EVALUATION OF PRF EFFICIENCY IN THE TREATMENT OF INFRABONY DEFECTS

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ABSTRACT

Aim: The present study aimed to investigate the effectiveness of PRF in the treatment of infrabony defects in patients with chronic periodontitis by evaluating the clinical outcome through periodontal depth, clinical attachment level at the baseline, 6 and 9 months post operatively.

Material and Methods: Sixty infrabony defects with probing depth ≥ 5 mm were treated. The inclusion criterion was the necessity for surgical bilateral maxillary treatment. By using split-mouth study design, each patient had one side treated with conventional flap surgery and the other side with conventional flap surgery and PRF. Clinical parameters, such as probing depth (PD) and clinical attachment lost (CAL), were recorded in both groups at baseline, 6 and 9 months post operatively.

Results: Positive effects for all clinical and radiographic parameters were evident in the group with PRF. Mean PD reduction demonstrated statistically significant greater results in the test group (4.00 ± 1.07 mm) compared to the control one (4.83 ± 0.99 mm), $p = 0.003$ after 9 months postoperatively. After 9 months, there were better results in the test group compared to the control group for CAL (5.60 ± 1.61 mm, 6.20 ± 1.58 mm), but statistically not significant.

Conclusion: Additional use of PRF in the conventional surgical treatment of infrabony defects demonstrated better parameters than the open flap debridement alone.

Keywords: infrabony defects, chronic periodontitis, periodontal regeneration, periodontal surgery, PRF

INTRODUCTION

Chronic periodontitis is inflammation caused by the interaction of pathogenic microorganisms with the host, producing products that initiate a reactive inflammatory and immune response. The end result is the destruction of the extracellular matrix, causing bone resorption [1], which definitely causes luxation, migration and early tooth loss.

The main purpose of modern periodontal therapy is the regeneration of all lost periodontal tissue,

including functional periodontal ligament, alveolar bone and cement.

The classic open surgical debridement of unresponsive infrabony defects of conservative treatment, removes periopathogenic bacteria as well as damaged, ulcerated, necrotized and proliferating tissue, but this intervention is insufficient for tissue regeneration of the destroyed structures. Growth factors released in response to tissue injury show

the ability to stimulate cells present in the periodontium resulting in the proliferation and differentiation of endothelial cells, osteoblasts, chondrocytes, and fibroblasts. [2] From this aspect, platelets (Tr) are considered a natural source of growth factors, which are believed to play a vital role in the healing process of lesions after periodontal treatment. [3] Platelet rich fibrin (PRF), belongs to the second generation of platelet concentrates which has regenerative potential and application in surgical treatment of periodontal disease. [4]

In fact, PRF has attracted the attention of numerous researchers and clinicians, because of its positive clinical effects, due to the spontaneous formation of a dense three-dimensional fibrin network incorporating growth factors from Tr and Leu, but also from blood, such as PDGF, TGF- β 1, IGF, VEGF. [5,6] These growth factors that are released continuously for 7 to 14 days locally stimulate bone cells, soft tissue and initiate angiogenesis. [7,8]

Some previous studies have shown that PRF can be used as the sole regenerative material for surgical treatment of periodontal pockets, i.e. with flap intervention [9, 10-12] demonstrating a reduction in periodontal pockets depth and CAL gain, but histologic studies are lacking to confirm the beneficial effect. [13] In vivo and in vitro bone matrix demineralization studies have reported effective treatment, with evident radiographic bone corrections and improvement of clinical parameters. [14, 15]

On the other hand, PRF is accepted as a supporting matrix of bone grafts when treating infrabony pockets, which can also be used as a graft covering membrane. Thus PRF associated with bone grafts has an angiotropic, hemostatic and osteoconductive characteristic. This combination is ideal for achieving excellent results in the treatment of infrabony defects. [16, 17-20]

Starting from the fact that PRF contains three important aspects of regeneration, which act synergistically: three-dimensional fibrin network, autogenous cells (Leu, Tr, macrophages and neutrophils) and growth factors, this study will follow the effect of its treatment application in infrabony defects in patients with chronic periodontal disease by follow-up of PD and CAL after 6 and 9 months of treatment.

