

## Comprehensive Management of Facial Burns from Boiler Explosion: Case Report

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### ABSTRACT

A 22-year-old male patient suffered an extensive facial burn after the accidental explosion of a domestic boiler. The burn involved the forehead, eyelids, nose, cheeks, lips, and chin, representing approximately 18% of total body surface area. On admission, he presented with severe pain, significant periorbital edema, and progressive airway compromise, necessitating endotracheal intubation and intensive care monitoring. Initial management included hemodynamic stabilization, fluid resuscitation according to the Parkland formula, analgesia, and infection prophylaxis. Multiple surgical debridements were performed to remove necrotic tissue and prepare the wound bed. Subsequently, **Suprathel®**, a biosynthetic, biodegradable poly lactide-based dressing, was applied to promote reepithelialization, reduce pain, prevent infection, and enhance dermal regeneration. The patient's evolution was favorable, with gradual reduction of edema, complete wound coverage, preservation of facial function including eyelid closure and oral competence, and minimal residual hyperpigmentation. No additional skin grafts were required. This case highlights the importance of an **integrated approach** to severe facial burns, combining early airway management, critical care support, surgical debridement, and advanced wound coverage with biosynthetic dressings. The use of Suprathel® demonstrates significant benefits in functional and aesthetic outcomes, pain reduction, and accelerated healing, emphasizing its role as a modern standard in the management of complex facial burns.

**KEYWORDS:** Facial burns, Suprathel®, airway management, surgical debridement, biosynthetic dressing, integrated burn care.

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### INTRODUCTION

Facial burns represent a significant clinical challenge due to the anatomical complexity, high vascularization of the region,

and the functional and aesthetic importance of the face. They account for a considerable percentage of total burns, and their management requires a multidisciplinary approach that

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combines critical care, surgical intervention, and rehabilitation to minimize physical and psychological sequelae. Exposure to domestic heat sources, such as boilers, is a frequent cause of accidental burns at home, especially when maintenance or handling is performed without adequate precaution.<sup>1,2</sup>

The face is particularly vulnerable to deep injuries due to thin skin and the presence of essential structures such as the eyes, nose, and mouth. Burns in this region may be associated with airway compromise, infection risk, motor and sensory alterations, as well as hypertrophic scars or contractures that affect aesthetics and patient quality of life. Early initial assessment, hemodynamic stabilization, pain control, airway management, and surgical debridement are fundamental pillars in treating these injuries.<sup>3</sup>

Comprehensive management of facial burns involves not only acute treatment but also planning for reconstruction, functional rehabilitation, and psychological support. Literature evidence shows that early intervention combined with advanced reconstructive techniques and specialized care improves survival and reduces long-term complications.<sup>4</sup>

In this context, we present the case of a patient who suffered a significant facial burn while inspecting a domestic boiler.

Clinical features, implemented comprehensive management, observed complications, and functional and aesthetic outcomes during follow-up are described to provide useful clinical evidence for the care of complex facial burns.<sup>5</sup>

### CASE REPORT

A 22-year-old male patient with no relevant medical history suffered extensive facial burns after a domestic boiler explosion during maintenance. The accident caused direct contact with hot water and steam, affecting the frontal region, eyelids, nose, cheeks, lips, and chin. On admission to the emergency department, the burn was estimated at approximately 18% of total body surface area using the “Rule of Nines,” concentrated exclusively on the facial region.

The patient was conscious but experienced severe pain, significant periorbital edema, and progressive respiratory compromise due to thermal trauma. Endotracheal intubation and mechanical ventilation were initiated to secure the airway and prevent obstruction from edema. Internal respiratory injuries were ruled out, and hemodynamic monitoring was initiated in the intensive care unit.



**Figure 1: Admission to the Burn Unit.**

Following initial stabilization and adequate analgesia, intravenous fluid resuscitation was administered according to

an adapted Parkland protocol for facial burns, along with antibiotic prophylaxis and respiratory support.

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Over the following days, multiple surgical debridements were performed under general anesthesia and sedation to remove necrotic tissue and assess underlying tissue viability. Subsequently, **Suprathel®**, a biosynthetic polylactide-based dressing designed for deep partial- and full-thickness burns, was applied to viable dermal areas to promote reepithelialization and protect against infection. The dressing was changed according to protocol every 5–7 days until adequate granulation and skin regeneration were observed. The patient showed favorable evolution, with progressive reduction of facial edema and pain control. Extubation was

performed after five days of ventilatory support without subsequent respiratory complications. Regular follow-ups in the burn unit and physical and functional rehabilitation therapy were conducted to prevent contractures and improve facial mobility. At 45 days of follow-up, the patient had complete skin coverage, minimal residual hyperpigmentation, preservation of essential facial functions (facial expression, eyelid closure, swallowing), and satisfactory aesthetic outcomes.



**Figure 2: Discharge from the Burn. Unit**

This case illustrates the importance of comprehensive management in severe facial burns, combining critical care, early airway management, timely surgical debridement, and advanced dressings such as Suprathel®, which allowed for minimized complications, accelerated healing, and preserved facial function and aesthetics.

