

Original Article

Treatment modalities in severe mento-sternal synechia

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Abstract: Objective: Scar contracture of the neck after a burn-injury can cause both functional and aesthetic problems, and still presents a challenge for plastic surgeons. The anatomic area and adjacent structures such as the lower lip, trachea and neuro-vascular structures which are affected by the scar make treatment difficult. Scarring and contracture of the neck region may severely limit function, cause alterations of normal posture and make intubation for surgery difficult. When a burn scar extends toward the face, eating and swallowing may be restricted and facial distortion may develop as the scar pulls the mouth downwards even the lower eyelids. Method: Following the upper extremity, the neck is the most common site affected by burn contracture. The method chosen for contracture release, depends on the severity of scarring and extent of involvement. If the contracture area is limited, z-plasties, skin grafts or local skin flaps are adequate for the treatment but when the whole anterior neck is affected, the treatment modalities are limited and mostly skin grafts either meshed or unmeshed are used. Results: In this study we evaluated the usage of alternative treatment methods involving skin grafts and local flaps for severe neck contractures and tried to discuss often encountered difficulties in treating these group of patients. Conclusion: Many techniques have been described for correction of neck contractures, including skin grafting, expanders, local regional flaps and free flaps. The treatment of choice should be modified for every patient.

Keywords: Mentosternal synechia, burn contracture

Introduction

Overcoming scar contracture of the anterior neck is one of the most challenging reconstructive procedures in plastic surgery. The adjacent structures such as trachea, musculoskeletal and neurovascular structures may be affected by postburn scar contracture or by hypertrophic scar formation. The contracture itself causes both aesthetic and functional problems. The hypertrophic scar formation in an area such as the neck hinders movement. In male patients recurrent chronic folliculitis forming in the bearded area is another difficulty that is faced during clinical course. Social and economic problems affecting the life of patients leads to suicidal attempts especially in the low socio-cultural regions. Suicidal attempts are usually performed by pouring out inflammable chemicals on the whole body surface. In such burns there is limited donor area for reconstruction that makes the treatment more difficult.

Clinical method

In our study we have evaluated 10 patients who have been treated in Ataturk Research and Training Hospital and Sisli Etfal Research and Training Hospital with severe neck contractures aging between 9 to 56 years (average 30.8). There were 7 male and 3 female patients.

The follow up time ranged from 18 months to 24 months. The post burn contractures in 5 patients were due to suicidal attempts, in 2 patients they were due to a homicidal attempt. In 3 patients accidental flame burn was present. **Figures 1, 2 and 3** summarizes the burns caused by inflammable chemicals that affected large body surface areas. The postburn contracture affecting the neck, caused retraction on the lower lip and there were severe axillary contractures accompanying the severe mento-sternal synechia.



Figure 1. Patient 1, Anterior preoperative view.

Table 1. Postoperative cervicomenal angle degrees of the patients

Patient Number	Postoperative cervicomenal angle degree
1	90°
2	85°
3	70°
4	85°
5	100°
6	80°
7	75°
8*	75°
9*	95°
10*	85°
Average	84°

*Patients with minor complications.

Contractures were released in all patients. In patients whose contractures were due to inflammable chemical burns even the available donor site for skin grafts were limited. All procedures were performed under general anaesthesia. Because of the severe mento-sternal syn-

echia, endotracheal intubation couldn't be performed so under local anesthesia the major contracture bands were released and intubation was performed subsequently. In 9 patients the malpositioning of trachea due to contractures necessitated tracheotomy. Following the endotracheal intubation, the contracture area was examined again and by hyper extension of the head backwards, the remaining contracture bands were determined and released with meticulous dissection. During this procedure care was given not to damage neuro-vascular structures beneath the scar tissue. In the surgical procedure hypertrophic scar tissue was excised.

