Comparison of Adjunctive Nd:YAG Laser Treatment to Antimicrobial Treatment

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Purpose: The aim of this pilot study was to compare the clinical outcome of initial periodontal scaling and root planing alone (SRP) or SRP combined with Neodynium Yttrium-Aluminum-Garnet (Nd:YAG) laser therapy (NLT) to the same protocol with the use of systemic antimicrobial drugs.

Materials and Methods: This double-blind split-mouth design study involved 15 otherwise healthy patients suffering from generalized chronic periodontitis. The subjects were randomly assigned to the two treatment groups. 1. Ultrasonic and hand supra- and sub-gingival scaling with root planing (SRP) on the right side (quardrants 1 and 4). NLT on the left side (quadrants 2 and 3) without the use of antimicrobial drugs as an adjunctive therapy. 2. SRP on the right side (quadrants 1 and 4). NLT on the left side (quadrants 2 and 3) with adjunctive antimicrobial therapy. The clinical parameters recorded during this study were the bleeding on probing index (BPI), periodontal probing depth (PPD), and the presence of the microbes Actinobacillus actinomycetemcomitans (AA), Porphyromonas gingivalis (PG), Bacteroides forsythus (BF), and Treponema denticola (TD). Clinical measurements and microbiological assessments were taken at baseline and after completion of treatment. The clinical protocol of the periodontal treatment includes microbiological assessment, SRP, polishing, and additional NLT for quadrants 2 and 3. All subjects received hygienic instructions and a 0.05% chlorhexidine rinse twice a day. The subjects received amoxicillin, metronidazol, or a combination depending on the outcome of the bacterial testing. The control group received a placebo.

Results: The present study demonstrated a significant reduction in mean total counts of the microorganisms AA and BF in the subgingival microbiota following the different test therapies. There tended to be a beneficial effect of the additional use of the Nd:YAG laser, where medication did not have this effect at 90 days.

Conclusion: This tendency could encourage clinicians to use the Nd:YAG laser as an adjunctive therapy and abandon the use of antimicrobial agents that increase the risk for antibiotic resistance.

Keywords: periodontitis, Nd:YAG, amoxicillin, metronidazol.

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In the past decades, numerous reports from different groups of investigators have provided significant data clarifying the etiology of periodontal diseases. Many of these studies included a description of the nature of bacterial species that are associated with periodontal health or disease. In order to treat this disease, different treatment protocols are suggested. SRP is the most common and well-documented periodontal treatment.[1-5] Many dental professionals provide SRP and polishing for patients at regular intervals to maintain periodontal stability, because a decrease of counts of pathogens was not sustained over time.[6] There is debate over the clinical and cost effectiveness of "routine scaling and polishing" and the optimal frequency at which it should be provided.[7] SRP does not seem to be effective for those sites with shallow initial periodontal probing depth. However, the reduction seems to be significant for medium and deep initial periodontal pockets.[8] In

the meta-analysis by Hsin-Chia Hung et al,[8] it was shown that surgical treatment (modified Widmann-flap) is better for reduction of periodontal probing depth, and these benefits become greater with the increase of initial periodontal probing depth. However, the differences seem to become smaller with follow-up time. Gain of attachment level was similar for the surgical approach when compared with SRP over time. There does not seem to be a significant reduction of periodontal pathogens when using these protocols.[9] When local antibiotic application was combined with SRP, a consistent reduction of periodontal probing depth and gain of attachment level was noticed. In their study, Winkel et al[10] showed that systemic usage of metronidazole and amoxicillin, when used in conjunction with initial periodontal treatment in adult periodontic patients, achieves significantly better clinical and microbiological results than initial periodontal treatment alone. Moreover, this research suggests that especially patients diagnosed with Porphyromonas gingivalis benefit from antibiotic treatment. However, local antibiotic applications alone did not influence these parameters differently than did SRP alone. Surgical treatment provides more benefits over the scaling and root planing than do adjunctive antibiotic treatments for deep pockets. Finally, studies in the last decade demonstrate that subgingival Nd:YAG laser treatment can result in significant reduction of the initial levels of periodontal pathogens. When combined with SRP, there was an additional gain of attachment level and reduction of pocket probing depth.[11-13] In many studies, these results are confirmed; however, controversy still exists about the additional effect of Nd:YAG laser treatment.[14-16]

Thus, the purpose of the present pilot study was to evaluate the changes in the composition of the subgingival microbiota resulting from SRP alone and in combination with systemically administered antimicrobial drugs, and SRP combined with NLT treatment with and without systemically administered antimicrobial drugs.