### DISCUSSION

Facial burns present a clinical challenge due to anatomical complexity, high vascularization, and functional and aesthetic importance. Airway preservation, pain

management, infection prevention, and reduction of scar sequelae are the treatment cornerstones. In severe cases, early intubation and ICU management are essential to prevent respiratory complications associated with facial edema and heat exposure.<sup>6,7</sup>

Early surgical intervention with debridement is crucial to remove necrotic tissue, reduce bacterial load, and prepare the wound bed for skin coverage. Traditionally, management of deep partial- and full-thickness burns included autologous skin grafts, conventional dressings, or collagen-based

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biosynthetics, with variable results in healing, pain control, and infection prevention.<sup>8</sup>

Currently, biosynthetic dressings such as Suprathel® have proven to be an innovative and effective tool in the management of superficial to deep burns. Suprathel® is a biodegradable polylactic acid polymer that acts as a semi-permeable barrier, providing protection against infection, reducing pain, maintaining a moist environment for reepithelialization, and facilitating dermal regeneration without requiring grafts in many cases. Its biocompatibility and mechanical properties allow adherence to the burn bed, preventing premature detachment and minimizing hypertrophic scarring or contracture formation. Recent studies demonstrate that Suprathel® significantly reduces dressing change frequency, shortens hospitalization duration, and improves aesthetic and functional patient satisfaction.<sup>9</sup>

In this case, Suprathel® coverage of extensive facial burns promoted skin regeneration and preserved essential structures without additional grafts. Early application after surgical debridement and strict ICU monitoring helped prevent infection, control pain, and maintain airway integrity. The favorable patient outcome, with complete healing, minimal hyperpigmentation, and preserved motor function, aligns with recent literature reporting the benefits of biosynthetic dressings.<sup>10</sup>

This case emphasizes that a comprehensive approach combining critical stabilization, timely surgical debridement, and advanced dressing technologies like Suprathel® optimizes functional and aesthetic outcomes in severe facial burns. Modern biosynthetic dressings represent a significant advancement in burn care, particularly in anatomically complex areas where preservation of function and appearance is critical to patient quality of life.<sup>11</sup>

### CONCLUSION

Burns are among the most complex medical emergencies, with functional and aesthetic implications, especially when affecting critical areas such as the face. Initial evaluation of a burn patient is based on two fundamental parameters: depth of injury and total body surface area affected. Burn depth is traditionally classified as first-degree (epidermal involvement, erythema, mild pain), superficial partial-thickness second-degree (partial dermal involvement, blistering, intense pain), and deep second- or third-degree (full dermal and subdermal involvement, charred or insensate skin, high risk of infection and abnormal healing). This classification helps estimate injury severity, functional and aesthetic prognosis, and guides therapeutic decisions regarding debridement, skin coverage, and systemic support requirements.<sup>12</sup>

Burn extent, assessed via the Rule of Nines or Lund-Browder method, is crucial for fluid resuscitation and hypovolemic shock risk assessment. In this case, the facial burn represented approximately 18% of body surface area, concentrated in regions of high functional and aesthetic importance such as

forehead, eyelids, nose, cheeks, lips, and chin. Even limited facial burns carry high risk of progressive edema, potentially compromising airway, vision, and swallowing, making early intubation and ICU care imperative.<sup>13</sup>

Comprehensive management of severe burns combines initial stabilization, pain control, infection prevention, surgical debridement, and advanced skin coverage. The initial phase includes hemodynamic monitoring, respiratory support, multimodal analgesia, and fluid administration according to protocols adapted to burned surface area and patient age, such as the Parkland formula. Endotracheal intubation in severe facial burns secures the airway while controlling edema and allows sedation and analgesia for surgical procedures and repeated wound care.<sup>14</sup>

Once stabilized, early debridement is essential to remove necrotic tissue, reduce bacterial load, decrease sepsis risk, and prepare the wound bed for definitive skin coverage. Traditionally, coverage included autologous skin grafts, collagen, or conventional dressings, but these approaches have limitations, including significant pain, frequent dressing changes, infection risk, and abnormal scarring.<sup>15</sup>

Today, biosynthetic dressings such as Suprathel® have transformed the management of deep partial- and full-thickness burns. Suprathel® is a biodegradable polylactic acid polymer providing a semi-permeable barrier, protecting against contamination and infection, maintaining a moist environment that promotes reepithelialization, and promoting dermo-epidermal regeneration without additional grafts in many cases. Its structure allows stable adherence to the burn bed, minimizes premature detachment, and reduces dressing change frequency, decreasing pain, stress, and infection risk. Recent studies document faster healing, lower incidence of hypertrophic scarring and contractures, and improved long-term aesthetic and functional outcomes.<sup>15</sup>

In this patient, Suprathel® application after surgical debridement allowed complete facial burn coverage, protected anatomically complex areas, and preserved essential functions such as eyelid closure, facial expression, swallowing, and lip movement. Favorable clinical evolution, with no infectious complications or need for additional grafts, demonstrates the effectiveness of combining early debridement, ICU critical care, and advanced skin coverage technology. The patient also benefited from reduced pain and edema, preserved aesthetic quality, and accelerated healing.

This case emphasizes that a modern, comprehensive approach to severe facial burns should include precise assessment of depth and extent, initial stabilization and airway management, timely surgical debridement, and the use of advanced dressings like Suprathel®. Combining these strategies not only optimizes functional and aesthetic recovery but also minimizes local and systemic complications, improves patient satisfaction, and facilitates faster and more effective rehabilitation.

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