

COMPARATIVE EFFECTIVENESS OF REDERMALIZATION, TRADITIONAL, AND COMBINED THERAPY IN THE TREATMENT OF POSTOPERATIVE FACIAL SCARS

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Abstract

Postoperative facial scars remain a major reconstructive and aesthetic concern because pathological scar formation may negatively affect facial appearance, tissue elasticity, psychological well-being, and social adaptation. Modern scar management increasingly focuses on regenerative therapeutic approaches capable of improving tissue remodeling and restoring normal dermal structure. This study investigates the comparative effectiveness of redermalization therapy, traditional treatment methods, and combined therapeutic approaches in the management of postoperative facial scars. Particular attention is given to scar thickness, vascularity, elasticity, pigmentation, collagen remodeling, inflammatory activity, and patient satisfaction during different stages of scar maturation. The findings demonstrate that combined therapeutic protocols integrating regenerative and conventional methods provide superior clinical and aesthetic outcomes compared with isolated treatment strategies. Redermalization therapy significantly improves tissue hydration, microcirculation, and collagen organization, while combined approaches demonstrate enhanced effectiveness in reducing fibrosis and accelerating physiological scar remodeling. Postoperative facial scar correction remains one of the most important challenges in reconstructive and aesthetic medicine because pathological scar formation may significantly affect cosmetic appearance, skin mobility, emotional state, and social adaptation. Contemporary therapeutic strategies increasingly combine regenerative technologies with conventional scar management methods to improve tissue remodeling and accelerate physiological healing processes. This study presents an expanded comparative evaluation of redermalization therapy, traditional scar treatment, and combined therapeutic protocols in patients with postoperative facial scars. Particular emphasis is placed on structural remodeling of connective tissue, restoration of dermal hydration, vascular stabilization, collagen reorganization, reduction of inflammatory activity, and improvement of long-term aesthetic outcomes. The findings demonstrate that regenerative approaches positively influence tissue metabolism and microcirculatory function, while combined therapeutic strategies provide the most effective correction of fibrotic deformities and pathological remodeling. Integrated treatment protocols significantly improve scar elasticity, reduce fibrosis intensity, normalize dermal architecture, and enhance patient satisfaction during postoperative rehabilitation.

Keywords: Postoperative facial scars, redermalization therapy, scar remodeling, hypertrophic scars, reconstructive surgery, regenerative medicine, collagen remodeling, scar treatment, aesthetic rehabilitation, combined therapy

1. Introduction

Scar formation represents a natural reparative response following surgical intervention or tissue injury; however, abnormal remodeling processes may result in hypertrophic, rigid, pigmented, or aesthetically unfavorable scar tissue. Facial postoperative scars are of particular clinical importance because even minor structural abnormalities may significantly influence facial symmetry, expression, emotional health, and quality of life. The biological process of scar maturation involves inflammation, angiogenesis, fibroblast activation, collagen synthesis, and extracellular matrix remodeling. Disturbances in these mechanisms may lead to excessive fibrosis, prolonged vascular activity, tissue rigidity, and pathological collagen accumulation. Traditional scar treatment methods including silicone therapy, corticosteroid injections, pressure therapy, and physiotherapeutic procedures have demonstrated variable effectiveness in controlling abnormal scar development. In recent years, regenerative medicine approaches such as redermalization therapy have attracted growing attention because of their ability to stimulate physiological tissue repair, improve microcirculation, enhance hydration, and normalize collagen organization. Redermalization therapy typically involves administration of biologically active compounds aimed at restoring dermal metabolism and supporting regenerative cellular processes. Combining regenerative interventions with conventional scar management techniques may provide synergistic therapeutic effects and improve long-term aesthetic outcomes. Comparative evaluation of these treatment approaches is therefore essential for optimizing individualized postoperative rehabilitation strategies in reconstructive and aesthetic facial surgery. Formation of postoperative scar tissue represents a natural reparative process initiated after surgical injury and involving inflammation, fibroblast activation, angiogenesis, extracellular matrix synthesis, and gradual tissue remodeling. Under physiological conditions these mechanisms result in formation of stable and flexible scar tissue with acceptable cosmetic characteristics. However, disturbances in reparative dynamics may lead to pathological fibrosis characterized by excessive collagen accumulation, prolonged vascular activity, tissue rigidity, pigmentation changes, and abnormal dermal architecture. Facial scars possess particular clinical significance because even minor postoperative deformities may negatively influence facial symmetry, expression, psychological well-being, and quality of life. Traditional therapeutic approaches including silicone-based treatment, corticosteroid administration, physiotherapy, pressure modulation, and anti-inflammatory management have demonstrated partial effectiveness in controlling abnormal scar formation. Nevertheless, many patients continue to experience persistent fibrosis, vascular irregularities, tissue stiffness, and unsatisfactory aesthetic outcomes despite conventional treatment. Advances in regenerative medicine have introduced redermalization therapy as a promising method aimed at restoring physiological tissue metabolism, improving dermal hydration, stimulating microcirculation, and optimizing collagen remodeling. Regenerative intradermal therapy promotes restoration of extracellular matrix balance and enhances cellular reparative activity within scar tissue. Combining regenerative treatment with traditional therapeutic methods may provide synergistic biological effects capable of improving scar maturation and reducing pathological fibrosis more effectively than isolated interventions. Understanding the comparative effectiveness of these therapeutic approaches is essential for developing individualized rehabilitation strategies in reconstructive and aesthetic facial surgery.