MATERIAL AND METHODS

Fifteen adults with chronic periodontitis who had not previously received periodontal therapy were recruited for the pilot study. Subjects were classified according to the Dutch periodontal screening index (DPSI)[17] and were included in the study if they had a score of 3+ or 4 (category C). A category-C subject has a pocket probing depth > 4 to 5 mm with recession. Exclusion criteria included pregnancy, lactation, and any systemic condition that might influence the course of periodontal disease or treatment (eg, diabetes, AIDS), or antibiotic therapy in the previous 6 months. In addition, subjects with a known allergy to metronidazol or amoxicillin and subjects suffering from any systemic condition that requires antibiotic coverage for routine periodontal procedures (eg, heart conditions, joint replacements etc.) were excluded.

In this randomized, split-mouth, double-blind clinical trial, subjects were screened for suitability, and if accepted, were informed of the nature, potential risks, and benefits of study participation. Following the signing of informed consent, subjects were entered into the study. At baseline, a complete perio survey was conducted, in which recession, mobility, and pocket probing depth were measured, and the bleeding index according to Silness and Loe was assessed. There is no agreement in the literature about number or group of teeth that should be sampled to establish specific periodontal microbiota. Müller et al[18] suggested the analysis of the deepest pockets of every quadrant of the dentition. The standardized clinical and microbiological examination included the microbiological sampling of the pocket of the first molars, canines, and lower incisor. AA, PG, TD, BF were counted, all being significant markers for destructive periodontal disease in adult subjects. Based on calculated odds ratios, BF and PG are the strongest bacterial markers for this disease and are infrequently cultured from subjects without periodontal bone loss.[19]

At the start of treatment, all subjects received instructions in proper home-care techniques, and scaling and root planing was performed in all quadrants. Before scaling and root planing in the second and third quadrant, Nd:YAG laser treatment was performed to change the structure of the debris and calculus. Finally, Nd:YAG laser treatment was repeated immediately after SRP in the left side quadrants.

A Fidelis Plus Nd:YAG Laser System (Fotona, Ljubljana, Slovenia) with a 300-µm optic fiber was used. The laser was applied along the long axis of the root surface with a smooth sweeping motion from the bottom of the pocket to the coronal part. The output power was 1.5 W at a pulse repetition rate of 15 Hz. The pulse width was VSP mode (80 to 120 s) (Fig 1).

Treatment of the entire oral cavity was completed within 24 h. Subsequently, subjects were randomly assigned to either the placebo or medication group. Amoxicillin (500 mg 3 times a day for 7 days) was systemically administered when only AA was found in the sample. Metronidazol (250 mg times a day for 7 days) was systemically administered when PG, PI, or BF was

found. If all pathogens were found in the sample, a combination of metronidazol and amoxicillin was prescribed. Subjects in the placebo group received a placebo drug using the same regimen as the antimicrobial therapy. The drug and placebo medications were specifically prepared for use in this study and were delivered in a vial as a solution in order not to be recognized as placebo or antimicrobial drug. Compliance was assessed by bringing in the vials on day 8. No severe adverse effects were observed in any of the subjects. At one month, all subjects were seen for hygiene instruction, and all teeth were cleaned and polished supragingivally using a rubber cup and dentifrice. At 90 days, the collection of all baseline data was repeated, while microbiological sampling was performed in a split-mouth design.

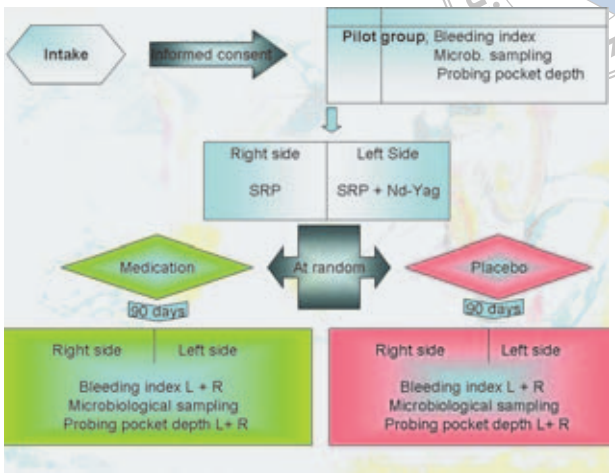

Fig 1 Study design.

