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MENTOSTERNAL CONTRACTURE RECONSTRUCTION WITH ALT FREE FLAP, Z-PLASTY, AND STSG: A CASE REPORT

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ABSTRACT
The consequences of post-burn neck contractures are considered the greatest challenge in reconstructive surgery. This deformity affects the neck area thereby limiting head movement. These complications can be associated with loss of articulation, cosmetic disfigurement and psychological changes that impair quality of life and result in loss of productivity. Therefore, an appropriate surgical management are essential to obtain optimal results. ALT (anterolateral) free flap can be used to resurface the defect, this technique provides a long pedicle with adequate lumen diameter of blood vessels. The z-plasty technique is useful for redirect a scar into better alignment with a natural skin fold or the lines of least skin tension. Split-thickness skin graft (STSG) is a preferred technique for large wound areas and relatively avascular sites. This study aims to report our experience in reconstructing burnt mentosternal contractures with ALT free flap, z-plasty and STSG. We present a clinical case of a thirty-five years old male with post-burn mentosternal contracture ONAH classification type III, dermogenic type diffuse flexion contracture of the colli region, anterior thorax region, and left and right superior extremity regions, dermogenic type linear contracture of the left and right anterior axillary regions, and burned ear deformity in the left and right auricular due to a history of burns from twenty-four years ago. A contracture release procedure was performed with ALT free flap reconstruction, z-plasty and STSG. After the reconstruction, a pleasing outcome was accomplished in terms of both functionality and esthetics. A severe mentosternal contracture was released, and the limited movement of the neck and both extremities was greatly lessened. Mentosternal contracture reconstruction with ALT free flap, z-plasty and STSG showed a good outcome in this case.

Keywords: ALT free flap, mentosternal contracture reconstruction, STSG, z-plasty

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INTRODUCTION

The consequences of post-burn neck contractures are considered the greatest challenge in reconstructive surgery. This deformity affects the neck area thereby limiting head movement. These complications can be associated with loss of articulation, cosmetic disfigurement and psychological changes that impair quality of life and result in loss of productivity (Bhatnagar & Singh, 2020). Therefore, an appropriate surgical management are essential to obtain optimal results. ALT (anterolateral) free flap can be used to resurface the defect, this technique provides a long pedicle with adequate lumen diameter of blood vessels. The z-plasty technique is useful for redirect a scar into better alignment with a natural skin fold or the lines of least skin tension. Split-thickness skin graft (STSG) is a preferred technique for large wound areas and relatively avascular sites (Perdanakusuma, 2009).

CASE REPORT

A male patient, 35 years old, came in conscious, complained that the neck felt difficult to straighten due to scars on the mouth, chin, neck, and chest. Previously, the patient had burns on the chest and both armpits due to fire from a kerosene lamp in April 2000. After the wound healed, scars appeared which made it difficult for the patient to move the neck and lift both armpits. The patient also complained that the saliva continued to flow due to the lips being pulled downward. The patient said that the wound had been treated with honey topically. The patient then did not continue burn treatment due to financial constraints. From the anamnesis, the patient was still able to speak, hearing loss (-). Currently, the patient is independently mobilized, oral intake is good. History of systemic disease, allergy, medicine, and surgery were denied.

From the mechanism of injury, the patient was sleeping at home, at that time a kerosene lamp was near his bed, then the lamp suddenly fell and hit the patient's chest. After the incident, the patient immediately rinsed the wound with water for about 10 minutes. Then the patient was taken to the nurse's house to be treated for wounds and given amoxicillin. Furthermore, the burn wound was treated openly with honey by the patient only 2 times. At the time of the incident, the patient was wearing a shirt and shorts. The incident occurred in the Dobo area, Maluku.

