Treatment of Periodontal Endosseous Defects With Platelet-Rich Plasma Alone or in Combination With Demineralized Freeze-Dried Bone Allograft: A Comparative Clinical Trial

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Background: Platelet-rich plasma (PRP) alone or combined with other regenerative materials was previously studied in human periodontal endosseous defects. There are no sufficient data evaluating to what extent the addition of demineralized freeze-dried bone allograft (DFDBA) to PRP may enhance the effectiveness of PRP. The aim of this randomized, double-masked, controlled clinical trial was to compare the effectiveness of autologous PRP alone or a PRP + combination in periodontal endosseous defects.

Methods: Twenty-four proximal endosseous defects in 24 patients with severe chronic periodontitis were randomly treated with PRP alone or in combination with DFDBA. The final evaluation at 6 months was based on clinical and radiographic parameters. Subtraction radiography was used. The primary outcome variable was clinical attachment level (CAL).

Results: The two treatment groups were initially comparable (mean CAL: 8.67 ± 2.19 mm for PRP + DFDBA and 8.25 ± 1.96 mm for PRP). Both treatments achieved statistically significant and similar CAL gain (3.08 ± 1.17 mm for PRP + DFDBA and 3.08 ± 0.95 mm for PRP), probing depth, defect depth, and area surface reduction. The percentage of defect fill did not significantly differ between the two treatments. There was a non-significant trend to greater defect fill (45.42% versus 41.29%), defect depth (54.05% versus 49.52%), and area surface (58.43% versus 52.16%) reduction with the graft. In both groups, 66.66% of the defects gained ≥3 mm of CAL.

Conclusion: Within its limits, this study demonstrated that both PRP and PRP combined with DFDBA resulted in significant clinical and radiographic improvement in human periodontal endosseous defects at 6 months, and the addition of DFDBA to PRP did not significantly enhance the treatment outcome. *J Periodontol 2009; 80:1911-1919.*

KEY WORDS

Chronic periodontitis; periodontal pocket; platelet-rich plasma; randomized controlled trial; regeneration; subtraction technique.

Growth factors are important for periodontal wound healing because they are implicated in the proliferation, chemotaxis, and differentiation of various cells.[1-4] High levels of growth factors are contained in platelet-rich plasma (PRP),[5,6] leading several investigators[7-14] to explore the in vitro response of osseous cells to PRP. The high growth factor concentration of PRP along with promising research results support the potential role of PRP as a mitogenic factor for periodontal tissue cells.

The application of PRP in human periodontal endosseous defects was studied in combination with other regenerative techniques with varying results. PRP has been combined with guided tissue regeneration (GTR),[15] bovine porous bone mineral (BPBM),[16] BPBM and GTR,[17-20] BPBM and enamel matrix protein derivative,[21] beta-tricalciumphosphate[22] and GTR,[23-25] porous hydroxyapatite,[26] demineralized freeze-dried bone allograft (DFDBA),[27,28] bioactive glass (BG),[29] and peptide-enhanced graft.[30]

