"A Review on Autologous Platelet-Rich Plasma (Prp) Associated with Split Thickness Skin Grafting (Stsg) in the Treatment of Chronic Non-Healing Ulcers"

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ABSTRACT:

Chronic non-healing ulcers present a significant clinical challenge due to their prolonged healing times and resistance to conventional treatments. Recent advances in regenerative medicine have introduced autologous platelet-rich plasma (PRP) as a promising therapeutic option. PRP, known for its high concentration of growth factors, has been shown to accelerate wound healing by enhancing tissue regeneration and angiogenesis. When combined with split-thickness skin grafting (STSG), PRP offers a synergistic approach to the management of chronic ulcers. This review evaluates the efficacy of PRP in conjunction with STSG in the treatment of chronic non-healing ulcers, drawing on recent clinical studies, case reports, and trials. The review highlights the biological mechanisms of PRP in wound healing, the procedural considerations in integrating PRP with STSG, and the clinical outcomes associated with this combined approach. Findings suggest that the use of autologous PRP alongside STSG significantly improves graft acceptance, reduces healing time, and promotes faster epithelialization, ultimately leading to better wound closure and patient recovery. However, the need for standardized protocols and further large-scale studies is emphasized to establish consistent guidelines for its use in clinical practice. This review aims to provide healthcare professionals with an updated perspective on this evolving treatment modality for chronic non-healing ulcers.

KEY WORDS: Chronic ulcers, Platelet-rich plasma, Split-thickness skin grafting, Regenerative medicine, Wound healing, Tissue regeneration.

1. INTRODUCTION:

An ulcer is a sore on the skin or mucous membrane with a full thickness depth and a slow healing tendency accompanied by disintegration of the tissue and may result in complete loss of the epidermis and often portions of dermis and even subcutaneous fat [1,2].

Chronic non healing ulcers can be defined as spontaneous or traumatic lesions that cause persistent defect in the skin typically in lower extremities for the period of more than 6 weeks and do not exhibit any tendency to heal and not responsive to initial therapy to produce anatomic and functional integrity despite appropriate standard treatment in a defined time period and have an underlying cause related to a systemic or a local disease [2,3,4,5&6]. Chronic wounds are also known as hard to heal wounds, non-healing wounds, recalcitrant wounds, and challenging or complex wounds [7].

The incidence of ulceration is more in ageing population and increased risk factor for atherosclerotic occlusion such as Smoking, Alcohol/drug abuse, Obesity, and Diabetes. Multiple factors have been contributors to impaired wound healing such as ischemia, infection, malnutrition, venous insufficiency, cardiac, haematological disorders, immunosuppressives and inadequate wound care [6].

TYPES OF NON-HEALING ULCERS:

There are different types of non-healing ulcers includes;

- Venous ulcers
- Arterial ulcers
- Pressure ulcers
- Diabetic ulcers and
- Traumatic ulcers [3].

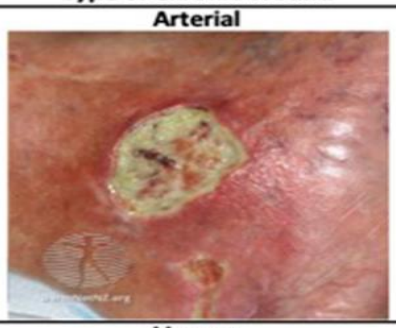
Type of Chronic Wound	Standard of Care
A Arterial 	Medical Intervention Arterial Intervention
B Venous 	Compression Therapy
C Diabetic Foot Ulcer 	Saline-Moistened Gauze Dressing Debridement Infection Control
D Pressure Ulcer 	Offloading Infection Control Pain Control

Figure 1.1: shows different types of non-healing ulcers and their standard care

Chronic ulceration of the lower leg, including foot, is a frequent condition, causing pain, social discomfort and generating considerable costs for the patients. These wounds cause severe emotional and physical stress and create a significant financial burden on patients and healthcare system [1].

Wound healing is a dynamic and complex process occurring in 3 phases: Inflammatory phase, tissue formation and remodelling phase but this process is disrupted in chronic ulcers by the lack of necessary growth factors (GFs) and cytokines that seem to be detained in one or more of the phases of healing leads to delay in the healing process [3,8].

Symptoms of ulcers are usually Includes:

- Increasing pain,
- Friable granulation tissue,
- Foul odour, and
- Wound breakdown instead of healing [2].

The goals of ulcer treatment is to obtain closure of the wound as early as possible and the conventional treatment for non-healing ulcers basically includes wound cleansing, tissue debridement, prevention, and treatment of infection, mechanical off-loading, adjustment of blood glucose levels and local care with dressing application these treatment modalities can't provide satisfactory healing in chronic ulcers since they are not able to provide growth factors that can modulate healing process [1,3].