From the physical examination, consciousness was compos mentis, vital signs were stable, and general status was in a normal range. Local status: Facial-Colli Region, on inspection it was found on Labialis Oris-Supraclavicular Region that diffuse contracture scar on the right side measuring 9 cm x 6 cm and on the left side measuring 15 cm x 7 cm, 1-5 mm high, erythema (-), hyperpigmentation (+), hypopigmentation (+), drooling (+), post burn ear deformity (+). On palpation, it was found dense consistency, fixed, felt warm like the surrounding skin, CRT <2 seconds, tenderness (-). On movement examination, limited active ROM (range of motion) of the neck. Local status: Anterior Trunk Region, on inspection it was found diffuse contracture scar measuring 23 cm x 12 cm, erythema (-), retracted nipple (+), superolateral (+), hyperpigmentation (+), hypopigmentation (+), with Vancouver scar scale: 9. Local status: Posterior Trunk Region, on inspection it was found hypertrophic scar. Local status: Superior Extremity Region Dextra et Sinistra, on inspection it was found linear contracture scar on the anterior (Axilla Region D) measuring 10 cm x 5 cm with hypopigmentation and hyperpigmentation (Vancouver scar scale: 9) and it was found linear contracture scar on the anterior (Axilla Region S) measuring 9 cm x 3 cm with hyperpigmentation (Vancouver scar scale: 9). On palpation, it was found solid consistency, fixed, feels warm like the surrounding skin, CRT <2 seconds, tenderness (-). On movement examination, limited active ROM (range of motion) of Axilla D et S.

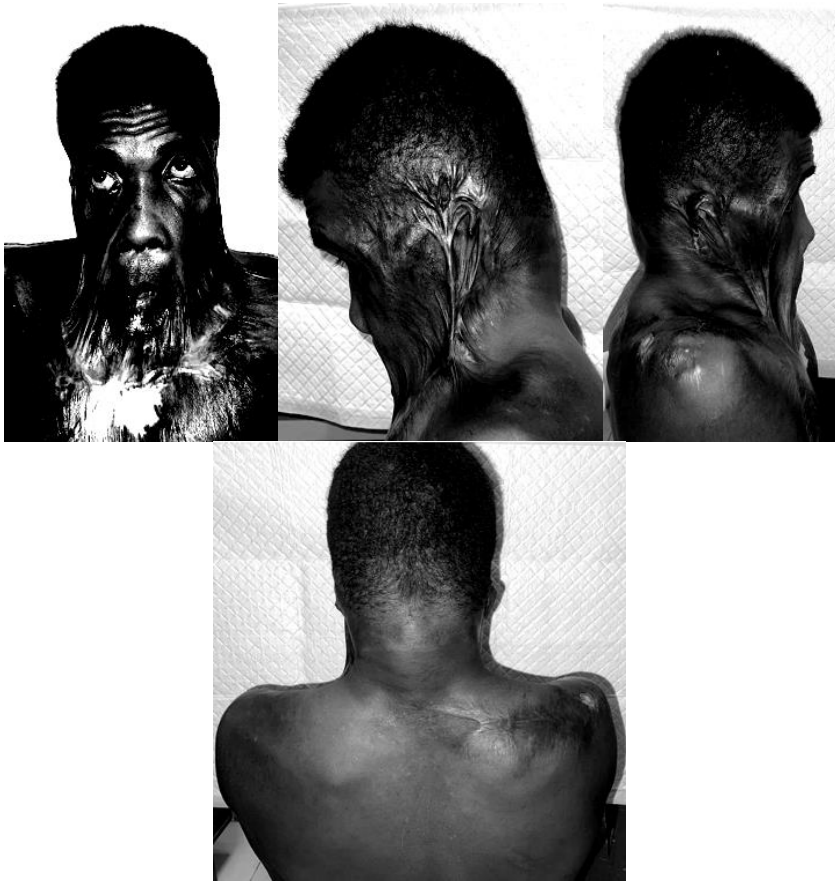

Figure 1. Clinical pictures

From the laboratory supporting examination, Creatinine was 1.65 mg/dL, e-LFG was 52.99 and from the Thorax X-Ray showed anterior compression of CV C3-4 causing kyphotic deformity accompanied by fusion of the C2-4 spinous process, cor and pulmo showed no abnormality. The working diagnosis of the plastic surgery department is Postburn Mentosternal Contracture ONAH Classification Type III, Dermogenic type of Diffuse Flexion Contracture (in the Colli region, Anterior Thorax, Left and Right Superior Extremity Regions), Dermogenic Type of Linear Contracture of the Left and Right Anterior Axillary Regions, Burn Ear Deformity Auricula in the left and right auricular. Treatment in the Plastic Surgery department is Pro Release Neck Contracture + Reconstruction of Defect Closure with Local Flap k/p ALT Free Flap and to consult to the Anesthesiology department to prepare the patient for the surgery.

