Mesenchymal Stem Cells and Stromal Vascular Fraction for Hair Loss
Current Status

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KEYWORDS

• Adipose-derived stem cells • Hair loss • Androgenic alopecia • Stromal vascular fraction
• Regenerative cell therapy

KEY POINTS

- Regenerative therapy has an expanding role in the treatment of various forms of alopecia.
- A review of the literature confirms the beneficial results of various cell therapies for such conditions as male and female androgenic alopecia and scarring alopecia.
- Adipose tissue allows for safe and easy access to regenerative cells and stromal vascular fraction and appears to be a low-risk harvesting procedure.
- The authors' experience shows positive indications for using purified fat and hair transplantation in certain hair loss conditions.

INTRODUCTION

Mesenchymal stromal cells (MSCs) are undifferentiated cells that are able to renew their population and become differentiated to produce all specialized cell types of the tissue from which they originate.[1,2] Apart from traditionally being isolated from the bone marrow, the first tissue from which stem cells were identified, MSCs have also been found in many other tissues, such as liver, cord blood, placenta, dental pulp, and adipose tissue.[2] Adipose-derived stromal cells (ADSCs) are easier to isolate and provide a higher number of stromal cells than bone marrow tissue.[3]

The main roles of MSCs are to maintain the stem cell niche, facilitate recovery after injury, and ensure homeostasis of organs and tissues.[4] ADSCs can differentiate into mesenchymal lineage cells but also secrete various cytokines and growth factors that have paracrine effects on surrounding cells: vascular endothelial growth factor (VEGF), hepatocyte growth factor (HGF), insulin-like growth factor (IGF), platelet-derived growth factors (PDGF), and others.[5,6] These factors seem to play a role in neovascularization, which is important in a variety of hair loss conditions.

Androgenic alopecia (AGA) remains the main cause of hair loss in both men and women.[7,8] The 2 medicines currently approved by the Food and Drug Administration for the treatment of AGA are finasteride (for men only) and minoxidil. Both carry untoward side effects and lack consistent efficacy.[9,10]

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THE AUTHORS' RATIONALE

In the authors' earliest work with adipose tissue, they saw its distinct potential as an adjunct in hair transplantation surgery in the reconstruction of scalp scars. The growth of hair follicles transplanted into scars is usually lower than in normal scalp because of a thick collagen pattern and compromised blood supply in scar tissue. The authors' method is to pretreat scalp scars with autologous adipose tissue injections and then perform the hair transplant procedure 3 months later. Early on in their work, the authors were encouraged by the finding that during the creation of recipient sites into which the hair grafts would be inserted, the scar tissue would usually bleed more than untreated scar tissue, a benefit of the angiogenesis that took place due to the addition of adipose tissue. This pretransplant fat transfer technique was applied successfully in treating scars of a variety of causes: burns, chemical injury, surgical injury, physical trauma, and congenital scar conditions (**Fig. 1**).

Based on the authors' observed benefits in these scar tissue cases, they decided to apply fat grafting for the treatment of AGA. Theoretically, adipose tissue could have the following beneficial effects.

Anti-inflammatory Effect

Many scarring and nonscarring types of alopecia have some degree of underlying inflammation. Mild perifollicular fibrosis and infiltrates have also been found in patients with androgenetic alopecia.[11] ADSCs may prevent further inflammation and possible damage to hair follicles through the enhancement of antioxidative and anti-inflammatory mechanisms. Their anti-inflammatory and immunomodulatory properties are reflected in their potential to inhibit maturation and production of cytokines and to impair the cytotoxic potential of natural killer cells and T lymphocytes.[12] Furthermore, ADSCs are able to inhibit the proliferation of B cells and their capacity to produce antibodies.[12]

Antiandrogen Effect

Areas affected with hair loss have higher levels of dihydrotestosterone (DHT), an androgen that causes hair loss. Finasteride decreases levels of

Fig. 1. A patient whose chemical injury in the temporal areas was pretreated with fat injections and then 3 months later underwent a hair transplant procedure.