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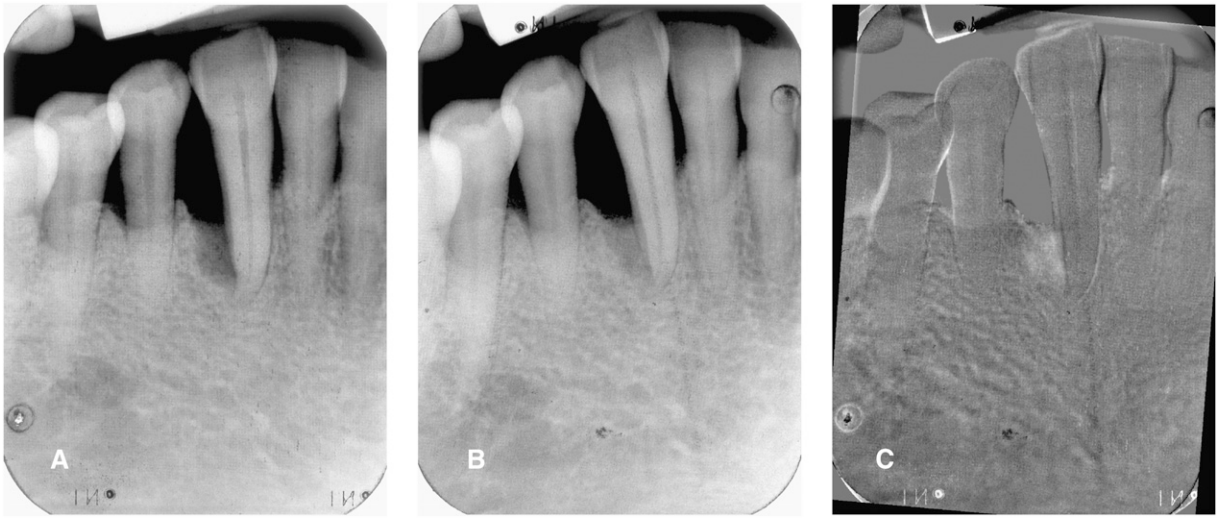

Figure 1.
Radiographic images of an endosseous defect treated with PRP + DFDBA. ***A)*** *Initial radiograph prior to treatment.* ***B)*** *Final radiograph 6 months after treatment with PRP + DFDBA.* ***C)*** *Subtracted image.*

Osseous grafts aim at osseous regeneration and clinical attachment level (CAL) gain. Despite limitations such as unpredictable defect resolution and formation of connective tissue attachment,[31] DFDBA is among the most successful osseous grafts.[31,32] The combination of PRP and DFDBA was compared to the combination of DFDBA and saline in a study by Piemontese et al.[28] and PRP alone in a study by Ilgenli et al.[27] The available data are limited, and further investigation is required, which led us to examine the hypothesis of an enhanced therapeutic outcome of PRP when it is mixed with DFDBA.

The main aim of the present randomized, double-masked, controlled clinical trial is to compare the clinical and radiographic effectiveness of a composite graft consisting of DFDBA and PRP (Fig. 1A through 1C) to PRP alone (Fig. 2A through 2C) in the surgical treatment of human periodontal endosseous defects.

MATERIALS AND METHODS

Patient Population

Twenty-four patients (16 males and 8 females; mean age 52.08 ± 7.33 years; age range 40 to 65 years) from the patient pool of the Department of Periodontology, School of Dentistry, University of Athens, were recruited from January 2005 to June 2005.

The patient inclusion criteria were as follows: presence of generalized chronic severe periodontitis;[33] absence of known systemic disease or condition that could interfere with normal wound healing; absence of a contraindication for radiographic evaluation; absence of periodontal treatment for the previous year; absence of systemic medication or antibiotic treatment for the previous 6 months; absence of a heavy smoking habit (>10 cigarettes per day); and absence of occlusal interferences.

Inclusion criteria also included the presence of one tooth with: clinical and radiographic indication of a proximal endosseous defect; probing depth (PD) at the site of the endosseous defect ≥6 mm; CAL at the site of the endosseous defect ≥6 mm; endosseous radiographic defect depth (dd) ≥3 mm (note: the acronyms for radiographic measurements are indicated in lowercase letters, in contrast to the acronyms for clinical measurements, which are indicated in capital letters); endosseous radiographic defect angle <55° and >15°; absence of furcation involvement; normal pulp vitality; no extensive tooth restoration (implicating no more than half of the crown); and absence of parafunctional habits.

Each patient signed an informed consent form prior to treatment initiation. The study was approved by the ethical committee of the School of Dentistry, University of Athens, and was conducted in accordance with the Helsinki Declaration of 1975, as revised in 2000.