Figure 2. Clinical Pictures Durante-Operation

During the operation, the patient was in the lying position with GA-IV, the operating field was disinfected with povidone iodine and narrowed with a sterile douche. The procedure began with an incision in the facial-coli region extending to the anterior trunk, followed by tissue infiltration and layer-by-layer incision down to the subcutis, releasing a contracture and exposing a 25 cm × 10 cm defect. The superior thyroid artery and vein, along with the external carotid vein, were identified and preserved. An anterolateral thigh (ALT) flap was designed to match the defect size, with tissue infiltration and incisions extending to the fascia, where the descending branch of the lateral circumflex femoral artery and vein were identified using Doppler imaging. After ligation, bleeding control, and flap elevation, the ALT flap was inset to close the defect. End-to-end anastomoses were performed between the superior thyroid artery and the descending lateral circumflex femoral artery, as well as between the descending lateral circumflex femoral vein and both the superior thyroid vein and external carotid vein, using non-absorbable monofilament 8-0 sutures, with patency confirmed by positive flow. The surgical wound was irrigated with 0.9% NaCl, and bleeding was controlled. The inner flap was sutured with 3-0 non-absorbable monofilament thread, while the skin was closed with 4-0 absorbable monofilament thread, and four hand-schoen drains were installed. A split-thickness skin graft (STSG) covering 1.5% of the medial femur region was harvested and applied to the secondary defect on the anterior trunk, secured with 4-0 absorbable thread. The ALT donor site was closed with 2-0 absorbable multifilament thread for the inner layer and 3-0 non-absorbable monofilament thread for the skin, while an STSG covering 1% of the area was applied to the secondary defect at the donor flap site and sutured with 4-0 absorbable thread. A redon drain No. 10 was placed in the femur region, and the flap was dressed with tulle and sterile gauze, while the ALT flap donor site was treated with gentamycin eye ointment, tulle, and sterile gauze. The STSG and donor wounds were dressed with tulle, Betadine gauze, and sterile gauze, and a tie-over dressing was applied to the STSG on the anterior trunk. The reconstruction yielded excellent functional and aesthetic results,

successfully releasing the severe mentosternal contracture and significantly improving neck mobility and extremity function.

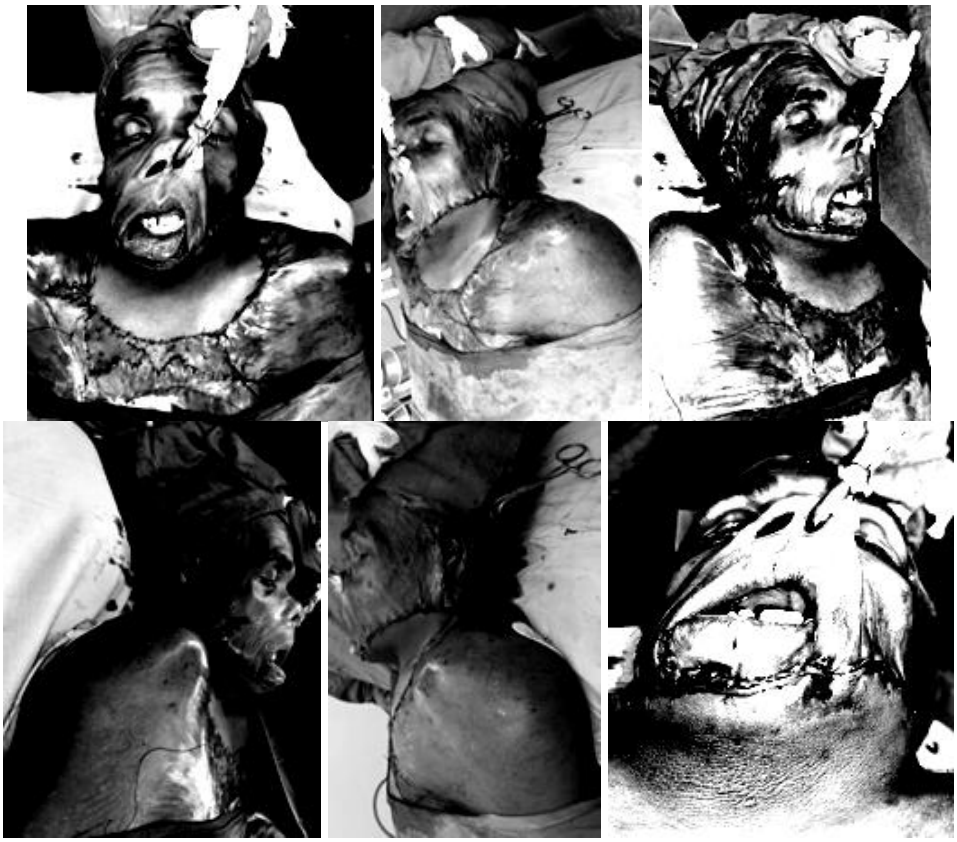

Figure 3. Clinical Pictures Post-Operative

Follow-up Observation (Day 1 Post-Operative)

