Short Communication

Improving gingival zenith in a unilateral cleft patient using Platelet-Rich Fibrin (PRF)

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ABSTRACT

This case evaluated the short term outcome of alveolar ridge augmentation in a unilateral alveolar cleft patient. A 22 year old female patient reported with gaps in her front teeth in 2011. Clinical examination revealed a repaired unilateral cleft of the hard palate (on left side) with a missing 21 and 22. Diagnosis was class II Subdivision with crossbite in 13 region. A non-extraction plan with a quad helix appliance, proximal stripping of lower anteriors. Canine substitution of 23 to replace 22 and prosthetic rehabilitation to replace 21. An alveolar ridge augmentation procedure using PRF (Platelet-rich fibrin) extracted from patient blood using a plasma centrifuge system. The success of grafted bone were evaluated radiologically at 6 months, 12 months postoperatively.

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1. Introduction

The primary goal of maxillary alveolar cleft reconstruction in cleft lip and palate (CL/P) patients is to build bone in the cleft area.¹ Various methods of alveolar ridge augmentation procedures have been used and the ideal bone graft material (autogenic, allogenic, xenogenic, and alloplastic grafts) for alveolar cleft reconstruction remains as controversial in CL/P management.

Tissue engineering has been used to provide new alternatives for bone reconstruction. A combination of autologous mesenchymal stem cells and platelets rich in plasma was first introduced by Hibi et al. for alveolar cleft reconstruction, which provided adequate bone bridging at the cleft site. Behnia et al. utilized mesenchymal stem cells carried on a scaffold that combined demineralized bone and calcium sulfate for alveolar cleft reconstruction.^{2–3}

Platelet-rich fibrin is a second generation of platelet concentrates which allows fibrin membranes to get enriched with platelets and growth factors, starting from an anticoagulant free blood harvest. PRF with bone grafts, 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. PRF can also be used as a membrane.

Clinical trials suggest that the combination of bone grafts and growth factors contained in PRP and PRF may be suitable to enhance bone density.^{4–5} In this case report, we performed a ridge augmentation procedure in a unilateral cleft patient to improve the bony defect using PRF and evaluated the early results.

2. Diagnosis and etiology

A 22 year old female patient (Fig. 1) reported with gaps in her front teeth. Clinical examination revealed a Unilateral cleft on left side with class II Subdivision malocclusion and anterior crossbite. She had a narrow V shaped maxillary arch and unilateral molar crossbite on left side. Maxillary left central and lateral incisors were missing (Fig. 1). Her treatment plan was non-extraction comprising of maxillary expansion, decrowding lower anteriors and prosthetic rehabilitation of 21.

Comprehensive orthodontic treatment was begun with slow palatal expansion of the maxillary arch using Quad helix appliance. Full fixed appliances (3 M UNITEK, Monrovia, CA) consisting of 4 bands and metal brackets were then bonded for leveling and alignment (Fig. 2). Right upper canine was distalized to keep the roots in sound bone using active lacebacks until healing was completed.

Bony defect in cleft region became larger at the end of maxillary expansion and canine distalization (Fig. 3) and compromised the

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Fig. 1. Pre-treatment photos.

Fig. 2. Intra-oral photos with Initial arch wire.

gingival esthetics in region of 21. Hence, a localized alveolar grafting in region of 21 was planned to improve gingival zenith before prosthetic rehabilitation.

3. Platelet rich fibrin and graft

Fifty milliliters of autologous blood was withdrawn and centrifuged in 10 ml tubes for 10 min at 3000 rpm to separate the platelet rich fibrin (PRF) (Fig. 4) from the blood.⁶ The fibrin glue (Fig. 5) was extracted with forceps on a flat container and allowed to coagulate for 3–5 min. Approximately 3 ml of PRF could be

obtained from 40 mL of whole blood, and it was sufficient to be mixed into the particles of cancellous bone chips.

The composite graft was a mixture of freeze dried bone alloplast and PRF (0.5gm/2ccPRF). This mixture (Fig. 6) was packed into the alveolar cleft defect and closed using resorbable mattress suture technique for 3 weeks. No functional stress/orthodontic force was avoided onto the grafted region for 3 weeks (Fig. 7).

Total treatment time was 15 months. Bonded lingual retainers were given to avoid relapse (Fig. 8). Prosthetic rehabilitation using an immediate denture to replace 21. Four year follow-up shows success of bone graft with minimal changes in clinical examination (Fig. 10).

Fig. 3. Post expansion photos showing a larger bony defect in 21 region.

Fig. 4. Platelet rich fibrin obtained after centrifuging patient's blood.

4. Discussion

PRF was first developed by Choukroun et al. is a second-generation platelet concentrate eliminated the risks associated with the use of bovine thrombin.⁷ The required quantity of blood is drawn into 10-ml test tubes and centrifuging results in three layers: a) Topmost layer consisting of acellular PPP, b) PRF clot in the middle, c) RBCs at the bottom. (Fig. 4). The centrifuged blood concentrates the platelets into a smaller volume and added to a bone graft (Figs. 5 and 6). A variety of growth factors like TGF- β and PDGF improve wound healing, stimulate collagen production, improve wound strength, and initiate callus formation.⁸

The main shortcoming of PRF is its preparation and storage. PRF membranes should be used immediately after preparation as it will

shrink resulting in dehydration altering the structural integrity of PRF. PRF when stored in refrigerator can result in risk of bacterial contamination of the membranes. The use of 16 gauge needle and proper access for IV preparation may not be possible in all patients.^{9–10}

Standard periapical radiographs were obtained in order to evaluate the reconstructed alveolar cleft, and evaluated using grading methods like the Bergland scale and Chelsae scale.¹¹ Bone grafts of types I and II according to the Bergland scale and bone grafts of types A and C according to the Chelsea scale were considered satisfactory, whereas the other types were considered unsatisfactory.¹² The evaluation of graft uptake in our patient was assessed with an Intra-oral peri-apical radiograph (IOPA) at 6 months, 1 year post-operatively (Fig. 9). According to Chelsea grading method the presence of bone tissue at the cement-enamel

Fig. 5. Isolation of platelet rich fibrin.

Fig. 6. Platelet-rich fibrin mixed with allograft.

Fig. 7. One week after PRF grafting.

Fig. 8. Post de-bonding photos.

Fig. 9. Comparison of bone density in the cleft region after grafting (A), 6 months (B) and 12 months (C).

Fig. 10. Four year follow up post-treatment photos.

junction of the teeth adjacent to the cleft and at least 75% of both roots covered by bone indicating type C and type I according to Bergland grading method.

5. Conclusion

Our patient grafted with PRF, demonstrated osteogenesis of autologous bone and lessen postoperative bone resorption. Thus,

PRF can be an inexpensive alternative method of localized alveolar ridge augmentation to improve gingival zenith in unilateral cleft palate patients.

Conflict of interest

The authors have none to declare.

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