Review Article

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Stromal Vascular Fraction In Wound Healing

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Abstract

Non healing wounds are a major problem all over the world. Many therapies have been introduced for the management of chronic non healing ulcers. It is always challenging to manage them. There is no well established method that accelerates the wound healing rate. Stromal vascular fraction is one of the recent techniques that helps in increased cell proliferation, angiogenesis and survival. This article discuss about the role of SVF in wound healing.

Keywords: Stromal vascular fraction; Wound healing; Lipoaspirate.

INTRODUCTION

Stromal vascular faction (SVF) is a adipose-derived stem cell based therapy which improves wound healing by re-epithelization, angiogenesis, and immunomodulation.[1]

HISTORY

In the mid-1960s, Rod bell first isolated SVF from rats. Later 1970s, Wagner isolated EC from SVF. In 1980s Jarell, William, et al. isolated SVF from human adipose tissue. Since then SVF has been investigated for various clinical applications.

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MECHANISM

In the inflammatory phase of wound healing, SVF decreases mast cells and myofibroblasts through immunosuppressive and anti-inflammatory effects, leading to reduced scar formation. In the proliferative phase, the differentiation of adipose-derived stem cells and growth factors contained in SVF helps. In the maturation phase, excessive collagen synthesis is suppressed, and remodeling of collagen is induced by chemokines (TGF: transforming growth factor) beta 3 and matrix metalloproteinases by downregulation of MMP1 and migration of human dermal fibroblasts.[2]

METHODS OF ISOLATION

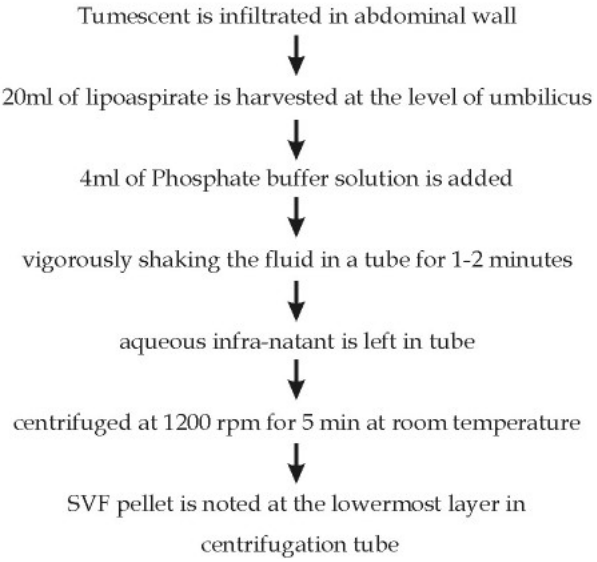
SVF is a mixture of adipose tissue, stromal tissue, blood and tumescent fluid which constitutes lipoaspirate. SVF can be prepared by 2 methods. We can isolate about 500,000–1,000,000 cells per gram of lipoaspirate tissue with a >80% viability.[3]

A. ***Mechanical methods:*** Digital planimetry is done to assess the wound. Under anaesthesia, tumescent is infiltrated in abdominal wall. A stab incision is given at umbilicus and 20 ml of lipoaspirate is harvested. 4ml of Phosphate

buffer solution is added. SVF is isolated by vigorously shaking the fluid in a tube for 1-2 minutes. When the tissue is separated, the aqueous infra-natant is saved. The tissue is washed 2-3 times. The infranatant are centrifuged at 1200 rpm for 5 min at room temperature. The SVF pellet will be noted at the lowermost layer in centrifugation tube. The SVF containing fluid is given in the bed of the wound and at the margin.

B. ***Enzymatic methods:*** Lipoaspirate is washed 2–3 times using an aqueous salt solution. The washed lipoaspirate is incubated with a collagenase solution. Enzymatic digestion is carried out in a heated shaker to provide constant agitation at 37°C for 30 min to 2 h. The tissue is centrifuged which separates the processed lipoaspirate into three layers, adipose tissue layer, aqueous layer, and the pellet. The SVF is contained within the pellet, although it can be recovered from the aqueous layer.[12] The pellet is washed toremove any residual enzyme and filtered to remove tissue fragments.

TECHNIQUE OF ISOLATION OF SVF



INDICATION

Acute and chronic wounds

Myocardial infarction

Cosmetic surgery

Osteoarthritis and bone regeneration

Inflammatory bowel disease

CONTRAINDICATION:

Not be used on devitalized tissue and infected wounds.

ADVANTAGES

SVF improves the rate of wound healing leaving minimal scars. Minimally invasive procedure,no ethical issues in isolation except for collagenase digestion and culture in vitro.[7] Simple and not time consuming.

DISADVANTAGES

Mechanical method has lower yield of progenitor stem cells and more of blood mononuclear cells(8). Enzymatic method requires specific laboratory equipment and experience. SVF cells without extracellular matrix components are vulnerable to immune system at the recipient site.

COMPLICATION

In vitro studies showed oncological risks which we should be very cautious.

RECENT ADVANCES

Clinical trials are utilising SVFs in conditions such as multiple sclerosis, Crohn's disease and peripheral neuropathy. The injectable product, "nanofat", is obtained by emulsification and filtration of the lipoaspirate. Although it has no viable adipose cells, is rich in CD34+ ADSCs. The efficacy of nanofat have been demonstrated in multiple case studies related to skin rejuvenation, scar healing, skin grafting for wound management, and treating vulvar lichen sclerosus (VLS)and also by standard ADSC-related phenotypic and differentiation studies.[9]

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