From the anamnesis, the patient complained about the pain in the post-operative wound (but had been treated by the analgesics given), febrile (-), nausea (-), vomiting (-). The patient's oral intake was good (post-transfusion of 1 PRC collar from Hb 7.80 to 9.20). From the physical examination, general status was good, but the blood pressure was 88/57 mmHg. Other vital signs were in normal range. Local status: Anterior Facial-Colli Trunk Region found post-operative wounds with viable flap, normal skin color like the surrounding skin, warm palpable, CRT <2 seconds, wound seepage (-), 6 drain HS were installed, and 0.5% STSG with no wound seepage, tie over (+); Left Femur Region found installed drain redon number 10FR production limited to hose (well functioned), 1% STSG with no wound seepage, and 1.5% STSG donor with no wound seepage. From the laboratory examination, it was found WBC 32.25, Hb 9.20, PLT 260. The working diagnosis of the Plastic Surgery department is Post Release Mentosternal Contracture + Reconstruction Close Defect with ALT Free Flap, Z-Plasty and STSG ec history of Post Burn Mentosternal Contracture ONAH Classification Type III, Dermogen Type of Diffuse Flexion Contracture in the colli region, anterior thorax, superior extremity region D et S, Dermogen Type of Linear Contracture in the Axilla Region D et S, Burn Ear Deformity Auricula D et S ec history of Combustio.

The treatment for Plastic Surgery is maintaining IV fluids (RL) at 20 dpm and administering analgesics as guided by the anesthesia team. Ceftriaxone 1 gram is to be given intravenously every 12 hours. The afferent drain should be monitored, with removal planned on postoperative day 3 (4/27/2024) or earlier if the production is less than 10 cc/24 hours. Blood transfusions of 1-2 units per day should continue until hemoglobin levels exceed 10 g/dL, with post-transfusion direct laboratory checks. Stitches in the femur region and anterior colli

to trunk areas should be removed on days 10-14 if the wounds show good healing progress. Flap care includes warming with an incandescent lamp, avoiding pressure on the flap, and conducting periodic evaluations. Split-thickness skin graft (STSG) sites should be evaluated on day 5 post-surgery, with donor site evaluation on day 14 post-surgery.

