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Autologous fibroblast therapy of the scar: A preclinical report

Surgical revision, dermabrasion, and laser therapy have been developed to improve scar over the past years. However, they were often associated with undesirable side effects such as erythema and hyperpigmentation. These side effects can be circumvented by autologous fibroblast injection, which provides a better control of the number of cells delivered and the depth of their placement. In this report, we describe a 31-year-old man presented with a traumatic forehead scar treated by autologous fibroblasts therapy. During 12 months of clinical follow-up, improvement on the color and the depth of the scar on patient’s forehead was observed.

A 31-year-old man presented with a traumatic forehead scar measuring 0.3 × 6 cm (Figure 1A). He was injured by a broken glass bottle and the wound on his forehead was closed the same day with eight stitches (nylon 5.0). The stitches were removed after 5 days and the patient came to Dr. Mainz Clinic the next day. Results of a physical examination revealed that the lesion was erythematous with irregular borders and palpation detected the lesion to be of fibroelastic consistency. After obtaining informed consent, the patient was included in the Institutional Research Board-approved autologous fibroblast transplantation therapy. In brief, the patient underwent a 4-mm posterior-auricular punch skin biopsy. The skin sample was placed in a cell culture medium at 4 °C and sent to the Maria Von Med-Biotechnology Co., laboratory by following good tissue practices (GTPs). The skin sample was cut into small pieces and incubated overnight with medium containing dispase and collagenase at 37 °C. The next day, isolated fibroblasts were cultured and multiplied over 8 weeks to produce 10^7 cells. The patient was given fibroblast injections 8 weeks after his first visit to the clinic and a clinical picture before administering the first injection was taken (Figure 1B). Two cycles of live fibroblast application were performed with an interval of 3 months. Each cycle consisted of three weekly applications of 10^7 live fibroblasts in 3 mL of Ringer’s solution. Each application consisted of 10–15 30-G needle injections with a distance of 0.1–0.2 mm between them and with a cell suspension of 0.1–0.2 mL in each injection. No adverse effects were observed during 12 months of clinical follow-up. Improvement in the color and the depth of the scar on patient’s forehead was observed (Figure 1C).

Various techniques for scar treatment have been developed over the past years (e.g., surgical revision, dermabrasion, and laser therapy). Although some of these techniques were helpful in improving the scar, they were often associated with undesirable side effects such as erythema and hyperpigmentation. These side effects can be circumvented by autologous fibroblast injection, which provides a better control of the number of cells delivered and the depth of their placement. Our pilot study suggested that autologous fibroblast therapy may be an alternative therapy for providing a safer and more effective way to minimize the undesirable hypertrophic scar formation.

Results of numerous studies have shown that injection of fibroblasts increases collagen formation, thereby increasing the thickness and density of dermal collagen without inducing inflammatory response. Most importantly, there have been no reports showing that intradermal injection of autologous fibroblasts can lead to keloid scarring or hypertrophic scarring. These results suggested that proliferation and collagen production of injected fibroblasts followed a negatively regulated cell–cell and cell–matrix contact pathways.

Injection of cultured autologous fibroblasts has been applied in various treatments, such as wound healing in severely burned patients, vocal fold scars, and plastic surgery. For severe burns, subcutaneous injection of fibroblasts at the boundaries of surface accelerated healing and the therapy was effective through lessening the scar of a burn and enhancing epithelialization. For vocal fold scars, multiple injections of autologous fibroblasts into the lamina propria were well tolerated and the mucosal wave grade improved, and sustained improvements through 12 months were seen. For performing plastic surgery, injections of autologous fibroblast were safe and effective to produce improvements in rhytids, acne scars, and other dermal defects.

In summary, autologous fibroblast injection can be considered as an alternative and useful approach for minimizing and avoiding hypertrophic scar formation. Higher numbers of fibroblasts were shown to offer better improvement rates in wound healing. However, further studies with different doses of injected fibroblasts and larger population are required.

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Figure 1 (A) A 31-year-old man with a deep scar on his forehead. (B) Clinical picture before the first injection. (C) Scar repair after autologous fibroblast therapy.