Section: Research Paper

ANTIMICROBIAL EFFICACY OF PRF ON SYSTEMIC ADMINISTRATION OF ANTIBIOTICS

Dr. V.R. Balaji, M.D.S., Professor and Head, Department of Periodontics & Implant Dentistry, CSI College of Dental Sciences & Research, Madurai.

Dr. Uma Sudhakar, M.DS., Professor and Head, Department Periodontics, Thai Moogambigai Dental College & Hospital, Chennai.

Dr. D. Manikandan, M.D.S, Reader, Department of Periodontics and Implant Dentistry, CSI College of Dental Sciences & Research, Madurai

Dr. S. Rakshana, Postgraduate, Department of Periodontics and Implant Dentistry, CSI College of Dental Sciences & Research, Madurai

Corresponding author: Dr. V.R. Balaji, M.D.S., Professor and Head, Department of Periodontics & Implant Dentistry, CSI College of Dental Sciences & Research, Madurai, Tamilnadu, India. Email id:vrbalajimds@gmail.com

Introduction: Leukocyte-platelet-rich fibrin (L-PRF) is a type of platelet concentrate that was developed by Dr. Joseph Choukroun in the early 2000s. It is classified as second-generation platelet concentrate[1]. In a variety of procedures, including extraction socket preservation, periodontal surgery, implant placement, and sinus augmentation, the utilization of L-PRF in dentistry and oral surgery has demonstrated promising results. It lacks any natural antibacterial properties. Therefore, when antibiotic treatment is required to control or prevent infection, L-PRF alone cannot substitute for antibiotics.

In some cases, L-PRF can be used in conjunction with antibiotic treatment. L-PRF, for instance, can be used in conjunction with antibiotics during oral surgery to support tissue regeneration and healing following the administration of the appropriate antibiotics to control infection. While antibiotics target and eliminate bacteria, the growth factors and regenerative properties of L-PRF can aid in tissue repair.

Aim: To determine whether PRF membranes have antibacterial efficacy against gram-positive and gram-negative microbes when antibiotics are administered systemically.

Materials and Methods: The study was conducted at CSI College of Dental Sciences and Research, Madurai. Ethical clearance was obtained from the Institutional Ethical Committee and Institutional Review Board. Informed consent was obtained from the study subjects.One hour prior to blood collection for PRF, 1 g of amoxicillin was administered systemically. The cup plate method was used to measure the inhibition zone. The antimicrobial activity of PRF samples against both aerobic and anaerobic organisms was tested on 50 patients in total.

Eligibility Criteria: Patients who were not taking any medications, had at least 20 teeth, had at least 40% of the sites with clinical attachment levels less than 4 mm and probing depths less than 4 mm, had crestal bone loss less than 2 mm, and had at least 40% of the sites with bleeding on probing met the inclusion criteria.Exclusion criteria included smokers, patients who had consumed alcohol, pregnant patients/nursing mothers, patients who had received antibiotics in any treatment within the past 3 months, history of known allergy to drugs, and bleeding. A history of sexual predisposition was included.

Preparation of L-PRF: Ten millilitres of blood was collected from patients undergoing periodontal surgery. Amoxicillin 1 g was administered systemically to her 1 hour before surgery. After 1 hour, blood samples were collected in sterile tubes without anticoagulants or additives. He then spun these tubes in a centrifuge (Fig. 1) at 2700 rpm for 12 minutes. The study utilized two L-PRF clots (Fig. 2) following the spin. Using a PRF box, the L-PRF clots were compressed into membranes (Fig. 3).

Antimicrobial activity: In the centre of bacteria-streaked agar plates, the prepared L-PRF samples were placed. One membrane from each patient was tested for antimicrobial activity against S. aureus, and the other membrane was tested for antimicrobial activity against E. coli. After that, the plates were left to incubate for 24 hours in a typical laboratory incubation chamber at 37°C. The clear zones surrounding each L-PRF sample, also known as zones of microbial inhibition, were measured with a metric ruler after the plates had been incubated (Fig. 4 & 5).