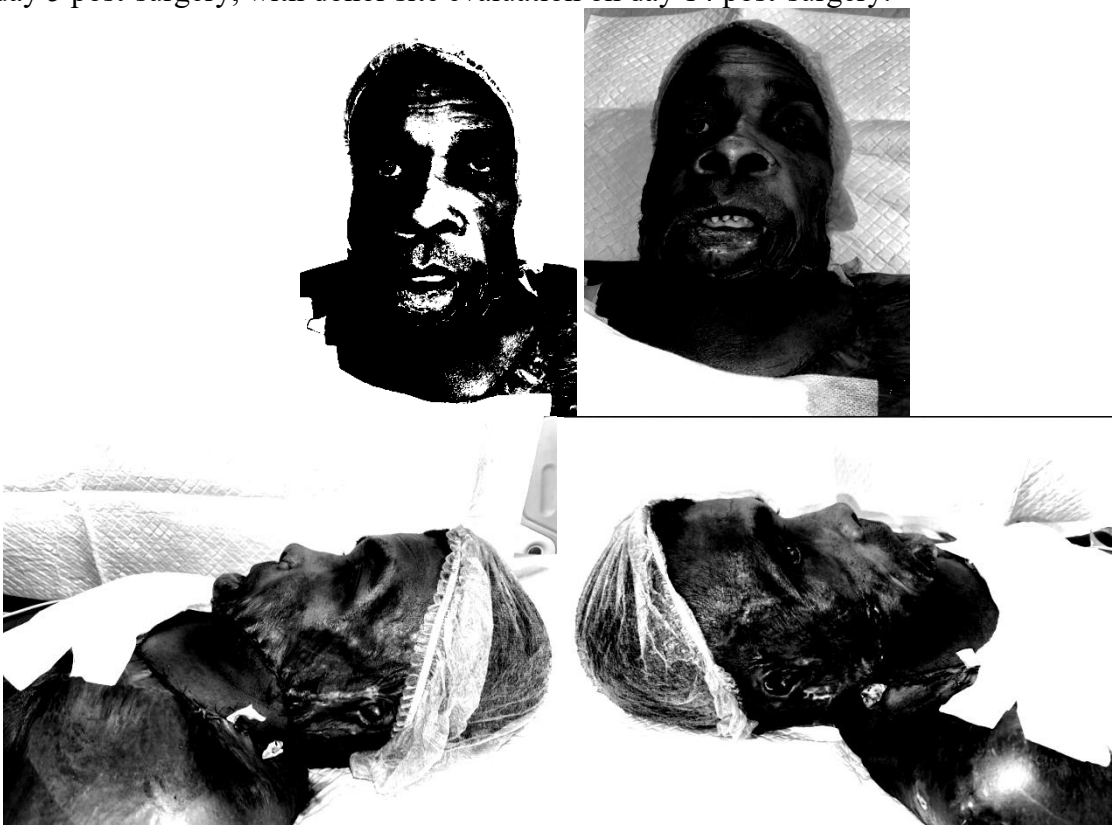

Figure 4. Clinical Pictures Follow-Up (Day 1 Post-Operative)

Follow-up Observation (Month 2 Post-Operative**)**
From the anamnesis, the post-operative wound on the neck has closed, has been treated openly and the post-operative wound on the left thigh has shrunk, minimal wound seepage. From the physical examination, the general condition was good, hemodynamically stable. Local status: Anterior Facial Colli-Trunk Region found epithelialized post-operative scar, 0.5% epithelialized STSG with active neck ROM extension; Superior Extremity Region D et S found anterior linear contracture scar size 10 cm x 5 cm with erythema (-), hyperpigmentation (+), hypopigmentation (+) in the right axilla and anterior linear contracture scar size 9 cm x 3 cm with erythema (-), hyperpigmentation (+), hypopigmentation (-) in the left axilla; Femur Region S found RSA 1%, hypergranulation tissue base (+), minimal slough (+), exudate (-), pus (-), 1% epithelialized donor STSG.

The working diagnosis of the Plastic Surgery department is RSA 1% femur region S ec Wound Dehiscence Post Release Mentosternal Contracture + Reconstruction Close Defect with ALT Free Flap, Z-Plasty and STSG ec history of Post Burn Mentosternal Contracture ONAH Classification Type III, Dermogen Type of Diffuse Flexion Contracture in the colli region, anterior thorax, superior extremity region D et S, Dermogen Type of Linear Contracture in the Axilla Region D et S, Burn Ear Deformity Auricula D et S ec history of Combustio. The treatment for Plastic Surgery is to wash the wound with 0.9% NaCl + Clorhexidine, to treat open wounds facial colli region - anterior trunk, to treat RSA femur region S with hydrocortisone cream + tulle + povidone iodine gauze + elastic bandage, to schedule routine check-up of the Medical Rehab polyclinic to train neck physiotherapy, and

Pro Release Contracture Axilla D Region with Thoracodorsal Artery Perforator Flap, Axilla S Region with Multiple Z-Plasty k/p STSG (July 2024).