Advanced treatment for chronic ulcers includes the use of hyperbaric oxygen therapy, skin grafting, VAC (vacuum assisted closure) and surgery such as angioplasty and reconstructive surgery [3].

SKIN GRAFTING IN CHRONIC NON-HEALING ULCERS:

Skin grafting is one of the most used techniques in the plastic-reconstructive surgery and dermatology. It is the common surgical procedure by which skin or a skin substitute is placed over the wound to replace and regenerate damaged skin and an important therapeutic option in the treatment of chronic leg ulcers [9].

Figure 1.2: Describes the technique of skin grafting

CLASSIFICATION OF SKIN GRAFTS: These are classified according to the thickness of the graft, geometry and source of donor tissue.

- According to thickness: 1. Spilt-thickness skin grafts (STSGs)

2. Full-thickness skin grafts (FTSGs)

- According to geometry: 1. Sheet grafts
  2. Mesh grafts
  3. Meek grafts
  4. punch grafts
- According to source: 1. Autografts- Taken from the patient
  2. Allografts- Taken from another person (from alive/dead donor)
  3. Xenografts- Non human donor is used (eg. porcine xenografts act similar to human cadaver skin) [9].

SPLIT-THICKNESS SKIN GRAFTING (STSGs):

Split-thickness skin grafting (STSG) is applied in plastic and skin surgeries caused by burns, trauma, and defects after scar resection and a widely accepted technique for wound closure for non-healing wounds and involves excision of the epidermis and part of the dermis, leaving behind the reticular dermis in the donor site, which enables the skin to heal by secondary intention, frequently used for functional repair [9,10,11&12].

There are different types of STSGs are identified: 1. Thin STSG-0.2mm
2. Middle STSG- 0.4mm
3. Thick- 0.6mm [9].

AUTOLOGOUS PATELET RICH PLASMA (PRP):

- Platelets play the major role in the initiation of wound healing process by adhere, aggregate, and release many growth factors, adhesive molecules, and lipids that control and enhance the migration, proliferation, and functions of keratinocytes, fibroblasts, and endothelial cells [3].
- PRP is a concentrate of platelet rich plasma protein derived from whole blood, centrifuged to remove red blood cells and is widely used in plastic and reconstructive surgery of various skin conditions, such as acute wounds, chronic wounds, maxillofacial bone defects and cosmetic issues [1,12].
- The platelet concentration in PRP is from 2-6 folds higher than its concentration in whole blood and application of PRP for the treatment of chronic ulcers is a relatively novel technique moreover it has a relatively small number of contraindications and has limited side effects and Since PRP is autologous method, it is biocompatible, safe and does not carry the risk of transmissible infections [1,3&13].

COMPOSITION OF PRP:

PRP contains many platelets, the a-granules of which contain many molecules, such as transforming growth factor-b (TGF-b), epidermal growth factor (EGF), vascular endothelial growth factor (VEGF), platelet-derived growth factor (PDGF), coagulation factors, calcium, serotonin, histamine and hydrolytic enzymes and these growth factors; particularly TGF-b are essential for wound healing by modulating mesenchymal cell recruitment, proliferation, and extracellular matrix synthesis during the healing process [1,12].

ADVANTAGES WITH PRP:

The merits of PRP are apparent since it is easy, cost effective and much more lasting compared to other treatment modalities; being autologous in nature, it is free from communicable pathogens- making it safe therapeutic tool with good clinical tool [3,4].