2. Materials and Methods

This study was conducted using a retrospective comparative clinical analysis of patients presenting with postoperative facial scars following reconstructive, maxillofacial, and aesthetic surgical procedures between 2020 and 2025. Patients were divided into three therapeutic groups according to treatment protocol. The first group received traditional scar therapy consisting of silicone-based treatment, corticosteroid administration, topical anti-inflammatory agents, and physiotherapeutic procedures. The second group underwent redermalization therapy involving regenerative intradermal treatment aimed at improving tissue metabolism, hydration, and collagen remodeling. The third group received combined therapy integrating both regenerative and traditional therapeutic approaches. Clinical evaluation included assessment of scar thickness, pigmentation, vascularity, elasticity, tissue density, pain, itching, and overall cosmetic appearance. Instrumental assessment was performed using ultrasound dermosonography and standardized scar evaluation scales including POSAS. Additional parameters included duration of scar maturation, presence of inflammatory

complications, and patient satisfaction during follow-up. Statistical analysis was conducted to compare therapeutic effectiveness among the three treatment groups and determine correlations between treatment modality and scar remodeling outcomes.

3. Results

The comparative analysis demonstrated significant differences in scar remodeling outcomes among the therapeutic groups. Patients receiving traditional treatment showed moderate improvement in scar thickness, pigmentation, and inflammatory symptoms; however, residual tissue rigidity and vascular irregularities frequently persisted during long-term follow-up. The redermalization therapy group demonstrated greater improvement in tissue hydration, elasticity, microcirculation, and collagen organization compared with conventional treatment alone. Ultrasound dermosonography revealed reduction in scar thickness, improved dermal homogeneity, and decreased vascular activity following regenerative intervention. The combined therapy group demonstrated the most pronounced clinical improvement, including accelerated scar maturation, reduction of fibrotic density, normalization of tissue structure, and improved cosmetic appearance. POSAS scores were significantly lower in the combined treatment group, reflecting better patient satisfaction and superior clinical assessment of scar quality. Patients receiving integrated therapy also reported reduced discomfort, itching, and stiffness during postoperative rehabilitation. Longitudinal monitoring demonstrated more stable long-term remodeling outcomes and lower recurrence of hypertrophic changes in patients treated with combined therapeutic protocols. Comparative clinical and instrumental evaluation demonstrated significant differences in scar remodeling dynamics among patients receiving traditional treatment, regenerative therapy, and combined therapeutic protocols. Individuals treated with conventional methods showed moderate reduction in inflammatory symptoms and partial improvement in pigmentation and scar thickness; however, persistent dermal rigidity, vascular instability, and connective tissue heterogeneity frequently remained evident during long-term follow-up. Patients undergoing redermalization therapy demonstrated more pronounced improvement in tissue hydration, elasticity, dermal density, and microcirculatory function compared with traditional therapy alone. Ultrasound dermosonographic examination revealed progressive normalization of collagen architecture, reduction in fibrotic tissue density, and stabilization of vascular activity following regenerative treatment. The most significant therapeutic improvements were observed in patients receiving combined treatment protocols integrating regenerative and conventional therapeutic methods. This group demonstrated accelerated scar maturation, greater reduction in hypertrophic tissue proliferation, improved dermal homogeneity, and enhanced elasticity of scar tissue. Instrumental monitoring confirmed decreased inflammatory activity and more physiological connective tissue remodeling during rehabilitation. POSAS evaluation also demonstrated substantially lower scar severity scores and higher patient satisfaction in the combined therapy group. Patients receiving integrated treatment reported reduced itching, pain, stiffness, and cosmetic discomfort during postoperative recovery. Long-term follow-up further demonstrated more stable remodeling outcomes and lower frequency of recurrent hypertrophic scar transformation among individuals treated with combined therapeutic approaches.

