# The Use of Alb-PRF as a Drug Delivery System for Malignant Lesion Treatment

doi: https://doi.org/10.32635/2176-9745.RBC.2023v69n2.3762

*O uso do Alb-PRF como Sistema de "Drug Delivery" para o Tratamento de Lesões Malignas*

El Uso de Alb-PRF como un Sistema de "Drug Delivery" para el Tratamiento de Lesiones Malignas

**Carlos Fernando Mourão[1]; Adam Lowenstein[2]**

## INTRODUCTION

The use of blood concentrates dates back to the 1970's[1,2], and these blood by-products have several applications in medicine and related areas. However, at the beginning of this century, there was a tremendous increase in the use of these biomaterials with the development of platelet-rich fibrin (PRF), using only a 9 ml blood collection tube followed by a centrifugation process at approximately 700 g for 12 minutes[3-5]. PRF became known as the second generation of blood concentrates as it differed from the previous ones that used anticoagulant drugs and other products to assist in clot activation, depending on their clinical application.

Since the introduction of PRF, there has been a significant increase in research on these blood concentrates. Many experiments were carried out to discover PRF's characteristics and properties, always aiming at the best technique or form of clinical use for its different variations. Methods were introduced to increase the concentration of blood cells, cytokines, and blood-derived growth factors[3-5]. In general, clinical research since then has demonstrated remarkable efficacy in using this biomaterial in the tissue healing process and the reduction of postoperative pain[6-8].

## DEVELOPMENT

In 2018, a method used blood collection tubes for special liquids (white cap). The method's centrifugation process does not allow the formation of the clot present in the original PRF. This presented a portion similar to PRF without the presence of the fibrin matrix, known as injectable PRF (i-PRF) or liquid PRF. After this initial process, the collection is performed, heating the blood serum with a portion of the platelet-poor plasma. It is followed by the incorporation of the area with the highest concentration of blood cells. The area is rich in growth factors and cytokines. For some authors, this area is known as platelet-rich plasma (PRP) or plasma rich in growth factors (PRGF). With the inclusion of this liquid portion in the previously produced albumin gel, Alb-CGF[4] (Albumin + Concentrate of Growth Factors) was created, later called Alb-PRF[5] (Albumin + PRF liquid).

Alb-PRF was initially developed to be a biocompatible biomaterial without the addition of chemicals, which would increase the degradation time of blood concentrates in the human body. In addition, the main idea was for Alb-PRF to be used as a barrier in guided bone regeneration in dental procedures[3]. However, due to its consistency and biological properties, its clinical application is increasing every day, as it is also used in cosmetic procedures, such as fillers.

With the development of Alb-PRF and research of this biomaterial, the developers of this blood concentrate carried out research to determine the time of reabsorption in the subcutaneous tissue of mice. In this study, it was observed by the researchers that after 21 days, the Alb-PRF remained in the applied region, and no significant degradation was noticed[5]. Theoretically, this period can be equivalent of four to six months in humans, according to the authors of this study.

Thus, incorporating it into the local treatment of malignant lesions becomes quite viable since it has already been observed that the binding between nanoparticles and serum albumin is a known and applicable method for carrying out the drug-delivery system (e.g., leukemia). The same process can be applied to Alb-PRF.

The process occurs through hydrophobic bonds with the nanoparticles used to treat malignant tumors (e.g., gold nanoparticles, biopolymers)[9]. This compound can be injected into the affected tissue, mainly in soft tissues, and kept for an extended period, which allows for the release of the drug in the affected site.

One of the issues to be studied is the size of albumin particles, which can influence the time of absorption and release of the drug. It is known that nanoparticles up to 8 nm[9] are quickly released by glomerular filtration, which will facilitate the elimination of the drug from the human body.

[1-2]Tufts University School of Dental Medicine, Department of Periodontology, Division of Dental Research Administration. Boston, USA.
[1]E-mail: carlos.mourao@tufts.edu. Orcid iD: https://orcid.org/0000-0001-5775-0222
[2]E-mail: adam.lowenstein@tufts.edu. Orcid iD: https://orcid.org/0000-0002-0751-4894
**Corresponding author:** Carlos Fernando Mourão. Kneeland Street, Boston, MA 02111, USA. E-mail: carlos.mourao@tufts.edu

The Alb-PRF production consists of an autologous blood concentration[3,5]. The blood drawing uses white cap tubes without any additive, and the blood sample then goes to the centrifuge to obtain the liquid phase (plasma + portion rich in cells) -- 8 minutes centrifugation at 700 RCF-max[3,5]. After processing, it was possible to use the plasma and remaining decanted blood material containing red cells.

