



Platelet Rich Fibrin Combined with Nano Crystalline Hydroxyapatite in Treatment of Grade II Mandibular Furcation Defect

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KEYWORDS

Mandibular fraction, NchHA, osteoblast, PRF

ABSTRACT

Aim: This study aims to evaluate the effect of Platelet Rich Fibrin combined with Nano crystalline Hydroxy apatite bone graft on grade II mandibular furcation involvement. **Subjects and methods:** Thirty patients having grade II mandibular furcation defects, with vertical probing depth (VPD) ≥ 5 mm and horizontal clinical attachment level (HCAL) ≥ 3 mm. Following phase I therapy were classified into two groups, group 1 received NcHA bone graft and group 2 received NcHA+PRF. Clinical and radiographic parameters were recorded at baseline, 6 and 12 months postoperatively. **Results:** Both treatment groups showed a significant probing pocket depth (PPD) reduction, clinical attachment gain, increase bone density 12-months after surgery compared with baseline. However, there was a highly significant PPD reduction and clinical attachment gain when PRF was added to NcHA. **Conclusion:** The NcHA bone graft in combination with PRF demonstrated clinical advantages beyond that achieved by the NcHA alone.

INTRODUCTION

Furcation involvement is one of the most compelling challenges faced in management of periodontal disease in multi-rooted teeth, resulting from loss of bone adjacent to and within the furcation.⁽¹⁾

In grade II furcation involvement, the bone is destroyed on one or more aspects of furcation but a portion of bone and periodontal ligament remain intact, permitting only partial penetration of the probe into the furcation. The depth of the horizontal component of the pocket will determine whether the furcation involvement is early or advanced. The radiograph may or may not reveal the grade II furcation involvement.⁽²⁾

Different methods of furcation management therapy include non-surgical periodontal therapy, open flap debridement, furcation plasty, root resection\ Hemisection, regenerative techniques (Guided Tissue Regeneration, bone graft, Enamel Matrix Derivatives) and tunneling.⁽³⁾

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In recent years there has been an increased demand for nano materials in treatment of periodontal defects. Different alloplastic bone grafts are being developed with nanoscale particles. The most popular ones to date are Nanohydroxyapatite bone grafts, which has been introduced for augmentation procedures in intrabony defects due to its biocompatibility, bioactivity, osteoconductivity, nontoxicity and non-inflammatory nature⁽⁴⁾.

Platelet-rich fibrin (PRF) is a second-generation platelet concentrate, prepared from centrifuged blood. PRF is a fibrin clot rich in platelets without addition of thrombin during preparation.⁽⁵⁾

The introduction of PRF clot, which is an attempt to accumulate platelets and cytokines together in a fibrin clot, offers the advantages of being resorbable, biocompatible, acts as a scaffold and also accelerates bone regeneration.^(6,7)

When HA is combined with PRF, a semi-fluid fibrin meshwork with platelet concentrates and growth factors acting as a barrier membrane, would enhance the regenerative potency. Slow, sustained release of growth factors (such as TGF- β , PDGF-AB, and vascular endothelial growth factor) and glycoproteins (such as thrombospondin-1) during ≥ 7 days and its well organized tetramolecular fibrin meshwork adds to its application as covering membrane, protecting the intrabony defect site from epithelial invasion.⁽⁸⁾

The present study was designed to evaluate the clinical and radiographic effect of Nano crystalline hydroxy apatite bone graft combined with Platelet Rich Fibrin in treatment of grade II furcation involvement.

SUBJECTS AND METHODS

The current study included thirty systemically healthy subjects (26 males and 4 females, mean age of 41.5 ± 3.4 years) undergoing periodontal therapy at the Out Patients Clinic, Department of Oral Medicine and Periodontology, Faculty of Dentistry, Al-Azhar University (Assiut branch). All eligible

patients were thoroughly informed of the nature, potential risks and benefits of their participation in the study and signed their informed consent documents.

Inclusion criteria:

The presence of degree II furcation defects (Ramfjord & Ash 1979)⁽⁹⁾ in vital, asymptomatic mandibular first molars with a radiolucency in the furcation area on an intra-oral periapical radiograph, vertical probing depth (VPD) ≥ 5 mm and horizontal clinical attachment level (HCAL) ≥ 3 mm following phase I therapy (scaling and root planning). Patients were divided randomly by flip of coin toss into two groups; (G1) treated with Nanocrystalline hydroxyapatite and (G2) treated with Nanocrystalline hydroxyapatite combined with platelet rich fibrin.

