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Platelet-rich Plasma with Scaling and Root Planing: A Double-blind Split-mouth Randomized Study

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Abstract

Background and aims. Along with conventional periodontal therapy, subginigval application of platelet-rich plasma (PRP) may provide more effective improvements in clinical parameters due to the presence of multiple growth factors. The aim of this double-blind, split-mouth, randomized study was to evaluate the adjunctive use of PRP with scaling and root planing (SRP) in the treatment of chronic periodontitis.

Materials and methods. A total of 87 non-smokers suffering from moderate to severe chronic periodontitis were selected. Parameters were probing pocket depth (PPD), clinical attachment level (CAL), plaque index (PI) and modified bleeding index (mBI). After full-mouth SRP the sites were randomly divided into experimental sites receiving subgingival application of autologous PRP and controls treated with placebo gel. Measurements were recorded at baseline, 3 months and 6 months. Paired t-test was used to compare response to treatment between the two sites.

Results. Statistically significant changes in parameters were seen in both groups from baseline to 6 months. Inter-group comparison revealed significantly more clinical attachment gain for the experimental group ($P>0.05$). The mean CAL gain was 2.40±0.4 mm for control sites and 2.68±0.5 mm for experimental sites.

Conclusion. This study supports the use of PRP during nonsurgical debridement of periodontal pockets measured 6 months after SRP.

Key words: **Dental scaling, platelet-rich plasma, root planing.**

Introduction

The goal of nonsurgical periodontal treatment (NSPT) is to eliminate pathogenic microbes to improve and maintain the periodontal architecture with a less morbid approach, which is not possible with surgical periodontal therapy.[1] Several clinical trials have demonstrated the effectiveness of scaling and root planing (SRP) in term of maintaining the periodontal health.[2–4] However, deep periodontal pockets remain as the confounding areas for effectiveness of this approach due to compromised debridement in areas with limited access.[5–8]

Polypeptide growth factors (PGFs) have become

the favorite adjunctive agents of periodontal surgeons to improve the clinical and radiological outcomes.[9,10] A number of growth factors are sequestered in platelets, including platelet-derived growth factor (PDGF), transforming growth factor-β (TGF-β), insulin-like growth factor (IGF), fibroblast growth factor (FGF), vascular endothelial growth factor (VEGF) and epidermal growth factor (EGF).[11–13] A convenient approach to obtain autologous PDGF and TGF-β is the use of platelet-rich plasma (PRP).[9] PRP facilitates PDL cell proliferation, enhances PDL protein and extracellular matrix synthesis, demonstrates the anabolic activity regarding bone formation and improves postoperative periodontal wound healing.[9–12,14]

Several studies in the literature have shown that application of PRP improves both the magnitude and quality of bone regeneration with surgical periodontal therapy.[9–12,14] However, if essentially the same concept could be implicated using a non-invasive approach, this would be commendable for both the clinician and patient.

We hypothesized similar benefits of NSPT with PRP in the treatment of chronic periodontitis like the surgical approach. No evidence is available in the literature regarding the comparison of NSPT with and without subgingival application of PRP. Therefore, the present study was undertaken to explore the beneficial effects of PRP with NSPT, if any, for the treatment of deep periodontal pockets.

Materials and Methods

A total of 87 non-smoking volunteers (48 males, 39 females), aged 30–50 (mean age of 45±4.6), suffering from moderate to severe chronic periodontitis were enrolled for this randomized, split-mouth, controlled clinical trial of 6-month duration. Inclusion criteria were two contralateral sites with pockets ≥5 mm associated with single-rooted teeth, approximately similar radiographic angular bone defects ≥3 mm, no history of periodontal therapy within the past 6 months, absence of any systemic illnesses, use of medications and absence of pregnancy and lactation. The subjects received thorough explanations about the study protocol, risks, benefits and procedures, and written informed consent was obtained. All the examinations, treatments and procedures associated with this study followed the principles of the Declaration of Helsinki of 1975, as revised in 2008. The study was conducted from January 2010 to March 2011.

The study primary outcome variable was clinical attachment gain (CAL) and secondary outcome variables were probing pocket depth (PPD) reduction, plaque index (PI) (Tureskey et al. modification of Quigley Hein Index), and modified sulcus bleeding index (mSBI). For CAL and PPD a UNC-15 periodontal probe (Hu-Friedy Mfg. Inc, Chicago, IL, USA) was used in the nearest millimeter. The parameters were recorded at baseline, after 3 months and after 6 months. The cementoenamel junction (CEJ) or, if present, the restorative margin was used as a reference point for the assessment of CAL. Measurements were made at six locations around each experimental tooth. All the PPD and CAL measurements were rounded down to the nearest millimeter.

