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New Formulation of Platelet-Rich Plasma Enriched in Platelet and Extraplatelet Biomolecules Using Hydrogels

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Faculty Disclosure Information

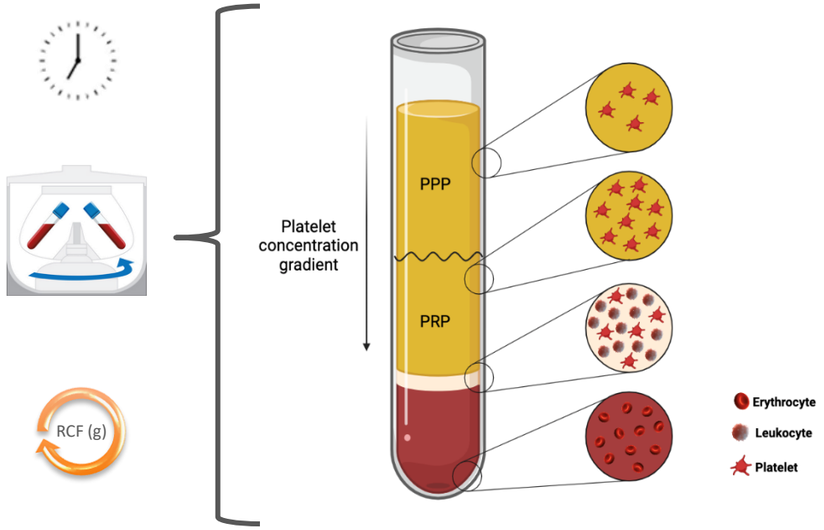
Nothing to disclosure

Introduction

- **Platelet-rich plasma (PRP)** is an **autologous biologic product used in several fields of medicine** for tissue repair due to the regenerative capacity of the biomolecules of its formulation.

- PRP consists of a plasma with a **platelet concentration higher than basal levels** but with basal levels of any biomolecules present out of the platelets

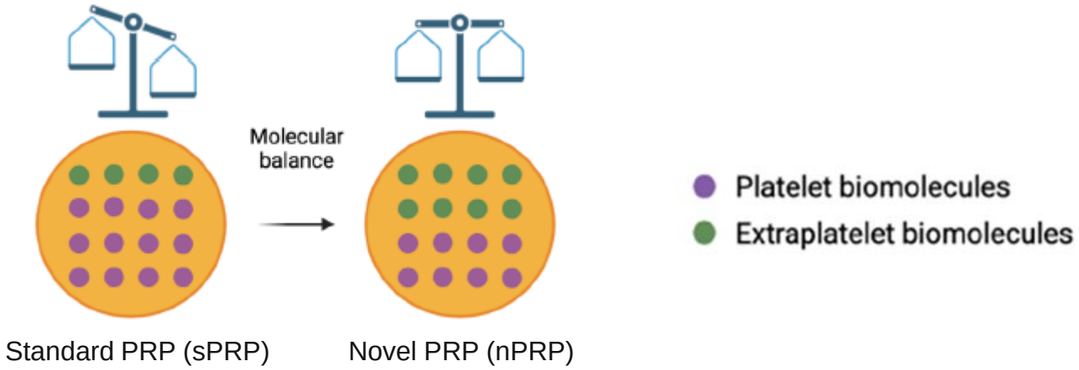
- Conventional methods of obtaining PRP are unable to modulate **extraplatelet molecules.**



