Journal of Advanced Medical and Dental Sciences Research

@Society of Scientific Research and Studies

Journal home page: www.jamdsr.com doi: 10.21276/jamdsr UGC approved journal no. 63854

(e) ISSN Online: 2321-9599; (p) ISSN Print: 2348-6805 SJIF (Impact factor) 2017= 6.261; Index Copernicus value 2016 = 76.77

Original Article

Evaluation of Efficacy of Platelet Rich Plasma as a Scaffold in Regenerative Endodontic Treatment: An in-vivo study

Parul Verma

Department of Conservative Dentistry and Endodontics, Senior Lecturer, IDS Sehora, Jammu, Jammu & Kashmir

ABSTRACT:

Background: In the past years, there has been several discoveries regarding regenerative endodonticsStudies conducted in the past showed that platelet concentrates can be used as a scaffold for regeneration. These platelet concentrates can be easily prepared in dental environment, are autologous and are high in growth factors like transforming growth factor, platelet derived growth factor and endothelial growth factor.The present study was conducted with the aim to determine PRP as a scaffold in regenerative endodontics. **Materials and methods:** The study was conducted in the Department of dentistry at the institute. The study included immature single rooted teeth that required root canal treatment. Teeth were randomly divided into two groups- group I received PRP and Group II received blood clot. Triple antibiotic powder (metronidazole, cefalor, ciprofloxacin) was placed. Subjects were recalled after 3 weeks for the resolution of symptoms and the triple antibiotic powder was placed again.Vitality was assessed, and the radiographs were taken to determine apical closure and periapical healing. Radiographic root area was measured preoperatively and postoperatively by a trained radiologist who was blinded. All the data was arranged in a tabulated form and analysed statistically using SPSS software. **Results:** The mean age of the subjects was 10.24 years. There were 12 males (60%) and 8 females (40%) in the study. Mean first preoperative reading was 18.35+/-3.23. mean second preoperative reading was 18.30+/-3.21. There were 50% teeth in Group I and 20% teeth in Group II that showed positive response to vitality tests. **Conclusion:** Platelet rich plasma are a useful scaffold material for regenerative endodontics, it favorably lead to apical closure and positive vitality test.

Key words: endodontics, regenerative, scaffold, Platelet.

Received: 10 September 2018 Revised: 2 November 2018 Accepted: 10 November 2018

Corresponding Author: Dr. Parul Verma, Department of Conservative Dentistry and Endodontics, Senior Lecturer, IDS Sehora, Jammu, Jammu & Kashmir, India

This article may be cited as: Verma P. Evaluation of Efficacy of Platelet Rich Plasma as a Scaffold in Regenerative Endodontic Treatment: An in-vivo study. J Adv Med Dent Scie Res 2018;6(12):1-4.

INTRODUCTION

Initially, immature permanent tooth with pulpal necrosis were managed by apexification. Iwaya in the year 2001 reported the initial case of revascularization of the immature tooth with apical periodontitis.[1] Due to this there has been a paradigm shift in the management of permanent teeth with pulp necrosis. In the past years, there has been several discoveries regarding regenerative endodontics.[2-4] The results of most of the studies were successful with positive recoveries of periapical lesion, root development and salvage of root sensitivity.[5] Different procedures and protocols have been given for the concentrations of irrigant solution to be used [6], antibiotics for disinfection [5,7] and material for regeneration of tissue [8,9]. Regenerative endodontic treatment is based on the concept of tissue engineering [10] that needs complete removal of the microorganisms, stem cell preservation and scaffolds and signal molecules.[11] Ideally a scaffold should allow stem cells to migrate, proliferate and differentiate. Studies conducted in the past showed that platelet concentrates can be used as a scaffold for regeneration. These platelet concentrates can be easily prepared in dental environment, are autologous and are high in growth factors like transforming growth factor, platelet derived growth factor and endothelial growth factor. Studies conducted in vitro have shown that these molecule signal cell migration,

differentiation and synthesis of matrix.[12] Nowadays, platelet concentrates have been used as a scaffolding for revitalization of the tooth. First generation platelet concentrates is platelet rich plasma and that is widely used nowadays.[13] Different case reports [3,14] and randomized controlled trials [15] have shown its use in periapical healing, thickening of the dentinal wall and apical closure. Another second generation platelet concentrate is platelet rich fibrin that is more advantageous than PRP. The present study was conducted with the aim to determine PRP as a scaffold in regenerative endodontics.