Periodontal and radiographic evaluation:

1. Periodontal evaluation and clinical parameter were recorded before surgical procedures included vertical probing depth (VPD),⁽¹⁰⁾ relative clinical attachment level (RCAL)⁽¹¹⁾, plaque⁽¹²⁾ and gingival index⁽¹³⁾.
2. Radiographic evaluation was done at; baseline, 6 and 12 months post surgically. A standardized periapical radiographs were taken using long cone parallel technique, customized bite, metal rod and parallel dental film positioning system.

PRF preparation:

A blood sample of the patient was drawn in 10 mL test tubes without an anticoagulant and centrifuged immediately. Blood was centrifuged for 10 min at 3000 rpm⁽¹⁴⁾. The resultant product consisted of the following three layers; the upper layer of acellular PPP (platelet-poor plasma), PRF clot in the middle and red blood cells at the bottom. PRF was easily separated from red corpuscles base using a sterile tweezers and scissors and then transferred mixed by NcHA crystals.



Surgical procedures:

1. Intra-oral antiseptis was performed with 0.12% chlorhexidine digluconate rinse
2. Surgical site was anaesthetized by block anesthesia.
3. A full thickness sulcular incision was made using scalpel and surgical blade No.15c.
4. The full thickness mucoperiosteal flap was elevated using mucoperiosteal elevator. Meticulous defect debridement and root planning were carried out using Gracy curettes (Hu Friedy, IL, Chicago) and ultrasonic instruments.

In Group 1: the surgical furcation defect was filled by Nanocrystalline hydroxyapatite (NcHA) (Nano-bone® (ARTOSS GmbH friedrich-Barnewitz-straBe3118119 Rostock/Germany), while in **group2** the defect was filled by mixture of PRF and NcHA (Fig 1,2,3).

5. The flaps were sutured coronally using 3-0 or 4-0 absorbable vecryl surgical suture with interrupted sutures.



Fig. (1) Show furcation grade defect

Post-surgical instructions and medications:

1. Patients were placed on systemic antibiotic, analgesic for one week and mouth wash for 4 weeks.
2. Patients were advised with repeated application of an ice pack over the area of the face related to the surgery for one day to avoid post-surgical edema. In the 1st week post surgically patients were asked to avoid sticky, spicy, hard and crispy food. The patients were instructed to discontinue tooth brushing around the surgical sites during the initial 10 days after surgery.

Post-surgical evaluations:

1. Clinical soft tissue measurement: The site-specific plaque index (PI), gingival index(GI), vertical probing depth (VPD), relative clinical attachment level (RCAL) were recorded at 6 and 12 months post surgically.
2. Standardized periapical radiographs were repeated at 6 and 12 months postsurgical.



Fig. (2) Show furcation defect filled with mixture of NcHA+PRF

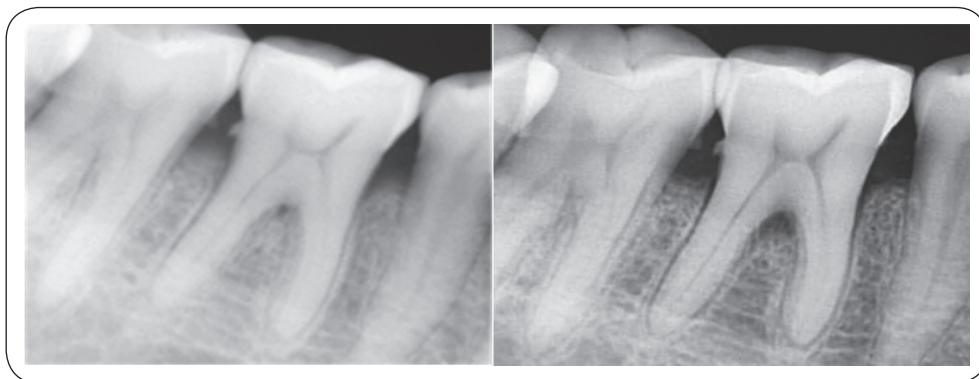


Fig. (3) Show furcation defect at base line and 12 month postsurgical after treatment with NcHA +PRF