RESULTS

The data were analyzed separately with respect to the bacterial counts, bleeding on probing, and pocket probing depth assessment.

Bacterial counts

The first analysis was conducted to assess the effects of treatment, medication, and their interaction on the four bacterial counts Aa, Bf, Pg, and Td. The analysis was performed according to a method using species-specific oligodeoxynucleotide probes for the identification of periodontal bacteria (Fig 2).[20]

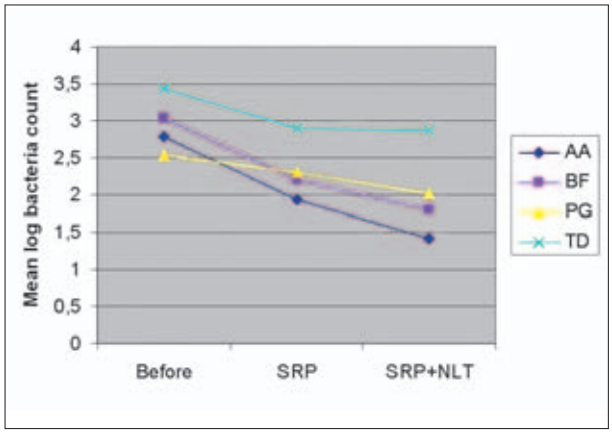

Fig 2 Mean log bacterial count according to treatment.

These four bacterial counts were used as four dependent variables. For each bacterial strain, there are measurements under three different conditions: before treatment, after NLT treatment (left side), and after SRP treatment (right side). These three conditions were used as a within-subject factor in the analysis. Each subject belongs to either the medication group or the placebo group. This variable, henceforth called "group", was used as the between-subject factor. Given the design of the data (several dependent variables and a within-subject factor) and the research question (evaluate the effect of independent variables on dependent variables), the statistical analysis used was a multivariate repeated-measures ANOVA.[21] The dependent variables are treated with multivariate tests while the within-subject factor is treated with univariate tests.

The analysis includes various statistical tests, which pertain to various research questions. An overview of the most important results is given in Table 1. For each combination of dependent variable and independent source, this table shows the F-value with its degrees of freedom in parentheses, p-value, and partial η^2.

It was cautiously concluded that condition might have an effect on the AA and BF strains. This implies that the means of the three conditions (before, after Nd:YAG laser/RSP, after RSP treatment) are not equal. It is then important to know which of these three means are different. The corresponding univariate contrast tests are reported in Table 2. Here, the mean before treatment (level 1) is compared to the mean after RSP treatment (level 2) and the mean after NLT treatment (level 3) for each strain. There is a significant difference between the mean before treatment and the mean after NLT treatment for both the AA and the BF strains.

Table 1 Overview of test results for bacterial counts

Bacterial count	Group	Condition	Group * Condition
AA	F(1, 13) = 0.00 p = 0.96 η^2= 0.00	F(2, 26) = 4.48 p = 0.02 η2= 0.26	F(2, 26) = 2.89 p = 0.07 η^2e= 0.18
BF	F(1, 13) = 0.09 p = 0.76 η^2= 0.01	F(2, 26) = 3.55 p = 0.04 η^2= 0.21	F(2, 26) = 1.35 p = 0.28 η^2= 0.09
PG	F(1, 13) = 0.64 p = 0.44 η^2= 0.05	F(2, 26) = 0.33 p = 0.72 η^2= 0.02	F(2, 26) = 1.99 p = 0.16 η^2= 0.13
TD	F(1, 13) = 0.13 p = 0.72 η2= 0.01	F(2, 26) = 0.56 p = 0.58 η2= 0.04	F(2, 26) = 1.50 p = 0.24 η2= 0.10
Multivariate	F(4, 10) = 0.27 p = 0.89 η^2= 0.10	F(8, 6) = 1.92 p = 0.22 η^2= 0.72	F(8, 6) = 1.39 p = 0.35 η^2= 0.65