Objective

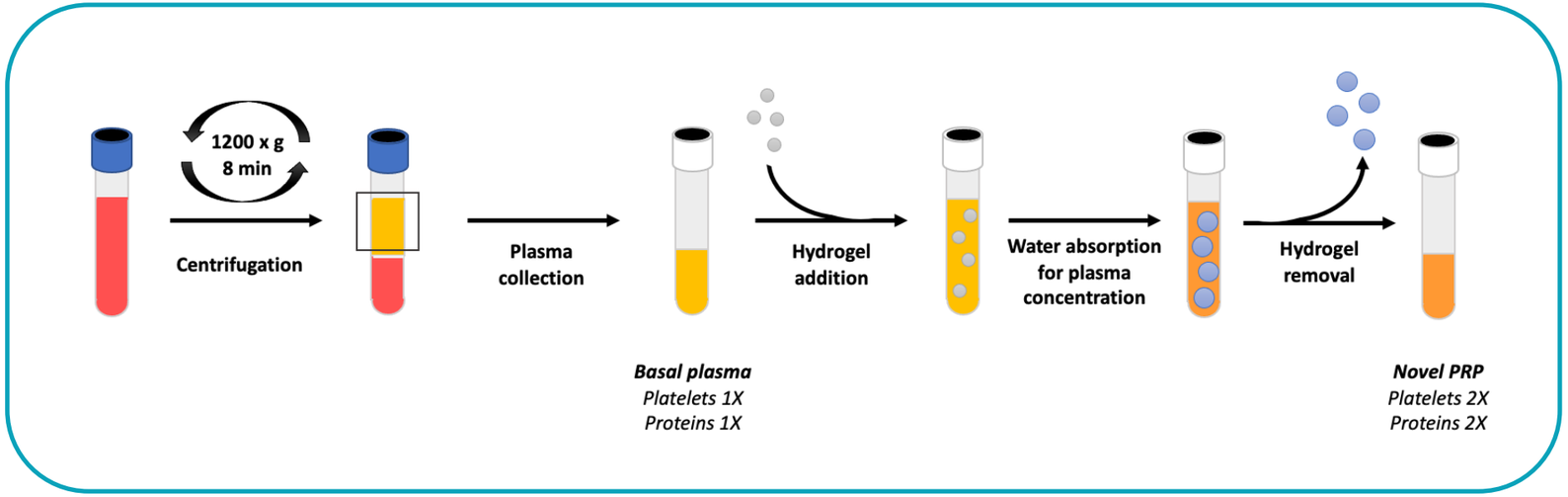
- The aim of this work is to develop a new method to obtain **PRP enriched in both platelet and extraplatelet molecules.**

- The hypothesis of this study is based on the fact that PRP containing not only a higher concentration of platelets but also **a higher concentration of extraplatelet biomolecules** could have a **stronger regenerative performance than a standard PRP**.



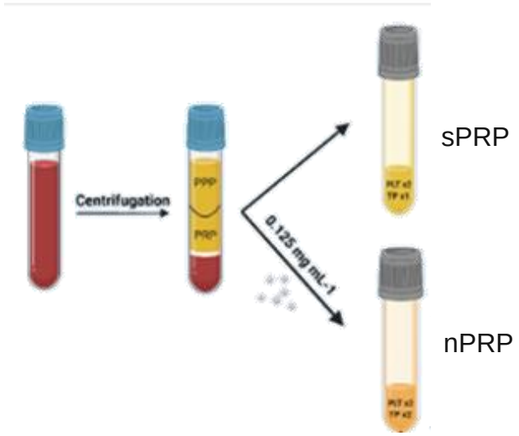
Methods

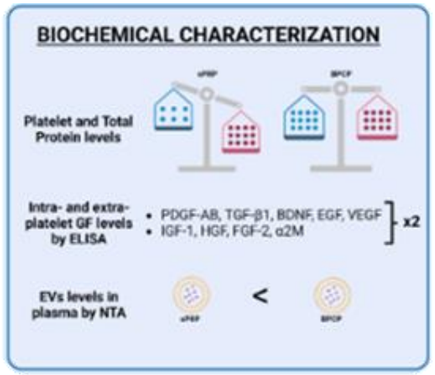
- **A plasma fraction** obtained from blood, containing the basal levels of platelets and proteins, was placed **in contact with the HEAA hydrogel powder to absorb half the volume of the water**

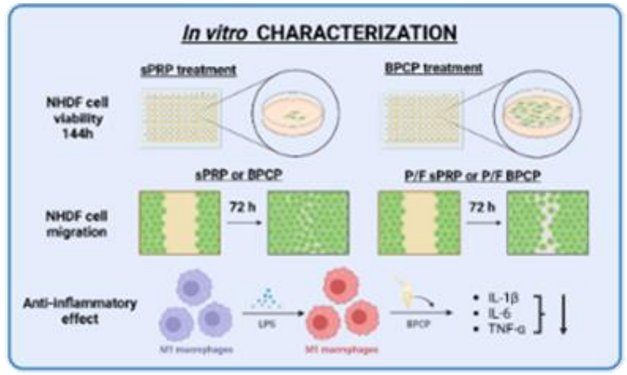


Methods

- The resulting plasma (nPRP) was characterized, and its bioactivity was analyzed in vitro.
- Standard PRP (sPRP) was used as a **control**.

