Regenerative Approach to Scars, Ulcers and Related Problems with Fat Grafting

Marco Klinger, MD[a,*], Andrea Lisa, MD[a], Francesco Klinger, MD[b], Silvia Giannasi, MD[a], Alessandra Veronesi, MD[a], Barbara Banzatti, MD[a], Valeria Bandi, MD[a], Barbara Catania, MD[a], Davide Forcellini, MD[b], Luca Maione, MD[a], Valeriano Vinci, MD[a], Fabio Caviggioli, MD[b]

KEYWORDS

• Autologous fat graft • Scar treatment • Chronic ulcer • Regenerative potential • Angiographic needles

KEY POINTS

- Autologous fat graft is an innovative surgical option for scars and ulcers that achieves tissue regeneration and remodeling without the need for new and even worse scarring.
- Autologous fat graft is an option of choice in case of wide nonlinear scars, in tension areas, or in cases of depressed scars.
- Experience suggests fat grafting effectiveness in treating chronic skin ulcer of small to moderate size, not exceeding 3.5 cm^2.
- The use of needles (18-gauge angiographic) is fundamental to treat fibrotic scar tissue. They allow one to perform a highly precise technique, overcoming tissue resistance.
- Fat processing with centrifugation increases adipose-derived stem cell content and reduces the amount of proinflammatory blood cells, maximizing regenerative properties.

Video of adipose tissue harvesting by infiltration accompanies this article at http://www.plasticsurgery.theclinics.com/

INTRODUCTION

Adipose tissue is a connective tissue containing a reservoir of mesenchymal stem cells that can divide indefinitely, producing various cellular lines.[1–3] Coleman's[4,5] processing and harvesting technique described in 1992 increased fat graft survival, making its adoption more reliable and predictable. Initially used as a filler to correct volume deficiencies and for esthetic purposes, autologous fat grafting

No financial support or benefits have been received by any author. We have no relationship with any commercial source that is related directly or indirectly to the scientific work. Devices used in this study: Coleman's original kit for lipostructure and 18G needle, Cordis®, a Johnson & Johnson Company, N.V, 9301 LJ, Roden, Netherlands.

[a] Plastic Surgery Unit, Department of Medical Biotechnology and Translational Medicine BIOMETRA, Humanitas Clinical and Research Center, Reconstructive and Aesthetic Plastic Surgery School, University of Milan, Via Manzoni 56, Rozzano, Milan 20089, Italy; [b] Plastic Surgery Unit, Reconstructive and Aesthetic Plastic Surgery School, MultiMedica Holding S.p.A., University of Milan, Via Milanese, 300, Sesto San Giovanni, Milan 20099, Italy

* Corresponding author.

E-mail address: Marco.klinger@humanitas.it

Clin Plastic Surg 42 (2015) 345–352

http://dx.doi.org/10.1016/j.cps.2015.03.008

0094-1298/15/$ – see front matter

has found a progressively greater field of application, and recently has entered regenerative medicine. The experience of Rigotti and coworkers[6] in treating radiodystrophic outcomes obtaining local improvement of tegument trophic characteristics after autologous fat grafting was pioneering.

Inspired by these results, we applied the same technique to burn scars with excellent clinical results. Histologic examination of the treated skin showed patterns of new collagen deposition, local hypervascularity, and dermal hyperplasia with tissue regeneration.[7] Building on these results, we began to treat other kinds of pathologic scars with an overall improvement in tissue quality. In our experience, autologous fat graft has proved to be an efficient and safe procedure to treat scars of different origin, demonstrating the capability of lipostructure to achieve architectural remodeling and loose connective regeneration.[8–14]

In different clinical settings, we observed how lipostructure managed to relieve neuropathic pain thanks not only to regenerative effects, but also as a result of molecular changes induced in the microenvironment and secretion of substances able to give prolonged analgesia.[15–22] Finally, we positively adopted its regenerative properties in the setting of posttraumatic "hard-to-heal" wounds, obtaining an improvement of healed skin quality and elasticity that appears very similar to normal skin.[23,24]

Our clinical experience shows that autologous fat grafting can be adopted in different clinical settings by evolving reconstructive into regenerative surgery. It is well known that scars of different origin may impede function, especially in cases of joint involvement, which may cause discomfort, tightness, or even pain, and achieve cosmetic deformity. Several surgical approaches to treat scar tissue have been described, such as surgical excision and resuturing, Z-plasty, W-plasty, and geometric broken line suturing. However, all these revision techniques are adopted in selected cases and may achieve suboptimal results.

Skin ulcer can be extremely challenging to approach. Treatment is typically to avoid ulcer infection, remove any excess discharge, maintain a moist wound environment, control the edema, and ease pain caused by nerve and tissue damage. Although all these procedures are followed, ulcers do not frequently re-epithelize, showing a tendency to become chronic. This tendency is caused by several factors, such as anatomic location and patient condition, concomitant pathologies, drug assumption, previous local therapy, and smoking.

This article describes how autologous fat grafting regenerative properties can be applied in scar tissue and ulcer treatment.

TREATMENT GOALS AND PLANNED OUTCOMES

In scar tissue–related problems and chronic ulcer, a proper assessment and adequate counseling before treatment are fundamental so that the patient is informed about the expected outcome. We indicate scar treatment with autologous fat graft in cases of wide nonlinear scars, in tension areas, or in cases of depressed scars. We propose treatment only on mature scars, giving a minimum threshold of 2 years from the causative factor. In all these clinical conditions surgical revision could result in a new and even worse scar than the previous one, whereas autologous fat graft and its regenerative properties are the more innovative surgical option.

Patients should be informed that their scars cannot disappear and the purpose of the procedure is local amelioration. Treatment goals include an increase in softness, flexibility, and extensibility of treated tissue with a release of scar bundles in superficial and deep planes, which can favor an improvement of mobility of the body district involved.

In the facial district treatment allows a partial restoration of facial mimic (kiss, smile, and other mood expression) because of the release of scar retraction. In cases of great skin depression a refill of these volume deficits can be obtained. In addition, pain symptoms related to scars can be reduced.

Patients should be informed that, after the first procedure, the result can be partial because of permanence of scar tissue retraction and depression. To obtain a satisfactory final result several procedures may be needed especially in more severe cases. Each procedure should be performed at least 3 months after the previous one to let fat graft manifest its regenerative effects. In some cases, scar release and local improvement can achieve a reduction of skin tension, allowing a secondary surgical scar revision.

In chronic ulcer, our experience suggests fat grafting effectiveness in treating areas of small to moderate size, not exceeding 3.5 cm^2. For bigger ulcer a combined approach with advanced dressing is needed. We treat posttraumatic ulcers that do not respond to advanced dressings. We are currently widening our indication to ulcers of different causes.

The aim of the treatment is to enhance the wound healing process relying on fat graft regenerative effects, obtaining a complete recovery of tissue integrity. Final re-epithelization can be obtained after more than a single procedure. As for scar treatment, pain symptoms related to ulcers, which highly affect patients' quality of life, can be improved.