Platelet Rich Fibrin Versus Collagen Membrane Combined with Beta Tri Calcium Phosphate/Collagen for Treatment of Dehiscence around Immediately Placed Implants Clinical and Radiographic Comparative Study

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ABSTRACT

Aim: This study designed to compare clinically and radiographically between Platelet Rich Fibrin (PRF) membrane and collagen membranes in combination with Beta tri calcium phosphate βTCP/collagen in treatment of dehiscence around immediately placed dental implant. Subjects and methods: This study was performed on 20 sites from 20 patients who each received an immediate implant for a single tooth replacement at a maxillary anterior or premolar site. Patients were divided into two groups according to the augmented materials used. One group received an immediate implant and filling of defects using Beta Tri Calcium Phosphate/Collagen bone graft covered with PRF membrane. The other group received an immediate implant and filling of defects with Beta Tri Calcium Phosphate/Collagen covered with collagen membrane. Cone beam computed tomography (CBCT) was taken before placement, and at 6 and 12 months post-surgery. Results: Both treatment procedures resulted in significant improvements for the primary outcome regarding bone fill as well as thickness and height of buccal bone. In addition, statistically significant differences were found in the buccal bone height, thickness and bone density for the group treated with Beta Tri Calcium Phosphate/Collagen combined with collagen membrane compared with sites treated with Beta Tri Calcium Phosphate/Collagen combined with PRF membrane. Conclusion: Beta Tri Calcium Phosphate/Collagen combined with collagen membrane is significantly superior than Beta Tri Calcium Phosphate/Collagen combined with PRF membrane in treatment of buccal bone dehiscence during immediate implant placement.

INTRODUCTION

Implant therapy is widely regarded as a reliable treatment option to replace missing teeth, for both function and esthetics.1,2

Original implant treatment guidelines advocated 3-6 months waiting period after tooth extraction to allow for soft and hard tissue healing before placing an implant, which was followed by an additional
3-6 months load-free period after implant placement to achieve osseointegration.³

Immediate implant placement (IIP) had been a popular treatment concept for patients as well as for clinicians since it reduces the number of surgical interventions and the total treatment time.⁴

During immediate implant placement there are some bony defects may occur such fenestration and dehiscence.⁵

Dehiscence is considered as one of the major bony defects, and defined as a V-shaped defect located along the alveolar bone margin (BM) toward the apex, and is more common in buccal side of the tooth.⁵

The etiology of dehiscences can be attributed to many factors, such as tooth ectopia, root projection, periodontal inflammation, frenum attachments, root vertical fracture and patient habits.⁶

A variety of surgical procedures have been utilized to improve buccal bone thickness for the placement of implants involving various grafting material techniques. Among these techniques, guided bone regeneration (GBR). GBR is used to treat fenestration and dehiscence around dental implants.⁷

Different bone substitutes have been used for treatment dehiscence around dental implants, such as autograft, allografts, xenografts and alloplastic materials. Autograft is considered the gold standard for bone augmentation because of their properties. However, donor site morbidity, potential resorption, size mismatch and an inadequate volume of graft material limit the use of autogenous grafts.⁸,⁹

Beta tricalcium phosphate/collagen β-TCP/coll is a biocompatible and bioresorbable material with properties similar to the inorganic phase of bone and resulted in formation of newly formed bone.¹⁰

To overcome problems associated with GBR procedure, barrier membranes are frequently used to stabilize graft materials and to serve as a separating barrier in GBR therapy.¹¹

Collagen membrane is widely used for the GBR procedure. Numerous clinical studies with these membranes have demonstrated their clinical usefulness.¹²

In the field of dental implants, PRF has been utilized as a clot, mixed with a bone graft, or as a membrane in an effort to enhance and accelerate tissue healing.