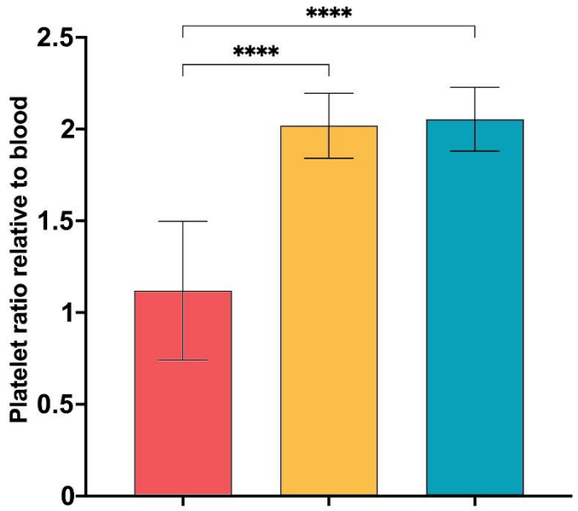




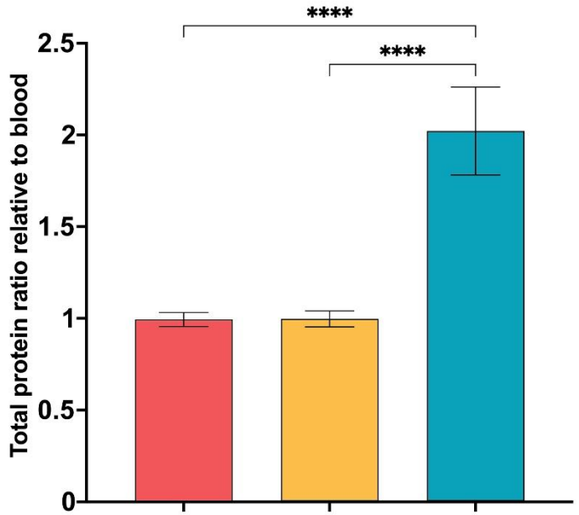


Results - Characterization

The novel PRP (nPRP) showed a **platelet concentration similar** to the standard PRP (sPRP) ($p>0.05$), but the concentration of **the total proteins were significantly increased** ($p<0.0001$).



