IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 15, Issue 3 Ver. VII (Mar. 2016), PP 43-46
www.iosrjournals.org

Research

Autogenous Platelet Rich Plasma In Healing Of Bone Defects

[1].Altaf H Malik,[2].Babar Ali Shah,[3].Ajaz A Shah,[4].Irshad Ahmed

Abstract:
Purpose*: To evaluate the efficacy of PRP in regeneration of bone in the defects of the oral and maxillofacial region.*
Materials and methods*: A comparative randomized study including 40 patients with bony defects of various pathological origion in 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 PRP was not used. Postoperatively, the patients were monitored regularly by radiographs to evaluate new bone growth at 1st ,3rd and 6th month clinically and radiographically.*
Results*: Faster bone healing was observed in the patients in whom PRP was used at every follow up .*
Conclusion*: Defects filled with PRP showed comparatively earlier and faster bone regeneration.*
Keywords*: bony defects; platelet-rich plasma; platelets*

I. 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, 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 % of 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[1]. 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[2].

II. Patients And Methods

The study was carried out as a comparative randomized study in the Department of Oral and Maxillofacial Surgery, Government Dental College, Srinagar (India). The study was approved by Head of Department of Oral & Maxillofacial Surgery and World Medical Association Declaration of Helsinki was strictly followed for the study.Fourty patients in the age group 18-42 were enrolled for the study in the year 2014-2015, after all the clinical and histological examinations were carried out. Patients with bony defects due to pathology , ranging from 1.5 to 7.1 cm in size were studied. All patients with underlying systemic compromise were excluded from the study and bony defects due to malignancy were excluded from the study. Patients were divided into two groups; group A which consisted of 20 patients received PRP and tricalcium phosphate the synthetic porous material as graft material whereas in group B which included 20 patients only tricalcium phosphate was used .The patients were randomly distributed into two groups with statically non-significant difference between two groups as regards age (table1),gender(table2) of the patients and size of the c bone defects (table3). A 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.

III. 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 pathological lesion was performed. The root canal treatment was performed wherever indicated and the defect left was filled with PRP and tricalcium phosphate graft in GP-A, whereas no PRP was used in group B patients and defects were filled with tricalcium phosphate only . PRP was prepared from 20 ml of blood withdrawn from each patient and centrifuged at 15000 rpm for 10 minutes to separate RBCs and plasma. The plasma was then centrifuged for 15 minutes, Calcium chloride [0.5%] was added and hot water bath given for 20 minutes, to achieve Platelet rich Plasma. PRP was now collected from the top layer and mixed with tricalcium phosphate , the ratio of tricalcium phosphate and platelet rich plasma was kept constant i.e. to every 2ml of platelet rich plasma, 2cc of graft was mixed for packing into the defect. This results in formation of a sticky gel that is relatively easy to apply to the surgical defects along with the synthetic porous graft material. 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 radio-pacity and trabecular pattern of bone

IV. 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 labelled as *dense* and *sparse*. The trabecular pattern was always ahead in group A in which PRP was used .At 1st month it was 40% in Group A compared to group B where it was 15%. At 6th 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 4). On follow up PRP group had less swelling at 1 week time period compared to non-PRP group (table5).There was less probability of pain in group A (table 6) and more probability of infection in group B (table 7)

Table 1 : Age wise Distribution of the Studied Subjects (n-40)

Age (yr)	Group A		Group B		p value
	N	%	n	%	
18 to 26	6	30.0	5	25.0	0.461 (NS)
27 to 33	7	35.0	7	35.0	
34 to 42	7	35.0	8	40.0	

Table 2 : Gender wise Distribution of the Studied Subjects (n-40)

	Group A		Group B		p value
	n	%	n	%	
Male	12	60.0	11	55	0.775 (NS)
Female	8	40.0	9	45	

Table 3: Dimension wise distribution of the lesions in cms (n-40)

Group	min	max	Mean	SD	p value
Group A	1.5	7.1	4.8	1.5	0.285 (NS)
Group B	2.9	7.0	4.2	1.5	

Table4: Radiographic evidence of trabecular bone formation

	Group A	Group B
1st month	Dense 8/20=40% Sparse 12/20=60%	Dense 3/20=15% Sparse 17/20=85%
3rd month	Dense 13/20=65% Sparse 7/20=35%	Dense 7/20=35% Sparse 13/20=65%
6th month	Dense 17/20=85% Sparse 3/20=15%	Dense 12/20=60% Sparse 8/20=40%

Trabecular pattern was labelled as 'Dense' and 'Sparse'

Table5:Swelling observed in the studied subjects

	Group A	Group b
1 week	8/20=40%	16/20=80%
1 month	0=0.0	0=0.0

3 month	**0=0.0**	**0=0.0**
6 month	**0=0.0**	**0=0.0**

Table 6 : Pain Observed During Follow Up in the Studied Subjects

	Group A		Group B		p value
	n	%	n	%	
1st Week	7	35.0	12	60.0	0.058 (NS)
1 Month	0	0.0	0	0.0	1.000
3rd Month	0	0.0	0	0.0	1.000
6 Month	0	0.0	0	0.0	1.000
p value (Intra group comparison)	0.000 (Sig)		0.000 (Sig)		

