respect to the treatment intervals were performed using the paired t test. Differences were considered as statistically significant at $p<0.05$.

RESULTS

Probing depths

Baseline PDs of periodontal involved teeth were statistically significant in the test group and control group ($p<0.05$). Six weeks after treatment, in both groups, a decrease in PDs could be found ($p<0.05$) with a higher impact in the test group than in the control, with a higher impact on the sites treated with adjunctive PDT ($p<0.05$).

Clinical attachment level

The attachment levels of periodontal involved teeth did not differ significantly in the test group and control group at baseline ($p<0.05$). After 6 weeks, a lower attachment gain could be observed in the control group than in the test group ($p<0.05$). Comparing the differences in CAL, an attachment gain could be observed in both groups, with a higher impact on the sites treated with adjunctive PDT ($p<0.05$).

Table 1: Depicts statistical analysis for pre and post intervention for adjunctive photodynamic therapy in both groups; with and without photodynamic therapy.

		Mean	Significance
Group 1	PD before	6.70 ± 1.081	0
	PD after	4.55 ± 1.146	
	CAL before	8.30 ± 1.218	0
	CAL after	6.65 ± 1.137	0
Group 2	PD before	6.92 ± 1.112	0
	PD after	5.95 ± 1.192	0
	CAL before	9.12 ± 1.256	0
	CAL after	8.46 ± 1.127	0

Group 1: With adjunctive photodynamic therapy, Group 2: Without adjunctive pdt, pd: probing depth, cal: clinical attachment level.

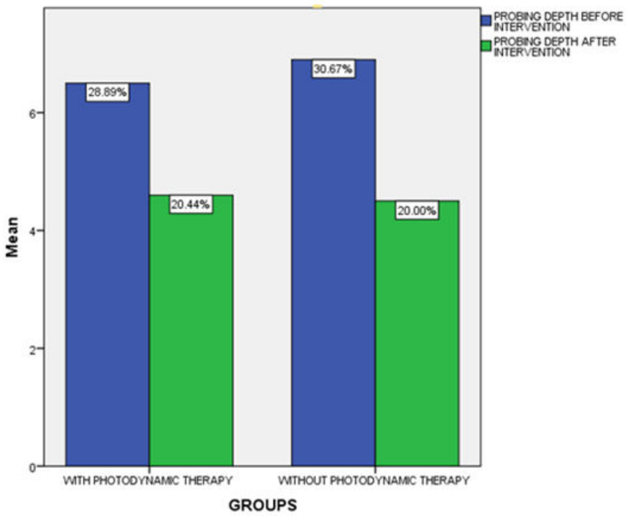

Figure 1: Bar graph represents the association between probing depths before and after intervention in both groups; with and without adjunctive photodynamic therapy ($p<0.05$) group 1 depicts significant improvement in probing depth reduction than group 2 (Group 1: With photodynamic therapy group 2: without photodynamic therapy).

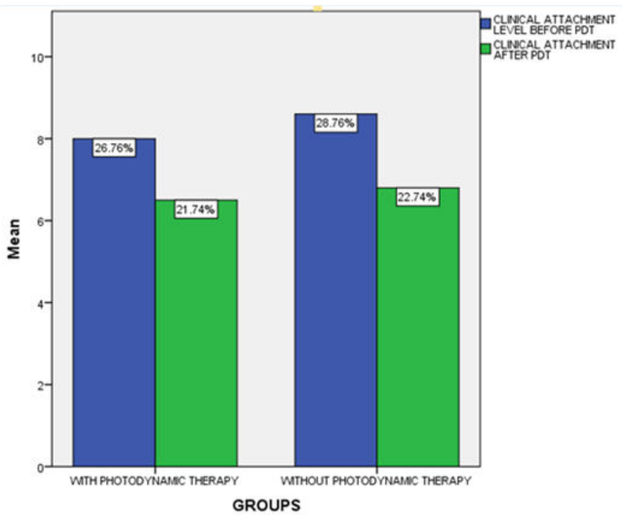

Figure 2: Bar graph represents the association between clinical attachment levels before and after intervention in both groups; with and without adjunctive photodynamic therapy, ($p<0.05$) group 1 depicts significant improvement in clinical attachment gain than group 2 (Group 1: with photodynamic therapy group 2: Without photodynamic therapy).

DISCUSSION

This study demonstrates that PDT procedures improved the clinical results for the non-surgical periodontal treatment of chronic periodontitis. The conventional mechanical device of the root is seen as a prerequisite for success in the long term [15]. Studies could, however, indicate that an additional benefit in the treatment of chronic periodontitis may come from adjunctive treatment processes like minocycline **[16,17]** or laser radiation [18,19].The Er:YAG laser is a new technique for sub-gingival debridement. The residual calculus after laser irradiation can be demonstrated to depend on the fluorescence threshold level, without removing a relevant quantity of the root cementum As to the microbiological results, Er:YAG laser, curettes, sonic and ultrasonic scalers have the same effects in chronic periodontitis patients [20]. Full mouth treatment concepts are another attempt at improved periodontal therapy to avoid early re-infection in untreated areas. Disputable data on microbiological effects of full mouth non-surgical periodontal therapy compared to the normal quadrant approach have been reported. A recent study has not confirmed any re-colonization differences after SRP for 24 hours compared to treatments during several sessions [21].