Table 2 Univariate contrast tests of bacterial count

Bacterial count	Contrast	Condition	Group * condition
AA	Level 2 vs Level 1	F(1, 13) = 2.74 p = 0.12 η^2= 0.17	F(1, 13) = 4.27 p = 0.06 η^2= 0.25
	Level 3 vs Level 1	F(1, 13) = 10.97 p = 0.01 η^2= 0.46	F(1, 13) = 3.76 p = 0.07 η^2= 0.22
BF	Level 2 vs Level 1	F(1, 13) = 2.86 p = 0.11 η^2= 0.18	F(1, 13) = 1.95 p = 0.19 η^2= 0.13
	Level 3 vs Level 1	F(1, 13) = 6.35 p = 0.03 η^2= 0.33	F(1, 13) = 0.00 p = 0.97 η^2= 0.00
PG	Level 2 vs Level 1	F(1, 13) = 0.17 p = 0.68 η^2= 0.01	F(1, 13) = 3.33 p = 0.09 η^2= 0.20
	Level 3 vs Level 1	F(1, 13) = 0.55 p = 0.47 η^2= 0.04	F(1, 13) = 0.04 p = 0.85 η^2= 0.00
TD	Level 2 vs Level 1	F(1, 13) = 0.82 p = 0.38 η^2= 0.06	F(1, 13) = 3.07 p = 0.10 η^2= 0.19

The next question is what are the size and direction of the differences. Table 3 shows for each strain the mean for each condition. These results are averaged across groups, which is valid because the interaction is nonsignificant. These are the means of the group means, which are slightly different from the means of the subjects, since the groups were not exactly the same size. It can be seen in Table 3 that the count of the AA strain is reduced from 2.79 before treatment to 1.411 after treatment. The count of the BF strain is

Table 3 Bacterial counts

				95% Confidence Interval	
Measure	Measure	Mean	Std. Error	Lower Bound	Upper Bound
AA	1	2.790	0.4681	0.778	3.802
	2	1.929	0.564	0.709	3.148
	3	1.411	0.480	0.374	2.448
BF	1	3.027	0.425	2.108	3.945
	2	2.205	0.526	1.068	3.343
	3	1.795	0.576	0.551	3.038
PG	1	2.527	0.533	1.376	3.678
	2	2.295	0.509	1.195	3.394
	3	2.018	0.534	0.863	3.172
TD	1	3.438	0.347	2.688	4.187
	2	2.906	0.489	1.849	3.963
	3	2.875	0.440	1.926	3.824

reduced from 3.027 to 1.795. These differences can be considered significant.

The conclusions are therefore that NLT treatment leads to a significant, strong reduction of the AA and BF strains. The RSP treatment yielded a smaller reduction of AA and BF strains, which was nonsignificant in this pilot study. Both the NLT and the RSP treatment yielded a reduction in the PG and TD strains as well, but these reductions were not significant in the present experiment. There was no significant evidence of a differential effect of medication on any strain. Moreover, there was no significant main effect of medication, ie, the mean bacterial counts were approximately the same in the medication and placebo groups. A follow-up analysis with only the post-treatment bacterial counts revealed that there was no significant difference in the bacterial counts between the medication group and the placebo group after 90 days: $F(4, 10) = 0.352$, $p = 0.837$, $\eta^2 = 0.123$ for the multivariate test; all univariate tests were also nonsignificant.

Bleeding

Bleeding was measured under four conditions for each subject: before NLT treatment, after NLT treatment, before RSP treatment, and after RSP treatment (Fig 3). These conditions were structured as two within-subject factors. The first within-subject can be named Time (before or after). The second within-subject factor is the Treatment (NLT or RSP). In addition to this, there is the between-subject factor Group (medication or placebo). There is only one dependent variable: bleeding. Accordingly, the data were analyzed with a repeated measures analysis of variance.[20] Follow-up tests such as the ones in Table 2 are not needed here because each test applies to only two means.

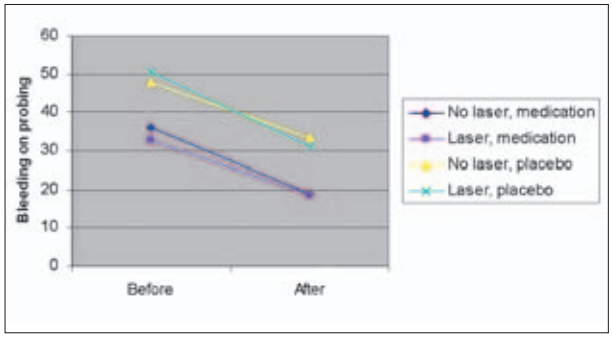

Fig 3 Bleeding on probing pre- and post-treatment.

