MAPULA RAZWINANI

PROJECT: The future of burn injuries depends on medicinal plants extracts Hydrocolloid Bandages

Background and rationale:

According to the DC attorney's website, South Africa has a high incidence rate of serious burn injuries and deaths which is the most common cause of death in children under the age of four. South African burns affect about 3.2% of the population annually (Teo, Van As and Cooper 2012). Childhood injury is among the significant mortality and morbidity globally that remain the most critical public health problems with devastating physical, psychological and socioeconomic consequences in low-and-middle-income countries (Adane, Admasie and Shibabaw 2022). According to a Medical Research Council report, In South Africa, about 3.2% of the population suffers burn injuries yearly, more than 1.8 million people. Globally, burn epidemiology suggests burn injury is the fourth most common type of traumatic injury worldwide (Purcell *et al.* 2022).

In 2018, the WHO indicated that an estimated 180,000 deaths every year are initiated by burns which are a leading cause of morbidity, including prolonged hospitalization, disfigurement, and disability, often resulting in stigma and rejection. Burn injuries are among the most severe types of injuries the human body suffers. In the study conducted by Shaikh, Dadmal and Kamble (Shaikh, Dadmal and Kamble 2022) 69% of their cases were treated by surgical intervention and 31% by daily dressing and wound care. The most surgical treatment for burns is skin grafting (Shaikh, Dadmal and Kamble 2022). Recently, the major challenge in the world is to design and develop an effective wound dressing for burned injuries (Eivazzadeh-Keihan *et al.* 2022).

Many efforts have been made to produce an effective bandage that has the potential to close the wound and accelerate scar healing as the process of wound regeneration is time-consuming. Evidence suggests that the efficacy of optimized wound healing, a variety of wound healing dressing materials are available; however, the material for a specific wound type is important for proper healing and dressings need to be in contact with the wound in

order to work, unlike wounds bandages that are designed to keep wound dressings in the wound place and can be used as a primary treatment in those patients who are unsuitable for skin grafting (Borda, Macquhae and Kirsner 2016). Despite the existence of various chemical products for burn treatment, there is a growing trend for natural products and traditional medicine worldwide (Momtaz *et al.* 2020). Medicinal plants have been used since ancient times for their various therapeutic activities and are safer compared to modern medicines, especially when properly identifying and preparing them and choosing an adequate dose administration (Jamshidi-Kia, Lorigooini and Amini-Khoei 2018; Qadir *et al.* 2021). It is well established that plants have important secondary metabolites through evolution as a natural means of surviving in a hostile environment (Agyare *et al.* 2016).

Various empirical formulations of medicinal plant extracts and their bioactive compounds have been encapsulated with biodegradable scaffolds and hydrogels have been fabricated and studied extensively for tissue engineering applications. As a result, renewed attention of scientists in the area of regenerative medicine has been drawn to tissue-engineered fabrications using medicinal plant extracts encapsulated scaffolds (Das *et al.* 2016). Therefore, the purpose of this study is to design, formulate and fabricate medicinal plant Hydrocolloid Bandages and investigate their cellular and molecular wound healing effects using in vitro techniques.

Study Design and scope:

The project aims to synthesize, design, and characterize a medicinal plant scaffolding hydrocolloid wound dressing that can regenerate burn wounds by accelerating the closing of wounds and scar healing. The study further aims to look at the effect of medicinal plant extracts hydrocolloid wound dressing In vitro for protection against damage to fibroblasts by oxygen-free radicals to assess the ROS scavenging properties by determining the inhibition effect on hydroxyl radicals and DPPH radicals. By examining the expression of collagen type II and 1 MMP mRNA levels for wound healing and skin regeneration. Graph Pad Prism 5.00 software will be used for data analysis (GraphPad Software Inc. San Diego, CA, U.S.A). The results will be presented as mean and standard deviation (SD). The One-way ANOVA test will be used followed by the Mann-Whitney post hoc test to determine the statistical significance between the groups. Dissemination of results by publication and conference.

Main Objective:

The main objective of this project is to design a medicinal plant scaffolding hydrocolloid wound dressing bandage that can regenerate burn wounds by accelerating the closing of wound and scar healing.

Specific Objectives:

- To design and characterize medicinal plant extracts scaffolding hydrocolloid wound dressing.
- To determine the anti-inflammatory, antioxidant, antiseptic and antimicrobial activity of medicinal plant extracts scaffolding hydrocolloid wound dressing.
- The effect of medicinal plant extracts scaffolding hydrocolloid wound dressing In vitro test for fibroblast growth stimulation and protection against damage to fibroblasts by oxygen free radicals.
- To determine the expression of collagen type II and 1 MMP mRNA using RT-PCR Quantification.

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