A platelet-rich fibrin (PRF) membrane is a readily available and inexpensive biomaterial that is beneficial in implant dentistry and periodontal plastic surgical procedures.¹³

**AIM OF THE STUDY**

The present study was designed to compare clinically and radiographically between Platelet Rich Fibrin (PRF) membrane and collagen membrane in combination with Beta tri calcium phosphate β-TCP/collagen in treatment of dehiscence around immediately placed dental implant.

**PATIENTS AND METHODS**

I. Study setting and population

The present randomized controlled clinical study was carried out on twenty patients of both sex (6 males and 14 females, aged 22 to 45 years; mean age: 32.25±3.15 years)

All patients were selected from those attending at the out-patient clinic, Oral Medicine and Periodontology Department, Faculty of Dental Medicine, Al-Azhar University, Assiut Branch.

The selected patients were planned to receive an immediate implant as a replacement of a hopeless maxillary teeth (midfacial vertical root fracture, endodontic failure and non-restorable caries and periodontally affected teeth) with a dehiscence of
the labial osseous plate in the anterior teeth and premolars of the maxilla (single rooted tooth).

The present randomized controlled clinical study was conducted in accordance with the revised World Medical Association Declaration of Helsinki and was approved by the research ethics committee of the Faculty of Dental Medicine, Al-Azhar University, Assiut.

Written informed consent was obtained from all patients.

II. Inclusion and exclusion criteria for selection:

1. Systemically healthy patients were selected.

2. The implant sites had sufficient vertical inter-arch space to accommodate the restorative components.

3. Patients with parafunctional, occlusal habit, smokers and bad oral hygiene were excluded.

III. Patients grouping and randomization

Patients were classified randomly into the following equal two groups using flipping coins.

Group I: Ten patients (3 males and 7 females ranged in age (between 22 and 40 years old with a mean age 31.5±2.7 years) were received immediate dental implant combined with Beta tri calcium phosphate/collagen β-TCP/coll(RTR)\(^1\) covered with Platelet Rich Fibrin membrane.

Group II: Ten patients (3 males and 7 female ranged in age (between 25 and 45 years old with a mean age 33±3.6 years) were received immediate dental implant combined with Beta tri calcium phosphate β-TCP/collagen covered with collagen membrane(Hypro-Sorb membrane)\(^2\).

IV. Pre-surgical preparation:

Pre-surgical preparation was done through; Periodontal preparation and Radiographic preparation.

A. Periodontal preparation

All patients were subjected to phase I periodontal therapy prior implant placement to provide an oral environment more favorable to wound healing.

B. Radiographic preparation

Cone Beam Computed Tomography were done for all patients.

V. Surgical Procedure

Each patient was asked to rinse her mouth with 0.2% chlorhexidine solution. After local anesthesia intrasulcular incisions were made to raise full thickness mucoperiosteal flap, the teeth were carefully removed by a traumatic extraction in order to protect and to preserve the alveolar bone. Sockets were curetted and irrigated with saline to remove granulation tissue and residual periodontal ligament. Sequential drilling with copious irrigation was carried out till the desired dimensions were achieved depending on the selected implant (Multi system-Italy)\(^3\). The selected implants were placed 2-3mm beyond the apex to achieve primary stability. The cover screw was placed on the top the implant.

PRF membrane was prepared according to the protocol developed by Choukroun.

In group I patients: PRF membrane was used to cover (RTR) bone graft. (Fig1)

In group II patients: Hypro-Sorb was used to cover (RTR) bone graft.

The surgical wounds were sutured to achieve primary closure.

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1. Septodont, Saint-Maur-des-Fosses, France
2. Bioimplon GmbH FriedrichList-Str. 27 Giessen. Germany
3. 20851 Lissone (MB) Italy Via General Guidoni, 7
Post-operative instruction and medication were given for all patients.
Sutures were removed 10-14 days after surgery.

