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Case Report

Monolayer acellular dermal matrix for reconstruction of face burn: A case report

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ABSTRACT

Introduction: Facial burns constitute a severe medical and psychological challenge, dramatically affecting patients' quality of life. We present an innovative approach involving the use of a monolayer acellular matrix—specifically the INTEGRA® Dermal Regeneration Template Single Layer—to optimize skin grafting outcomes in a facial burn patient.

Case report: The case revolves around a 45-year-old woman suffering a facial burn due to a clothes iron accident. Following escharectomy, dermabrasion, and homologous tissue graft placement, a monolayer acellular dermal matrix was strategically applied to the right malar area. Subsequently, we conducted a reconstruction with partial-thickness grafts. The integration of grafts with the acellular dermal matrix was seamless, absent of complications. The patient's healing process was marked by significant improvement, devoid of infections, bleeding, or any need for graft resection.

Discussion: This case underscores the profound benefits of using a monolayer dermal matrix in facial burn reconstruction. Despite necessitating surgical expertise and meticulous wound preparation, this approach substantially reduced operating room time and improved clinical outcomes. This study illuminates the potential of acellular dermal matrix application in facial burn reconstruction,

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paving the way for further research and clinical advancements in this area.

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Introduction

Facial burns, due to their physical and psychological ramifications, are a significant health concern. They may lead to disfigurement, functional loss, and adverse psychological impacts such as self-consciousness, social isolation, and depression. The repercussions of these burns often extend to a patient's socio-economic standing, inducing dependence on family and society. Additionally, facial burns can lead to complications such as difficulty in breathing, eating, speaking, and long-term issues like infections and contractures.¹ Therefore, techniques to reduce the impact of facial burns are vital.

Patients with extensive deep partial or full-thickness burns often need early excision of necrotic tissue and skin grafting to promote wound healing. However, grafting methods can vary in their outcomes. Wounds treated with split-thickness skin graft (STSG) may contract and distort the surrounding areas, while full-thickness skin grafts (FTSG) generally maintain the recipient site's dimensions, offering improved functionality and aesthetics. A considerable factor affecting these outcomes is the thickness of the transferred dermal component during grafting.²

To mitigate these concerns, acellular dermal matrix (ADM) materials are utilized. ADM, a decellularized biomaterial, is increasingly used in plastic surgery, including severe burn reconstructions. Notably, the INTEGRA® Dermal Regeneration Template Single Layer, a widely-used dermal template, comprises a porous matrix of cross-linked bovine tendon collagen fibers and glycosaminoglycan, along with a polysiloxane layer simulating the epidermis.³

This case report focuses on the utilization of a single layer extracellular matrix Integra to enhance skin grafting outcomes in facial burn cases.

Case report

A 45-year-old woman with a history of juvenile myoclonic epilepsy presented with a facial burn from a clothes iron following a seizure episode with loss of consciousness. Initial management at a local hospital involved pain control and wound coverage. She was transferred to our hospital the next day, where she was found to be hemodynamically stable and conscious. The total burn surface area was determined to be 3%, affecting the right side of the face and the right frontal region (Figure 1).

Subsequent surgical intervention involved tangential escharectomy and partial dermabrasion of the affected areas, performed without complications. Further escharectomy and grafting were scheduled for 72 h later (Figure 2).

On the third day following admission, avulsive escharectomy was performed, followed by placement of homografts on the third-degree facial burn.

On day 10, the patient underwent another surgery where the homografts were removed, and the wound bed was debrided and prepared. A monolayer acellular dermal matrix (INTEGRA®) was applied to the right malar region and subsequently covered with partial-thickness grafts taken from the scalp in the same surgical session (Figure 3). In the oral commissure, segmented full thickness skin grafts were placed in order to decrease the risk of infection of the ADM due to accumulation of food when eating (whiter skin seen in the picture placed in the upper and lower lip, Figure 3). The ADM and grafts were conventionally bolster with xeroform occlusive gauze and cotton dressing.

On day 15, graft and acellular dermal matrix uncovering showed complete graft integration without signs of infection, bleeding, or resection, while the donor areas were epithelializing. Hence, the



Figure 1. Patient with facial burn upon admission to our institution.

patient was discharged, with follow-up graft uncovering scheduled as an outpatient procedure. Post-discharge, the patient required additional surgical interventions to correct microstomia and flanges on her right nasolabial fold and chin causing lip eversion.

