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Correction of Post Burn Severe Broad Type Neck Contracture using Multiple Z-Plasty: A Case Report

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ABSTRACT

Background: Post burn contracture of the neck is one of the most common sequeles. The management of neck contracture is challenging because of both functional limitations and aesthetic apperance distortion of the patient. Besides affecting neck movement, neck contracture can also influence lower face function.

Aims : This study aims to report a-31 year old female patient with post burn contracture of the neck, following a kerosene lamp explosion that resulted in flame burn.

Case Presentation: The patient presented with a severe broad type neck contracture with complaints of limited range of motion in her neck and restricted mouth movement, accompanied by drooling caused by lower lip retraction, making it difficult to close her lower lip completely Surgical procedure was performed without excision of scar tissue. Multiple Z-plasty incisions were used to distribute the soft tissue and release the contracture.

Result: Patient achieved satisfactory result after surgery. The patient was followed up seven months and one year after surgery with improvement of her symptoms.

Conclusion: Multiple Z-plasty is a safe and realible procedure for releasing post-burn neck contracture. It serves as an effective surgical technique for treating post-burn neck contractures, allowing patients to avoid the need for grafts and preventing additional wounds from donor site harvesting.

KEYWORDS: burn, contracture, neck, Z-plasty, release contracture

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BACKGROUND

Burn injuries, especially severe acute burns, present challenges for both immediate care and long-term rehabilitation. After surviving the critical phase of a burn injury, patients frequently face secondary complications, including physical, social, and functional impairments. One of the most common complications following burn injuries is hypertrophic scarring, which affects approximately 32-72% of burn patients. This scarring can lead to contractures—tightening of the skin and underlying tissues—that restrict movement, alter appearance, and cause deformities.[1,2]

The neck is especially vulnerable to contracture development following burn injuries.[1] Neck contractures not only limit neck mobility but may also cause significant deformities in the facial area, such as abnormal oral occlusion, cicatricial ectropion, and altered positioning of the trachea.[3] These contractures can severely impact both the aesthetic and functional outcomes for patients, often requiring surgical intervention.[1,4] The goal for post-burn neck contracture is to return the ability to extend, flex, rotate, and laterally bend the neck.[5]

Post-burn neck contractures are classified into nine groups, based on the severity of contracture and associated functional impairment, and are categorized as mild, moderate, or severe. In mild cases, the scar becomes visible only during neck extension, with a neck extension range of 95-110°. Moderate cases show visible scarring even in the resting position, with a reduced neck extension of 85-95°. Severe contractures present with a neck held in a flexed position, with neck extension limited to less than 85°. Following this severity classification, neck contractures are further categorized by shape: a linear scar appears as a narrow

line, a band scar covers less than 50% of the anterior neck surface, and a broad scar covers more than 50% of the anterior neck surface. [3]

This study aims to report a-31 year o ld female patient with post burn contracture of the neck, following a kerosene lamp explosion that resulted in flame burn.

CASE PRESENTATION

A 31-year-old female presented to the Plastic Surgery Outpatient Clinic with complaints of limited range of motion in her neck, accompanied by drooling caused by lower lip retraction, making it difficult to close her lower lip completely. The patient had been experiencing these symptoms for the past 19 years, following a kerosene lamp explosion that resulted in flame burns and caused burn scar contractures on her anterior neck, right and left upper extremities, chest, and abdomen. The patient did not undergo surgery or receive specialized wound care for her burns. Ten years later, she underwent her first surgery, which involved skin grafts and flaps. Despite this operation, she continued to experience limited neck mobility, difficulty chewing due to tension on her lower lip, and drooling caused by her inability to fully close her mouth. The contractures reappeared some time after the surgery. On local examination of the neck, a severe broad-type neck contracture was observed, and the neck's range of motion was severely restricted.

The patient was prepared for surgery under general anesthesia and positioned in a supine position. The contracture lines and proposed incision sites were marked pre-operatively. In this case, only contracture release was performed using multiple Z-plasty incisions without excision of skin tissue until the tension was reduced. Dissection was carried down to the base of the scar, reaching underlying normal tissue with caution to prevent unnecessary damage to the blood supply to ensure flap survival. Each resulting flap was repositioned and sutured according to the design.

Figure 1. Clinical appearance after trauma

Figure 2. The pre-surgical apperance of the neck contracture **(a,b)**

Figure 3. The design of multiple Z-plasty **(a,b)**

Figure 4. Post-operative results, anterior view **(a,b),** worm's eye view **(c),** lateral view **(d,e)**

Figure 5. 7-months follow-up **(a,b,c,d,e)**

Figure 6. 1-year follow-up **(a,b,c,d,e)**

The patient was maintained in a supine position after surgery. Capillary refill time and color were monitored during her hospitalization. The dressing was changed seven days post-surgery, and sutures were removed between days seven and ten. The patient was advised to attend regular follow-up visits at the outpatient clinic to evaluate the range of neck extension and lower lip movement. Once the wound had healed, the patient was instructed to begin self-exercises to practice neck extension, flexion, and rotation. Seven months and 1-year after surgery, the range of motion in the neck and the retraction of the lower lip had improved, and drooling had ceased. Unfortunately, hypertrophic scar at the incision site became more visible.