MATERIALS AND METHODS

This study belongs to the split-mouth category, which included 60 bone defects, in systemically

healthy patients of both sexes, with an age range of 30-50 years. The selection of patients and intervention was made at the Clinic for Oral Diseases and Periodontology at the University Clinical Dental Centre Skopje in the period 2015-2017. The study group was formed of patients with bilateral infrabony defects that were divided into two groups, 30 defects treated with open surgical debridement (modified Widman) and application of PRF, and 30 defects treated only with open surgical debridement forming the control group.

The selection of patients was made according to inclusion and exclusion criteria. These criteria included a diagnosed and radiographically confirmed infrabony defects in distal maxilla section, with a depth of ≥ 5 mm. The study excluded patients with platelet disorders, haemostasis and other systemic diseases, smokers, pregnant women, nursing mothers, and patients with poor oral hygiene. Patients filled out an information form and written consent for the planned surgical procedure.

Preoperative phase

Each patient was first instructed and motivated to maintain good oral hygiene. Then the dental plaque and calculus were removed by ultrasound and manually. Initial therapy was re-evaluated after 7 days. All patients were haematologically monitored preoperatively by complete blood count analysis and haemostasis.

Clinical evaluation and measurements

Clinical evaluation and measurements were made on the depth of periodontal pockets and clinical loss of attachment by the same therapist. The first measurement was done just before the intervention, 6 and 9 months after the surgery.

Preparation of PRF

The procedure began with the collection of 12 ml of blood in test tubes without an anticoagulant just before each patient's surgery. The test tubes were then centrifuged at 3000 rpm for 12 min with a Multifuge Heraeus centrifuge, using the Choukroun method. The tubes containing the fibrin network were returned to the operating room, where they were separated from the erythrocyte sediment and the acellular plasma.

Surgical procedure

After anaesthesia was applied, a sulcular incision was made buccally and palatally, followed by elevating full thickness flap to the mucogingival line. After thorough processing of the operating field with ultrasound and manually, the PRF membrane was inserted, the flap was reposed and sutured. In case of the control group, after the periodontal pockets were processed, the flap was reposed and sutured without adding PRF.

Post-surgical procedure

Postoperatively, all patients were prescribed analgesics three times daily, at most 5 days as needed. Locally, patients were instructed to rinse their mouth two to three times daily with 0.12% Chexidine Gluconate (CHX) for 2 weeks. The sutures were removed after 7 days. After one week a gentle brushing with a soft toothbrush was recommended to the study participants. Control examinations were conducted at 6 and 9-month intervals in the two different treated regions. The indicated parameters were followed up again by the same therapist.

a, b)

c, d)

e)

f)

g)

Picture 1. Operational course of interventions:

- a) incision;
- b) lifting;
- c) debridement;
- d) deep curettage of periodontal pockets;
- e) f) application of PRF periodontal defect;
- g) suturing phase

Data analysis was performed in the statistical program STATISTICA

RESULTS

The findings indicated that the value of PD defect after 9 months of treatment had significantly better results in the study group (4.00 ± 1.07 mm) than the control group (4.83 ± 0.99 mm), $p = 0.003$, table 1 and 2.

Table 1. Difference in values of periodontal pocket depth index (PD) at baseline, after 6 and 9 months of incision surgery using PRF in the examined group

Friedman ANOVA Chi Sqr. (N = 30, df = 2) = 47.64; p = 0.000				
Parameter	Average Rank	Sum of Ranks	Mean	Std. Dev.
PD baseline	2.82	84.50	5.83	1.29
PD after 6 months	1.95	58.50	4.77	1.25
PD after 9 months	1.23	37.00	4.00	1.02

Table 2. Difference in PD values at baseline, at 6 and 9 months post-operatively without PRF in the control group

Friedman ANOVA Chi Sqr. (N = 30, df = 2) = 30.10; p = 0.000				
Parameter	Average Rank	Sum of Ranks	Mean	Std. Dev.
PD baseline	2.57	77.00	5.73	1.08
PD after 6 months	1.87	56.00	5.23	1.01
PD after 9 months	1.57	47.00	4.83	0.99

Although not statistically significant, better clinical findings were evident in the PRF-treated group than in the control, for CAL (5.60 ± 1.61 mm, 6.20 ± 1.58 mm) after 9 months, Tables 3 and 4.