The results are shown in Table 4. Only the effect of Time is significant. The corresponding means are shown in Table 5 and indicate that the bleeding decreased after the treatment.

These results show that the mean bleeding after treatment is lower than before treatment, but that there are no significant differences within the subset of cell means obtained before the treatment, and that there are no significant differences within the subset of cell means obtained after the treatment. This pattern is further illustrated in Table 6. Here, the pairwise differences between the four measurements of bleeding are given, averaged across the two groups. Significant differences are indicated with an asterisk. The table shows that each mean after treatment is significantly lower than each mean before treatment, but not significantly different from the cell mean after treatment.

Table 4 Bleeding

Source of variation	Test result
Treatment	F(1, 13) = 0.19 p = 0.67 η^2= 0.01
Treatment * Group	F(1, 13) = 0.34 p = 0.57 η^2= 0.03
Time	F(1, 13) = 21.22 p = 0.00 η^2= 0.62
Time * Group	F(1, 13) = 0.03 p = 0.86 η^2= 0.00
Treatment * Time	F(1, 13) = 0.10 p = 0.76 η^2= 0.01
Treatment * Time * Group	F(1, 13) = 1.67 p = 0.22 η^2= 0.11
Group	F(1, 13) = 2.50 p = 0.14 η^2= 0.16

Table 5 Means, standard errors and confidence intervals for bleeding before and after treatment

			95% Confidence Interval	
Time	Mean	Std. Error	Lower limit	Upper limit
Before	41.830	5.178	30.643	53.018
After	25.487	4.494	15.778	35.195

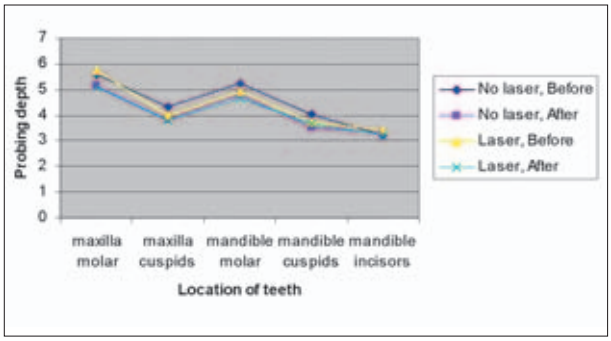

Fig 4 Probing depth according to location, treatment, and time.

Table 6 Pairwise differences between the four measures of bleeding. Each cell contains the mean difference of the row-variable minus the column variable

	No laser before	Laser before	No laser after	Laser after
No laser before		0.321	15.839(*)	17.170(*)
Laser before-	0.321		15.518(*)	16.848(*)
No laser after	-15.839(*)	-15.518(*)		1.33
Laser after	-17.170(*)	-16.848(*)	-1.33	

*) Difference is significant at 0.05 level.

Probing pocket depth

The probing pocket depth assessment was done under four conditions for each subject: before NLT treatment, after NLT treatment, before RSP treatment, and after RSP treatment (Fig 4). These conditions were structured as two within-subject factors. The first within-subject can be named Time (before or after). The second within-subject factor is the Treatment (NLT or RSP). In addition to this, there was an assessment for five teeth within each condition. This can either be structured as a within-subject factor with five levels or as five different dependent variables. These two possibilities correspond to different but equally important questions about the data, so both will be explored. Finally, there is the between-subject factor Group (medication of placebo).

In the first analysis, the five teeth were considered as five dependent variables: maxilla – molar (16 and 26); maxilla - canines (13 and 23); mandible – molar (36 and 46); mandible – canines (33 and 43); and mandible – incisor (31 and 41). The required analysis is a multivariate repeated measures analysis of variance. The multivariate tests are shown in Table 7. In each row, the null hypothesis is that the source in the first column has no effect on the probing pocket depth at

Table 7 Multivariate test on probing depth

Source of variation	Test result
Group	$F(5, 9) = 0.45$
	$p = 0.81$
	$\eta^2 = 0.20$
Treatment	$F(5, 9) = 0.50$
	$p = 0.77$
	$\eta^2 = 0.22$
Treatment * Group	$F(5, 9) = 1.90$
	$p = 0.19$
	$\eta^2 = 0.51$
Time	$F(5, 9) = 1.45$
	$p = 0.30$
	$\eta^2 = 0.45$
Time * Group	$F(5, 9) = 0.31$
	$p = 0.89$
	$\eta^2 = 0.15$
Treatment * Time	$F(5, 9) = 2.26$
	$p = 0.14$
	$\eta^2 = 0.56$
Treatment * Time * Group	$F(5, 9) = 0.53$
	$p = 0.75$
	$\eta^2 = 0.23$

any location. The table shows that none of the sources has a significant effect, which suggests that nothing has changed for any location under any treatment in any group.