MATERIALS AND METHODS

The study was conducted in the Department of dentistry at the institute. The study included immature single rooted teeth that required root canal treatment. The study was approved by the institutional ethical board and all the subjects were informed about the study and a written consent was obtained from the guardians. Teeth with or without periapical lesion having pulpal necrosis with the chances of restoration were included in the study. Teeth were fractures, mobility or ankylosis were excluded from the study. Pulp testing was diagnosed clinically by electric pulp testing and cold stimulation test. Presence of clinical signs and symptoms were noted. Teeth were randomly divided into two groups- group I received PRP and Group II received blood clot. Endodontic treatment was performed as per the standards by American association of endodontics. Triple antibiotic powder (metronidazole, cefalor, ciprofloxacin) was placed. Subjects were recalled after 3 weeks for the resolution of symptoms and the triple antibiotic powder was placed again. In the following visits, the antibiotic powder was removed, and the canals were irrigated with saline and EDTA. This was followed by the injection of the PRP mixture into the canal space till CEJ. MTA was placed as final restoration. In group II, filling was done to initiate bleeding and the canal was filled with bleed till the CEJ and allowed to clot. Follow ups were performed every 3 months for a period of 1 year. Vitality was assessed, and the radiographs were taken to determine apical closure and periapical healing. Radiographic root area was measured preoperatively and postoperatively by a trained radiologist who was blinded. All the data was arranged in a tabulated form and analysed statistically using SPSS software. Student t test was used for analysis. Probability value of less than 0.05 was considered as significant.

RESULTS

Table 1 shows the demographic information of the subjects. The mean age of the subjects was 10.24 years. There were 12 males (60%) and 8 females (40%) in the study. There were 75% incisors and 25% premolars as study teeth in the study.

Table 2 illustrates the mean root area measurements in the study. Mean first preoperative reading was 18.35+/-3.23. mean second preoperative reading was 18.30+/-3.21. The postoperative readings increased to 20.30+/-3.77 during the first time and 20.34+/-3.65 during the second time.

Table 3 shows the postoperative symptoms amongst the groups. Complete apical closure was seen amongst 70% (n=7) subjects in Group I and 60% (n=6) subjects in Group II. The mean percentage increase in RRA in Group I was 23.5% and in Group II was 24%. There were 50% teeth in Group I and 20% teeth in Group II that showed positive response to vitality tests.

Table 1: Demographic characteristics of the study

Variables	Frequency
Mean age	10.24 years
Gender	
Males	12 (60%)
Females	8 (40%)
Type of tooth	
Incisor	15 (75%)
Premolar	5 (25%)

Table 2: root area measurements amongst subjects

Root area measurement	Mean +/- SD	P value
Preoperative 1	18.35+/-3.23	>0.05
Preoperative 2	18.30+/-3.21	
Postoperative 1	20.30+/-3.77	>0.05
Postoperative 2	20.34+/-3.65	

Table 3:Post-operative symptoms amongst the groups

Variable	Group I	Group II
Complete apical closure	7(70%)	6(60%)
Mean % increase in RRA	23.5	24
Positive response to vitality tests	5(50%)	2(20%)

DISCUSSION

The Necrotic and immature permanent teeth can obtain benefit from the biologically established treatment procedures in regard of restoration of root development and reinforcement of dentinal walls for increasing the likelihood of long-term retention of teeth[16-19]. As per a retrospective survey there is a higher survival rate with use of regenerative endodontic treatment when it was compared with apexification using mineral trioxide aggregate and calcium hydroxide[20]. With the advent of regenerative endodontics, the growth of cells and vasculature is obtained by the formation of scaffold that has different growth factors.[16,21] They suggested method for the formation of scaffold creation involves theinduction of bleeding from the periapical tissue and hence leads to the formation of an intracanal blood clot[22]. Different reports have indicatedfavorable success using blood clot scaffolds [23-28]; whereas, since it is not possible to induce bleeding in the root canal [29,30] the scientists have began their search for other 3-Dimensionsla scaffolds that be made without bleeding.[17] Recent studies have shown that platelet rich plasma [31-35] that is plasma containing platelet concentrates having greater number of growth factors insist in proliferation of stem cells leading to healing and regeneration of tissue.[36,37] Release of growth factors from the PRP are important for cellular processes like mitogenesis, differentiation, chemotaxis and healing stimulation.[37] PRP are extensively used in head and neck surgery, cardiovascular surgery and maxillofacial surgical fields.[36] In some fields of regenerative endodontics some researchers have used PRP as an adjuvant to blood clot scaffolds.17,19,20 Reports by Torabinejad andTurman[31] and Bezgin et al [33] have shown that cases in where platelet rich plasma was used alone resulted in good formation of scaffold giving a direction towards the capacity of PRPs in the revascularization process. In our study, mean first preoperative reading was 18.35+/-3.23. mean second preoperative reading was 18.30+/-3.21. The postoperative readings increased to 20.30+/-3.77 during the first time and 20.34+/-3.65 during the second time. Apical closure was seen amongst 70% (n=7) subjects in Group I and 60% (n=6) subjects in Group II. The mean percentage increase in RRA in Group I was 23.5% and in Group II was 24%. There were 50% teeth in Group I and 20% teeth in Group II that showed positive response to vitality tests.Geisler [17]in his study stated that outcomes of regenerative therapy mayvary between the teeth that exhibit partial necrosis and those that exhibit full necrosis, where pulp is completely lost. Huang [18] in his study illustrated that the type of regenerationof pulp varies per the different clinical situations. Flake et al [38] regarded a mean RRA increase of 31% to indicate obvious root development