Patient Management

Presurgical. The pretreatment examination included a full-mouth plaque score (FMPS),[34] the simplified gingival index (GI),[35] bleeding on probing (BOP), CAL, PD, gingival recession (GR), tooth mobility (MOB), and full-mouth periapical radiographs. A 15-mm calibrated periodontal probe‖ was used. PD,

‖ PCPUNC-15, Hu-Friedy, Chicago, IL.

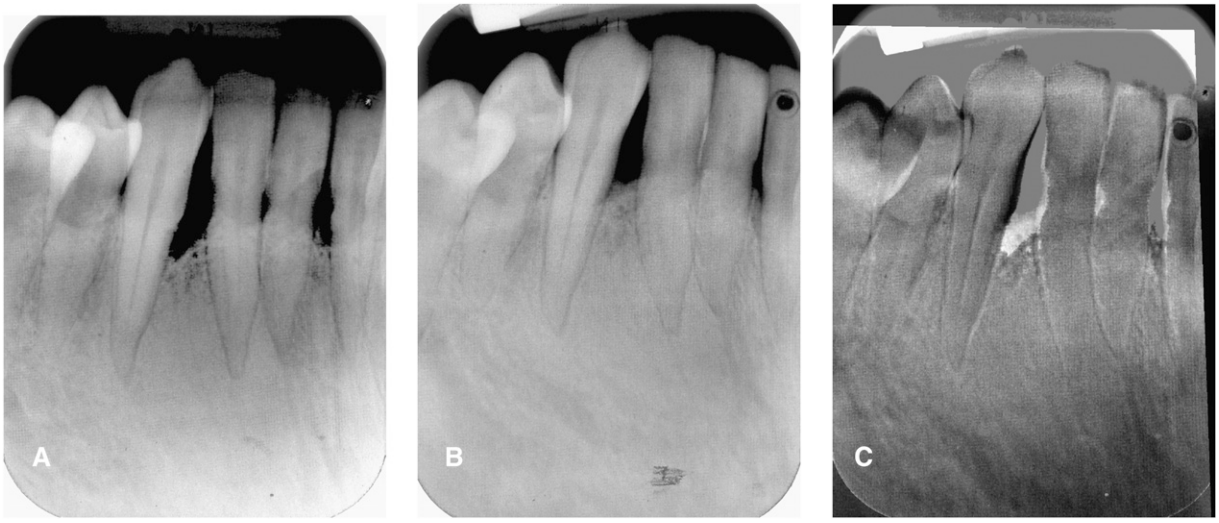

Figure 2.
Radiographic images of an endosseous defect treated with PRP. ***A)*** *Initial radiograph prior to treatment.* ***B)*** *Final radiograph 6 months after treatment with PRP.* ***C)*** *Subtracted image.*

CAL, and GR were measured to the nearest millimeter. All radiographs were taken by the same operator with standardized conditions.

Six weeks after phase I treatment, FMPS, GI, BOP, CAL, PD, GR, and MOB were assessed. Patients presenting BOP ≥25% at reevaluation were excluded from the study.[36] A single defect was studied per patient. An occlusal acrylic stent, prepared for each defect, had two guiding grooves at specific sites (buccally and lingually) and served as a fixed reference point for the clinical measurements. Then, FMPS, GI, BOP, CAL, PD, GR, of keratinized tissue width (KTW), and the thickness of soft tissues (TST) (initial measurements) were assessed while the acrylic stent was in place. Each parameter was assessed at two specific proximal sites (buccally and lingually), except for maxillary defects, where KTW and TST were evaluated only buccally. Between the two measurements of each parameter, the highest was selected, except for KTW and TST, where the lowest was recorded.

Surgical. Immediately prior to the surgery by the flip of a coin, each defect was randomly assigned to either a combination of PRP and DFDBA (experimental) or PRP alone (control). The coin was flipped each time by the same individual (Dr. Sotirios Kotsovilis, Department of Periodontology, School of Dentistry, University of Athens, Athens, Greece) who was not involved in the study in any other way. DFDBA was derived from cancellous bone of the femoral head¶ and was in particle form (diameter range: 250 to 425 μm).