Platelet Concentration

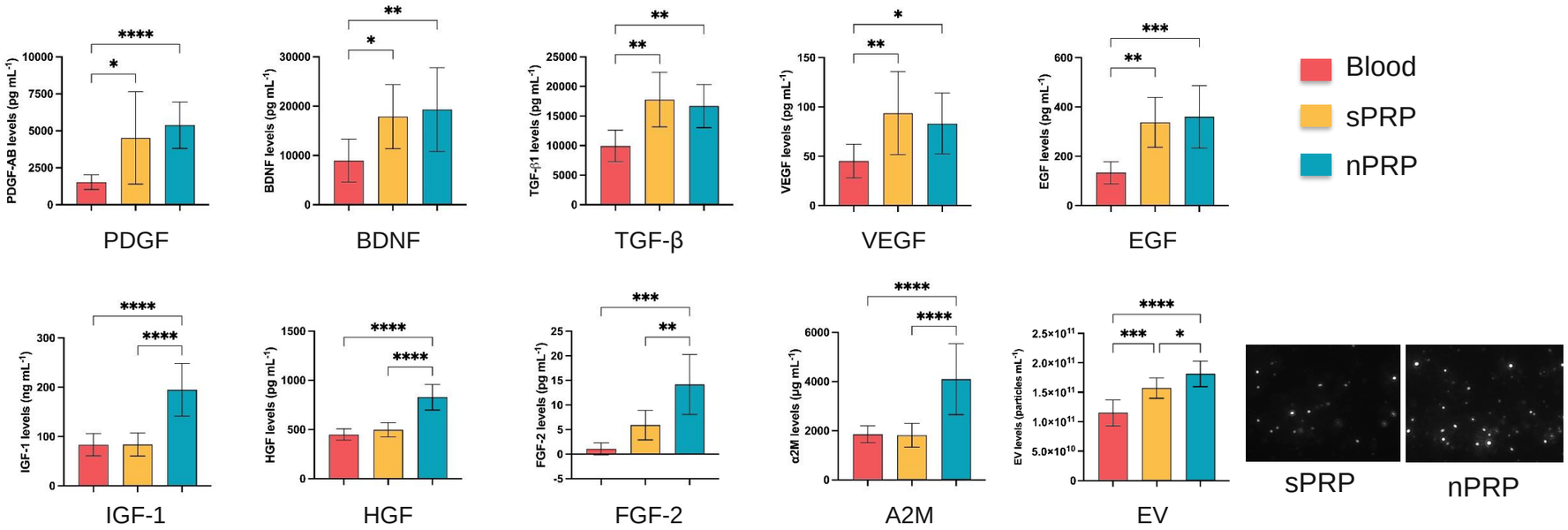


Total Protein Concentration

Blood
sPRP
nPRP

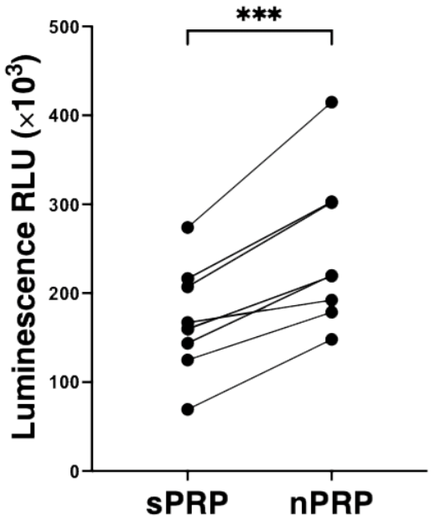
Results - Characterization

- **Platelet factors had the same levels** in both PRP (p>0.05): PDGF, BDNF, TGF-β, VEGF, EGF.
- **nPRP had higher levels of extraplatelet molecules and extracellular vesicles** (EV) (p<0.05): IGF-1, HGF, FGF-2, A2M.

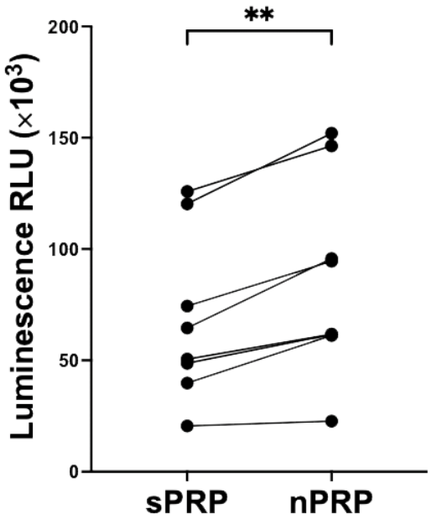


Results – Cell viability

The cells exposed to the **nPRP showed increased cell viability** than those exposed to a sPRP in human dermal fibroblasts (NHDF) ($p < 0.001$) and primary chondrocytes ($p < 0.01$)



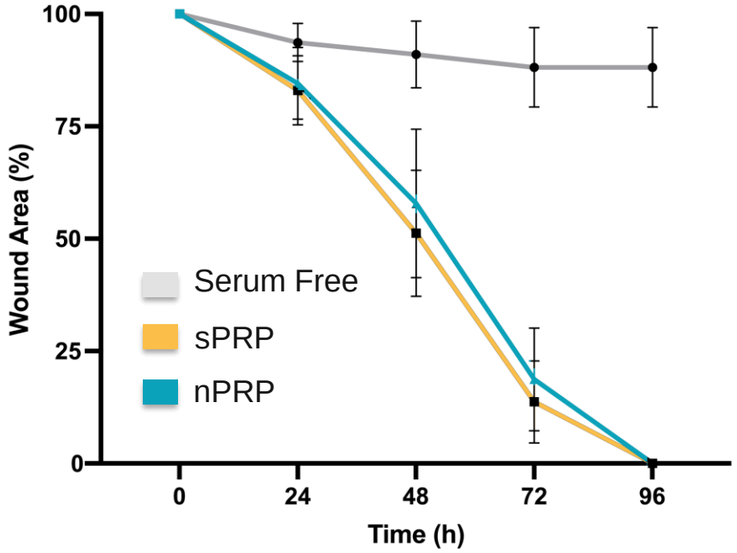
NHDF

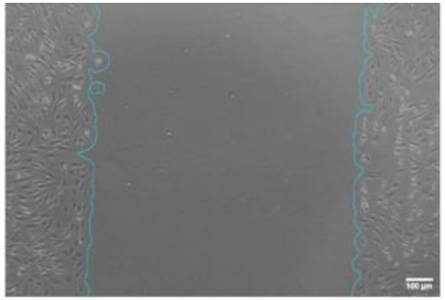


Chondrocytes

Results – Cell migration

Regarding to **cell migration capacity**, it was found that the process is platelet-dependent, achieving **similar wound healing closure percentage between sPRP and nPRP**.