Statistical Analysis: The statistical analysis was carried out utilising IBM SPSS (IBM Corp., 2011). Armonk, New York: IBM Corp., IBM SPSS Statistics for Windows, Version 20.0. The data was summarised using the mean and standard deviation. A 'P' value of <0.05 was considered as statistically significant difference.

Results: The results were recorded as the observable zones of inhibition in millimetres. Zones of inhibition were noted for both L-PRF samples. According to statistical analysis using Kolmogorov-Smirnov and Shapiro-Wilk test, significant difference in Zone of inhibition was seen against both the species. The Zone of inhibition was found to be significantly higher against E.coli (Table 1). The Mean and **Standard Deviations** are represented in Table 2.

Discussion: According to the current study, L-PRF prepared after systemic antibiotic administration shows measurable antimicrobial activity against specific oral microbiota[3-5]. This suggests that L-PRF may be able to concentrate antibiotics due to its distinctive structure.

Given the current study's findings, it is reasonable to assume that the systemically administered antibiotics may have been incorporated into the L-PRF if it was prepared at least one hour after antibiotic prophylaxis6. However, it is difficult to draw firm conclusions in the absence of specific information or data from those previous studies.

Further research is required to better comprehend the impact of pre-operative antibiotics on L-PRF's clinical behavior[7-8]. The effects of pre-operative antibiotic use on the antimicrobial properties, wound healing, and tissue regeneration of L-PRF during dental surgical procedures could be the focus of future research. More insight into the potential synergistic effects and optimal use of antibiotics in conjunction with L-PRF for improved clinical outcomes can be gained by evaluating the clinical outcomes in relation to the incorporation of antibiotics into L-PRF.

Conclusion: Within the limitations of the study, zones of inhibition against both microbes were identified in PRF membranes. However, Escherichia coli exhibited a broader zone of inhibition compared to Staphylococcus aureus, implying stronger antibacterial activity.

References

1. Dohan DM, Choukroun J, Diss A, Dohan SL, Dohan AJ, Mouhyi J, Gogly B. Platelet-rich fibrin (PRF): a second-generation platelet concentrate. Part I: technological concepts and evolution. Oral Surg Oral Med Oral Pathol Oral RadiolEndod 2006;101:e37–44.
2. Kobayashi E, Fluckiger L, Fujioka-Kobayashi M, Sawada K, Sculean A, Schaller B, Miron RJ. Comparative release of growth factors from PRP, PRF, and advanced-PRF. Clin Oral Investig 2016;20:2353–60. 7. Miron RJ, Fujioka-Kobayashi

3. Greco F, de Palma L, Spagnolo N, Rossi A, Spacchia N, Gigante A. Fibrin-antibiotic mixtures: an in vitro study assessing the possibility of using a biologic carrier for local drug delivery. J Biomed Mater Res. 1991 Jan;25(1):39-51.
4. Kram HB, Bansal M, Timberlake 0, Shoemaker WC. Antibacterial effects of fibrin glue-antibiotic mixtures. J Surg Res. 1991;50(2):175- 8.
5. Redl H, Schlag G, Stanek G, Hirschi A, Seelich T. In vitro properties of mixtures of fibrin seal and antibiotics. Biomaterials 1983;4(1):29-32.
6. Marenzi G, Riccitiello F, Tia M, di Lauro A, Sammartino G. Influence of Leukocyte- and Platelet-Rich Fibrin (L-PRF) in the healing of simple postextraction sockets: A split-mouth study. Biomed Ras Int. 2015;2015:369273doi 10.115512015 369273.
7. Woolverton CJ, Singh M, Macphee M, Drohan W. Antibiotic release from fibrin sealant. Proceedings of the International Symposium of Controlled Release of Bioactive Materials 1995;22 :750-1.
8. Yasmeen S, Riyazuddean G, Rabbani J. Calorimetric and spectroscopic binding studies of amoxicillin with human serum albumin. J of Therm Anal Calorim. 2017;127:1445-1455.