CONCLUSION

Platelet rich plasma are a useful scaffold material for regenerative endodontics, it favorably lead to apical closure and positive vitality test. Though no significant difference was observed in the outcome between blood clot and platelet rich plasma.

REFERENCES

1. Iwaya SI, Ikawa M, Kubota M. Revascularization of an immature permanenttooth with apical periodontitis and sinus tract. Dent Traumatol. 2001;17:185 – 7.
2. Jung IY, Lee SJ, Hargreaves KM. Biologically based treatment of immaturepermanent teeth with pulpal necrosis: a case series. J Endod. 2008;34:876 – 87.
3. Torabinejad M, Turman M. Revitalization of tooth with necrotic pulp and openapex by using platelet-rich plasma: a case report. J Endod. 2011;37:265 – 8.
4. Chen MY, Chen KL, Chen CA, Tayebaty F, Rosenberg PA, Lin LM.Responses of immature permanent teeth with infected necrotic pulp tissue and apical periodontitis/abscess to revascularization procedures.IntEndod J. 2012;45:294 – 305.
5. Lei L, Chen Y, Zhou R, Huang X, Cai Z. Histologic and immunohistochemicalfindings of a human immature permanent tooth with apical periodontitisafter regenerative endodontic treatment. J Endod. 2015;41:1172 – 9.
6. Law AS. Considerations for regeneration procedures. J Endod. 2013;39:S44 – 56.
7. Scarparo RK, Dondoni L, Bottcher DE, Grecca FS, Rockenbach MI, Batista ELJr. Response to intracanal medication in immature teeth with pulp necrosis:an experimental model in rat molars. J Endod. 2011;37:1069 – 73.
8. Ray HL Jr, Marcelino J, Braga R, Horwat R, Lisien M, Khaliq S. Long-termfollow up of revascularization using platelet-rich fibrin. Dent Traumatol.2016;32:80 – 4.
9. Rodriguez-Benitez S, Stambolsky C, Gutierrez-Perez JL, Torres-Lagares D,Segura-Egea JJ. Pulp revascularization of immature dog teeth with apicalperiodontitis using triantibiotic paste and platelet-rich plasma: aradiographic study. J Endod. 2015;41:1299 – 304.
10. Langer R, Vacanti JP. Tissue engineering. Science. 1993;260:920 – 6.
11. Hargreaves KM, Giesler T, Henry M, Wang Y. Regeneration potential of theyoung permanent tooth: what does the future hold? J Endod. 2008;34:S51 – 6.
12. Huang FM, Yang SF, Zhao JH, Chang YC. Platelet-rich fibrin increases proliferationand differentiation of human dental pulp cells. J Endod. 2010;36:1628 – 32.
13. Assoian RK, Grotendorst GR, Miller DM, Sporn MB. Cellular transformation bycoordinated action of three peptide growth factors from human platelets.Nature. 1984;309:804 – 6.
14. Sachdeva GS, Sachdeva LT, Goel M, Bala S. Regenerative endodontictreatment of an immature tooth with a necrotic pulp and apicalperiodontitis using platelet-rich plasma (PRP) and mineral trioxideaggregate (MTA): a case report. IntEndod J. 2015;48:902 – 10.
15. Jadhav G, Shah N, Logani A. Revascularization with and without platelet-richplasma in nonvital, immature, anterior teeth: a pilot clinical study. J Endod.2012;38:1581 – 7.
16. Wigler R, Kaufman AY, Steinbock N, et al. Revascularization: a treatment for permanent teeth with necrotic pulp and incomplete root development. J Endod 2013;39:319–26.

