ANTIMICROBIAL PHOTODYNAMIC THERAPY IN THE NON-SURGICAL TREATMENT OF AGGRESSIVE PERIODONTITIS: CLINICAL, BIOCHEMICAL AND MICROBIOLOGICAL RESULTS

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Abstract

The treatment of aggressive periodontitis has always presented a challenge for clinicians, but there are no established protocols and guidelines for the efficient control of the disease. The aim of this clinical trial was to investigate the applicability of Antimicrobial Photodynamic Therapy (aPDT) as an alternative for the non-surgical treatment of aggressive periodontitis. Ten patients with clinical diagnosis of aggressive periodontitis were treated in a split-mouth design with either aPDT using a laser source of 660 nm of wavelength associated to a phenotiazine photosensitizer or scaling and root planing using hand instruments (SRP). Antibiotics were not used in this trial, so that its adjunctive effect would not interfere in the outcomes of both groups. Gingival Recession (GR), probing depth (PD) and Relative Clinical Attachment Level (RCAL) were evaluated using an automated probe at baseline and 90 days later. Biochemical parameters measured in the gingival crevicular fluid at -7, 0, 1, 7, 30 and 90 days were: TNF-alfa and RANKL. The effect of therapies on 40 bacterial species was assessed by checkerboard DNA-DNA hybridization at -7, 0 and 90 days. Clinically, aPDT and SRP presented similar and significant reductions in GR, PD, and gains in RCAL. Biochemically, both treatments presented similar and significant reductions in crevicular TNF-alfa and RANKL. Microbiologically, the proportions of 7 bacterial species were significantly affected by SRP, and 2 by the PDT. The aPDT was more effective in reducing proportions of *A. actinomycetemcomitans*, and SRP of *T. forsythia* and *P. gingivalis*.

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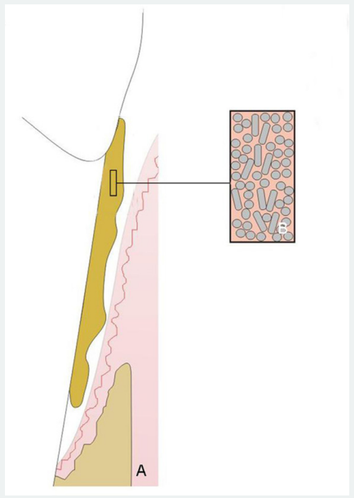
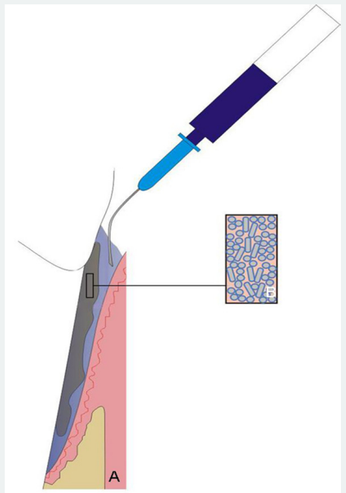
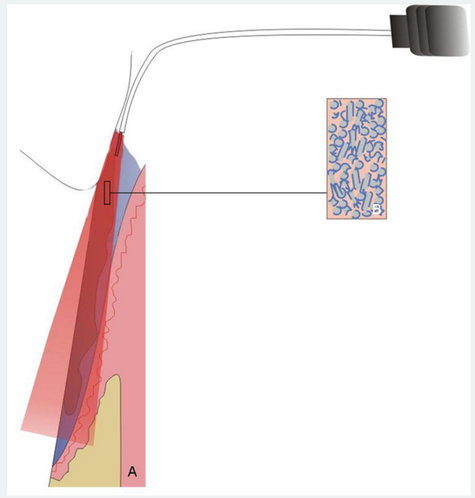
Antimicrobial Photodynamic Therapy: Schematic Procedure



(A) Subgingival biofilm
(B) Magnification of biofilm

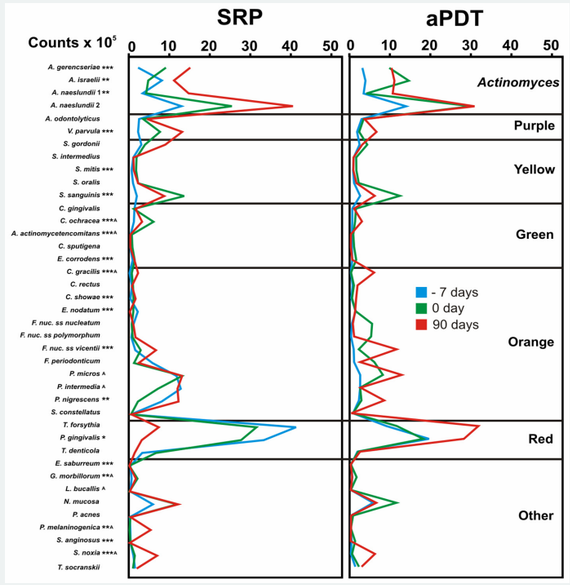


(A) Photosensitization
(B) Microorganisms stained



(A) Exposure to the laser beam
(B) Microorganisms destroyed

Microbiological Results



Mean counts of 40 bacterial species at -7 days, baseline and 90 days. Significance of differences between the treatments is marked with a letter "A" ($p < 0.05$) and differences over time were marked as *$p < 0.05$, **$p < 0.01$ and ***$p < 0.001$