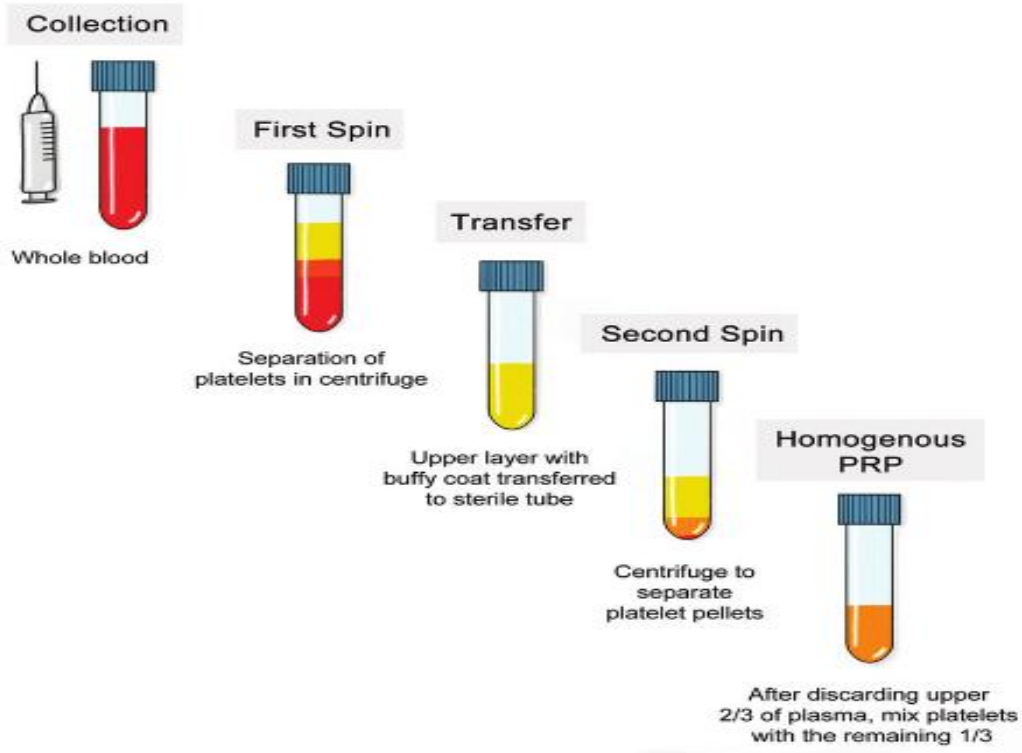


Figure 1.3 Describes the Preparation of Platelet Rich Plasma (PRP)

2. DISCUSSION:

Chronic non-healing ulcers, characterized by their resistance to conventional treatment and prolonged healing time, represent a significant clinical challenge. These ulcers, commonly found in the lower extremities, result from various underlying conditions such as ischemia, infection, and venous insufficiency. As they persist for more than six weeks, chronic ulcers often cause emotional and physical distress to patients, creating a substantial burden on healthcare systems.

Traditional treatments like wound debridement, infection control, and standard wound care have been insufficient in many cases. Although such interventions help manage symptoms, they often fail to address the primary impediment to healing: the lack of sufficient growth factors necessary for tissue regeneration. The phases of wound healing—inflammatory, tissue formation, and re-modelling are disrupted in chronic ulcers, leading to delayed or stagnant recovery. Factors like smoking, diabetes, obesity, and alcohol use exacerbate this impaired healing process, further complicating treatment efforts.

Several types of chronic ulcers, such as venous, arterial, pressure, diabetic, and traumatic ulcers, share common symptoms including persistent pain, wound breakdown, and foul odor. Given the slow progress with conventional methods, more advanced treatments have gained prominence, including hyperbaric oxygen therapy, VAC (vacuum-assisted closure), and skin grafting techniques. Among these, split-thickness skin grafting (STSG) has emerged as a valuable tool for closing wounds, particularly in plastic and reconstructive surgery. STSGs involve the removal of the epidermis and part of the dermis, leaving behind a portion of the skin capable of regeneration. By facilitating secondary intention healing at the donor site, STSGs contribute to faster recovery in non-healing wounds.

In recent years, the combination of STSG with autologous platelet-rich plasma (PRP) has shown promising results in the treatment of chronic ulcers. PRP, a concentration of platelets from the patient's own blood, contains growth factors such as TGF-β, EGF, VEGF, and PDGF, which play crucial roles in enhancing wound healing. These factors promote cellular proliferation, tissue regeneration, and angiogenesis, accelerating the healing process in chronic ulcers. The biocompatibility of PRP, due to its autologous nature, reduces the risk of complications like infection or immune rejection.

PRP's ability to provide a safe, cost-effective, and relatively simple therapeutic option makes it an attractive alternative in ulcer management. Its application in conjunction with STSG has demonstrated improved wound closure, reduced healing time, and better patient outcomes. Moreover, PRP's easy preparation and application, coupled with limited contraindications and side effects, highlight its potential as a standard adjunct in the management of chronic ulcers. However, further research is necessary to establish standardized protocols for its use and to confirm its efficacy across different types of chronic ulcers.

The combination of PRP with STSG represents a significant advancement in the treatment of chronic non-healing ulcers. This approach, by addressing the root causes of impaired wound healing, offers hope for patients suffering from these debilitating conditions. Further studies are needed to validate its long-term efficacy and to optimize its integration into routine clinical practice.

3. CONCLUSION:

Chronic non-healing ulcers remain a significant clinical challenge, often unresponsive to standard treatments. The use of autologous PRP in combination with STSG has shown promise in enhancing wound healing by accelerating tissue regeneration and improving graft success. PRP's rich concentration of growth factors and its biocompatibility make it a safe and cost-effective option. Early clinical outcomes suggest faster healing and better wound closure. However, more research is required to standardize protocols and confirm its efficacy across various ulcer types for widespread clinical use.

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