The procedure included intrasulcular incisions, full-thickness flaps, a papilla-preservation technique (when deemed advantageous), meticulous debridement, root planing, defect filling with PRP or PRP + DFDBA, flap repositioning, and suturing using a modified vertical mattress and interrupted sutures.

Prior to defect filling with either treatment, the following surgical measurements were performed: stent to alveolar crest (SAC); stent to defect base (SDB); mesio-distal defect width (MDW) measured at crest level; bucco-lingual defect width (BLW) measured at crest level; number of osseous walls (NOW); and number of tooth surfaces (NSURF) implicated in the defect.

The assessment of SAC and SDB was performed buccally and lingually while the stent was in place by measuring with the periodontal probe to the nearest millimeter. The highest SDB measurement was recorded. The periodontal probe was also used for MDW and BLW assessment.

Doxycycline hyclate was systemically administered for 10 days: 100 mg every 12 hours on the day of surgery and every 24 hours for the next 9 days.

All surgical procedures were performed by the same operator (NM), who was masked to the treatment group to which a patient was assigned until the initiation of the surgery.

Post-surgical. Each patient was seen every 2 weeks for the first month and then once a month thereafter. The final clinical (FMPS, GI, BOP, CAL, PD, GR, KTW, and TST while the stent was in place) and radiographic (periapical radiographs) evaluations were performed at 6 months. All clinical (pretreatment, initial, surgical, and final) measurements were performed

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by the same calibrated examiner (EP), who was masked to the treatment group to which a patient was assigned for the entire study duration.

PRP Preparation

The Curasan method was used for PRP preparation,[#,37] which started immediately prior to surgery. Citrated blood (8.5 ml), drawn from the patient, was centrifuged in a standard laboratory centrifuge** for 10 minutes at 2,400 rpm. The overlying yellow solution was centrifuged for 15 minutes at 3,600 rpm to separate PRP from platelet-poor plasma (PPP). Then, the PPP was removed. The remaining PRP was stirred for 20 seconds in a standard mixing device.[††] PRP (0.6 ml) was activated by adding 0.1 ml $CaCl_2$–thrombin solution that was produced by adding 5 ml of 10% $CaCl_2$ solution to 5,000 units of topical thrombin.[‡‡,38] PRP was placed into the defect ~1 hour after the blood draw.

Radiographic Measurements

Subtraction radiography was used. Each initial and final radiograph was transformed into a digitized image to a resolution of 300 dots per inch with eight bits of gray-level resolution per pixel. The reference image for each defect was the initial digitized image (from the initial radiograph). A second digitized image (from the final radiograph) was reconstructed for each defect according to its reference image by using a software program,[§§] which provided geometric standardization. A reconstructed image was produced by correcting the geometric projection of the final radiograph. The alignment of the second image was based on five reference points from the initial image. Each defect had a pair of digitized images (initial and reconstructed).[39-41]

The following measurements taken from each initial and reconstructed digital radiograph were linear, area surface (in pixels), and angular (in angle degrees): cemento-enamel junction (CEJ) to the point along the root surface at the alveolar crest level (acl); CEJ to the defect base level (dbl); mesio-distal defect width (mdw) at the alveolar crest level; defect angle formed by the CEJ, defect base, and crest; and defect area surface.

For the area measurements, an image-processing and analysis program[||||] was used. Each parameter was assessed twice (2 weeks apart). The measurement documented was the average of these two scorings.[42,43] In most sites, the two scorings were identical. In ~10% of the sites, the two scorings differed by 2% to 3%. The changes between the initial and final measurements were expressed as percentages of the initial values. All radiographic measurements were performed by the same calibrated examiner (HCS), who was masked to the treatment group and to the clinical measurements.