Bacteria	Treatment	Time -7 days	Time 0 day	Time +90 days
A. actinomycetencomitans *	SRP	0.33±0.30 A	0.61±0.49 B	0.26±0.25 AB
	aPDT	0.27±0.25	0.61±0.49	0.02±0.01
C. gingivalis	SRP	1.25±0.56	1.10±0.61	1.55±0.75
	aPDT	0.35±0.25	1.25±0.56	0.80±0.53
C. ochracea *	SRP	1.12±0.56 A	5.96±4.96 B	3.15±0.76 B
	aPDT	0.35±0.15	1.06±0.37	2.76±0.82
C. sputigena	SRP	0.25±0.25	0.76±0.53	0.26±0.25
	aPDT	0.25±0.25	0.80±0.55	0.00±0.00
E. corrodens	SRP	0.81±0.53 A	1.32±0.57 B	1.27±0.73 AB
	aPDT	0.36±0.30	1.32±0.57	0.37±0.24
C. gracilis *	SRP	0.05±0.05 A	0.61±0.49 B	2.15±0.87 C
	aPDT	0.00±0.00	0.05±0.05	5.76±4.93
C. rectus	SRP	0.66±0.31	0.92±0.39	0.65±0.36
	aPDT	0.45±0.25	0.76±0.38	1.66±0.52
C. showae	SRP	0.26±0.25 A	1.00±0.41 AB	1.55±0.84 B
	aPDT	0.11±0.07	0.30±0.25	1.32±0.40
E. nodatum	SRP	2.08±1.02 A	0.98±0.56 AB	0.13±0.07 B
	aPDT	1.22±0.57	1.12±0.53	1.07±0.40
F. nuc. ss. nucleatum	SRP	1.00±0.67	0.61±0.55	1.00±0.67
	aPDT	0.25±0.25	5.25±4.98	0.51±0.50
F. nuc. ss. polymorphum	SRP	0.51±0.33	0.81±0.58	1.51±1.00
	aPDT	0.05±0.05	5.01±5.00	0.81±0.53
F. nuc. ss. vicentii	SRP	1.46±0.63 A	2.81±1.14 B	6.56±5.40 C
	aPDT	0.71±0.35	1.95±0.70	11.31±6.48
F. periodonticum	SRP	5.70±4.93	1.15±0.55	2.31±1.13
	aPDT	0.81±0.53	5.80±4.94	2.31±0.86
P. micros *	SRP	11.61±6.85	13.00±6.45	13.01±6.62
	aPDT	2.32±0.77	7.91±4.73	12.56±6.26
P. intermedia *	SRP	12.66±6.33	7.05±5.15	11.85±9.82
	aPDT	2.31±0.69	2.30±0.93	2.40±0.83
P. nigrescens	SRP	7.95±5.29 AB	2.12±0.73 B	12.11±9.80 A
	aPDT	2.00±0.61	2.61±0.80	8.26±4.99
S. constellatus	SRP	0.41±0.29	0.42±0.26	0.52±0.50
	aPDT	0.56±0.33	0.52±0.24	0.12±0.07
T. forsythia	SRP	41.05±14.41	31.31±10.93	7.26±5.37
	aPDT	8.76±4.72	11.36±6.47	31.50±8.11
P. gingivalis	SRP	33.11±12.78 A	27.51±10.85 AB	3.06±0.78 B
	aPDT	19.30±10.20	17.85±7.09	27.91±10.61
T. denticola	SRP	3.16±1.00	6.56±5.12	1.30±0.55
	aPDT	1.66±0.73	1.81±0.52	2.30±0.59

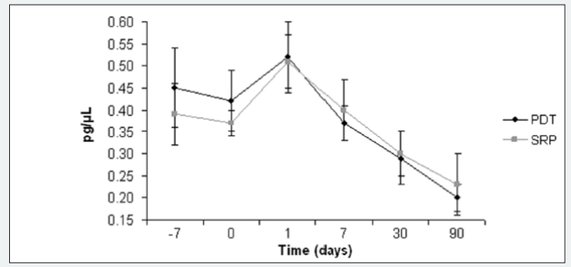
Significant differences between the treatments ($p < 0.05$) are marked with an * and different letters mean that times are significantly different ($p < 0.05$)

Clinical Results

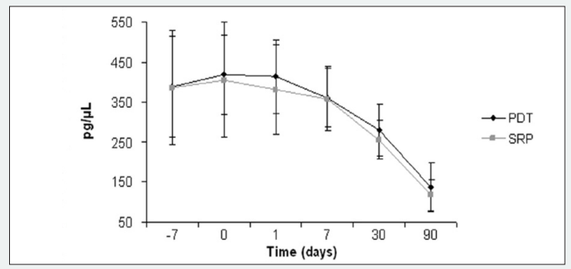
Index/Treatment	Baseline (±SD)	3 Months (±SD)	*P* value
PD			
aPTD	4.92 ± 1.61	3.49 ± 0.98	†
SRP	4.92 ± 1.14	3.98 ± 1.76	†
P Value	n.s.	n.s.	
GR			
aPTD	1.03 ± 0.35	0.90 ± 0.31	n.s.
SRP	1.53 ± 0.56	1.50 ± 0.57	n.s.
P Value	n.s.	n.s.	
RCAL			
aPTD	9.93 ± 2.10	8.74 ± 2.12	†
SRP	10.53 ± 2.30	9.01 ± 3.05	†
P Value	n.s.	n.s.	

Significance of differences within (Wilcoxon signed rank test, non-parametric test) and between (Mann-Whitney U test, non-parametric test), the groups († $P < 0.05$; n.s: non significant).

Biochemical Results



Mean concentration of TNF-α in the GCF. Error bars represent standard deviation



Mean concentration of RANKL in the GCF. Error bars represent standard deviation

Conclusions

Antimicrobial Photodynamic Therapy and Scaling and Root Planning led to similar results in relation to clinical and biochemical parameters, while microbiologically they affected different groups of bacteria, suggesting that their association would be indicated for the non-surgical treatment of aggressive periodontitis.