Statistical analysis:

The data were collected, tabulated and statistically analyzed by IBM® SPSS® Statistics Version 20 for Windows using ANOVA test. 1-Data were explored for normality using Kolmogorov-Smirnov and Shapiro-Wilk tests, Plaque index and Gingival index data showed non-parametric (not-normal) distribution, while Pocket depth, RCAL and Bone density data showed parametric (normal) distribution. 2-Pearson test was used to test the correlation between different variables. The significance level was set at $P \leq 0.05$.

RESULTS

Thirty patients with chronic periodontitis and class II furcation defects in vital, asymptomatic mandibular first molars with a radiolucency in the furcation area on an intra-oral periapical radiograph, vertical probing depth (VPD) ≥ 5 mm and horizontal clinical attachment level (HCAL) ≥ 3 mm following phase I therapy were selected to participate in the present study.

During the periods of the study there was no abnormal reaction and complications were observed after periodontal therapy.

The changes in the mean values of clinical and radiographic parameters during the observation periods of the present study were illustrated in tables (1)

TABLE (1) Demonstrate the statistical comparisons of clinical parameters at time intervals; baseline, 6 month and 12 month in group 1 and group2

Parameter	Interval	G1	G2
PI	base line	0.81 \pm 0.06	0.75 \pm 0.07
	6month	0.72 \pm 0.08	0.64 \pm 0.10
	12month	0.64 \pm 0.06	0.62 \pm 0.08
	p value	<0.001*	0.002*

Parameter	Interval	G1	G2
GI	base line	0.75 \pm 0.09	0.70 \pm 0.14
	6month	0.70 \pm 0.08	0.63 \pm 0.13
	12month	0.64 \pm 0.08	0.60 \pm 0.12
	p value	<0.001*	<0.001*
PD	base line	5.87 \pm 0.31	5.82 \pm 0.75
	6month	4.89 \pm 0.32	4.22 \pm 0.20
	12month	3.82 \pm 0.23	0.21 \pm 3.23
	p value	<0.001*	<0.001*
RCAL	base line	7.62 \pm 0.38	7.90 \pm 0.42
	6month	6.19 \pm 0.32	5.39 \pm 0.51
	12month	4.83 \pm 0.43	0.15 \pm 3.98
	p value	<0.001*	<0.001*
BD	base line	101.95 \pm 14.04	100.49 \pm 5.31
	6month	120.70 \pm 10.66	127.00 \pm 6.20
	12month	136.42 \pm 9.92	4.50 \pm 148.05
	p value	<0.001*	<0.001*

G1= NcHA G2= NcHA +PRF PI=plaque Index GI= Gingival Index PD =pocket depth RCAL= Relative Clinical Attachment Level BD= Bone Density significant*; ($p < 0.05$) ns; non-significant ($p > 0.05$)

DISCUSSION

Chronic periodontitis in individual patients with severe attachment loss can be treated successfully with a variety of methods that are often combined. regeneration is the main objective of therapy in these patients with severe bone loss. A variety of bone grafts have been used for many years to treat chronic periodontitis with severe attachment loss. The objectives of these materials are probing depth reduction, clinical attachment gain and regeneration of new bone, cementum and periodontal ligament⁽¹⁵⁾.

Bone substitutes in the form of Nano hydroxy-apatite can be used successfully to fill osseous defect as it has advantages like close contact with surrounding tissues, quick resorption characteristics and large number of molecules on the surface⁽¹⁶⁾.



Platelet-rich fibrin (PRF) is in the form of platelet gel and can be used in conjunction with bone grafts, which offers several advantages including promoting wound healing, bone growth and maturation, graft stabilization, wound sealing, and hemostasis and improving the handling properties of graft materials⁽¹⁷⁾.

The current study assesses clinical and radiographic parameters to evaluate the effect of NcHA combined with PRF in the treatment of mandibular grade II furcation defects.