Approximately 2 ml of the initial portion of plasma was collected using a syringe with an 18 G needle, while the rest of the blood (portion rich in cells, and red blood cells) was preserved at room temperature (20°C). The syringes containing platelets poor plasma (PPP) were inserted into a device for the human plasma denaturation of proteins. After 10 minutes at a temperature of 75°C, the syringes were stored at room temperature for another 10 minutes to allow cooling[3,5].

Subsequently, using a 10 ml syringe with an 18 G needle, the 4 ml of the rich portion from the buffy coat layer was collected, added to the heated PPP layer in the glass container[3,5], and gently mixed with nanoparticle or any other drug to activate the biomaterial for drug delivery.

## CONCLUSION

According to the present idea, Alb-PRF containing the nanoparticles for cancer treatment could be a viable drug delivery system vehicle in malignant lesions. This type of drug delivery system is a novel downstream application of Alb-PRF.

### CONTRIBUTIONS

The authors participated in all the phases of the manuscript and approved the final version to be published.

### DECLARATION OF CONFLICT OF INTERESTS

There is no conflict of interest to declare.

### FINANCIAL SOURCES

None.

## REFERENCES

1. Tangen O, Berman HJ, Marfey P. Gel filtration. A new technique for separation of blood platelets from plasma. Thromb Diath Haemorrh. 1971;25(2):268-78.
2. Ross R, Glomset J, Kariya B, et al. A platelet-dependent serum factor that stimulates the proliferation of arterial smooth muscle cells in vitro. Proc Natl Acad Sci U S A. 1974;71(4):1207-10. doi: https://doi.org/10.1073/pnas.71.4.1207
3. Mourão CFAB, Gheno E, Lourenço ES, et al. Characterization of a new membrane from concentrated growth factors associated with denaturized Albumin (Alb-CGF) for clinical applications: a preliminary study. Int J Growth Factors Stem Cells Dent. 2018;1(2):64-9. doi: https://doi.org/10.4103/GFSC.GFSC_21_18
4. Lourenço ES, Mourão CFAB, Leite PEC, et al. The in vitro release of cytokines and growth factors from fibrin membranes produced through horizontal centrifugation. J Biomed Mater Res A. 2018;106(5):1373-80. doi: https://doi.org/10.1002/jbm.a.36346
5. Gheno E, Mourão CFAB, Mello-Machado RC, et al. In vivo evaluation of the biocompatibility and biodegradation of a new denatured plasma membrane combined with liquid PRF (Alb-PRF). Platelets. 2021;32(4):542-54. doi: https://doi.org/10.1080/09537104.2020.1775188
6. Miron RJ, Xu H, Chai J, et al. Comparison of platelet-rich fibrin (PRF) produced using 3 commercially available centrifuges at both high (~ 700 g) and low (~ 200 g) relative centrifugation forces. Clin oral investig. 2020;24(3):1171-82. doi: https://doi.org/10.1007/s00784-019-02981-2
7. Mourão CFAB, Mello-Machado RC, Javid K, et al. The use of leukocyte- and platelet-rich fibrin in the management of soft tissue healing and pain in post-extraction sockets: a randomized clinical trial. J Craniomaxillofac Surg. 2020;48(4):452-7. doi: https://doi.org/10.1016/j.jcms.2020.02.020
8. Moraschini V, Mourão CFAB, Machado RCM, et al. Does platelet-rich fibrin decrease dimensional changes and improve postoperative comfort in post-extraction sockets? An overview of systematic reviews. Appl Sci (Basel). 2020;10(17):5750. doi: https://doi.org/10.3390/app10175750
9. Ma Y, Cai F, Li Y, et al. A review of the application of nanoparticles in the diagnosis and treatment of chronic kidney disease. Bioact Mater. 2020;5(3):732-43. doi: https://doi.org/10.1016/j.bioactmat.2020.05.002

**Recebido em 2/2/2023**
**Aprovado em 3/2/2023**

Associate-Editor: Daniel Cohen Goldemberg. Orcid iD: https://orcid.org/0000-0002-0089-1910
Scientific-Editor: Anke Bergmann. Orcid iD: https://orcid.org/0000-0002-1972-8777