All the pre- and post-treatment clinical parameters were recorded by an examiner who was masked to the type of treatment received by the subjects while another clinician provided treatment to both groups. Power calculations were performed before the study was initiated. To achieve 80% power and detect mean differences of the clinical parameters between the groups, 40 sites per group were required.

Intra-examiner Calibration

Intra-examiner calibration was achieved by examination of 20 patients twice, 24 hours apart, before the study. Calibration was accepted if measurements at baseline and 24 hours were similar up to 1 mm at the 95% level.

Platelet-rich Plasma Preparation

The PRP preparation procedure was described previously by Piemontese et al.[10] A total of 60 mL of patient's blood was mixed with 7 mL of citrate anticoagulant solution and centrifuged in two cycles of 2400 rpm for 10 minutes and 3600 rpm for 15 minutes. The centrifugation process separated RBCs and WBCs into one compartment and the platelets and plasma into another. Plasma was drawn out leaving 7 mL of platelet-rich concentrate. Immediately before application, this PRP was mixed with 1 mL of a solution of 10% calcium chloride mixed with 1000 United States units of topical thrombin. The PRP was prepared by one of the investigators.

Randomization and Treatment

Following thorough SRP, the selected sites were randomly divided into experimental and control groups by computer-generated software. The subjects were blinded regarding allocation for treatment modality. The experimental sites were treated with autologous PRP, delivered subgingivally using a blunt 22-gauge needle placed at the bottom of the pocket until the pocket was overfilled. Pressure was applied with a

piece of moist gauze on the site for 5 minutes following delivery. The control sites were treated with placebo gel in the same manner.

The patients were instructed to refrain from tooth brushing around the treated sites for a period of 2 days. A 0.12% chlorhexidine (Peridex Zila Pharmaceuticals, Phoenix, AZ, USA) rinse was prescribed, and the patients were instructed to rinse twice daily for 2 weeks. The patients also received oral hygiene instructions including the use of modified Bass brushing technique. The patients were re-evaluated at regular intervals of 15 days as part of regular periodontal re-evaluation and for supragingival prophylaxis if necessary.

Statistical Analysis

Data were analysed using SPSS 10.5 (SPSS, Chicago, USA). Statistical analysis of the clinical parameters was based on values from one site in the experimental region (surface) and one site in the control region (surface). Within each region (surface), the site with the deepest pocket at baseline was used. Data were expressed as means ± standard deviations. Changes in CAL and PPD were analyzed in a one-way ANOVA model. The comparison of two treatment modalities was performed using paired t-tests. All the statistical tests were performed as two-sided tests at $P<0.05$ level of significance. PPD reduction values were analyzed with the same model as the clinical attachment levels, using the same experimental sites.

Results

Eighty out of 87 subjects completed the study. Postoperative clinical healing was uneventful at all the sites. No visible adverse reactions were noticed during the study period. The CAL gain and the other parameters were taken as the primary and secondary outcomes, respectively. Table 1 presents clinical parameters for both groups at each visit. Baseline values for all the parameters showed non-significant differences between the groups ($P>0.05$). Table 2 shows mean changes between both groups at different time intervals. The results of the present study showed that both treatment modalities (SRP + placebo and SRP + PRP) resulted in significant improvements. Inter-group comparisons showed significantly better improvements in clinical attachment gain for the test group.

Discussion

The present randomized, split-mouth, controlled clinical trial evaluated the adjunctive use of PRP with SRP. The results showed significant improvements in treatment outcome variables as compared to SRP alone for the treatment of chronic periodontitis.

Previous studies have demonstrated the beneficial effects of PRP during periodontal surgical therapy.[15] Now the question arises whether these benefits can also be encountered with nonsurgical approach or not. This study was carried out to evaluate the effects of PRP in NSPT.

This study measured clinical attachment gain as the primary outcome variable for evaluating the efficacy of treatment groups. We determined a little but significant additional benefit of PRP. This may be a matter of discussion that around 0.3 mm difference in clinical attachment gain seems to be worthless for additional time of preparation and delivery of PRP.