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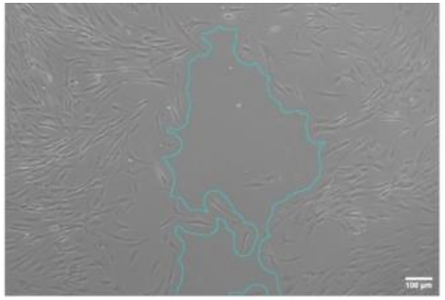

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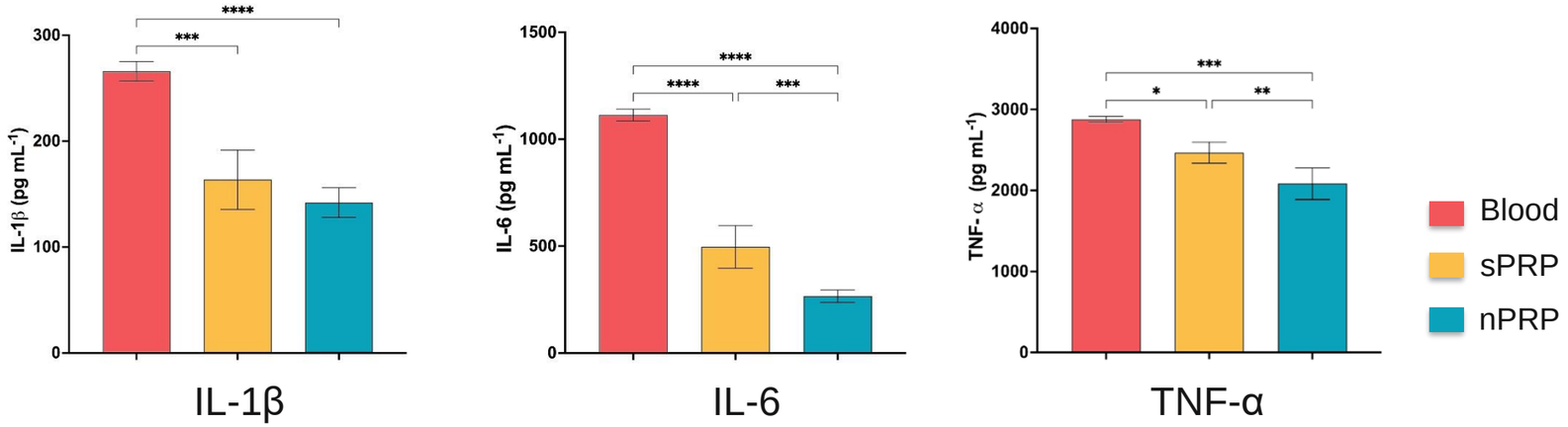
Results - Inflammation