Six months post-dermabrasion, the patient exhibited no unstable or keloid scars, with pliable skin and excellent elasticity in the grafted areas, absent any scar contractures or serious functional limitations (Figure 4). The cosmetic outcome was satisfactory, and the patient, initially impacted not just physically but also psychologically, regained her confidence through our institution's comprehensive, interdisciplinary care and experienced no significant sequelae impacting skin or function.

Discussion

In recent years, there has been a significant increase in the utilization of Acellular Dermal Matrix (ADM) in the field of plastic surgery.³ Recent studies predominantly focus on its application in the facial region, particularly in nasal reconstruction,⁴ facial trauma cases,⁵ and cranial base reconstructions.⁶ In the context of burns, the majority of applications involve the upper extremities, encompassing hands, shoulders, and the axillary area.⁷ While literature addressing facial burns is limited, there has been a noticeable emergence of studies evaluating ADM usage in this context over the past five years.⁸

Jackson et al. presented outcomes resulting from the use of Matriderm (a single-layer bovine collagen coated with elastin) in the facial reconstruction of a paediatric patient with full-thickness burns, achieving excellent aesthetic and postoperative outcomes.² More recently, Ávila et al. conducted a comparative study assessing the use of glycerolized Acellular Dermal Matrix (GADM), a cost-effective dermal matrix, in burn reconstruction across a sample of 29 patients in various anatomical regions, including 2 cases of facial burns. Their findings demonstrated satisfactory integration without necessitating prolonged hospital stays compared to autografts alone.⁹

Most market-available ADMs are bilayer due to their availability and cost, which requires a two-stage surgical procedure, leading to prolonged hospitalization and increased risk of infection.¹⁰ Remarkably, this report documents, to our knowledge, the first of a one-stage repair using Integra ADM and skin autograft in acute facial burn reconstruction. This approach, using the INTEGRA® Dermal Regeneration Template Single Layer, resulted in impressive outcomes, including reduced operating time, zero complications, and superior functional and cosmetic results. Key to achieving these results was



Figure 2. Right lateral view of facial burn after first surgical procedure.

the rigorous surgical debridement and the creation of a well-vascularized, non-infected wound bed before applying the dermal matrix and skin graft.³

Further healing corrections were required eight months post-burn, primarily in areas where ADM was not applied, underscoring the potential benefits of sustained matrix application in wound healing. Our patient developed microstomia due to scar retraction in the oral commissure, necessitating corrective intervention via dermabrasion and full-thickness skin grafting in the lower lip and multiple z-plasty in the upper lip and nasolabial fold.³ However, thanks to timely intervention, a satisfactory overall outcome was achieved.

While the one-layer dermal matrix technique offers benefits such as reduced surgical time, it also carries inherent risks. An increase in graft thickness can potentially slow the imbibition and revascularization phases of skin graft healing, thereby raising the risk of graft loss.¹⁰ It is important to note that this matrix is typically used in managing sequelae; therefore, these described risks were potentially heightened in our patient as this was an acute management of the burn. Therefore, this approach necessitates significant surgical expertise to mitigate these risks and optimize patient outcomes.¹⁰ Further larger-scale studies are warranted to validate these findings and refine ADM application techniques in facial burn reconstruction.



Figure 3. Right lateral view of facial burn after placement of INTEGRA® Monolayer acellular dermal matrix and with the partial-thickness grafts.



Figure 4. Facial right lateral view 6 months after discharge, an optimal aesthetic outcome is observed without functional limitations.

Conclusion

Facial burns significantly affect patients' lives. As clinicians, we aim to optimize aesthetic and functional outcomes. This case underscores single-layer ADM's potential in enhancing wound healing and cosmetic results in burn patients. However, more extensive research is necessary to validate ADM's efficacy in comprehensive burn management.

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Ethical approval

The research protocol was submitted to the Ethics Committee of the University Hospital Fundación Santa Fe de Bogotá for ethical approval.

Patient consent

Written consent has been received for photo publication.

Declaration of competing interest

The authors have no financial interest to declare in relation to the content of this article.

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