Given the nonsignificant multivariate tests, the univariate follow-up tests per location should be considered with caution. These tests are shown in Table 8. Most tests were nonsignificant. There are three exceptions, but these do not exhibit a clear pattern, and the associated p-values are close to 0.05, so it is hard to see why these outcomes should overrule the outcomes of the multivariate tests.

In the second analysis, the five teeth were considered as a within-subject factor (Location) with five levels: maxilla – molar (16 and 26); maxilla – canines (13 and 23); mandible – molar (36 and 46); mandible – canines (33 and 43); and mandible – incisor (31 and 41). The analysis tested the effect of Location and the effects of all interactions with Location. However, the analysis showed that all effects were nonsignificant, except the main effect of Location ($p = 0.000$, $\eta^2 = 0.688$). This result means that some teeth are in better condition than other teeth, depending on their location, both before and after the treatment, but not depending on the treatment or the group.

Note that there is a certain imbalance in the design because the molars and canines are measured both in the upper and the lower jaw, whereas the incisors were measured only in the mandible. Therefore, we also conducted a third analysis in which we omitted the data of the mandibular incisors. The remaining four teeth can thus be structured by two within-subject factors: jaw (maxilla or mandible) and Type (canines or molars). Of course, the factor Type can just as well be called Position (canines or molars). In addition to this, there were the within-subject factors Time and Treatment, and the between-subject factor Group. This analysis showed a significant effect of Type ($F(1, 13) = 59.28$, $p = 0.00$, $\eta^2 = 0.82$) and a significant effect of Time ($F(1, 13) = 5.73$, $p = 0.03$, $\eta^2 = 0.31$). All other effects were nonsignificant. The relevant means are shown in Table 9. These are the means of the group means. The average probing depth is significantly larger for the molars than for the canines, and significantly smaller after the treatments than before the treatments. There is no significant effect of NLT vs RSP, medication vs placebo, or any interaction.

DISCUSSION

The present study demonstrated a significant reduction in mean total counts of the microorganisms AA and BF in the subgingival microbiota following the different test therapies. The data in the present investigation provide encouraging, but not conclusive evidence that adjunctive Nd:YAG laser therapy may be beneficial in controlling periodontal infections without the need for antimicrobial therapy. Over the years, the bacteria that antibiotics control have developed resistance to these antibiotics, which has become a public health problem. The widespread use of antibiotics promotes the spread of antibiotic resistance. Infections that could be treated easily in the past are now a risk to children and adults. When other adjunctive therapies can prevent the use of antibiotics in any therapy and demonstrate similar results, this adjunctive therapy should be the first option.

As one can see in Table 2, there is no significant difference between the mean before treatment and the mean after RSP treatment (and since there is no significant interaction, this holds for both groups) for both the AA and BF strain. However, there is a significant difference between the mean before treatment and the mean after NLT treatment, for both the AA and the BF strain. Therefore, the data suggest that the adjunctive laser therapy provides a better microbiological out-

