination of plaque deposits (VPI), bleeding on probing (BOP), periodontal pocket depth (PPD), clinical attachment level (CAL) was done at beginning; filling in of the questionnaire regarding the oral health profile; followed by professional oral cleaning; randomized division of patients in the two groups; patients training concerning proper dental hygiene at home (tooth brushing technique after Bass, effectuated with soft tooth brushes and toothpastes containing fluoride); conducting the SRP in patients of first group, in the selected quadrant and in the two quadrants not involved in the study; applying the LANAP protocol to the teeth belonging to the second group (the remaining quadrant); instructing the patients regarding the post-interventional recommendations (rinses with chlorhexidine mouthwash, twice a day, after brushing, for two weeks); 6 weeks later, a second examination of plaque deposits (VPI), bleeding on probing (BOP), periodontal pocket depth (PPD) and clinical attachment level (CAL); the second registration of answers in the questionnaire; comparison between the obtained results in the two assessments.

The clinical protocols comprised: Professional cleaning, with Satelec Newtron ultrasonic scaler (Acteon® Group, U.S.A.) and Air-N-Go Airflow (Acteon® Group, U.S.A.), rotating brushes, and prophylactic paste; Conducting SRP, under local anesthesia, using Gracey area-specific curettes for manual scaling and root planing; applying the 1064 nm Nd: YAG laser (Lightwalker AT-S, Fotona®, Slovenia) with 2.5 W power, MSP pulse for 20 seconds per tooth for the first application) in the LANAP therapy under local anaesthesia; a second application of laser after the SRP of the periodontal pocket (3.5 W power, with a VLP pulse for 20 seconds per tooth, to acquire the fibrin clot which will seal off the periodontal pocket).

Questionnaire: The used Oral Health Impact Profile (OHIP) questionnaire comprises 14 questions, and it was used to assess the quality of life linked to patient's perception regarding their periodontium conditions, before and after performing the specific dental treatment (represented by SRP, and LANAP), and the effects on their well-being (Figure 1) [22,23]. The answers used in this questionnaire were five (very often; quite often; occasional; rarely; never; I do not know).

Name and surname:						
Date:						
<b>How often have you had this problem: in the last year / 6 weeks after the treatment?</b>						
	Very often	Quite often	Occasional	Almost never	Never	I do not know
1. Have you had difficulties in pronouncing some words because of the problems you have with your teeth, oral cavity or dentures?						
2. Have you noticed that your sense of taste has worsened because of the problems you have with your teeth, oral cavity or dentures?						
3. Have you felt pain in the oral cavity?						
4. Have you felt that it is uncomfortable to eat certain foods because of the problems you have with your teeth, oral cavity or prostheses?						
5. Have you felt intimidated by your teeth, oral cavity or dentures?						
6. Have you felt tense because of the problems you have with your teeth, oral cavity or dentures?						
7. Have you had an unsatisfactory diet because of the problems you have with your teeth, oral cavity or dentures?						
8. Have you had to interrupt your meals because of the problems you have with your teeth, oral cavity or dentures?						
9. Have you felt that it is difficult for you to relax because of the problems you have with your teeth, oral cavity or dentures?						
10. Have you felt embarrassed because of the problems you have with your teeth, oral cavity or dentures?						
11. Have you been a little irritable with other people because of the problems you have with your teeth, oral cavity or dentures?						
12. Have you encountered difficulties in carrying out your usual tasks and work because of the problems you have with your teeth, oral cavity or prostheses?						
13. Have you felt that life in general is less satisfactory because of the problems you have with your teeth, oral cavity or dentures?						
14. Have you been totally unable to work because of the problems you have with your teeth, oral cavity or dentures?						
<b>Instructions for completing the questionnaire:</b>						
This questionnaire investigates how the problems you have with your teeth, oral cavity or dentures could have caused you "problems" in your daily life. We want to know how often you had each of the 14 problems listed during the last year. Each question on the left side of the page refers to a specific dental problem. Mark the answer to the right of the question to indicate how often you had that problem in the last year.						

Figure 1. The Oral Health Impact Profile-14 (OHIP-14) questionnaire used in this research

The statistical analysis was carried out using the SPSS 24 software (Armonk, NY, USA: IBM). The results are considered significant at a significance level of 0.05.

