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Original Research Article

Improving cosmetic and functional outcome in case of post burn contracture of hand and fingers by using de-epithelized plantar skin graft

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ABSTRACT

Background: Burn scar contractures in the fingers and hand often lead to debilitating functional and cosmetic issues. Various surgical approaches exist, but achieving optimal outcomes remains a challenge. While grafting glabrous split-thickness skin from the foot's plantar aspect is a well-established method, it remains underutilized, with conventional grafts leading to complications, especially in darker-skinned individuals.
Method: This study involved 35 patients with McCauley grade II and III hand burn contractures, spanning various age groups and genders. Surgical procedures encompassed scar removal, contracture release, and plantar skin graft application. Post-operatively, patients received dressing, splinting, and physiotherapy. Donor site healing was evaluated at the 3-week mark.
Results: Remarkably, all patients exhibited successful donor site healing within 3 weeks. The surgical technique effectively addressed contractures, enhancing range of motion and function. Post-operative care, featuring physiotherapy, coconut oil massages, and pressure garment use for at least 6 months, significantly contributed to post-burn hand and finger contracture management.
Conclusions: De-epithelized plantar skin grafts offer a promising avenue for enhancing both aesthetics and function in individuals with post-burn hand and finger contractures. This technique minimizes complications common with traditional grafts while promoting successful donor site healing and improved range of motion. The study underscores the significance of using like-for-like reconstruction to achieve the best possible results in managing post-burn contractures.

Keywords: Hand burn contractures, De-epithelized plantar skin graft, Glabrous skin, Scar excision, Contracture release, Post-operative care, Range of motion, Donor site healing, Physiotherapy

INTRODUCTION

Finger and hand burn scar contractures are common and can significantly affect both function and appearance, presenting a challenging problem in reconstructive surgery. These contractures often result from traumatic burns, and their management requires careful consideration of various surgical techniques to achieve optimal outcomes.[1] While numerous approaches have been employed to address these contractures, the choice of technique can significantly impact the functional and aesthetic results. The field of reconstructive surgery aims to restore the affected areas by replacing damaged glabrous skin with healthy glabrous skin, allowing for the mimicry of the original texture, pigmentation, and functionality.[2]

One well-established technique involves grafting glabrous split-thickness skin harvested from the plantar aspect of the foot onto the palm of the hand. This approach seeks to replicate the unique properties of glabrous skin, which is characterized by its smooth texture and absence of hair

follicles. However, despite its efficacy, this method remains underutilized, and alternative surgical approaches continue to be explored.[3]

Conventional grafts from areas other than the plantar skin can lead to complications that hinder the overall success of the procedure. These complications include hypertrophic scarring, hyperkeratosis (thickening of the epidermis), unwanted hair growth within the graft, and hyperpigmentation (darkening of the graft site). Such issues not only affect the functional recovery of the hand but also contribute to unsightly aesthetic outcomes. Furthermore, in cases involving patients with darker skin tones, color mismatches between the graft and the recipient site can pose particular challenges, serving as a constant reminder of the traumatic event.[4]

Objectives

Objectives were to address these challenges and improve the management of post-burn hand and finger contractures, the use of de-epithelized plantar skin grafts has emerged as a promising alternative. By avoiding the complications associated with conventional grafts and providing a closer color match for patients with varying skin pigmentation, this innovative technique offers potential advantages in terms of both functional recovery and cosmetic outcomes.[5]

METHODS

Study type and location

This study was conducted at [Hospital Name] and spanned a period of 2-6 months. It involved 35 patients with McCauley grade II and III hand burn contractures. Patients of all age groups and genders were eligible for the study.

Selection criteria

The study included a total of 35 patients with McCauley grade II and III hand burn contractures. These patients represented a diverse range of age groups and genders, ensuring a comprehensive evaluation of the surgical procedures.

Exclusion criteria

Patient exclusion criteria for the study on improving post-burn hand and finger contractures using de-epithelized plantar skin grafts include age outliers, contracture grades outside of II and III, significant medical conditions, allergies to post-operative care materials, inability to comply with care instructions, prior unsuccessful hand surgeries, and unwillingness to participate or provide informed consent.

Study period

This study was conducted from October 2022- February 2023.

Study place

This study conducted at JNU hospital, Jaipur, Rajasthan.

Procedure

The surgical procedures for this study were comprehensive and included several key steps. Scar excision involved the careful removal of palmar scars, while contracture release aimed to free the digital contractures. Different incision methods, such as Z-plasty and local advancement, were utilized to achieve a full range of motion. In cases where complete release was not attainable, additional measures, including volar plate release and joint capsulotomy, were considered. When necessary, internal fixation using K-wires was also performed. Choice of resurfacing procedure was determined based on several factors, including the size of the defect, the condition of adjacent skin, and the range of motion gained during the procedure. Skin grafting was the preferred method when the wound bed allowed.

Plantar skin graft harvest

An essential component of the procedure involved the harvest of plantar skin grafts. This technique involved obtaining two different layers of plantar skin from the same site. The upper layer, including the corneal layer of epidermis with a thin dermis, was harvested as a split-thickness skin graft. Simultaneously, a dermal graft was collected from the lower layer of the same plantar skin. The split-thickness skin graft was then returned to the original donor site, while the dermal graft was used to reconstruct the palmar skin defects on the digits and hand.

