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Article Title:

Study of platelet‐rich fibrin combined with rat periodontal ligament stem cells in periodontal tissue regeneration

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Summary of the article

Periodontal disease is a serious and chronic disease. The loss of teeth caused by periodontal disease accounts for a large proportion of the causes of tooth loss. Scientists began using platelet‐rich fibrin to induce periodontal tissue regeneration. platelet‐rich fibrin has a good ability to promote bone tissue repair and is readily available, the most importantly is platelet‐rich fibrin is not expensive. Xuejing Duan, Zhiyong Lin, Xiujuan Lin,Zhiqian wang et al,conducted an experiment using platelet-rich fibrin and stem cells from rat periodontal ligament and combined it other four different groups of cells and cells combination to try to understand the possibility of regenerate the formation of new periodontal ligament fibers and bone.

The methods used five different groups of cells and cells combinations. They used high speed handpieces to open small windows on rat’s first molar of the buccal mandibular area. There was a partly removed of bone, cementum, and periodontal ligament. Cells and cells combination were transplanted into the window on the tooth. Rats were killed on day 12 and day 24. Samples were extracted from them through a surgical procedure to observe proliferation within five different groups.

The authors concluded that platelet-rich fibrin and periodontal ligament stem cells groups had a large amount of new bone formation. The PRF may be good for autologous transplant because it is inexpensive and easy to prepare but PRF+PDLSC combination provided better bone formation during the experiment.

The name of study is  Study of platelet‐rich fibrin combined with rat periodontal ligament stem cells in periodontal tissue regeneration were published in the Journal of Cellular and Molecular Medicine in January 2018 <https://www.ncbi.nlm.nih.gov/pubmed/?term=Study+of+platelet%E2%80%90rich+fibrin+combined+with+rat+periodontal+ligament+stem+cells+in+periodontal+tissue+regeneration>

This article did not have any commercial or associative interests that represent a conflict of interest.

Study analysis:

This article ‘s study type is Randomized Controlled Studies (RCT). This study was conducted in China in 2016.

Seo BM, Miura M et al Found periodontal ligament stem cells (PDLSCs)  in  vivo can proliferate and form cementum, periodontal ligament and alveolar bone, they also can be induced in vitro form osteoblasts, adipocytes and chondrocytes, Therefore, they provide a research basis for periodontal regeneration and transplantation. Because they can be extracted from periodontal tissue and can be formed different periodontal supporting tissues, so they have good progress in the preclinical research.

Platelet-rich fibrin (PRF) is the new generation from the platelet-rich plasma (PRP). Unlike PRP, PRF does not need biological agents and has no toxicity or immunogenicity. PRF is also cheap and has no risk of cross-infection because it can from autotransplant. PRF promotes new bone formation and endothelial cell proliferation and angiogenesis. PRF and PDLSCs are both good materials for periodontal tissue transplant but there are no reports or studies combined those two materials together for periodontal tissue transplant.

The authors conduct this study aimed at PRF and PDLSCs combined transplant to rat’s mouth in order to observe the effects between different groups

The experiments used fifty eight week old male mice, the total number is 25.Those experimental were divided into five groups: blank, collagen (implanted collagen membrane), collagen + cells (implanted collagen membrane and rat PDLSCs), PRF (implanted PRF membrane) and PRF + cells (implanted PRF membrane and rat PDLSCs).  (Duan, Xuejing, et al, 2018, pp. 1047–1055.)

The periodontal membrane cells were extracted from the rat's teeth made PDLSC and blood samples were extracted from the orbit of the rat made PRF before the surgery. The authors used high speed opened a small window on rat’s first molar of the buccal mandibular area and removed partly bone, cementum, and periodontal ligament. Five different groups cells and cells combination were transplanted into the window. The rats were killed 12-24 days after surgery to observe proliferation in different groups.

Tissues from the edges of the rats ‘mandibular window were putted in the 10% formalin at 4°C, after 48 hours then decalcified for 2 weeks and cut to sample slice for stain. The researchers used a microscope and spot advanced software that took six pictures of the three stained samples in some exposure value at high magnification for observed.

The researchers found that the PRF+CELLS group has large number of new cellular cementum and PDL fibers covering the window area. In contrast, collagen + cells groups were filled with connective tissue which blocked new bone formation. In the PRF group, only a little new cementum was found, and not new bone were observed.

Researchers did not use examiners calibrated.

Results

In the experimental group: new bone and cementum covering the root denuded.

In the control group: connective tissue blocked the defect area prevent new bone form.

The researchers are finding that the PRF+CELLS group has large number of new cellular cementum and PDL fibers was covering the window area. In contrast, collagen + cells groups were filled with connective tissue which blocked new bone formation. In the PRF group, only a little new cementum and not new bone observed. Micro‐CT analysis demonstrated that samples from the PRF + cells group showed much more newly formed hard tissue than the other groups at similar layers. The results were statistically significant because the new cellular cementum was covering the windows area at 24 days after surgery.

Conclusions

PRF is present in platelets and stimulates the growth of various cells because it is rich in many growth factors. PRF can also differentiate into osteoblasts and odontoblast cells in vitro. The fibrin in PRF forms a scaffold for cell proliferation. PRF promoted proliferation of the PDLSCs in the rat. PRF + PDLSCs form new bone, periodontal ligament, and cellular cementum after 24 days of the surgery. This finding can lead to further research in the cell implant establish new periodontal attachment to treat periodontal disease.

Authors suggested for further investigations:1. Further research should be considered to improve obtaining new normal PDL fibers in periodontal regeneration.

2. Animal model of chronic periodontitis also should be considered in the future research, in which the periodontal condition would be more complicated. (Duan, Xuejing, et al, 2018, pp. 1047–1055.)

Next studied can use more animal model especial the animal with the periodontal disease will give researchers the condition similar to human chronic periodontal disease.

Your impression

This study is important in the dental hygiene field because the chronic periodontal disease has caused a large proportion of tooth loss. As a foreign dentist, I see a lot of patients who have lost many teeth due to chronic periodontal disease, and even at a young age. They have to wear removable dentures. I've always wanted to change my patients' perceptions and try to save their teeth with various treatments, and I've tried to treat multiple patients with varying degrees of chronic periodontal disease for a long time. After comparing the high cost of treatment with an insignificant effect, many patients give up treatment and choose to have their teeth removed rather than keeping them. After reading this article, I think it is a good direction for the treatment of periodontal disease. First of all, there are no rejection or ethical limitations to autologous transplantation. Second, Platelet-rich fibrin (PRF) and periodontal ligament stem cells (PDLSCs) are easier to obtain and cheaper if it is from autologous.

My questions are:1. If the technology were to be used in large Numbers in the clinic, would operations be costly?

2. Will the complicated operation affect the promotion and application of the clinic?

References

1. Duan, Xuejing, et al. “Study of Platelet‐Rich Fibrin Combined with Rat Periodontal Ligament Stem Cells in Periodontal Tissue Regeneration.” Journal of Cellular and Molecular Medicine, vol. 22, no. 2, 2018, pp. 1047–1055.