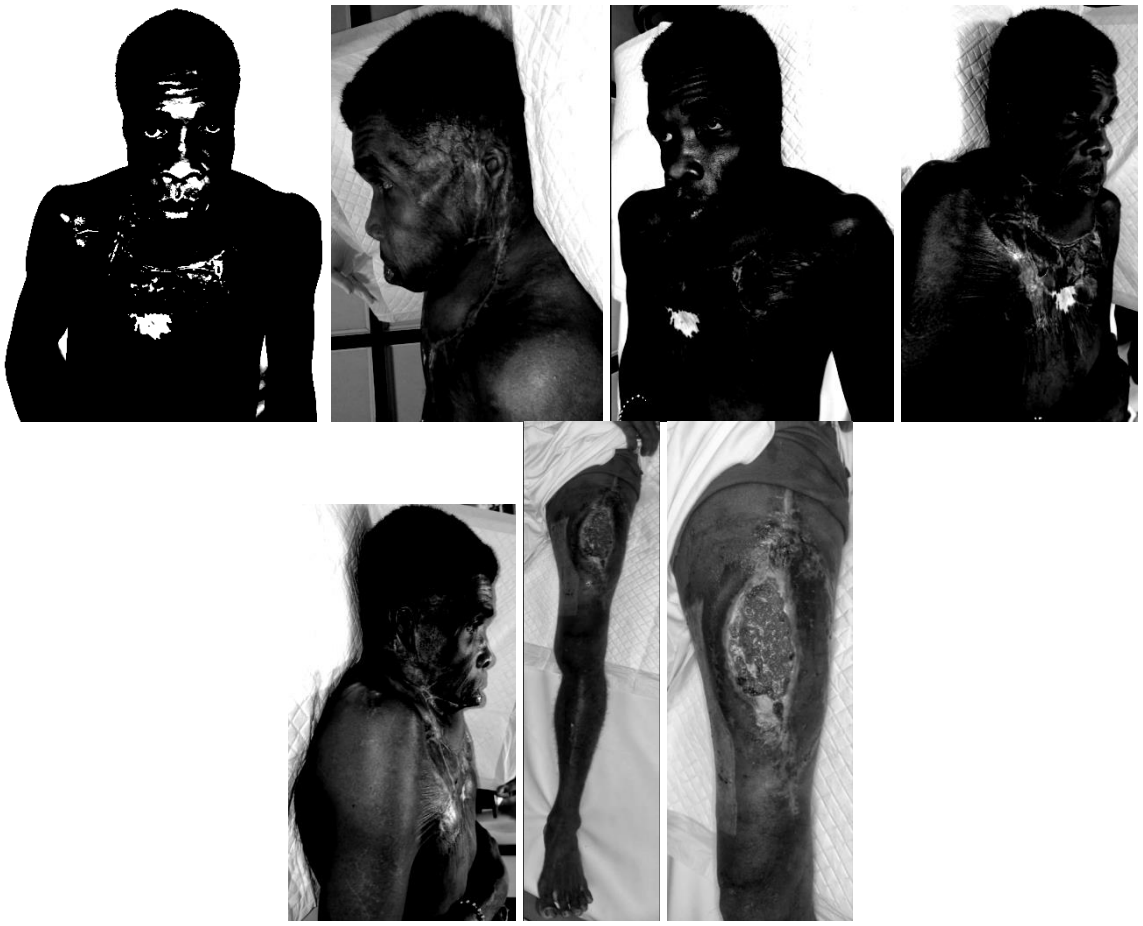

Figure 5. Clinical Pictures Follow-Up (Month 2 Post-Operative)

DISCUSSION

Mentosternal contracture is a condition characterized by abnormal scar tissue formation between the chin (mentum) and sternum, often resulting from severe burns, trauma, or surgical complications. It presents with restricted neck movement, tight scar bands, and potential functional impairments such as difficulty eating, breathing, or speaking, along with aesthetic concern (Benson et al., 2024). The Nigerian classification of mentosternal contracture defines four types based on severity and skin availability. Type 1 is mild anterior contractures (subtypes 1a-c by band width). Type 2 is moderate anterior contractures, where neck and jaw alignment is possible (subtypes 2a-c by band width). Type 3 is severe anterior contractures with fixed neck flexion; subtype 3a has adequate skin for coverage, while 3b does not. Type 4 involves posterior contractures, with subtypes 4a-c based on band number, skin availability, and coexistence of anterior contractures. This system guides severity assessment and surgical planning (Onah, 2005).

In this case, the anamnesis revealed that the patient's mechanism of injury was burns on the chest and both armpits due to fire from a kerosene lamp in April 2000. After the wound healed, scars appeared which made it difficult for the patient to move the neck and lift both armpits. From this mechanism, burn injuries (thermal, chemical, or electrical), and/or other traumas can occur which can cause mentosternal contracture due to the burn wounds (Mody et al., 2014). Based on the Nigerian classification of mentosternal contracture, the patient's medical condition was classified as ONAH Classification Type III. Where Type III is a severe

anterior mentosternal contracture characterized by the neck being fixed in a flexed position, with the chin, and occasionally the lower lip, adhered to the anterior trunk. The patient cannot achieve the anatomical alignment of the neck and jaw (Hassan, 2020).