Arithmetic Determinations

The arithmetic determinations were as follows:

- Aveolar crest to the defect base (ACDB) = SDB – SAC.
- dd = dbl – acl.
- % dd change = (initial dd – final dd) × 100/initial dd.
- % alveolar crest change = (initial acl – final acl) × 100/initial ad.
- % defect fill = (initial dbl – final dbl) × 100/initial dd.
- % area surface change = (initial area – final area) × 100/initial area.
- % mdw change = (initial mdw – final mdw) × 100/initial mdw.

Statistical Analyses

Mean values and standard deviations were calculated for all clinical and radiographic parameters at each time interval. The distribution of continuous variables within the two treatment groups was compared using the Student statistic and the non-parametric Wilcoxon rank sum test. The paired *t* and Wilcoxon matched-pairs signed ranks tests were applied to detect differences between initial and final values. Unless stated differently, *P* values derived from Wilcoxon tests are reported. The potential association between categoric variables was examined by the χ^2 test. The estimated sample size required for a two-sample comparison of means was 12 per treatment group assuming a 5% significance level of the two-sided test, an 80% power, and postulated mean CAL gains measured at 6 months in the experimental and control groups of 3.5 ± 0.85 mm and 2.5 ± 0.85 mm, respectively. A commercially available statistical software program[¶¶] was used. The level of statistical significance was set at 5% ($P = 0.05$).

RESULTS

Postoperative healing was uneventful for all defects. All 24 patients completed the 6-month follow-up period.

The experimental and control groups were statistically comparable in: patient age, gender distribution, smoking habit (Table 1); pretreatment FMPS, GI, and BOP (prior to phase I treatment); initial FMPS, GI, and BOP (prior to surgery); FMPS, GI, and BOP changes with phase I treatment (Table 2); and initial PD, CAL, ACDB, MDW, BLW, KTW, and defect angle

PRP kit, Curasan, Kleinostheim, Germany.
** Heraeus Labofuge 300, Kendro Laboratory Products, Osterrode, Germany.
†† Vortex – Mixer, Curasan.
‡‡ Thrombin-JMI, GenTrac, Middletown, WI.
§§ EMAGO/Advanced, version 3.1, Oral Diagnostic System, Amsterdam, The Netherlands.
|||| Image Tool 3.0 (6) for Microsoft Windows XP, Department of Dental Diagnostic Science, University of Texas Health Science Center, San Antonio, TX.
¶¶ Stata 8.0, Stata, College Station, TX.

(Table 3); and they had similar tooth-group location, NOW, NSURF (Table 1), and MOB. The ACDB for all defects was ≥4 mm except for one in each group, where the ACDB was 3 mm. Phase I treatment resulted in significant mean FMPS, GI, and BOP decreases for both groups.

The initial and final measurements were compared for each group. All patients demonstrated a low FMPS throughout the study. The mean final FMPS, GI, and BOP in both groups showed a significant decrease to pretreatment (Table 2). Both modalities achieved statistically significant CAL gain, PD (Table 4), defect depth, area surface reduction, and angle increase (Table 4). For both groups, the mdw and MOB remained unchanged.

Table 1.

Initial Characteristics by Treatment Group*

Parameter	PRP	PRP + DFDBA
Age (years; mean ± SD)	50.42 ± 6.57	53.75 ± 7.94
Gender (n)		
Males	8	8
Females	4	4
Smoking (n)		
Never	9	8
Active†	3	4
Tooth group location (n)		
Mx incisors	1	2
Mx canines	0	1
Mx second premolars	2	1
Mx molars	1	0
Md incisors	0	1
Md canines	2	3
Md premolars	2	0
Md molars	4	4
NOW		
Combination of one or two	3	2
Combination of two or three	2	4
Two	3	4
Three	4	2
NSURF		
One	6	8
Combination of two or three	6	4
Adequate TST (n teeth)		
Buccally	12	9
Lingually	12	11

Mx = maxillary; Md = mandibular.
* All comparisons were non-significant ($P > 0.05$). The association between categoric variables was assessed by the χ^2 test. The distribution of age within the two treatment groups was compared using the Wilcoxon rank sum test.
† Daily cigarette consumption ≤10.