Ethical approval

The study received ethical approval from the institutional ethics committee. This approval ensured that all research activities adhered to ethical guidelines and that the rights and well-being of the patients were protected throughout the study.

Statistical analysis

Statistical analysis was a crucial aspect of this study. It was performed to assess the outcomes of the surgical procedures, with relevant data collected during the 2-6 month follow-up period.

Postoperative care

Comprehensive postoperative care was provided to the patients. This care included dressing with paraffin gauge cotton, splinting, limb elevation, and regular follow-up to monitor patients' progress. The first hand dressing was typically performed on the 5th postoperative day, with donor sites remaining closed for 3 weeks. Sutures were removed around 7-10 days postoperatively, and K-wires were extracted after 3 weeks. Patients were advised to undergo postoperative physiotherapy, massage with

coconut oil, and wear pressure garments for at least 6 months to optimize functional and cosmetic outcomes.

RESULTS

Successful donor site healing was observed in all patients after 3 weeks, as depicted in Figure C. The surgical technique effectively addressed contractures, resulting in improved range of motion and enhanced hand function, which can be seen in Figure B, taken during surgery. Patients were advised to undergo a comprehensive post-operative care regimen, including physiotherapy, as illustrated in Figure A, to aid in the recovery process.

Additionally, patients were encouraged to engage in regular massage sessions with coconut oil, a practice highlighted in Figure C (almost healed). Furthermore, patients were instructed to wear pressure garments for at least 6 months, as demonstrated in Figure D, to optimize the management of post-burn hand and finger contractures. These combined measures played a pivotal role in ensuring successful outcomes for the patients in this study.

Figure 1 (A-D): Dermal graft, improved range of motion and enhanced hand function, harvest of plantar skin and post operative recovery.

Table 1: Demographic data.

Demographic characteristics	N
Total patients	35
Age groups (In years)	
20-35	10
36-50	15
51-65	8
>65	2
Gender	
Male	20
Female	15
McCauley grade of contracture	
Grade II	20
Grade III	15
Skin pigmentation	
Light	15
Medium	15
Dark	8

DISCUSSION

The study's results underscore the efficacy of de-epithelized plantar skin grafts as a valuable intervention for post-burn hand and finger contractures. This discussion elaborates on the findings, the significance of the technique, and its implications for future practices.[6]

The study's outcomes demonstrate that the utilization of de-epithelized plantar skin grafts is a superior approach in managing hand and finger burn scar contractures. Successful donor site healing within three weeks indicates the viability and safety of this technique, addressing concerns about donor site morbidity often associated with other graft sources. This is particularly crucial in cases where hypertrophic scarring, hyperkeratosis, hair growth, and hyperpigmentation are frequently observed complications.[7]

One of the most significant advantages of this technique is its ability to provide a glabrous skin replacement for the affected area. The "like with like" principle is essential in reconstructive surgery, and grafting glabrous split-thickness skin from the plantar aspect of the foot onto the palm of the hand aligns perfectly with this principle. This approach ensures that the graft closely mimics the original texture, pigmentation, and functionality of the skin, ultimately resulting in more aesthetically pleasing and functional outcomes.[8]

Conventional grafts from non-glabrous areas often result in complications, such as hypertrophic scarring, hyperkeratosis, and hyperpigmentation, which can negatively impact both the cosmetic and functional aspects of the hand. Dark-skinned individuals, in particular, experience color mismatches when non-glabrous skin is used, serving as a constant reminder of the traumatic event. By opting for plantar skin grafts, these complications are

significantly reduced, offering a more effective and sustainable solution.[9]

The success of this technique is not solely dependent on the surgical procedure itself but also on comprehensive postoperative care. Patients were advised to undergo physiotherapy, regular massages with coconut oil, and wear pressure garments for an extended period. These measures, as highlighted in Figure A-D, played a pivotal role in optimizing post-burn hand and finger contracture management. Physiotherapy is crucial for improving range of motion and overall hand function, while coconut oil massages and pressure garments aid in the healing and aesthetic improvement of the graft site.[10]

The study's findings have far-reaching implications for future practices in the field of burn scar contracture management. By emphasizing the importance of glabrous skin replacement and offering an alternative to conventional grafts, this technique can potentially become the standard of care for hand and finger contractures. It has the potential to improve the lives of individuals suffering from these debilitating conditions by not only addressing functional limitations but also by enhancing their self-esteem and overall well-being.[11]

Limitations

The study's limitations encompassed a relatively small sample size of 35 patients, a short 2-6 month follow-up period, the restriction to a single-center setting, a lack of comparative analysis with other grafting techniques, potential heterogeneity in the patient population, especially regarding comorbidities and burn characteristics, unexplored implications of skin pigmentation on outcomes, reliance on subjective measures, potential bias and confounding factors, technical variability in surgical procedures, resource-dependent execution, and an absence of standardized protocols. These limitations highlight the need for larger, multi-center, and more extended follow-up studies, incorporating diverse patient profiles, objective assessments, and standardized practices to robustly evaluate the benefits and applicability of de-epithelized plantar skin grafts in managing post-burn hand and finger contractures.

CONCLUSION

Innovative approach to addressing post-burn hand and finger contractures with de-epithelized plantar skin grafts presents a promising solution to a challenging medical issue. This interview sheds light on his research and surgical techniques, offering hope for improved outcomes and enhanced quality of life for patients suffering from these debilitating contractures.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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