The physical examination of mentosternal contracture involves assessing neck mobility, particularly the range of motion in flexion, extension, and lateral movements, noting any restrictions. The scar's characteristics, including its thickness, width, and texture, are evaluated, especially its adhesion to underlying structures. The position of the chin and jaw is observed to determine if the chin is tethered to the anterior trunk and if the jaw can reach an anatomical position. Functional impacts such as difficulty in speaking, eating, or breathing are assessed, along with any associated deformities like tension or distortion in the lower lip (Gupta & Sahni, 2020). The skin's elasticity and the availability of unaffected tissue around the neck for potential reconstruction are also examined. Functional assessments typically focus on the range of motion and the presence of any deformity that could affect daily activities. In addition, specialized tests like range of motion exercises are often incorporated into physical therapy to prevent further contracture and improve mobility (Kraus et al., 2008).

On the initial physical examination, there were found diffuse contracture scar in the facial-colli region and anterior trunk region accompanied by limited active ROM (range of motion) of the neck area, drooling, and post burn ear deformity. There were also found hypertrophic scar in the posterior trunk region and linear contracture scar in the both superior extremity region (Devi et al., 2013). In addition to physical examination, a Chest X-ray was the imaging modality of choice for this case, which showed anterior compression of CV C3-4 causing kyphotic deformity accompanied by fusion of the C2-4 spinous process. No fractures or other abnormality of cor and pulmo was found (De Sousa, 2019). Severe neck contractures are common complications in burn survivors with head and neck injuries, despite multidisciplinary care. Neck reconstruction often takes precedence due to the critical need for airway access and protection, which are essential for further surgical interventions and should be addressed promptly (Kraus et al., 2008).

Treatment focuses on restoring function and appearance, starting with non-surgical options like physical therapy, compression garments, and silicone sheets to manage scarring (Loghmani, 2018). Severe mentosternal contractures are generally managed through surgical interventions, including Z-plasty, W-plasty, skin grafts, flap surgeries, or a combination of those all (Hormozi & Shafii, 2010). In cases involving larger injuries, tissue expansion may be used to prepare the area for flap reconstruction. These procedures are typically carried out under general anesthesia to ensure patient comfort and proper management of the contracture release and graft harvesting (Embu et al., 2008). Adjunct therapies, such as laser treatments, injectable steroids, or artificial skin substitutes, can further enhance outcomes. Early intervention and wound care are key to prevention and better prognoses. Typically, the main goal of surgical treatment for neck contractures (aiming to release scar bands, restore the normal contour of the neck, and prevent the recurrence of scar tissue) depends largely on a thorough assessment of the issue and meticulous planning of the reconstructive approach. Proper evaluation and strategic surgical planning almost guarantee a favorable outcome in restoring function and aesthetics (Prasad et al., 2021), (Pallua et al., 1997).

In this case, the procedure began with an incision in the facial-coli region extending to the anterior trunk, followed by the release of the contracture and exposure of a 25 cm × 10 cm defect. An anterolateral thigh (ALT) flap was designed to match the defect size, with tissue infiltration and incisions extending to the fascia, where the descending branch of the lateral circumflex femoral artery and vein were identified using Doppler imaging. After ligation,

bleeding control, and flap elevation, the ALT flap was inset to close the defect (Dhua & Raheel, 2022). The end-to-end anastomoses were performed between the superior thyroid and descending lateral circumflex femoral arteries, and the veins were similarly connected. The ALT flap was inset to close the defect, and a split-thickness skin graft (STSG) was harvested for the secondary defect. The donor site was closed, and drains were placed to ensure proper healing. The STSG and donor wounds were dressed with tulle, Betadine gauze, and sterile gauze, and a tie-over dressing was applied to the STSG on the anterior trunk. Mentosternal contracture reconstruction resulted in significant improvements in neck mobility and function (Tripathi et al., 2023).

Functional and aesthetic reconstruction of the contracted neck is crucial for improving a patient's quality of life. The most feasible surgical approach is typically chosen when it offers good functional and aesthetic outcomes while minimizing the risk of recurrent mentosternal contractures (Ahmad et al., 2022). In this case, the patient reported effective pain management immediately after the procedure and during follow-up. Early postoperative physiotherapy, typically initiated within a day or two, was employed to enhance recovery, particularly when flaps were used for resurfacing. This approach helps improve mobility and prevent further complications associated with the contracture (Tsai et al., 2006).

CONCLUSION

Mentosternal contracture reconstruction with ALT free flap, z-plasty and STSG showed a good outcome in this case and successfully restored function and appearance of the patient.

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