A t-test for paired samples was carried out to compare the treatments. The Wilcoxon signed-rank test was performed when the effects of the two treatments were tested on similar teeth and, therefore considered in pairs.

## Results

### Clinical results

Table 3 shows the p-values for both LANAP and SRP therapeutic procedures

Table 3. p-values for both LANAP and SRP procedures

Variable	p-value
Visible plaque index (VPI)	0
Bleeding on probing (BOP)	0
Periodontal probing depth (PPD)	0
Clinical attachment level (CAL)	0

Table 4. The effect of LANAP on the periodontal variables

		Mean	N	Std. Deviation
<i>Pair 1</i>	VPI 1	7.0667	15	4.94927
	VPI 2	1.0000	15	0.84515
<i>Pair 2</i>	BOP 1	10.0000	15	4.24264
	BOP 2	1.2000	15	1.01419
<i>Pair 3</i>	PPD 1	0.7133	15	0.15055
	PPD 2	0.4933	15	0.09612
<i>Pair 4</i>	CAL 1	-0.7467	15	0.15055
	CAL 2	-0.5200	15	0.09411

The differences are significant in the case of the 4 variables.

Table 5. The effect of SRP on the periodontal variables

		Mean	Nfour	Std. Deviation
<i>Pair 1</i>	VPI 1	8.8667	15	4.94927
	VPI 12	1.0687	15	0.84515
<i>Pair 2</i>	BOP 1	9.7333	15	4.24264
	BOP 2	1.2667	15	1.01419
<i>Pair 3</i>	PPD 1	0.6533	15	0.15055
	PPD 2	0.4667	15	0.09612
<i>Pair 4</i>	CAL 1	-0.7000	15	0.15055
	CAL 2	-0.5467	15	0.09411

Table 4 shows that the outcomes of LANAP present notable effects on BOP, the average PPD, and CAL, with statistically notable differences after the treatment. The average values showed that three variables (VPI, BOP, PPD) diminished after the accomplishment of the treatment, which suggested favourable results in the therapy of periodontal conditions with LANAP.

As seen in Table 5, for SRP alone, the average values decrease for bacterial plaque, bleeding, and probing depth, thus suggesting an improvement as well.

Results regarding the answers to the questionnaire

All terms of the OHIP-14 questionnaire were comprehensible for the patient's perception, and the items were appropriate for



the impact evaluation of the problem connected to oral health in the patient's life. OHIP-14 items encountered the Incomprehension Index situated between 0.0% and 1.5%, the reason for which the

understanding of the items by the patients was supposed to be adequate.

Table 6 presents the answers to the OHIP questionnaire regarding the patients' concerns about the oro-dental system before and after treatment.

Table 6. Answers to used OHIP questionnaire, regarding the patients' concerns in the oro-dental system before and 6 weeks after treatment

No. of the question	How often have you had this problem in the last year, before the treatment / 6 weeks after the treatment?						
		<i>Very often</i>	<i>Quite often</i>	<i>Occasional</i>	<i>Almost never</i>	<i>Never</i>	<i>I do not know</i>
1.	Before treatment	0	0	3 20.0%	2 13.33%	8 53.33%	2 13.33%
	6 weeks after treatment	0	0	2 13.33%	1 6.66%	10 66.66%	2 13.33%
2.	Before treatment	0	1 6.66%	2 13.33%	2 13.33%	8 53.33%	2 13.33%
	6 weeks after treatment	0	0	1 6.66%	2 13.33%	10 66.66%	2 13.33%
3.	Before treatment	2 13.33%	2 13.33%	7 46.55%	4 26.66%	0	0
	6 weeks after treatment	0	0	5 33.33%	6 40.0%	4 26.66%	0
4.	Before treatment	1 6.66%	3 20.0%	6 40.0%	5 33.33%	0	0
	6 weeks after treatment	0	2 13.33%	4 26.66%	4 26.66%	5 33.33%	0
5.	Before treatment	2 13.33%	2 13.33%	4 26.66%	6 40.0%	1 6.66%	0
	6 weeks after treatment	0	1 6.66%	3 20.0%	1 %	10 66.66%	0
6.	Before treatment	2 13.33%	4 26.66%	4 26.66%	3 20.0%	1 6.66%	1 6.66%
	6 weeks after treatment	0	0	1 6.66%	2 13.33%	11 73.33%	1 6.66%
7.	Before treatment	1 6.66%	3 20.0%	3 20.0%	4 26.66%	3 20.0%	1 6.66%
	6 weeks after treatment	0	0	2 13.33%	4 26.66%	8 53.33%	1 6.66%
8.	Before treatment	0	3 20.0%	4 26.66%	5 33.33%	2 13.33%	1 6.66%
	6 weeks after treatment	0	0	2 13.33%	2 13.33%	11 73.33%	0
9.	Before treatment	0	2 13.33%	4 26.66%	4 26.66%	4 26.66%	1 6.66%
	6 weeks after treatment	0	0	2 13.33%	3 20.0%	9 60.0%	1 6.66%
10.	Before treatment	2 13.33%	4 26.66%	4 26.66%	3 20.0%	1 6.66%	1 6.66%
	6 weeks after treatment	0	0	2 13.33%	2 13.33%	10 66.66%	1 6.66%