The mean changes in PD, CAL, GR, KTW, angle, dd, acl, area, and mdw, as well as the % defect fill (Table 5), were not significantly different between the two groups.

When the defects were classified into subgroups in relation to their ACDB (≤5 and >5 mm), MDW (≤4 and >4 mm), BLW (≤7 and >7 mm), angle (≤30° and >30°), NOW, and NSURF status, the CAL changes obtained remained statistically significant for both treatments. None of the defect characteristics significantly affected the mean CAL gain achieved with either treatment. The mean CAL gain did not significantly differ between the two treatment modalities for defects belonging to the same ACDB or CAL or angle or MDW or BLW or NOW or NSURF subgroup.

The difference in clinical significance of the CAL gain between the two groups was assessed by using a 2- or 3-mm threshold change. When a 2-mm threshold change was selected, 83.33% of the control and 100% of the experimental defects showed a clinically significant gain. When a 3-mm threshold change was selected, 66.66% of the defects in each group demonstrated clinical significance.

Exploration of the possible impact of the defect configuration on the radiographic outcome revealed that the CAL, ACDB, and angle were not significantly associated to the % defect fill obtained with either treatment (Table 6). Furthermore, the % defect fill was similar between the two treatments for defects of the same CAL or ACDB or angle subgroup (Table 6).

DISCUSSION

The present randomized clinical trial assessed the adjunctive effect of DFDBA to PRP in the treatment of 24 human endosseous defects in 24 patients. Half of the defects were treated with PRP alone, and the rest received PRP + DFDBA. The final evaluation at 6 months was based on clinical and radiographic parameters.

The two groups were comparable in age, gender, smoking, pretreatment inflammation level, initial defect characteristics, and response to phase I treatment. The number of active smokers was similar between the two groups, which is in accordance with previous studies,[27,29] and none of them consumed >10 cigarettes daily. A negative effect on regenerative treatment was documented for smokers consuming >10 cigarettes daily.[44]

Both treatments led to a significant and similar improvement in PD, CAL, dd, area surface, and defect fill. A similar angle increase was seen for both treatments, which was probably due to changes in the defect configuration. Either treatment failed to affect the mesio-distal defect width. Both treatments prevented crest resorption, GR, and keratinized tissue reduction.

Table 2.

Comparison of Pretreatment and Final FMPS, GI, and BOP Values by Treatment Group

Parameter	Pretreatment	Initial	Final	*P* Value*
FMPS				
PRP	0.75 ± 0.14	0.22 ± 0.10	0.13 ± 0.13	0.002
PRP + DFDBA	0.74 ± 0.14	0.24 ± 0.12	0.14 ± 0.06	0.002
P value†	0.77		0.73	
GI				
PRP	0.64 ± 0.26	0.23 ± 0.15	0.16 ± 0.19	0.005
PRP + DFDBA	0.71 ± 0.15	0.20 ± 0.36	0.14 ± 0.05	0.002
P value†	0.42		0.75	
BOP				
PRP	0.71 ± 0.26	0.27 ± 0.17	0.26 ± 0.28	0.003
PRP + DFDBA	0.79 ± 0.11	0.24 ± 0.26	0.16 ± 0.06	0.002
P value†	0.21		0.58	

* Comparison between pre- and final treatments using the Wilcoxon matched-pairs signed ranks test.
† Comparison between treatment groups using the Wilcoxon rank sum test.

Table 3.