Table 3. Difference in CAL values at baseline and at 6 and 9 months after incision surgery with PRF application in the study group

Friedman ANOVA Chi Sqr. (N = 30, df = 2) = 44.67; p = 0.000				
Parameter	Average Rank	Sum of Ranks	Mean	Std. Dev.
CAL baseline	2.78	83.50	7.47	1.74
CAL 6 months follow-up	1.95	58.50	6.37	1.56
CAL 9 months follow up	1.27	38.00	5.60	1.61

Table 4. Difference in CAL values at baseline, at 6 and 9 months after incision surgery without PRF application in control group

Friedman ANOVA Chi Sqr. (N = 30, df = 2) = 26.45; p = 0.000				
Parameter	Average Rank	Sum of Ranks	Mean	Std. Dev.
CAL baseline	2.55	76.50	7.30	1.64
CAL 6 months follow-up	1.85	55.50	6.63	1.35
CAL 6 months follow-up	1.60	48.00	6.20	1.58

There is an evident difference between the values of PD and CAL in the study and control groups of patients at 9 months follow-up - Tables 5 and 6.

Table 5. Difference in PD values between the study and the control group after 9 months of intervention

Parameter	Rank Sum Study group	Rank Sum Control group	U	Z	p-level	N Study group	N Control group
PD after 9 months	711.50	1118.50	246.50	-3.01	0.003	30	30

Table 6. Difference in CAL values between the study group and the control group after 9 months of intervention.

Parameter	Rank Sum Study group	Rank Sum Control group	U	Z	p-level	N Study group	N Control group
CAL after 9 months	832.00	998.00	367.00	-1.23	0.22	30	30

Graph 1. Correlation between PD and CAL after 9 months of PRF surgery

There is a positive correlation between the clinical finding of the group treated with surgery and PRF, compared to the group treated with surgery alone, at 6 and 9 months postoperatively. A very strong positive significant correlation was found between PD and CAL, 9 months after PRF surgery. Namely, correction of CAL is followed by better PD results.

DISCUSSION

Periodontal pocket depth reduction and loss of clinical attachment are the most important clinical parameters showing healing results in the absence of histological analysis of soft and hard tissue. [21] In our study, we found a decrease in the PD and CAL index in the control and study groups after 6 and 9 months compared to baseline. PD in the study group varies 4.00 ± 1.07 mm, the index of clinical attachment loss in the study group varies in the interval 5.60 ± 1.61 mm. PD in the control group varies in the interval 4.83 ± 0.99 mm, CAL in the control group ranges in the interval 6.20 ± 1.58 mm. The value of PD after intervention with PRF is lower than the value at baseline, the difference between the values for $Z = 4.01$ and $p < 0.001$ ($p = 0.000$) is significant.

The value of PD after treatment is lower than the value at baseline, the difference between the values for $Z = 3.41$ and $p < 0.001$ ($p = 0.000$) is also significant. These results show that we have fairly rapid and significant results in both groups, confirming that surgical therapy is a solid therapeutic modality in infrabony pockets over 5 mm. PD 9 months after surgery showed lower values than baseline and after 6 months and these differences were significant at $Z = 3.82$ and $p < 0.001$ ($p = 0.000$) and $Z = 2.37$ and $p < 0.05$ (respectively), $p = 0.02$). The value of PD 9 months after PRF surgery is lower than the value at baseline and after 6 months, where the differences are significant $Z = 4.62$ and $p < 0.001$ ($p = 0.000$), $Z = 3.72$ and $p < 0.001$ ($p = 0.000$).

Comparatively, the results obtained 6 months after the treatment between the two groups showed that the PD value in the control group was higher than the control group, but the difference between the values for $Z = -1.71$ and $p > 0.05$ ($p = 0.09$) is not significant, unlike the results after 9 months where the value of PD in the control group is higher than the control group, and the difference between the values for $Z = -3.01$ and $p < 0.01$ ($p = 0.003$) is already significant. These comparative results, obtained after 9 months, indicate that treatment with PRF gives consistent, stable results.

CAL values after 6 months after surgery were lower than the values at baseline, the difference between the values for $Z = 3.27$ and $p < 0.01$ ($p = 0.001$) was significant. The values after 9

months are $Z = 3.68$ and $p < 0.001$ ($p = 0.000$), $Z = 2.24$ and $p < 0.05$ ($p = 0.03$).