Table 1. Parameters (mm) for sites treated with SRP+PRP or SRP alone at different time intervals

	Baseline	3 months	6 months
		PI	
Control	4.18 ±0.35	3.53±0.46	3.19±0.42
Test	4.13±0.33	3.58±0.50	3.07±0.30
P-value	0.507	0.708	0.125
		mSbI	
Control	2.27±0.27	1.94±0.25	1.50±0.41
Test	2.17±0.28	1.68±0.29	1.23±0.25
P-value	0.115	0.000	0.001
		PPD (mm)	
Control	6.8±0.65	4.10±0.67	3.93±0.73
Test	6.93±0.62	4.30±0.76	3.90±0.67
P-value	0.379	0.215	0.874
		CAL (mm)	
Control	8.1±0.55	6.13±0.65	5.7±0.61
Test	8.15±0.53	5.85±0.70	5.45±0.55
P-value	0.680	0.072	0.058

Table 2. Inter-group comparison of parameters at different time intervals

Mean difference	t-value	P-value
	PI	
Baseline–3 months	-1.368	0.175
Baseline–6 months	1.804	0.075
3–6 months	2.395	0.019
	mSBI	
Baseline–3 months	5.386	0.000*
Baseline–6 months	2.768	0.007*
3–6 months	0.290	0.773
	PPD	
Baseline–3 months	-0.666	0.507
Baseline–6 months	1.347	0.182
3–6 months	1.922	0.058
	CAL	
Baseline–3 months	2.453	0.016*
Baseline–6 months	2.419	0.018*
3–6 months	-0.214	0.831

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Conflict of interests: none

However, as far as hypothesis for enhancement of outcome of PRP with SRP is concerned it might be true. The use of a PRP as an adjunct to SRP procedure might be relevant due to the presence of several growth factors in PRP, including PDGF, TGF-β, IGF, FGF, VEGF, EGF.[9-11] PRP stimulates the proliferative activity of osteoblastic cells but acts as a growth inhibitor for epithelial cells. PDGF is a potent mitogen, chemotactic agent and stimulator of protein synthesis for cells of mesenchymal origin. IGF acts in combination with PDGF to promote mitogenesis and protein synthesis in epithelial and mesenchymal cells. TGF-β stimulates or inhibits the growth of many cell types, depending upon the presence of other growth factors and is a potent chemoattractant for macrophages. TGF-β also increases granulation tissue formation and the tensile strength of healing wounds. VEGFs are active in angiogenesis and endothelial cell growth. EGF results in cellular proliferation, differentiation and survival of epithelial cells.[11–13]

PRP immobilizes blood clot that is a crucial and desirable event in the early phases of periodontal wound healing, due to its sticky nature with high fibrin content.[9,10,14] Autologous nature eliminated the risk of disease transmission, making it a safer treatment modality.[3]

The findings of SRP group were corroborated with previous findings for nonsurgical periodontal therapy.[16,17] The outcomes of the test group were in accordance to the previous surgical reports that proposed significantly better CAL gain with PRP-associated group.[10,18] Piemontese et al[10] analyzed significantly greater clinical benefits in terms of PPD (4.6±1.3 mm), CAL (3.6±1.8) and gingival recession (-1.0±1.3 mm) for PRP and DFDBA in comparison to DFDBA with saline for the treatment of 3-wall infrabony defects. Okuda et al[18] observed significantly more favorable clinical improvements for combination of platelet-rich plasma and hydroxyapatite as compared to bone graft alone in intrabony periodontal defects. A recent study evaluated a more significant treatment outcome for PRP as compared to open flap debridement for the treatment of 3-wall defects in chronic periodontitis.[19] Hanna et al[9] reported that addition of platelet-rich plasma to xenograft significantly improved the clinical periodontal response of grafting procedure.

Previous researches also showed limited amount of healing with PRP.[20–22] Choi et al[23] investigated the contradictory effect of PRP on bone regeneration with an autogenous bone graft in a canine mandibular model; they acknowledged the retardation in new bone formation with addition of PRP in autogenous bone graft. Concentration and duration of growth factors are also responsible for metabolic activity of the affected cells. Survival and mitotic potentials of alveolar bone cells have an inverse relationship with PRP concentrations.[20–23]

PRP is autologous in nature; it might be considered cost-effective and free from cross-infection, so it can be used. There are discrepancies in the magnitude regarding the outcomes of PRP in the literature for surgical therapy. This study is just like a start for consolidation of the benefits of scaling and root planing. Long-term, multicenter randomized, controlled clinical trials are required to reach a final verdict. If the results of this study are generalized for patients it would be a much better option for enhancing the advantages of non-surgical approach.

A possible understanding for heterogeneity in the existing literature might be the diversity between studies in prognostic factors that have been documented to affect the outcome of periodontal therapy. Clinically, several factors including demographic data of patients, baseline parameters, biologic and physicochemical properties of involving biomaterials, as well as therapeutic variables and postoperative maintenance regime may disperse the extent of attachment gain following periodontal procedures.[24,25]

Conclusion

In conclusion, the findings of this study supported the use of PRP during routine nonsurgical debridement of periodontal pockets to improve treatment outcomes for chronic periodontitis.

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