11.	Before treatment	1 6.66%	3 20.0%	4 26.66%	2 13.33%	4 26.66%	1 6.66%
	6 weeks after treatment	0	0	1 6.66%	2 13.33%	11 73.33%	1 6.66%
12.	Before treatment	1 6.66%	4 26.66%	4 26.66%	3 20.0%	2 13.33%	1 6.66%
	6 weeks after treatment	0	0	2 13.33%	3 20.0%	9 60.0%	1 6.66%
13.	Before treatment	1 6.66%	2 13.33%	3 20.0%	4 26.66%	4 26.66%	1 6.66%
	6 weeks after treatment	0	0	1 6.66%	2 13.33%	11 73.33%	1 6.66%
14.	Before treatment	0	1 6.66%	2 13.33%	3 21.426%	8 53.33%	1 6.66%
	6 weeks after treatment	0	0	1 6.66%	1 6.66%	12 80.0%	1 6.66%
<b>TOTAL</b>	<b>Before treatment</b>	<b>13</b>	<b>34</b>	<b>54</b>	<b>50</b>	<b>46</b>	<b>13</b>
	<b>6 weeks after treatment</b>	<b>0</b>	<b>3</b>	<b>29</b>	<b>35</b>	<b>131</b>	<b>12</b>

According to the results of the study, listed in Table 6, the scores obtained 6 weeks after the finalization of the applied periodontal treatments determined the improvement of the patient's answers in the OHIP-14 questionnaire.

## Discussions

The study suggested that the association of SRP and the use of Nd: YAG lasers as an additional treatment of periodontal conditions at specific parameters can be suitable to take out residual debris from the periodontal pocket, and with it, there can be a small or absent thermal effect on the tooth root surface. The Nd: YAG laser appears to be the most appropriate for nonsurgical periodontal therapy. Additionally, new and well-designed research is necessary to evaluate the effectiveness of Nd: YAG lasers associated with SRP in nonsurgical periodontal treatments.

Abu-Ta'a et al. consider that even though laser therapy has had encouraging outcomes in the treatment of periodontitis, additional studies are necessary for evidence-based dental practice [23]. In their research, Dortaj et al. found that non-surgical periodontal therapy (NSPT) and treatments with Nd: YAG laser determine a greater diminution of periodontal probing depth (PPD) compared to NSPT alone, and this decrease is induced by a greater gingival reduction (GR) rather than new

gingival attachment gain. Therefore, the associated therapy with Nd: YAG laser, used with the current settings, does not improve the clinical results in NSPT of residual periodontal pockets [24]. Many authors consider that lasers represent additional promising devices for non-surgical therapy of periodontal conditions that provide many advantages, but their utilization should not replace conventional SRP treatment [25,26]. According to Yukna et al. [18], LANAP has an accurate treatment protocol based on biological and clinical concepts that associate laser therapy with the conventional principles of established periodontal therapy. Both types of therapies present similar objectives, but LANAP possesses some benefits (being non-invasive, less traumatic, and causing less swelling, with reduced postoperative discomfort and more accelerated healing). They underlined that both therapies present equal or better overall outcomes in comparison with conventional periodontal surgery. Thereby, LANAP shows itself to be an effective treatment of chronic periodontitis because of its minimally invasive character. These authors consider that long-term monitoring evidence and controlled clinical trials represent a need to compare LANAP to other surgical therapies. In their review, El Mobadder et al. underline that the non-surgical treatment with laser application presents several advantages, like better disinfection of the periodontal pockets,

bactericidal consequences on periodontal pathogens, and the elimination of dental biofilm, with a positive capacity for decreasing the inflammatory process of periodontal conditions [25]. Nevins et al. conducted single-centre, prospective clinical research to assess the clinical outcomes of LANAP. They observed the improvement of the health status in the majority of the treated areas but considered that LANAP therapy should be studied with long-term clinical trials, compared with conventional therapy, to obtain detailed comparable data [27].