Comparison of Initial Defect Characteristics Between the Two Groups Using the Wilcoxon Rank Sum Test

Parameter	PRP (mean ± SD)	PRP + DFDBA (mean ± SD)	*P* Value
PD_I (mm)	7.42 ± 1.08	7.33 ± 1.78	0.67
CAL_I* (mm)	8.25 ± 1.96	8.67 ± 2.19	0.62
$ACDB_I$ (mm)	6.09 ± 1.92	5.58 ± 2.28	0.47
MDW_I (mm)	5.08 ± 2.28	4.25 ± 1.82	0.33
BLW_I (mm)	7.83 ± 1.59	7.67 ± 1.44	0.77
KTW_I (mm)	4.58 ± 1.73	5.42 ± 1.00	0.21
$Angle_I$ (degree)	32.33 ± 8.39	31.83 ± 8.69	0.93

Subscript 1 = initial.
* Measured without a stent.

Both treatment modalities had similar effectiveness. However, there were non-significant indications that greater defect fill (45.42% versus 41.29%), defect depth reduction (54.05% versus 49.52%), and area surface reduction (58.43% versus 52.16%) were obtained with PRP + DFDBA than PRP alone. Six (50%) defects treated with PRP and five (41.66%) defects treated with PRP + DFDBA presented a reduction of the area surface ≥60%. Five (41.66%) defects treated with PRP and four (33.33%) defects treated with PRP + DFDBA demonstrated a reduction of the defect depth ≥60%.

The CAL gain for the PRP + DFDBA group was in accordance with studies using PRP with bovine bone,[16] hydroxyapatite,[26] BG,[29] and DFDBA.[28] The PRP CAL gain, PD reduction, and % defect fill were in accordance with those observed previously with PRP.[30] Comparison between the change in clinical parameters achieved with PRP in the present study and those reported for open flap debridement by Laurell et al.[45] in a meta-analysis revealed that open flap debridement in endosseous defects leads to a CAL gain two times less than in the present study and to PD reduction similar to that found in this study.

The CAL gain achieved was not affected by the defect characteristics within each treatment group, and the treatment modality did not influence the CAL gain in defects of similar characteristics. Moreover, there was no evidence of an association of the radiographically imaged defect fill with the defect characteristics.

The results of the present study contradict the results of a study by Ilgenli et al.[27] on the superiority of PRP + DFDBA over PRP in CAL gain, PD reduction, radiographic defect fill, and angle change. However, the findings of the present study are in accordance with those of Ilgenli et al.[27] regarding the lack of association between the CAL gain and the defect angularity, as well as on similar crest resorption and defect width changes, between the two treatments. The long follow-up time, the acrylic stent, and the digital subtraction radiography are among the strong points of the study design of Ilgenli et al.,[27] whereas the use of the defect instead of the patient as the unit of statistical analysis appears to be a limitation.

Contrary to the results of the present study, the impact of the ACDB and angle on CAL gain and radiographic defect fill was documented for GTR[46] and enamel matrix derivative,[47] with narrow and deep defects being more successfully treated. Furthermore, defect angularity was correlated to the radiographic defect fill in defects treated with open flap debridement.[48] The small defect number might be the main reason for not showing this association. In the present study, radiographic defect angles ≤30° were defined as narrow, and defect angles >30° were defined as wide. Ideally, the narrow (≤25°) and wide (≥37°) defects should be defined as suggested by Cortellini and Tonetti,[49] but the application of such

Table 4.

Comparison of Initial and Final PD, CAL, and Angle by Treatment Group Using the Wilcoxon Matched-Pairs Signed Ranks Test

