Reconstruction of Severe Burn Scar Contracture Deformity of the Extremities Using Split-Thickness Skin Grafts

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ABSTRACT

Contractures of the extremities after severe burns, particularly in the joint areas, can make daily life more challenging for patients. The functional restrictions caused by scar tissue and joints usually necessitate surgical interventions, with the most effective surgical options so far debatable. Here, we analyzed outcomes of split-thickness skin grafts in 7 pediatric patients seen at our center with regard to regain of function, complication rates, recurrence, and range of movement. The burn scars were located in the knee (5 patients) and the elbow (2 patients). After split-thickness skin grafts and physical therapy, all patients showed improved quality of life.

KEY WORDS: *Functional limitations, Joint contracture, Scar tissue*

INTRODUCTION

The management of patients with burn injuries presents distinct challenges in both the acute and delayed context. At the most basic level, the focus after burn injury is on maintaining patent airways, providing proper breathing, and improving circulation. Early burn wound excision and repair are undertaken once hemodynamic stability has been obtained. Traditionally, this entails removing devitalized tissue and covering the tissue with split-thickness skin grafts.[1] After debridement, a viable bed of vascularized tissue, such as granulation tissue, muscle, subcutaneous tissue, periosteum, or paratenon, is frequently present on which to put a split-thickness skin graft. Other options that can be considered for contracture management are local flaps, free flaps, and full-thickness skin flaps.[2,3]

Severe burn scar contractures of the extremities, particularly in the joint areas, entail not only esthetic issues but also functional limits, which can make daily life more challenging. The functional restrictions caused by scar tissue in joints usually necessitate surgical interventions.[4] In clinical practice, skin grafts and flaps are still the most often used surgical procedures. However, according to a recent systematic analysis, the most effective surgical approach for resolving joint burn scar contracture remains unclear.[5] In this study, we analyzed outcomes of split-thickness skin grafts in pediatric patients seen at our center with regard to regain of function, complication rates, recurrence, and range of movement.

MATERIALS AND METHODS

All data were analyzed anonymously and according to the principles in the 1975 Declaration of Helsinki, revised in 2013. Written informed consent was obtained from patients who met the inclusion criteria.

Pediatric patients with large joint (including knee and elbow) burn scar contracture were analyzed retrospectively; we included those who were treated with split-thickness skin grafts (n = 7 patients). Patients with joint contracture for any other reason and treated with any other technique, including flaps, full-thickness skin grafts, and injections, were excluded. Data were collected from medical records of patients seen from 2017 to 2022 at Kocaeli University Hospital (Kocaeli, Turkey). We reviewed patient sex, age, complications, contracture location, and burn type.

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All patients were given general anesthesia and preoperative antibiotics according to local guidelines, followed by a transverse incision at the joint line level, gentle extension of the joint up to the full range of motion, and proper hemostasis. The skin transplant was extracted from the lateral portion of the thigh (donor site). The graft was secured with 3/0 silk and a tie-over, and the donor site was covered with Vaseline gauze and a pressure bandage. Splints were applied to operated joints to secure graft attachment. Splints remained in place for various periods depending on the mobility of the joint or clinical evidence of a tendency for the contracture to recur. After splints were removed, patients underwent a 3-month postoperative physical therapy regimen. We included follow-up periods at 3 and 6 months, when range of movements of all patients was measured postoperatively. Follow-up data included whether recurrence or other complications (infections, elimination) occurred.

RESULTS

Seven patients with total or partial contractures were treated with split-thickness skin grafts only. Among the patients, 3 were boys and 4 were girls, and mean follow-up was 12 months after surgery. The mean age of the patients was 5 years (range, 3-10 years). Three patients had upper extremity contractures, and 4 patients had lower extremity contractures. The burn scars were located in the knee (5 patients) and the elbow (2 patients). The patients had sustained electrical burns (1 case) and flame burns (6 cases). There were no complications (infection, elimination) observed in any patient. Only 2 patients had contractures after operation that did not require reoperation. Both of these patients did not want surgery again because their life quality was not affected. After surgery, all patients showed improved quality of life and ability to better perform daily routines.

Patient example

A 7-year-old female patient who had been receiving follow-up at an external center for burns presented to our center. On physical examination, flexion contracture was found in the right knee. Extension movement was minimal, and there was loss of function (Figure 1). After the contracture was surgically opened, it was repaired with a split-thickness skin graft (Figure 2). No recurrence was observed at postoperative year 5, and no loss of function was observed (Figure 3).

FIGURE 1. Preoperative Image of Patient, Showing Right Knee Flexor Contracture

FIGURE 2. Perioperative Image of Patient, Showing Right Knee Transverse Excision

FIGURE 3. Postoperative Image of Patient at 5-Year Follow-Up, With Patient Having Full Function Range of Movement of Knee

DISCUSSION

Scar contractures are common after joint burns, resulting in functional limits and esthetic flaws in patients. Joint burn scar contracture can theoretically be prevented with proper wound care, early escharectomy, skin grafting, and early physical therapy.[6] The basic goal of reconstruction is to remove and replace any scars. To begin, the entire scar must be excised, the constricted tissue, including the scar's edges, must be removed, and all tissue tension must be released completely. These steps may cause extreme defects. Second, the scar that has been released must be reconstructed.[7] Reconstruction can frequently result in insufficient scar tissue release, which is the primary cause of recontraction. Reconstructive surgeons face a problem when it comes to reconstructing large defects after scar excision. Donor site selection is often limited by burn scars and scars from past operations. Even in these types of situations, split-thickness skin grafts are an option, but there is still high recontraction risk.[8] This is consistent with the discovery that the rate of contracture of split-thickness skin grafts varies directly with the skin laxity of the given site; the most common sites are the neck, eyelids, dorm of the hand, and flexor surfaces of joints.[9]

In such cases, local flaps or free flaps are another option. In our center, we prefer to use split-thickness skin grafts for contracture in younger patients. Flap surgery is not preferred among young patients because it is more difficult to follow-up compared with adult patients. In addition, flap surgery is much more difficult when we consider large joint defects. Nevertheless, there are some important considerations for the result to be successful. First, the defect should be properly measured, and the skin graft should be the same size as the defect. The first incision should be made horizontally. When the horizontal incision is done, we can release a contraction of the large joint simultaneously. If the contraction of the joint is not completely removed, recontraction may occur. To

avoid this situation, after the contraction is released, the tension must be completely relieved by the extending joint. Another important point for the surgeon to consider is care when dissecting around the joint capsule because of the main arteries, veins, and nerves related with knee and elbow joints.

After the split-thickness skin graft is adapted, the skin graft should be closed with Vaseline gauze. Dressing of the graft should be done properly. Postoperative splint application reduces the risk of contracture in the future. We applied splints to the patients in a neutral position (0 degrees) for 10 days, with patients then referred to physical therapy to prevent joint immobility. Pressure suits and silicone gel should be applied to prevent hypertrophic scarring. We also recommend a personalized pressure suit to all of our patients after postoperative day 10.

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