VI Patient evaluation

A. Clinical evaluation

All patients were evaluated clinically using the following:

1. Implant stability
2. Peri-implant probing depth

B. Radiographic evaluation

Cone beam computed tomography (CBCT) was done for all patients at baseline, 6 and 12 months postoperatively to evaluate:

1. Buccal bone plate thickness
2. Bone density

VII. Statistical analysis

The data were collected, tabulated and statistically analyzed using IBM SPSS Statistics Version 20 for Windows.

RESULTS

A. Clinical parameters (table 1)

1. Implant stability

There was no statistically significant difference between (Group I) and (Group II) in primary and secondary stability.

2. Peri-Implant probing depth

There was statistically significant difference between (Group I) and (Group II), at 6 months only where (p=0.02).

B. Radiographic parameters (table 1)

1. Buccal bone plate thickness

There were statistically significant differences between (Group I) and (Group II) at 6 months and 12 months where (p=0.02).

2. Bone density

There was statistically significant difference between (Group I) and (Group II), at 12 months only where (p=0.02).

Fig. (1) a-e: Clinical photographs of group I patient
(a) Preoperative view. (b) After implant placement.
(c) β-TCP/col graft filled the defect.
(d) Platelet-rich fibrin membrane placed over graft-filled defect.
(e) Post-operative view.
Table (1) Showing clinical and radiographic results of the studied groups at different intervals including means ± standard deviation as well as significance levels.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Clinical parameters</th>
<th>Radiographic parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Implant stability</td>
<td>Peri-implant probing depth</td>
</tr>
<tr>
<td></td>
<td>Baseline 6m</td>
<td>baseline 6m</td>
</tr>
<tr>
<td>G1</td>
<td>62.30 ±1.41</td>
<td>75.5 ±2.56</td>
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<tr>
<td>G2</td>
<td>61.50 ±1.52</td>
<td>75.20 ±3.09</td>
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<td>P value</td>
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</table>

DISCUSSION

Immediate implant placement is widely regarded as a reliable option to replace missing teeth, for function and esthetics.¹

Dehiscence is considered as one of the major bony defects during implant placement, the presence of such defects decreases the bony support and may lead to gingival recession.¹⁴

The present clinical trial was designed to compare clinically and radiographically between Platelet Rich Fibrin (PRF) membrane and collagen membrane in combination with Beta tri calcium phosphate β-TCP/collagen in treatment of dehiscence around immediately placed dental implant.

The present study was used CBCT examinations in diagnosis, treatment plan as well as evaluation of treatment outcomes because CBCT can be considered a precise method for determining the buccal bone volume around dental implants as well as measuring the bone height between the implant platform and the first contact with bone at the buccal wall as mentioned by Shiratori et al (2012).¹⁵

The present study was used β-tri-calcium phosphate/collagen (β-TCP/coll) as a bone substitute because it is a biocompatible and bioresorbable material with properties similar to the inorganic phase of bone and resulted in formation of newly formed bone as mentioned by Brkovic et al (2012)¹⁶ and to overcome some of disadvantages associated with the use of autogenous bone graft such as donor site morbidity, increased cost, potential resorption, size mismatch, and an inadequate volume of graft material.

In accordance to findings of systematic review and meta-analysis, GBR with particulate graft material and resorbable collagen membranes is an effective technique for lateral alveolar ridge augmentation prior to or simultaneously with dental implant placement, having similar implant survival rates compared to pristine bone, the present study was used collagen membrane with β-TCP/coll to treat dehiscence defect.¹¹

In accordance to Dohan et al (2006)¹² stated that PRF can serve as a resorbable membrane that can be used in preprosthetic surgery as well as in implantology to cover bone augmentation sites, the present study was used PRF membrane with β-TCP/coll to treat dehiscence defect.

No adverse reactions and no complications observed during the periods of the study. No implant failed up to 12 months after insertion, result in a 100% survival rate, no clinical mobility was detected in any of the implants throughout the follow up period. This was confirmed by radiographic evaluation that revealed absence of peri-implant radiolucency.
This indicates success of implant in accordance to criteria of implant success reported by Karoussis et al (2004) and Misch et al (2008).

