

*Short Communication*

## Autogenous platelet rich plasma in healing of bone defects

Altaf H. Malik<sup>1\*</sup>, Rubeena Tabasum<sup>2</sup>, Manzoor Ahmad<sup>3</sup> Ajaz A Shah<sup>1</sup> and Irshad Ahmad<sup>1</sup>

<sup>1</sup>Post Graduate Department of Oral and Maxillofacial Surgery, Govt Dental College, Srinagar, Kashmir, India.

<sup>2</sup>Department of Ophthalmology, GMC, Srinagar, Kashmir, India.

<sup>3</sup>Department of ENT, GMC Srinagar, Kashmir, India.

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The aim of this study is to evaluate the efficacy of platelet rich plasma (PRP) in regeneration of bone in defects of the oral and maxillofacial region. A comparative nonrandomized study including 40 patients with bony defects of the maxillofacial region was carried out in the Department of Oral and Maxillofacial Surgery. Patients were divided into two groups: group A received PRP and in group B no graft was used. Postoperatively, the patients were monitored regularly by radiographs to evaluate new bone growth at 1<sup>st</sup>, 3<sup>rd</sup> and 6<sup>th</sup> month clinically and radiographically. Faster bone healing was observed in the patients in whom PRP was used at every follow up. Defects filled with PRP showed comparatively earlier and faster bone regeneration.

**Key words:** Bony defects, platelet-rich plasma, platelets.

### INTRODUCTION

Pathology, surgical resection and traumatic avulsion can lead to osseous defects of the jaw bones. Oral implants, enucleation of various cystic lesions, periodontal procedures, excision of tumorous lesions and maxillofacial reconstruction are highly dependent on successful bone regeneration. Bone regenerative techniques include graft materials, proteins and barrier membranes which are used commonly to improve bone quality before or after ablative or reshaping procedures. The healing characteristics and hemostatic properties of PRP enable it to support tissues and structures in desired configurations. PRP has a measure of safety relating to its autologous derivation and apparently decreases the risk of transmissible diseases (HIV, Hepatitis B,C etc.). Natural blood clot contains 95% red blood cells (RBCs), 5%

platelets, less than 1% white blood cells and numerous amounts of fibrin strands. A PRP blood clot contains 4% RBCs, 95% platelets and 1% WBCs. Platelets primarily are involved in wound healing through clot formation and the release of growth factors that initiate and support wound healing (Turvey et al., 2008). PRP is obtained by withdrawing a sample of a patient's blood pre-operatively, concentrating autologous platelets and applying the resultant gel to the surgical site. By this application, we increase the amount of platelets about two to four times. A healing rate of surgical sites having received PRP has been shown to heal two to three times more than the sites without PRP application (Marx et al., 1998). At present, growth factors (GFs) and bone morphogenetic proteins (BMPs) with their bone healing stimulating properties bring hope to improve the treatment results in patients with bone defects, either posttraumatic or secondary to bone resorption, such as solitary bone cysts (Górecki, 2004). The cost of recombinant GFs and BMPs

\*Corresponding author. E-mail: [drmalikaltaf@gmail.com](mailto:drmalikaltaf@gmail.com).

however, restricts their use in clinical practice to a limited number of academic and reference centres. The cost-effective, alternative method to expensive treatment with GFs and BMPs may be the use of autologous growth factors in the form of platelet rich plasma (PRP) (Bose and Balzarini, 2002; Kassolis et al., 2000). The positive effect of PRP with allogeneic bone grafts on healing of bone defects has been demonstrated by *in vitro* and *in vivo* studies (Marx et al., 1998; Robiony et al., 2002; Slater et al., 1995). The aim of this study was to evaluate the results of cystic bone cysts treated with enucleation and grafting combined with PRP and compared with the defects not treated with PRP.

### Patients and methods

The study was carried out as a comparative nonrandomized study in the Department of Oral and Maxillofacial Surgery, Government Dental College, Srinagar (India). The study was approved by Head of Department of Oral and Maxillofacial Surgery and World Medical Association Declaration of Helsinki was strictly followed for the study. Forty patients in the age group 18-37 were enrolled for the study after all the clinical and histological examinations were carried out. Patients with bony defects ranging from 2 to 4.7 cm in size were studied. All patients with underlying systemic compromise were excluded from the study. Patients were divided into two groups: group A which consisted of 20 patients received PRP as graft material, whereas in group B, which included 20 patients, no graft was used. Formal consent was obtained from the patients.