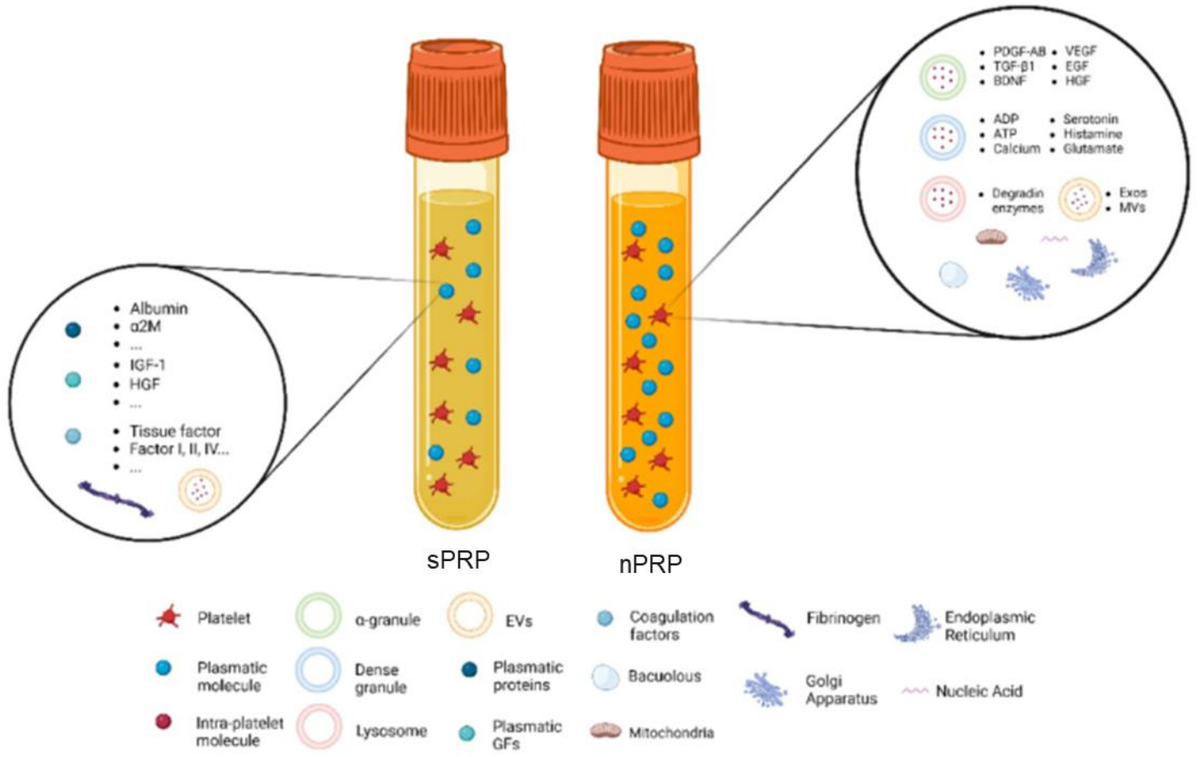
- An **inflammatory environment** was produced using **LPS** in previously differentiated **M1 macrophages.**

- When cytokine levels were measured by ELISA after **nPRP** administration, a significant **decrease of pro-inflammatory IL-1b (p < 0.0001), IL-6 (p < 0.0001) and TNF-α (p < 0.001)** was observed.



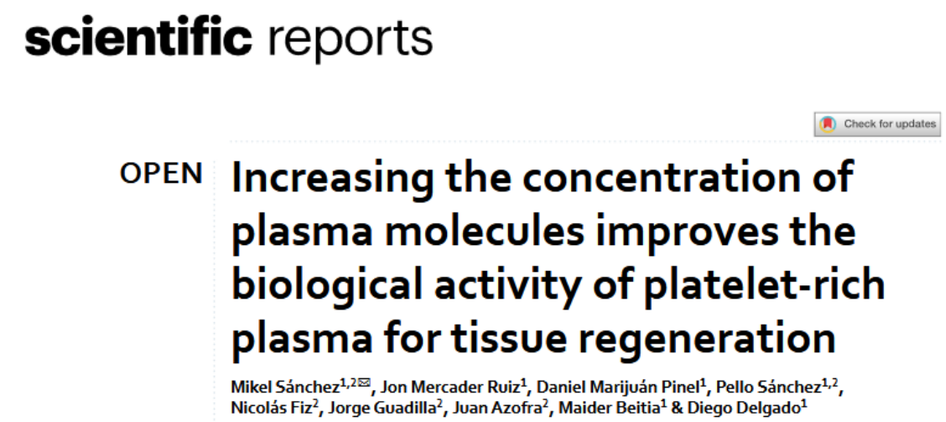
Conclusion

This novel absorption-based method produces a PRP with novel characteristics compared to the standard PRPs, with promising in vitro results that could potentially trigger improved tissue regeneration capacity.



References

1. Everts PA, et al. Profound Properties of Protein-Rich, Platelet-Rich Plasma Matrices as Novel, Multi-Purpose Biological Platforms in Tissue Repair, Regeneration, and Wound Healing. Int J Mol Sci. 2024 Jul 19;25(14):7914. doi: 10.3390/ijms25147914.
2. Mercader J, et al. Current Challenges in the Development of Platelet-Rich Plasma-Based Therapies. Biomed Res Int. 2024 Aug 9:2024:6444120. doi: 10.1155/2024/6444120.
3. Mercader J, et al. New Formulation of Platelet-Rich Plasma Enriched in Platelet and Extraplatelet Biomolecules Using Hydrogels. Int J Mol Sci. 2023 Sep 7;24(18):13811.doi: 10.3390/ijms241813811.
4. Sánchez M, et al. Increasing the concentration of plasma molecules improves the biological activity of platelet-rich plasma for tissue regeneration. Sci Rep 2025 Feb 6;15(1):4523. doi: 10.1038/s41598-025-88918-0.



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