

The anti-inflammatory effect of the platelet-rich plasma in the periodontal pocket

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ABSTRACT

Objective: Chronic periodontitis (CP) is a common inflammatory disease that causes destruction to the supporting tissues of the teeth. Many treatment modalities tried to stop the disease progression. Platelet-rich plasma (PRP) is one of the regenerative methods that used in adjunct to conventional periodontal treatment. The aim of this study was to evaluate the anti-inflammatory effect of PRP by monitoring the lymphocyte count before and after its application to the periodontal pocket. **Materials and Methods:** Twenty patients, with CP and a pocket depth equal to or deeper than 4 mm, subjected to scaling, root planing, and PRP injection into the pocket. The lymphocyte count measured before and after 1 month from PRP application. Clinical periodontal parameters were taken during two visits (1 month apart), with customized stent fabrication. **Results:** All clinical periodontal parameters showed a reduction in their value following 1 month of PRP application. There was a noticeable reduction in lymphocyte count from (mean 2.47 ± 0.91) to (mean 1.94 ± 0.77). **Conclusion:** In addition to its traditional uses, PRP has a great role in the periodontal treatment by its anti-inflammatory effect.

Key words: Lymphocyte count, periodontal pocket, platelet-rich plasma

INTRODUCTION

Chronic periodontitis (CP) is “an infectious disease resulting in inflammation within the supporting tissues of the teeth, progressive attachment, and bone loss.”^[1]

Progression of CP is depending on the virulent microorganisms and host response to pathogenic infection.^[2] Scaling and root planing considered as a conventional nonsurgical treatment of periodontal diseases.^[3] Platelet-rich plasma (PRP) injection, concentrated platelets from autologous blood activated by the addition of thrombin and calcium, works to improve periodontal ligament cell production and

protein development, which will lead to accelerating periodontal wound healing.^[4]

When PRP activated, the growth factors and proteins released to the local environment, accelerating postoperative wound healing and tissue repair.^[5]

Examination of the connective tissue during periodontal disease under a microscope reveals a disruption of the normal anatomy of the connective tissues by a huge infiltration of numerous defense cells, particularly neutrophils, macrophages, plasma

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cells, and lymphocytes with the extracellular release of their destructive enzymes.^[6] Changes in leukocyte, neutrophil, and lymphocyte numbers used as a healing monitor during periodontal treatment.^[7]

The aim of this study was to evaluate the anti-inflammatory effect of PRP in the treatment of pockets, as an adjunct to scaling and root planing, by measuring the lymphocyte count before and after treatment.

MATERIALS AND METHODS

Sample selection and study design

Twenty patients involved in this study. All patients had CP, according to the periodontal disease classification system of the American Academy of Periodontology,^[8] and a pocket depth equal to or more than 4 mm. All patients have no history of any systemic diseases. Patients' age ranged from 25 to 50 years. The gender distributed equally between females and males.

The exclusion criteria included smokers, alcohol drinkers, pregnant women, a pathological condition in the area, and patients on medications such as anti-inflammatory drugs or antibiotic treatments within the past 3 months. All these conditions affect the lymphocyte count.

Patient preparation and stent fabrication

Informed consents were taken. All patients subjected to the conventional periodontal treatment such as motivation, instruction, and supragingival and subgingival scaling. Impressions were taken for occlusal stent fabrication to standardize the readings for the same site throughout the visits. The stent was made from thermal-forming splint/copolyester with 1-mm thickness.

Clinical periodontal parameter recording

In the first visit, before root planing, periodontal parameters such as plaque index (PLI), gingival index (GI), bleeding on probing (BOP), probing pocket depth (PPD), and relative attachment level (RAL) were recorded as a baseline before PRP application. The stent adjusted to cover two-thirds of the crown. RAL was recorded from the lower border of the stent to the deepest point of the pocket. In the second visit, after 1 month from PRP application, all periodontal parameters were recorded again.

Platelet-rich plasma preparation

Seven milliliters of blood was taken from each patient at the first visit to prepare the PRP and to

estimate lymphocyte count. One milliliter of blood was used to estimate the lymphocyte count, and 6 ml of blood was distributed into three sodium citrate vacuum tubes (each tube with 2 ml), with a gentle rocking of the tubes back and forth several times to ensure the complete incorporation of blood with the anticoagulant. The blood then was subjected to centrifuge at two cycles.^[9] The first cycle was at 3000 rounds/min (rpm) for 5 min, and then, the plasma supernatant layer (which contains platelets and white blood cells) was taken and put it in a plain tube ready to the second cycle. The second cycle was at 3500 rpm for 15 min. The upper two-thirds of the solution was discarded and the lower third (which contains the red spot and platelet pellets) was taken as a pure PRP.

