

Executive Summary



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1. **Title of the Project:** Autologous Platelet-rich Plasma (PRP) Loaded Personalized Wound Care Patch at Patient Bedside for Effective Burn Wound Care

2. **Date of Start of the Project:** 1st Oct, 2022

3. **Aims and Objectives:**

Objective: Development of novel effective treatment modalities for large asymmetric burn wound which capable to regenerate lost skin tissue, protect from the burn wound infection and most importantly affordable for common Indian population. We will develop portable wound care air-brushing device and personalized burn care kits for patient specific degree-of-burn as an effective and affordable burn wound care modalities at low resources medical setting. The following are the aims to accomplish the proposed project.

Aim-1: Development of compact prototype device for fabrication of personalized wound healing patch at patient bedside.

Aim-2: Development of polymer kits specific to degree-of-burn.

Aim-3: Preclinical validation of burn wound healing efficacy of PRP-airbrush patch for burn wound using small animal.

Aim-4: Possible Clinical Trials Using Prototype Airbrushing Device and Kits.

4. **Significant achievements (not more than 500 words to include List of patents, publications, prototype, deployment etc)**

We developed and patented next generation airbrushed device for co-axial airbrushing to fabricate CORE-SHELL nanofibers and particles with wide range of biodegradable polymers (having tailor degradation properties) where core can be loaded with antimicrobials/drugs/bioactive molecules/PRP with their sustained release for inherent long-lasting protection from the burn wound infection/maintain chemical cues (GF) for skin tissue regeneration. Based on our preliminary studies, our novel *in-situ* hydrogel matrix (where hydrogel from in-situ microgel particles provide inherent porosity for cell migration through hydrogel) and nanofiber patch (porous nanofiber matrix) with antibiotics/(±)PRP deposited on the wound providing ECM mimicking 3D matrix should promote deep-dermal and chronic wound regeneration. Moreover, such fiber and gel patch can be deposited over wound 10 to 100 times faster compared to conventional electrospinning method and ONE Application of fiber/gel patch capable to regenerate scar free acute wound as well as chronic wound (unlike several hospital visit for autologous PRP therapy for current PRP-based-diabetic wound care).

We are currently in the process of in vivo studies to validate the efficacy of PRP loaded airbrushing patch for burn wound care.

Publication and Patents:

1. Ruby Singh, Purandhi Roopmani, Meenakshi Chauhan, Suparna Mercy Basu, Waghela Deeksha, MD Kazem, Sarbani Hazra, Eerappa Rajakumara, Jyotsnendu Giri, Silver sulfadiazine loaded core-shell airbrushed nanofibers for burn wound healing application, International Journal of Pharmaceutics, 2022
2. Sarviya, N.; Basu, S. M.; Mani, R.; Chauhan, M.; Kingshott, P.; Giri, J. Biomimicking nanofibrous gelatin microspheres recreating the stem cell niche for their ex-vivo expansion and in vivo like differentiation for injectable stem cell transplantation. Biomaterials Advances **2022**, 139, 212981. DOI: <https://doi.org/10.1016/j.bioadv.2022.212981>.
3. Sarviya, N.; Basu, S. M.; Induvahi V.; Giri, J. Laponite-Gelatin Nanofibrous Microsphere Promoting Human Dental Follicle Stem Cells Attachment and Osteogenic Differentiation for Non-invasive Stem Cell Transplantation Macromolecular Bioscience **2022** (Accepted). DOI: 10.1002/mabi.202200347

Manuscripts under review:

1. Airbrushed nanofibers with bioactive core and antibacterial shell for wound healing application, Ruby Singh¹, Purandhi Roopmani, Uzma Hasan, Poonam Dogra, Shreya Sudeep Pande, Jyotsnendu Giri, European Journal of Pharmaceutics and Biopharmaceutics (3rd times review)
2. Cord blood platelet rich plasma (PRP) as a potential alternative to autologous PRP for allogenic preparation and regenerative applications Rajesh Mani, Purandhi Roopmani, Jayakumar R, Jyotsnendu Giri, International Journal of Biological Macromolecules (Under Review)

Patent Filed:

1. A cyclic anhydride-modified proteins composition and a process for hydrogel preparation for the same. Patent Application No: 202341040152

Concluding remarks: Successfully completion of the project will provide a portable wound care device with disposable degree-of-burn specific material kit for personalized (autologous PRP) effective and affordable burn wound care.