The present study showed a statistical significant difference in both groups at different time intervals in the form of significant reduction in pocket depth, gain in clinical attachment and level of bone fill at sites treated with NcHA (G1) with $p\text{-value} < 0.001$, This in accordance with study by **Prathap et al**⁽¹⁸⁾ used n-HA in the treatment of bilateral grade II furcation involvement in the mandibular first molars and concluded that application of n-HA, resulted in a significant horizontal and vertical probing depth reduction and clinical attachment level gain.

There were statistical significant difference in pocket depth, clinical attachment level and bone density in patients treated with NcHA and PRF(G2) where $p\text{-value} < 0.001$ this in accordance with the study by **Pradeep AR 2011**⁽¹⁹⁾ who reported that, greater reduction of pocket depth, greater gain in RVAL and RHAL and significantly greater percentage of mean bone fill when using HA with PRF in class II furcation involvement.

In the present study the improvement in mean values of probing depth, clinical attachment level and bone density in patients treated by NcHA +PRF was greater than those in patients treated with NcHA bone graft alone this was in accordance with study by **Atiaa AM 2015**,⁽²⁰⁾ which concluded that the improvement was greater in patient with class II Furcation treated with NcHA +PRF than patients treated with NcHA bone graft alone this may be due to the synergistic effect of both NcHA and PRF.

Results of the present study were in accordance with a study by **Nagasri M et al.**, 2016⁽²¹⁾ who concluded that there were improvement on probing depth, Clinical attachment level and radiographic bone fill when using NcHA bone graft +Platelet rich fibrin in intrabony defect, and a study by **Enas ahmed et al**⁽⁴⁾ who concluded that Adjunctive use of PRF membrane in combination with NcHA bone graft in treatment of intrabony defect resulted in clinically, radiographically statistically significant compared with NcHA bone graft alone, in terms of PPD reduction, CAL gain and increase BD. In another study by **Rahman Siddiqui et al 2016**⁽²²⁾ vertical and horizontal height of furcation was better when using PRF in treatment of class II furcation involvement.

Finally, to our knowledge there are a few studies reporting the use of NcHA combined with PRF in the treatment of furcation defects. There for a direct comparison with other studies is so deficient.

CONCLUSIONS

1. Both NcHA and NcHA/PRF significantly improved the clinical parameters and bone density.
2. The adjunctive use PRF combined with NcHA bone graft resulted in clinically and radiographically statistically significant compared with NcHA bone graft alone.
3. Nanocrystalline hydroxy appatite can be used as promising bone graft in the treatment of furcation defects

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الأزهر

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الملخص العربي

الهدف من الدراسة:

تهدف هذه الدراسة الي تقييم تأثير الصفائح الدموية الغنية بالليفين مزوجة ببدائل عظميه من حبيبات الهيدروكسي أباتيت متناهية الصغر في علاج الخلل العظمي للفك السفلي من الدرجة الثانية.

الموضوعات والأساليب:

تم اختيار ثلاثين مريضاً يعانون من خلل عظمي من الدرجة الثانية مع عمق الجيب اللثوي \geq خمسة ملم ومعدل مستوى التصاق اللثة \geq ثلاثة ملم بعد المرحلة الأولى من العلاج. تم تصنيفهم إلى مجموعتان الأولى تمت معالجتها بحبيبات الهيدروكسي أباتيت متناهية الصغر والثانية تمت معالجتها بحبيبات الهيدروكسي أباتيت متناهية الصغر مزوجة بالصفائح الدموية الغنية بالليفين، وتم تسجيل المقاييس الإكلينيكية وبالأشعة عند بداية العلاج وبعد 12 شهراً من التدخل الجراحي.

النتائج:

أظهرت كلا المجموعتان انخفاض كبير في عمق الجيب واكتساب مستوى التصاق اللثة وزيادة كثافة العظم بعد 12 شهراً من الجراحة مقارنة بالمقاييس الأولية قبل العلاج، وعند إضافة الصفائح الدموية الغنية بالليفين كان الانخفاض في عمق الجيب واكتساب مستوى التصاق اللثة وزيادة كثافة العظم أكثر.

الاستنتاج:

أظهرت الصفائح الدموية الغنية بالليفين مزوجة مع حبيبات الهيدروكسي أباتيت متناهية الصغر نتائج أفضل بكثير من نتائج حبيبات الهيدروكسي أباتيت متناهية الصغر وحدها.