The patient's compliance should be correctly assessed. Likewise, in the areas that present probing depths of 1–5 mm, a non-surgical approach with sustained root planing, periodontal therapy for maintenance, and continuous home care is advised as a treatment approach [27]. According to Moya-Villaescusa et al., it is of great importance to study periodontal diseases with reference to the variables (like BL, PPD, BOP, or CAL) and their probable connections in relation to the patient satisfaction level. They observed that periodontal diseases, particularly in critical stages, had a negative effect on the oral health-related quality of life (OHRQoL) of patients. The severity of periodontal disease impacted post-treatment pain, while the amount of periodontal disease did not seem to influence OHRQoL. The statistically notable differences ( $p < 0.05$ ) were linked with the pre-and post-treatments in all the studied items and by the degree or stage of the disease, but these differences were not observed in extended periodontal diseases [20].

In 1997, Slade developed the "Oral Health Impact Profile-14 (OHIP-14)" questionnaire [28]. OHIP-14 assessed the quality of life in conjunction with people's approaches to oral conditions and their consequences for their well-being. This questionnaire revealed good predictability, validity, and precision. This OHIP-14 is utilized across the entire world for many research goals, with adaptations in relation to language and interest areas [21,22]. The evaluation of the adult quality of life related to oral health represents one of the fundamental requirements [29-31]. OHIP-14 is the most conventional HRQoL instrument and

has registered more than 1000 citations in Scopus [29].

Two different methods are utilized for scoring OHIP. In the "simple count method" (OHIP-SC), the final score represents the sum of the impacts communicated more frequently than occasionally. Answers 3 and 4 represent the damaging effect of oral health on an individual's life, while answers 0, 1, and 2 indicate the positive effect. In the "additive method" (OHIP-ADD), the final score represents the sum of the 14 item keys, at whatever frequency, calculated by adding up the answers to all 14 items, with the final score varying from 0 to 56. The higher value of the final score represents the worst for oral health [21].

In this research, we used the "simple count method" to calculate the OHIP score of patients. The obtained results showed that periodontal symptomatology negatively impacted the level of OHRQoL.

In their review, Khan et al. studied the relationship between non-surgical periodontal treatment and patient-based results with the OHIP-14 questionnaire. The usual observation was in reference to the physical pain in the short-term monitoring, but this sign was notably ameliorated in the long-term studies. They suggested non-surgical periodontal therapy as a "gold standard" perspective for improving the results, decreasing comorbidities, and increasing patient safety [32].

Paśnik-Chwalik et al. [33], carried out a systematic review referring to the impact of periodontal conditions on QoL evaluated through the OHIP-14 questionnaire, and the outcomes of their research were accountable for a meta-analysis. All the studied research shows a remarkable impact of periodontal conditions on the OHIP-14 values, which were depreciated directly proportional.

The clinical importance of the study and the OHIP questionnaire applied before and after the application of the treatments in both study groups is given by the impact of periodontal symptomatology on the deteriorated OHRQoL. This is due to psychological discomfort and stress, complicated interpersonal relations, and the inconveniences of everyday occupations too. All these confirm



the fact that a holistic approach to the therapy of periodontal disease is necessary.

### Conclusions

The clinical results demonstrated the fact that noninvasive treatments are effective in diminishing periodontal probing depth, visible plaque index and bleeding on probing in periodontal patients. The OHIP-14 questionnaire items were coherent for the respondents and it has proven to be a useful tool for evaluating the effect of periodontal symptoms on deteriorated Oral Health-related Quality of Life (OHRQoL), which includes psychological discomfort and stress, complicated interpersonal relations, and inconveniences in everyday occupations.

Both the association of the Nd: YAG laser with scaling and root planing (LANAP) and SRP alone provided safe and efficient outcomes, resulting in high levels of satisfaction among patients at 6 weeks after treatment.

**Conflict of interest:** None to declare.

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