In current literature, only minor differences in treatment effects among these treatment strategies were observed among adults with chronic periodontitis **[22]**. A systematic antibiotic constituent in the long-term management of periodontal diseases provides significant clinical benefits from the sub-antimicrobial dose doxycycline therapy as an addition to SRP [23]. However, the use of this therapy in addition to non-surgical periodontal debridement among smokers could not be demonstrated [24]. In periodontal therapy systemic antimicrobials should be an adjunct to mechanical debridement. These results validates the search for new methods of treatment to improve conventional debridement. The limited access to plaque by topical agents and the development of antibiotic resistance make alternative strategies necessary in order to control the use of biofilms and treat periodontal diseases [25]. PDT is mediated by singlet oxygen, which affects extracellular molecules directly. Polysaccharides present also have photo damage potential within the extracellular matrix of the polymers in a bacterial biofilm. Such dual activity is not antibiotic-like and can have a major benefit from aPDT. Furthermore, it seems unlikely that singlet oxygen or free radicals will develop resistance to cytotoxic action. The PDT is equally effective against antibiotic, antibiotic, resistant and susceptible bacteria, and repeated photosensitization does not induce resistant strain selection [26]. The PDT procedure involves the laser activation of photosensitizing dye. As laser light irradiated only the test quadrants, there were no effects on bacteria in the control quadrants.

The results of this study correspond to those of the study that evaluate the effect only and in combination with conventional SRP of photo disinfection. In the group treated with SRP alone after 12 weeks, the authors have assessed 33 patients with chronic periodontitis for a clinical attachment gain of 0.36 0.35 mm. For SRP with adjunctive PDT, a gain of 0.86 0.61 mm was observed. These values are within the same range as in this study; the control group has less RAL values than the adjunctive PDT values in the group. A greater reduction in the BOP in the test group was observed in both studies. Although the values for SRP with adjunctive PDT were substantially different, the differences were minor. In a 6-month follow-up, however, the effects of local drug delivery on the SRP were evaluated, PD differences were observed from 0.1 to almost 0.5 mm and smaller effects for attachment gains, although statistically different differences could be observed [27]. A study assessing the effect of a chlorhexidine sub-gingival chip could detect a 0.5 mm difference in clinical attachment gain in favour of Chlorhexidine after six months [28].

However, it remains a question whether these improvements are clinically significant. The additional PDT application to SRP of one exposure did not lead to further improvements in pocket depth reduction and attachment gain, when evaluating patients who received supportive periodontal therapy, but it led to significantly higher BOP scores than SRP alone. In patients with aggressive periodontitis, SRP was also compared to PDT alone. In a split mouth design, ten patients were treated. In both groups after 3 months a significant reduction in BOPs was observed. PD values and clinical attachment levels have also reduced after 3 months [29].

. A positive effect on attachment gain reduced PD and reduced use of metronidazole plus amoxicillin as sole therapy for periodontal treatments with mechanical debridement have recently been shown. However, the clinician should expect remaining mineralized deposits on the root surface, irrespective of the use of antibiotics or aPDT as the sole treatment system. This residual sub gingival calculus may serve as a base for bacteria and help to develop pockets and to progress periodontal disease [30]. Any viable bacteria on rough surfaces of residual calculus could serve as a source of periodontal lesion re-infection and cause periodontitis to progress.

In this study, all of the patients obtained SRP periodontal therapy with both hand instruments (curettes) and a piezo-electric hand piece for all the teeth. No difference was found in the treatment of chronic periodontitis concerning clinical outcome between ultrasonic and manual debridement. In addition, each patient was treated with both debridement procedures so that quadrants treated with split mouth design could be compared intra-experimentally. A gentle gingival sulcus probing was performed with a pressure sensitive probe, since the sampling force of 20 g was demonstrated to avoid trauma of periodontal tissues during sampling. The present study shows that the use of PDT in conjunction with non-surgical treatment results has a positive impact. Increasing the number of exposures to photodynamic therapy is a newer approach to treat non-surgically as it is inferred that this could affect the microbial count. Thus, it could be possible to improve non-surgical periodontal therapy by adding antimicrobial photodynamic treatment exposures to conventional non-surgical therapy approaches. Furthermore, the microbiological effects behind the clinical benefits observed should be studied and the decrease in microbial load to repeated exposures must be observed.

CONCLUSION

From the above study, it can be concluded that in patients with chronic periodontitis, multiple exposures of adjunctive photodynamic therapy after conventional non-surgical therapy, i.e. scaling and root planning improves clinical outcomes.

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