The value of CAL after 6 months of PRF intervention showed lower values than the value at baseline, the difference between the values for $Z = 3.88$ and $p < 0.001$ ($p = 0.000$) is significant. The value of CAL after 9 months after PRF surgery is lower than the value at baseline and after 6 months after PRF surgery, the difference between values is significant. $Z = 4.54$ and $p < 0.001$ ($p = 0.000$), $Z = 3.62$ and $p < 0.001$ ($p = 0.000$). The value of CAL in the control group after 9 months of surgery was higher than the value in the examined group, but the difference between the values for $Z = -1.23$ and $p > 0.01$ ($p = 0.22$) was not significant.

To date, there are more than 10 published relevant randomized trials in which PRF is used as regenerative therapy of infrabony defects, either alone or in combination with bone grafts. [16]

Thorat et al. obtain a significant statistical difference in the results of PD and CAL after 9 months ($p < 0.01$) in the control and the study group. But in the group treated with PRF, they received a greater reduction in PD ($4.56-0.37$) and CAL ($3.69-0.44$). Similar results show Ajwani et al. [12] Their results showed a significant difference ($p = 0.005$) between PD and CAL scores at baseline and after 9 months, in favour of the PRF-treated group.

These results are in line with the results obtained by Sharma et al. [22] who receive a vertical CAL increase of 2.33 mm in the PRF group, compared to 1.28 mm in the control group with only 9 months of the surgery. Rosama et al. [23] also received a significant positive result by decreasing CAL after one year by about 3.36 ± 0.38 mm compared to the control group. Regarding PD, the difference between the groups ranges from 2.29 ± 0.3 mm for the experimental group. Pradeep et al. 9 also received a significant reduction in PD (3.77 ± 1.19) after 9 months compared to the group treated with open flap debridement surgery only. Their findings for CAL, like our results, show better results in both groups after 9 months, with the PRF- treated group being better, but without a significant difference compared to the control group. Bajaj et al. [24] also received a decrease in PD ($4.291 \pm .04$ mm) compared to the control group (1.58 ± 1.02) and a CAL gain in the study (2.87 mm) compared to the control group (1.37 mm) 9 months post operatively, but without statistically significant values. The reason for this result may be true regeneration via a new attachment in

the PRF-treated group, and in the control group, healing through repair and improved CAL are the result of long epithelial adhesion. [25]

CONCLUSIONS

Additional use of PRF in the conventional surgical treatment of intrabony defects demonstrated decrease in PD and CAL values recorded at 9 months compared to those at 6 months and at the baseline. However, multicentre randomized, controlled clinical trials will be required to prove PRF's clinical and radiographical effects over bone regeneration on the long run.

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Резиме

ПРОЦЕНА НА ЕФЕКТИТЕ ОД ПРИМЕНАТА НА PRF ВО ТРЕТМАНОТ НА ИНФРАКОСКЕНИТЕ ДЕФЕКТИ

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Цел: Да се испита ефектот на PRF во третманот на инфракоскени дефекти кај пациенти со хронична пародонтопатија преку проценка на клиничкиот статус пред хируршка интервенција, шест и девет месеци по интервенцијата.

Материјал и метод: Третирали се шеесет инфракоскени дефекти со длабочина на пародонталните џебови (PD) ≥ 5 mm. Во испитувањето се вклучени и дијагностицирани PD во горна вилица, кои се рендгенографски потврдени билатерално странично со длабочина од ≥ 5 mm. Користејќи дизајн на студија split-mouth, кај секој пациент едната страна е третирана со конвенционална флап-интервенција, а другата е третирана со флап-оперативна метода и дополнување со PRF. Клиничките параметри, како што се PD и ниво на клинички атачмен (CAL), се одредувани во двете групи пред интервенцијата и шест и девет месеци по неа.

Резултати: Позитивни терапевтски ефекти се евидентни во групата третирана комбинирано (flap + PRF). Наодите укажаа дека вредностите на PD по девет месеци од третманот има значајно подобри резултати ($4,00 \pm 1,07$ mm) во однос на контролната ($4,83 \pm 0,99$ mm), $p = 0,003$. Иако без статистичко значење, евидентни се подобри клинички наоди кај групата третирана со PRF во однос на контролната, за CAL ($5,60 \pm 1,61$ mm, $6,20 \pm 1,58$ mm) по девет месеци.

Заклучок: Дополнителната примена на PRF во конвенционалниот хируршки третман на инфракоскени дефекти покажа подобар клинички резултат во однос на стандардно применуваната флап-интервенција.

Клучни зборови: инфракоскени дефекти, хронична пародонтопатија, пародонтална регенерација, пародонтална хирургија