Parameter	Initial (mean ± SD)	Final (mean ± SD)	*P* Value
PD (mm)			
PRP			
Buccal	7.17 ± 1.19	3.33 ± 0.89	0.002
Lingual	6.08 ± 1.24	3.25 ± 0.75	0.002
Deepest	7.42 ± 1.08	3.50 ± 0.91	0.002
PRP + DFDBA			
Buccal	7.08 ± 1.88	3.58 ± 0.79	0.002
Lingual	6.67 ± 1.72	2.92 ± 0.52	0.002
Deepest	7.33 ± 1.78	3.58 ± 0.79	0.002
CAL* (mm)			
PRP			
Buccal	8.08 ± 2.11	3.83 ± 0.72	0.002
Lingual	7.08 ± 1.68	4.25 ± 1.06	0.002
Deepest	8.25 ± 1.96	4.33 ± 0.99	0.002
PRP + DFDBA			
Buccal	8.58 ± 2.19	4.92 ± 1.73	0.002
Lingual	7.83 ± 2.44	5.00 ± 1.76	0.006
Deepest	8.67 ± 2.19	5.50 ± 1.73	0.004
Angle (degree)			
PRP	32.33 ± 8.39	47.08 ± 15.24	0.001
PRP + DFDBA	30.83 ± 8.69	41.17 ± 13.39	0.004

* Measured without a stent.

a classification in the present study would have produced a very small number of narrow and wide defects. Furthermore, the range of defect angularity for the wide defects was rather limited because there were only three defects with an initial angle >40°, with one (51°) of them belonging in the PRP + DFDBA group and two (45° and 48°, respectively) belonging in the PRP group.

A limitation of the present study is the 6-month follow-up time, which could be regarded as rather short, especially for the evaluation of osseous changes. A longer follow-up period might have revealed statistical significance mainly in defect fill and resolution.

CONCLUSIONS

Within its limits, the present study demonstrates that, at 6 months after the surgical treatment of human periodontal endosseous defects, both PRP and PRP combined with DFDBA resulted in significant clinical and radiographic improvement, but the addition of DFDBA to PRP failed to significantly further enhance the treatment outcome obtained by PRP alone.

Table 5.

Comparison of Mean Changes Obtained With Treatment Between the Two Groups Using the Wilcoxon Rank Sum Test

Parameter	PRP (mean ± SD)	PRP + DFDBA (mean ± SD)	*P* Value
ΔPD (mm)	3.92 ± 1.1	3.75 ± 1.49	0.61
ΔCAL* (mm)	3.08 ± 0.95	3.08 ± 1.17	0.95
ΔGR* (mm)			
Buccally	0.33 ± 1.44	0.83 ± 1.12	0.45
Lingually	0.83 ± 0.94	1.17 ± 1.27	0.56
ΔKTW (mm)			
Buccally	0.33 ± 0.62	−0.17 ± 0.39	0.88
Lingually	0.00 ± 0.00	0.08 ± 0.29	0.32
% Δ dd	49.52 ± 23.58	54.05 ± 18.82	0.82
% Δ acl	11.54 ± 2.95	9.26 ± 2.51	0.18
% Δ area	52.16 ± 22.09	58.43 ± 19.04	0.72
Δ angle (degree)	−14.75 ± 15.96	−10.33 ± 8.47	0.58
% fill	41.29 ± 17.33	45.42 ± 18.20	0.77

Δ = change.
* Measured without a stent.

Table 6.

Defect Fill by Treatment Group and Defect Characteristics

Parameter	% Defect Fill (mean ± SD)		*P* Value*
	PRP	PRP + DFDBA	
ACDB			
≤5 mm	43.13 ± 17.62	48.41 ± 14.88	0.86
>5 mm	39.34 ± 18.50	38.11 ± 21.61	0.47
P value	0.47	0.27	
Angle			
≤30°	42.47 ± 9.48	39.25 ± 18.50	0.76
>30°	41.77 ± 23.18	54.04 ± 15.41	0.315
P value	0.87	0.12	
CAL_I†			
≤7 mm	38.36 ± 16.55	43.08 ± 20.69	0.68
>7 mm	42.75 ± 18.64	46.58 ± 18.27	0.64
P value	0.68	0.73	0.86

Subscript 1 = initial.
* *P* values were obtained by using the Wilcoxon rank sum test.
† Measured without a stent.

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The authors report no conflicts of interest related to this study.

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