DISCUSSION

Deep thermal injuries in the neck region frequently lead to severe post-burn contractures. These contractures can significantly impact patients' daily lives, causing various functional and physical challenges.[6] Post-burn neck contractures are challenging for reconstructive surgeons, as the scarring can pull the chin, cheeks, and lower lip downward, creating a flexion deformity.[3,4,6,7] In this case, the patient did not receive proper wound treatment or rehabilitation during the acute phase due to economic constraints. This is a common theme in developing countries, where low socioeconomic status and limited healthcare facilities cause burn patients to not receive optimal treatments, resulting in unavoidable formation of contractures.

Reconstruction of post-burn neck contractures depends on the availability of healthy tissue.[3] A common technique to release the tension in neck contractures is the large Z-plasty, favored due to the rich blood supply in the neck region. This technique is particularly effective for limited scar bands, as it helps to lengthen the scar and redistribute tension, thereby improving mobility. In cases of more extensive or broader contractures, additional reconstructive options, such as skin grafts, local flaps, regional flaps, or distant flaps, may be necessary in accordance with the reconstruction ladder principles. While skin grafts can be used for reconstruction, they carry a risk of recurrence of contracture unless supplemented with splinting to maintain the graft's shape and function over time.[1,5,6]

Z-plasty was first introduced by Denovillers in 1856, then Limberg demonstrated its geometric principles in 1929, and it was later popularized by Davis and Kitlowski in 1939. Z-plasty can release linear scar contractures, lengthen scar tissue, change the direction of the scar, and flatten uneven scar surfaces. A 60° angle is considered optimal, as it provides significant lengthening of up to 75% with minimal lateral tension. Angles less than 60° result in less diagonal contracture lengthening and an increased risk of flap tip necrosis. Conversely, angles greater than 60° provide more diagonal contracture lengthening but also increase lateral tension. However, in practice, several factors affect the use of Z-plasty, such as the presence of hypertrophic scars, skin texture, and skin elasticity.[8]

The goal of neck reconstruction in this patient was to restore cervicomental angle. In this patient, multiple Z-plasty was chosen to address the neck contracture. The decision to use multiple Z-plasty was based on several considerations by the surgical team, including minimizing the risk of contracture recurrence, which is often associated with skin grafting, a relatively quick healing time, and the advantage of not requiring an additional donor site. According to a study by Bouladaas et al, Z-plasty is a simple technique that requires minimal hospital stay and provides faster recovery.[9]

Direct excision of scar tissue in neck contractures is generally avoided, as it may worsen tissue deficiency.[2] In this patient, only incision was made to release tension without excision. This approach aligns with studies by Mody et al. and Song Y et al., who noted that incisions alone are performed in cases

of severe or extensive contractures due to the large defect, excessive tension, and limited donor sites.[10,11]

A hypertrophic scar became more noticeable in follow-up photos of the patient after one year, during which she was seven months pregnant. This aligns with a study by Ibrahim et al. that reported two extreme cases of keloid worsening and recurrence during pregnancy, as well as a study by Kim HD et al. on recurring auricular keloids during pregnancy.[12,13] Another theory, proposed by Moustafa et al., suggests that scars may become hypertrophic during pregnancy due to increased estrogen levels, which are thought to contribute to the "flare-up" of keloid growth.[14] Estrogen and androgens have vasodilatory effects, which can intensify inflammation and potentially worsen existing scars or encourage pathological scar development.[15] During advanced gestational age of pregnancy, sex hormone and blood volume will increase, resulitng in dermal and vascular changes that will alter wound healing process.[16] In this case, treatment for the hypertrophic scar at the suture site has not yet been given. We plan to reevaluate the condition after the patient gives birth, possibly including the use of silicone sheets as part of the treatment.

CONCLUSION

Multiple Z-plasty is a safe and realible procedure for releasing post-burn neck contracture. It serves as an effective surgical technique for treating post-burn neck contractures, allowing patients to avoid the need for grafts and preventing additional wounds from donor site harvesting. However, hypertrophic scarring may still develop along the suture lines of multiple Z-plasty, which may necessitate further treatment.

CONFLICT OF INTEREST

There are no conflict of interest

DECLARATION OF PATIENT CONSENT

The authors confirm that informed consents (Consent to Participate and Consent to Publish) were obtained for this study.

DATA AVAILABILITY STATEMENT

The data generated during the current study are available from the corresponding author on reasonable request.

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