The assessment criteria used postoperatively to assess the outcome of treatment were pain, swelling, infection, graft rejection, and radiographic interpretations of the trabecular pattern of bone in the 1st, 3rd, and 6th-month follow-up.

### Surgical procedure

The surgical procedure was planned under local anaesthesia or general anaesthesia depending on extension of the lesion and patient factors. Standard draping procedures were used for the patient and part preparation was carried out. A standard incision was used to raise the full thickness mucoperiosteal flap and access to the lesion was gained. Full enucleation of the lesion was performed. The root canal treatment was performed wherever indicated and the defect left was filled with PRP graft in GP-A, whereas no graft material was used in group B patients. PRP was prepared from 20 ml of blood withdrawn from each patient and centrifuged at 15000 rpm for 10 min to separate RBCs and plasma. The plasma was then centrifuged for 15 min, Calcium chloride [0.5%] was added and hot water bath given for 20 min to achieve Platelet rich Plasma. PRP was now

collected from the top layer, for packing into the defect. Proper closure of the defect was performed after haemostasis was achieved. A layer wise closure was carried out wherever needed. All the patients were administered antibiotics and anti-inflammatory drugs which was same for both the groups. Suture removal was performed on the seventh day. The assessment was done as:

- (1) Pain on a scale of 1–10 assessed by the visual analogue scale method.
- (2) Swelling (present/absent).
- (3) Infection (present/absent).
- (4) Graft rejection (present/absent).
- (5) Radiographic interpretations on the basis of radiopacity and trabeculi pattern of bone.

### RESULTS

The clinical and radiographic evidence showed earlier bone formation in PRP group with more probability of bone formation in group A. The trabecular pattern was always ahead in group A in which PRP was used. At 1<sup>st</sup> month, it was 40% in Group A compared to group B where it was 15%. AT 6<sup>th</sup> month follow up, it was 85% in group A compared to group B in which only 60% of the patients showed trabecular pattern on radiographic analysis (Table 1).

### DISCUSSION

Early bone formation in PRP is as a result of the effect of different growth factors which are secreted by platelets, which cause mitogenesis, angiogenesis, fibroblastic and osteoblastic activity, macrophage activation, maturation of bone and osteoclast mediated resorption (Gilberto and Mariano, 2005). In our study, trabecular pattern of bone formation at 1 month follow up was seen in 40% of patients in PRP group compared to 15% in non PRP group. This indicates that PRP enhances new bone formation by its early healing potential (Gerard et al., 2006). The same observations, in terms of radiographic changes in the grafts from radiolucency to radio-opacity, have been reported by Silva et al. (2005). Kanno et al. (2005) also observed that PRP exerts a favorable effect on human osteoblast like cells and acts both to enhance bone regeneration and as an activator in wound healing. At 3<sup>rd</sup> month of follow-up, the radiographic evidence of bone formation was 65% in PRP group in contrast to 35% of group B. Our findings at 1 and 3 months were in agreement with those of Kim et al. (2002) who studied the use of Bio-Oss and PRP in cranial defects and observed increased bone density on plain radiographic and computed tomography scans (Freymler and Aghaloo, 2004). Aghaloo et al. (2002) observed increased tendency of bone formation at 1 and 2 months in his

**Table 1.** Radiographic evidence of trabecular bone formation.

Month	Group A	Group B
1 <sup>st</sup>	8/20=40%	3/20=15%
3 <sup>rd</sup>	13/20=65%	7/20=35%
6 <sup>th</sup>	17/20=85%	12/20=60%

study on rabbit cranial defects and he observed histomorphometric and radiographic tendency toward increased bone formation with PRP. At 6<sup>th</sup> month follow up, about 85% of patients in Group A showed radiographic evidence of bone formation in contrast to 60% in group B. This is almost in agreement with the study of Marx et al. (1998) on mandibular continuity defects that were grafted with autogenous bone with PRP and autogenous bone without PRP. A maturity index of about 1.62 was obtained in his study, with a P value 0.001. The increased trabeculation with PRP is in agreement with the observation of Weibrich et al. (2004) and Anitua et al. (2006).

The clinical and radiographic interpretations in our study conclude that the defects that were filled with a PRP heal faster compared to the defects not filled with PRP.

## Conclusion

PRP is autologous and does not induce any significant complication. PRP provides earlier availability of growth factors and thereby enhances the osteoinductive properties of the remaining bone and improves trabecular bone density.

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