4. Discussion

The findings confirm that regenerative and combined therapeutic approaches provide substantial advantages in the management of postoperative facial scars compared with conventional treatment alone. Scar remodeling is a biologically complex process influenced by inflammatory regulation, fibroblast activity, collagen turnover, vascular stability, and tissue metabolism. Traditional therapeutic methods primarily target suppression of excessive fibrosis and inflammation, while regenerative interventions additionally stimulate physiological tissue repair and restoration of dermal homeostasis. Redermalization therapy appears to improve microcirculation, cellular metabolism, and extracellular matrix organization, thereby promoting more balanced collagen remodeling and improved scar elasticity. The superior outcomes observed in the combined therapy group likely result from synergistic interaction between anti-inflammatory, regenerative, and structural remodeling mechanisms. Instrumental evaluation through ultrasound dermosonography confirmed progressive normalization of scar architecture and reduction of fibrotic activity following integrated treatment. These findings emphasize the importance of individualized multimodal rehabilitation strategies in

reconstructive and aesthetic facial surgery. Early initiation of regenerative therapy during active remodeling phases may further improve long-term outcomes and reduce risk of pathological fibrosis. Contemporary scar management increasingly relies on combined protocols integrating regenerative medicine, pharmacological modulation, physiotherapy, and instrumental monitoring to optimize both functional and cosmetic recovery. Multidisciplinary cooperation among reconstructive surgeons, dermatologists, rehabilitation specialists, and aesthetic medicine professionals remains essential for achieving maximal therapeutic effectiveness. The findings confirm the important role of regenerative medicine technologies in improving postoperative facial scar rehabilitation and optimizing connective tissue remodeling. Scar maturation is regulated by highly complex biological mechanisms involving inflammatory mediators, fibroblast proliferation, collagen synthesis, angiogenesis, extracellular matrix turnover, and tissue metabolism. Conventional therapeutic approaches mainly focus on suppressing inflammation and controlling excessive fibrosis, whereas regenerative interventions additionally stimulate physiological reparative pathways and restoration of dermal homeostasis. Redermalization therapy appears to enhance microvascular circulation, improve oxygen and nutrient delivery, normalize extracellular matrix composition, and promote balanced collagen organization within scar tissue. The superior effectiveness observed in combined therapeutic protocols likely results from synergistic interaction between regenerative stimulation and anti-fibrotic modulation. Instrumental imaging confirmed gradual restoration of dermal architecture and reduction of pathological connective tissue density during integrated rehabilitation. The study also highlights the importance of early therapeutic intervention during active remodeling phases because prolonged inflammatory activity and delayed correction may contribute to irreversible fibrotic changes. Contemporary reconstructive and aesthetic medicine increasingly emphasizes individualized multimodal treatment strategies combining regenerative procedures, pharmacological modulation, physiotherapy, and objective instrumental monitoring to maximize functional and cosmetic outcomes. Effective management of postoperative facial scars therefore requires coordinated multidisciplinary cooperation involving reconstructive surgeons, dermatologists, rehabilitation specialists, and aesthetic medicine professionals.

5. Conclusion

Redermalization therapy and combined therapeutic protocols demonstrate significant effectiveness in improving postoperative facial scar remodeling and aesthetic outcomes. Regenerative interventions contribute to normalization of tissue metabolism, enhancement of microcirculation, improved collagen organization, and reduction of fibrotic activity. Combined therapy integrating regenerative and traditional treatment methods provides superior clinical results compared with isolated therapeutic approaches, leading to accelerated scar maturation, improved elasticity, reduced vascularity, and greater patient satisfaction. Objective instrumental assessment confirms the beneficial structural changes occurring during integrated rehabilitation. Continued advancement of regenerative medicine technologies and individualized multimodal treatment strategies remains essential for optimizing management of postoperative facial scars and improving long-term reconstructive outcomes. Regenerative redermalization therapy and combined multimodal treatment protocols demonstrate substantial effectiveness in improving postoperative facial scar remodeling and aesthetic rehabilitation outcomes. Restoration of tissue metabolism, enhancement of microcirculation, normalization of collagen organization, and reduction of fibrotic activity contribute to improved scar elasticity and physiological maturation. Combined therapeutic approaches integrating regenerative and conventional interventions provide superior clinical and cosmetic results compared with isolated traditional treatment methods. Objective instrumental assessment confirms progressive normalization of dermal structure and reduction of pathological remodeling during integrated rehabilitation. Continued development of regenerative technologies and individualized therapeutic protocols remains essential for optimizing postoperative scar management and improving long-term reconstructive outcomes in facial surgery.

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