Table 8 Test results for probing depth at each location

	maxilla – posterior	maxilla – canines	mandible – posterior	mandible – canines	mandible – anterior
Treatment	F(1, 13) = 0.03 p = 0.87 η^2= 0.00	F(1, 13) = 0.33 p = 0.57 η^2= 0.03	F(1, 13) = 1.97 p = 0.18 η^2= 0.13	F(1, 13) = 0.04 p = 0.84 η^2= 0.00	F(1, 13) = 0.45 p = 0.51 η^2= 0.03
Treatment * Group	F(1, 13) = 0.66 p = 0.43 η^2= 0.05	F(1, 13) = 0.65 p = 0.44 η^2= 0.05	F(1, 13) = 4.99 p = 0.04 η^2= 0.28	F(1, 13) = 0.00 p = 0.99 η^2= 0.00	F(1, 13) = 0.00 p = 0.96 η^2= 0.00
Time	F(1, 13) = 6.35 p = 0.03 η^2= 0.33	F(1, 13) = 2.33 p = 0.15 η^2= 0.15	F(1, 13) = 3.55 p = 0.08 η^2= 0.21	F(1, 13) = 2.28 p = 0.16 η^2= 0.15	F(1, 13) = 0.13 p = 0.72 η^2= 0.01
Time * Group	F(1, 13) = 0.37 p = 0.56 η^2= 0.03	F(1, 13) = 0.01 p = 0.92 η^2= 0.00	F(1, 13) = 0.26 p = 0.62 η^2= 0.02	F(1, 13) = 0.22 p = 0.65 η^2= 0.02	F(1, 13) = 0.43 p = 0.52 η^2= 0.03
Treatment * Time	F(1, 13) = 0.34 p = 0.57 η^2= 0.03	F(1, 13) = 1.93 p = 0.19 η^2= 0.13	F(1, 13) = 0.26 p = 0.62 η^2= 0.02	F(1, 13) = 1.62 p = 0.22 η^2= 0.11	F(1, 13) = 4.76 p = 0.05 η^2= 0.27
Treatment * Time * Group	F(1, 13) = 0.34 p = 0.57 η^2= 0.03	F(1, 13) = 0.39 p = 0.54 η^2= 0.03	F(1, 13) = 0.26 p = 0.62 η^2= 0.02	F(1, 13) = 2.69 p = 0.13 η^2= 0.17	F(1. 13) = 0.96 p = 0.35 η^2= 0.07

Table 9 Probing depth at different locations

TYPE	TIME	Mean	Std. Error	95% Confidence Interval	
				Lower limit	Upper limit
Molars	Before	5.384	0.174	5.009	5.759
	After	4.900	0.179	4.513	5.286
Canines	Before	4.020	0.197	3.595	4.445
	After	3.717	0.168	3.353	4.080

come. The clinical outcome, bleeding index, and pocket probing depth assessment do not differ significantly between the groups; both were reduced after treatment independent of treatment or whether or not the subject received medication. These results are encouraging and suggest that clinicians may abandon the use of antibiotics in periodontal treatment, thus decreasing the risk for antibiotic resistance.

The results furthermore show that mean bleeding after treatment is lower than before treatment, but that the two treatments (NLT and RSP) over time were not significantly associated with different levels of bleeding (averaged across both times). The decrease in bleeding on probing effect was the same after 90 days for both groups, so it did not matter whether or not the subject received any medication at 90 days.

This pilot study, however, did provide data at 90 days which will be critical in determining whether the improved clinical and microbiological outcomes observed for the adjunctive therapies, particularly the combined adjunctive therapies, will be sustained over time. In addition, larger numbers of subjects would be helpful in distinguishing additive or even synergistic effects of combining two different forms of therapy (medication and Nd:YAG laser) to SRP.

CONCLUSION

In many tests it was observed that the effect was nonsignificant, while 2 was fairly large. This indicates that the power of the study is too low, due to an insufficient number of subjects.[22] Therefore, it should not be concluded that the nonsignificant effects are really nonexis-

tent. The conclusion should rather be that the number of subjects is too small for a reliable conclusion. The large confidence intervals point in the same direction. Note that the logic of statistical testing demands that the null hypothesis is retained whenever there is insufficient evidence to reject it, and a small number of subjects may well be a cause of this. A tendency found in the different tests is a beneficial effect of the additional use of the Nd:YAG laser, where medication did not have this effect. This trend could encourage clinicians to use the Nd:YAG laser as an adjunctive therapy and abandon the use of antimicrobial agents that increase the risk for antibiotic resistance.

Since the NLT treatment was always given on the left side, and the classical treatment on the right side, the kind of treatment is confounded with the laterality. Although the effect of laterality may be unlikely from a substantive point of view, it cannot be ruled out a priori on a methodological basis. The design would be stronger if the treatment were counterbalanced with respect to the laterality, ie, if half of the group received the laser treatment on the left side and the RSP treatment on the right side, while the other half received the treatments on the opposite sides. It would also be interesting to gain more insight in the course of the effect over time. Therefore, additional measurements after 1 week and 30 days will be added in the multicenter international follow-up study.

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