The results of the present study showed marked reduction in PPD at 6 and 9 months post-surgery this results agree with Hassan (2009) who evaluate the combination of autogenous bone graft and bioabsorbable polyglycolic polylactic acid polymer versus autogenous bone graft alone in treatment of dehiscence around immediate implant and concluded that, the efficacy of guided bone regeneration in treatment of dehiscence around immediate implant.

Regarding to buccal bone plate thickness there was gain in buccal plate thickness from baseline to 12months post-surgically in both groups. Sites treated with collagen membrane plus β-TCP/collagen show gain in buccal plate thickness from baseline to 12months post-surgically was 0.94 and 2.90 mm compared with 0.98 and 2.60 mm in sites treated with PRF membrane plus β-TCP/collagen. This result agree with Sarnachiaro et al (2015) they evaluate allograft and collagen membrane for treating buccal dehiscence with immediate implant placement, and found that the net gain in labial plate on cone beam computerized tomography (CBCT) was 3.0 mm, where 0 mm existed at pretreatment.

CONCLUSION

Beta Tri Calcium Phosphate/Collagen combined with collagen membrane is significantly superior than Beta Tri Calcium Phosphate/Collagen combined with PRF membrane in treatment of buccal bone dehiscence during immediate implant placement.

REFERENCES


العنوان:
دراسة مقارنة إكلينيكية وبالأشعة
غشاء الألياف الغني بالصفائح مقابل غشاء الكوالجين بالتزامن مع ثالثي فوسفات الكالسيوم بيتا/ كوالجين في علاج التفرز حول غرسات الأسنان الفورية

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الملخص:
يرجع هذا البحث إلى مقارنة إكلينيكية وإشعاعية مع غشاء الألياف الغني بالصفائح الدموية وغشاء الكوالجين جنبًا إلى جنب مع ثالثي فوسفات الكالسيوم بيتا/ كوالجين في علاج التفرز أثناء وضع غرسات الأسنان الفورية.

الهدف:
أجريت هذه الدراسة على عشرين مرضيًا وقد تم تصنيف المرضى بشكل عشوائي في مجموعتين أطلق عليهما:
- مجموعة أولى: تلقى المرضى غشاء الألياف الغني بالصفائح الدموية وثالثي فوسفات الكالسيوم بيتا/ كوالجين.
- مجموعة الثانية: تلقى المرضى غشاء الكوالجين وثالثي فوسفات الكالسيوم بيتا/ كوالجين.

المواد والأساليب:
أجريت هذه الدراسة على عشرين مرضيًا، وقد تم تصنيف المرضى بشكل عشوائي في مجموعتين أطلق عليهما:
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- مجموعة الثانية: تلقى المرضى غشاء الألياف الغني بالصفائح الدموية وثالثي فوسفات الكالسيوم بيتا/ كوالجين.

النتائج:
الكوالجين، في علاج التفرز، أفضل من غشاء الألياف الغني بالصفائح الدموية، من حيث فرقة العظام والتبادل الأفقي للعظام، وارتفاع وسمك العظام، والكثافة العظمية.

الخلاصة:
يرجع هذا البحث إلى مقارنة إكلينيكية وإشعاعية مع غشاء الألياف الغني بالصفائح الدموية وثالثي فوسفات الكالسيوم بيتا/ كوالجين، في علاج التفرز أثناء وضع غرسات الأسنان الفورية، مع ثالثي فوسفات الكالسيوم بيتا/ كوالجين، حيث أظهرت النتائج إفادة كبيرة في علاج التفرز، من حيث فرقة العظام والتبادل الأفقي للعظام، وارتفاع وسمك العظام، والكثافة العظمية.

الكلمات المفتاحية:
الثالثي، ثالثي فوسفات الكالسيوم، الفورية.