Using insulin syringe, 10% of the syringe volume was filled with calcium chloride (activator) and 90% by PRP added slowly, with forth and back motion to mix the syringe contents.

Platelet-rich plasma application

After anesthetizing the affected tooth, root planing was done using universal curette. PRP was injected into the pocket. Slight pressure applied to the area using moist gauze for 5 min, for a clot to be formed.^[10]

Lymphocyte count

In the first visit, 1 ml was used to estimate lymphocyte count. In the second visit, 1 ml of blood also used to estimate lymphocyte count after 1 month from PRP application.

Statistical analysis

Statistical analysis was made with the Statistical Package for the Social Sciences (version 20.0; Armonk, New York, 2011).^[11] Both descriptive (mean, standard deviation, and percentage) and inferential statistics (*t*-test and Pearson correlation) were used. The relationship considered statistically significant if $P < 0.05$.

RESULTS

The clinical periodontal parameters (PLI, GI, BOP, PPD, and RAL) were shown a reduction in their mean values after 1 month from the treatment with the PRP, with a highly significant difference [Table 1]. During this period (1 month), no complications had been observed.

There was a marked reduction in the lymphocyte count at baseline (2.47 ± 0.91) and after 1 month (1.94 ± 0.77), with a highly significant difference ($P = <0.000$) between them [Table 2].

When the amount of plaque increased, the lymphocyte count is also increased leading to increase in the gingival inflammation and destruction of the periodontium [Table 3].

DISCUSSION

Many articles had studied the regeneration property of PRP.^[12] El-Sharkawy *et al.*, in 2007, demonstrated that PRP may suppress cytokine release, limit inflammation, and promote tissue regeneration.^[13] Tavassoli-Hojjati *et al.*, in 2016, concluded that the growth-stimulating effect of PRP is dose dependent with the best results in low concentrations.^[14] On the other hand, the results of *in vitro* study by Kobayashi *et al.*, in 2017, suggest that PRP promoted gingival fibroblast migration and proliferation but have little to no effect on osteoblast differentiation.^[15]

Table 1: Differences between the clinical periodontal parameters at the baseline and 1 month after the application of platelet-rich plasma

Variables	Mean±SD		t*	P
	Baseline	After 1 month		
PLI	0.84±0.22	0.76±0.21	17.19	<0.000 (HS)
GI	1.75±0.25	1.38±0.20	30.84	<0.000 (HS)
BOP %	74.58±28.22	38.82±21.50	4.50	<0.000 (HS)
PPD	5.13±0.67	4.41±0.73	33.84	<0.000 (HS)
RAL	8.72±2.27	7.89±2.31	17.19	<0.000 (HS)

*One sample t-test. HS: Highly significant, SD: Standard deviation, PLI: Plaque index, GI: Gingival index, BOP: Bleeding on probing, PPD: Probing pocket depth, RAL: Relative attachment level

Table 2: Differences between the lymphocyte count at the baseline and 1 month after the application of platelet-rich plasma

Variables	Mean±SD		t*	P
	Baseline	After 1 month		
Lymphocyte count	2.47±0.91	1.94±0.77	12.14	<0.000 (HS)

*One sample t-test. HS: Highly significant; SD: Standard deviation

Table 3: Pearson correlation between lymphocyte count and clinical periodontal parameters

Variables	Statistical analysis	PLI	GI	BOP	PPD	RAL
		Lymphocyte count	r	0.24	0.15	0.21
	P	0.30	0.50	0.36	0.93	0.55

r: Pearson correlation, PLI: Plaque index, GI: Gingival index, BOP: Bleeding on probing, PPD: Probing pocket depth, RAL: Relative attachment level

Our study results showed a decrease in the mean value of clinical periodontal parameters (PLI, GI, BOP, PPD, and RAL) after 1 month of using PRP. This result could be due to the growth factors that released from the platelets which accelerate the healing process.^[10,13]

There was a noticeable decrease in lymphocyte concentration after PRP treatment; this is because the platelets in the PRP release a considerable amount of RANTES (a major monocyte chemoattractant) from its alpha-granules. RANTES also inhibits many cytokines released by basophils,^[10,16] resolution of inflammation, and decrease in the concentration of lipoxin A₄ (anti-inflammatory marker) which in turn depress the number of inflammatory cells.^[13]

Concerning the correlation between the lymphocyte count and clinical periodontal parameters, the study revealed a direct proportion between lymphocyte count and PLI, GI, BOP, and PPD; when the PLI, GI, and BOP scores increase, they indicate that the bacterial toxins, the inflammatory process, and the lymphocyte count are also increased.

CONCLUSION

PRP has anti-inflammatory properties; it decreases the inflammation and accelerates the healing process. As a result, it will decrease the pocket depth and increase the attachment gain.

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Conflicts of interest

There are no conflicts of interest.

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