

Effectiveness of a Combined Technique Using P-Shaped Flaps and Full-Thickness Skin Grafts for Correction of Post-Burn Scar Deformities of the Dorsal Hand Surface in Children

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Abstract Objective: To evaluate the effectiveness of a combined technique using P-shaped palmar flaps and full-thickness skin grafts for correction of post-burn scar deformities of the dorsal surface of the hand in children. **Methods:** A total of 88 pediatric patients (26 girls, 29.5%; 62 boys, 70.5%) aged 7–16 years were treated at the Plastic Surgery Department of the Andijan Children’s Multidisciplinary Medical Center between 2015 and 2025. Patients were divided into two groups: the main group (n=43) underwent correction using the proposed technique with P-shaped palmar flaps combined with full-thickness grafts, while the control group (n=45) underwent conventional split-thickness grafting. Evaluation criteria included flap viability, scar morphology, transcutaneous oxygen partial pressure (PtcO₂), functional outcome, and cosmetic results. **Results:** Good or satisfactory long-term outcomes were achieved in 92.9% of the main group compared with 85.4% in the control group. Complications were lower in the main group (5.1% partial flap necrosis) compared with the control group (14.6% unsatisfactory results, including recurrence). Subjective evaluation revealed improved self-esteem and social adaptation in most patients. **Conclusion:** The combined technique with P-shaped flaps and full-thickness grafts provides superior functional and cosmetic outcomes compared with traditional split-thickness grafting, with fewer complications and better scar elasticity.

Keywords Post-burn hand deformity, Scar contracture, Syndactyly, Autograft, Full-thickness skin graft, P-shaped flap, Pediatric burn surgery

1. Introduction

Burn injuries remain one of the most common causes of acquired deformities of the upper extremities. In extensive burns involving more than 30% of the body surface, hand burns are almost always present. Hand burns account for 5.1–6.5% of all burn injuries, and deformities develop in 40–50% of patients, leading to disability in 22.5% of cases. Restoration of hand function is therefore one of the most urgent and complex problems in burn rehabilitation.

Due to the complex anatomical and functional features of the hand, post-burn sequelae often include flexion contractures of the fingers, damage to the extensor tendon apparatus, scar deformities of the dorsal surface, and syndactyly. These may be complicated by extensor joint contractures and frequently result in unsatisfactory outcomes. Traditional surgical techniques often lead to recurrence.

Controversy remains regarding the optimal timing of surgery, the choice of graft thickness, the feasibility of simultaneous correction of multiple deformities, and the specific aspects of dorsal hand reconstruction in the presence of flexion contractures. To address these challenges, we propose a combined surgical technique designed to improve functional and cosmetic outcomes while reducing complications.

2. Aim of the Study

To evaluate the effectiveness of a combined surgical technique using P-shaped palmar flaps and full-thickness skin grafts for correction of post-burn scar deformities of the dorsal hand surface in children, compared with conventional split-thickness grafting.

3. Materials and Methods

Study design and setting: A prospective comparative study was conducted in the Plastic Surgery Department of

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the Andijan Children's Multidisciplinary Medical Center from 2015 to 2025.

Patients: 88 pediatric patients aged 7–16 years with post-burn scar deformities of the dorsal surface of the hand were included. There were 26 girls (29.5%) and 62 boys (70.5%).

Inclusion criteria: children with post-burn scar contractures and/or syndactyly of the dorsal surface of the hand.

Exclusion criteria: patients with active infection, systemic diseases contraindicating surgery, severe circulatory impairment in the hand, or previous unsuccessful reconstructive surgery of the same area.

Groups:

- **Main group (n=43):** treated with the proposed technique (P-shaped palmar flaps + full-thickness skin grafts).
- **Control group (n=45):** treated with conventional split-thickness skin grafts.

Preoperative evaluation: Complete blood count, urinalysis, ECG, blood biochemistry, coagulation profile, RW, HBs-antigen testing.

Evaluation criteria:

- Type of scar (normotrophic, atrophic, hypertrophic).
- Scar and graft surface temperature dynamics.
- Transcutaneous oxygen partial pressure (PtcO₂) and O₂ consumption (polarography, PU-1 device).
- Postoperative complications.
- Functional and cosmetic outcomes (good, satisfactory, unsatisfactory).
- Subjective patient assessment of appearance and psychological comfort.

Surgical technique:

- Radical excision of scars from the dorsum of the hand and web spaces.
- Harvesting of P-shaped palmar flaps from unaffected interdigital areas.
- Defects covered with full-thickness skin grafts from the lateral thigh.
- Donor sites closed with interrupted sutures.

Postoperative care:

- First dressing on days 5–7.
- Hematomas drained if present.
- Biostimulants, vitamins, antibiotics, and local magnetic therapy (from day 3).

4. Results

Flap viability and oxygenation:

- O₂ consumption: main group 2.16 ± 0.14 nmol O₂/min/mg protein; control group 2.27 ± 0.43 ($p > 0.05$).
- PtcO₂: normotrophic scars – 86.7 mmHg; atrophic – 82 mmHg; hypertrophic – 93.1 mmHg.

Temperature monitoring:

- Normotrophic scars: stable normalization by day 7.

- Atrophic scars: delayed healing, fragile tissue.
- Hypertrophic scars: delayed temperature normalization (up to day 10), prolonged edema.

Clinical outcomes:

- Main group (n=43): 39 patients (92.9%) had good/satisfactory results; 3 (7.1%) unsatisfactory.
- Control group (n=45): 35 patients (85.4%) good/satisfactory; 6 (14.6%) unsatisfactory.
- Complications: main group – 2 cases (5.1%) partial flap necrosis due to hematoma; control group – higher recurrence and graft contracture.

Subjective outcomes:

Patients reported improved appearance, emotional well-being, and confidence in school, work, and social activities.

5. Conclusions

The combined surgical technique using P-shaped palmar flaps with full-thickness grafts provides improved cosmetic and functional results compared with conventional split-thickness grafting. The method ensures softer and more elastic scars, better integration with surrounding tissues, fewer complications, and enhanced patient satisfaction. This approach can be recommended as an effective method for the correction of post-burn scar deformities of the dorsal surface of the hand in children.

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