Table 7 : Infection Observed During Follow Up in the Studied Subjects

	Group A		Group B		p value
	n	%	n	%	
1st Week	0	0.0	0	0.0	1.000
1 Month	0	0.0	1	5.o	0.317
3rd Month	0	0.0	0	0.0	1.000
6 Month	0	0.0	0	0.0	1.000
p value (Intra group comparison)	1.000 (NS)		0.406 (NS)		

V. 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[3]. 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[4] . The same observations, in terms of radiographic changes in the grafts from radiolucency to radio-opacity have been reported by Silva et al[5]. Kanno et al[6] 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 3rd 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., who studied the use of Bio-Oss and PRP in cranial defects and observed increased bone density on plain radiographic and computed tomography scans[7] . Aghaloo et al[8] observed increased tendency of bone formation at 1 and 2 months in his study on rabbit cranial defects and he observed histomorphometric and radiographic tendency toward increased bone formation with PRP. AT 6th 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[2] 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 [9] and Anitua and others in their studies[10]. There was less swelling in PRP group compared to non-PRP group in our study. The same finding was also reported by Anauti (1999)[10] and Fennis (2001) who evaluated the modulation of wound healing and soft tissue ingrowths in synthetic and allogenic implants with platelet gel[11]. This findings also constant with Dr. Man and Coworkers who found that platelet rich plasma is very effective in stopping capillary bleeding and helps in the hemostasis and wound healing, thereby reducing the postoperative swelling and pain [12]. In our study the earlier healing and bone formation was observed that led to the earlier return of function and restorative procedures, same findings were observed by Robiony in 2002 who observed early restoration of atrophic mandibles with implants in whom PRP was used with bone grafts[13].The less probability of infection in group A is attributed to the fact that PRP acts as would sealant and dural water proofing agent. This findings was in consistent with the finding of Green and David who found that the presence of platelets and the leukocytes leads to hemostatic and antimicorobial support, thereby reducing dehiscence and infection in the graft[14].

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.

VI. 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 it improves trabecular bone density.

References

[1]. Turvey FM. Oral & Maxillofacial Surgery. 2nd ed. St Louis, Missouri: The WBSaunders, Elsevier; pp. 501–510.

[2]. Marx RE, Carlson ER, Eichstaedt RM, Schimmele SR, Strauss JE, Georgeff KR. Platelet-rich plasma: growth factor enhancement for bone grafts. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1998; 85:638–646.
[3]. Gilberto S, Mariano T. Use of autologous platelet-rich plasma (PRP) in periodontal defect treatment after extraction of impacted mandibular third molars. J Oral Maxillofac Surg 2005; 63:766–770. 4.Gerard D, Carlson ER, Gotcher JE, Jacobs M. Effects of platelet-rich plasma on the healing of autologous bone grafted mandibular defects in dogs. J Oral Maxillofac Surg 2006; 64:443–45
[4]. Silva RV, Camilli JA, Bertran CA, Moreira NH. The use of hydroxyapatite and autogenous cancellous bone grafts to repair bone defects in rats. Int J Oral Maxillofac Surg 2005; 34:178–184.
[5]. Kanno T, Takahashi T, Tsujisawa T, Ariyoshi W, Nishihara T. Platelet-rich plasma enhances human osteoblast-like cell proliferation and differentiation. J Oral Maxillofac Surg 2005; 63:362–369.
[6]. Freymiller EG, Aghaloo TL. Platelet-rich plasma: ready or not? J Oral Maxillofac Surg 2004; 62:484–488.
[7]. Aghaloo TI, Moy P, Freymiller EG. Investigation of platelet-rich plasma in rabbit cranial defects: a pilot study. Int J Oral Maxillofac Surgery 2002; 60:1176–1181.
[8]. Weibrich G, Hansen T, Kleis W, Buch R, Hitzler WE. Effect of platelet
[9]. concentration in platelet rich plasma on preimplant bone regeneration. Bone 2004; 34:665–671.
[10]. Anitua E, Sa´nchez M, Nurden AT, Nurden P, Orive G, Andı´a I. New insights into and novel applications for platelet-rich fibrin therapies. Trends Biotechnol 2006; 24:227–234.
[11]. Fennis.J.P.M, Stoelinga.P.W: Reconstruction of the mandible with an autogenous irradiated cortical scaffold, autogenous corticocancellous bone-graft and autogenous platelet-rich-plasma: an animal experiment. Int. J. Oral and Maxillofac. Surg. 2005: 34:166
[12]. Man, Daniel, Plosker. Harvey, Winland-Brown, Jill E: The Use of Autologous Platelet Rich Plasma (Platelet Gel) and Autologous Platelet-Poor Plasma (Fibrin Glue) in Cosmetic Surgery; Jan 2001: Volume 107(l):238-239
[13]. RobionyM.,Polini.F.Costa.F.,Politi.M.Osteogenesis Distraction and Platelet Rich Plasma forBone Restoration of the Severly Atrophic Mandilble:Preminilary ResultJ Oral Maxillofacial Surgery 60:630-635,2002
[14]. Green, David M., and Klink,B: Platelet gel as an intra-operatively procured platelet-based alternative to fibrin glue. Plast Reconstr. Surg. 1998; 101:1161