17. Geisler TM. Clinical considerations for regenerative endodontic procedures. DentClin North Am 2012;56:603–26.
18. Huang GTJ. Dental pulp and dentin tissue engineering and regeneration: advancement and challenge. Front Biosci (Elite Ed) 2012;3:788–800.
19. Hargreaves KM, Diogenes A, Teixeira FB. Treatment options: biological basis ofregenerative endodontic procedures. J Endod 2013;39:S30–43.
20. Jeeruphan T, Jantarat J, Yanpiset K, et al. Mahidol study 1: comparison of radiographic and survival outcomes of immature teeth treated with either regenerativeendodontic or apexification methods—a retrospective study. J Endod 2012;38:1330–6.
21. Murray PE, Garcia-Godoy F, Hargreaves KM. Regenerative endodontics: a review ofcurrent status and a call for action. J Endod2007;33:377–90.
22. American Association of Endodontics. Clinical considerations for a regenerativeprocedure. Available at: www.aae.org. Accessed May 4, 2014.
23. Iwaya SI, Ikawa M, Kubota M. Revascularization of an immature permanent toothwith apical periodontitis and sinus tract. Dent Traumatol2001;17:185–7.
24. Banchs F, Trope M. Revascularization of immature permanent teeth with apical periodontitis: new treatment protocol? J Endod2004;30:196–200.
25. Ding RY, Cheung GS, Chen J, et al. Pulp revascularization of immature teeth withapical periodontitis: a clinical study. J Endod2009;35:745–9.
26. Bose R, Nummikoski P, Hargreaves K. A retrospective evaluation of radiographicoutcomes in immature teeth with necrotic root canal systems treated with regenerative endodontic procedures. J Endod2009;35:1343–9.
27. Lenzi R, Trope M. Revitalization procedures in two traumatized incisors withdifferent biological outcomes. J Endod2012;38:411–4.
28. S € onmez IS, Akbay Oba A, ErkmenAlmaz M. Revascularization/regenerationperformed in immature molars: case reports. J ClinPediatr Dent 2013;37:231–4.
29. Nosrat A, Homayounfar N, Oloomi K. Drawbacks and unfavorable outcomes ofregenerative endodontic treatments of necrotic immature teeth: a literature reviewand report of a case. J Endod2012;38:1428–34.
30. C¸ehreli ZC, _ Is¸bitiren B, Sara S, Erbas¸ G. Regenerative endodontic treatment (revascularization) of immature necrotic molars medicated with calcium hydroxide: acase series. J Endod2011;37:1327–30.
31. Torabinejad M, Turman M. Revitalization of tooth with necrotic pulp and open apexby using platelet-rich plasma: a case report. J Endod2011;37:265–8.
32. Jadhav GR, Shah N, Logani A. Revascularization with and without platelet-richplasma in nonvital, immature, anterior teeth: a pilot clinical study. J Endod 2012;38:1581–7.
33. Bezgin T, Yılmaz AD, C¸elik BN, S € onmez H. Concentrated platelet-rich plasma used inroot canal revascularization: 2 case reports. IntEndod J 2014;47:41–9.
34. Jadhav GR, Shah N, Logani A. Comparative outcome of revascularization in bilateral,non-vital, immature maxillary anterior teeth supplemented with or without platelet rich plasma: a case series. J Conserv Dent 2013;16:568–72.
35. Martin G, Ricucci D, Gibbs JL, Lin LM. Histological findings of revascularized/revitalized immature permanent molar with apical periodontitis using platelet-richplasma. J Endod2013;39:138–44.
36. Nikolidakis D, Jansen JA. The biology of platelet-rich plasma and its application inoral surgery: literature review. Tissue Eng Part B Rev 2008;14:249–58.
37. Alsousou J, Ali A, Willett K, Harrison P. The role of platelet-rich plasma in tissueregeneration. Platelets 2013;24:173–82.
38. Flake NM, Gibbs JL, Diogenes A, et al. A standardized novel method to measureradiographic root changes after endodontic therapy in immature teeth. J Endod2014;40:46–50.