Then split thickness skin grafts were harvested from lower extremity in all the patients. The graft thickness ranged from 0.012 to 0.015 inches. The raw surface was covered with thick split thickness skin graft depending on the anticipated mobility of the recipient bed and the need to contour the graft

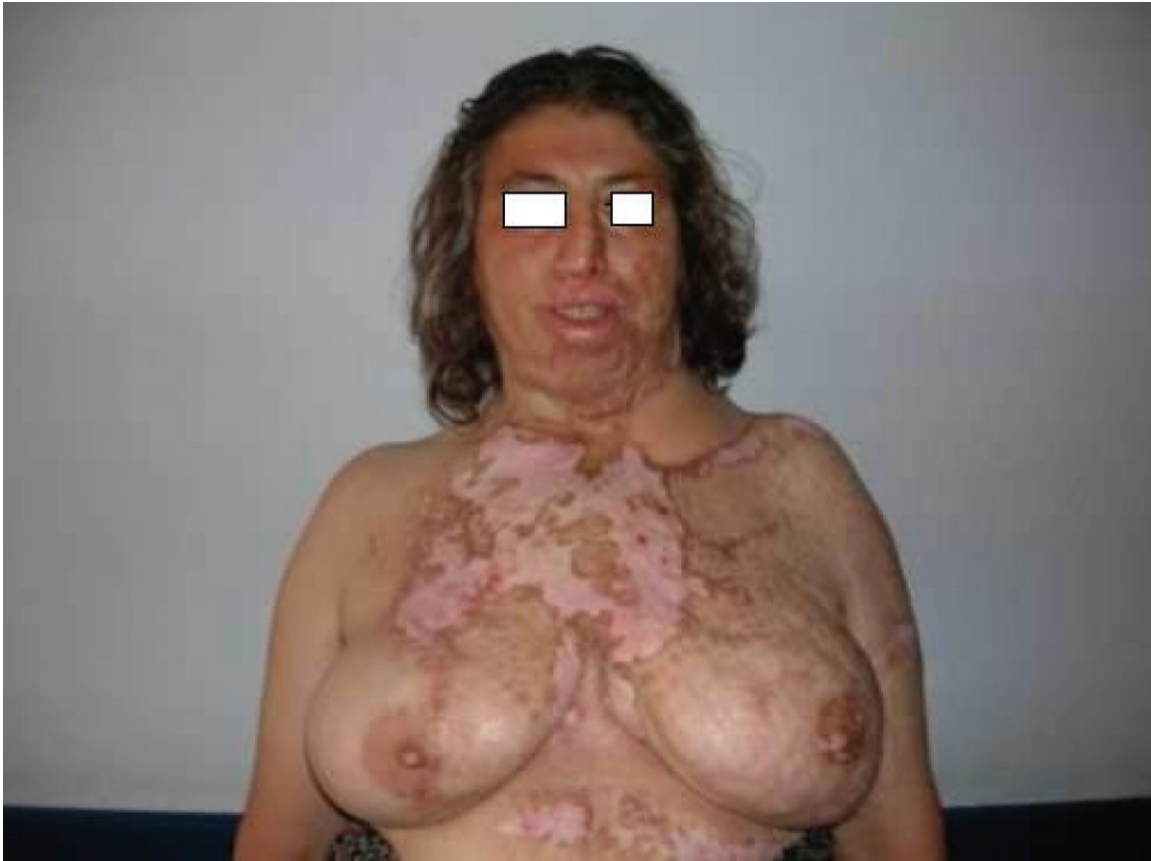


Figure 2. Patient 1, Anterior postoperative view.

to attain adequate apposition with the recipient bed [1, 2] The graft was secured with skin staples and a single layer of gauze dressing consisting of chlorhexidine acetate (Bactigras-Smith+Nephew) and rolled cotton was applied. Further immobilization was ensured with semi-rigid cervical collar. Depending on the mobility of the area the cervical collar was left in place for a variable period ranging from 8 months to 12 months. Initial dressings were removed after three days and subsequent daily dressings were performed with a single layer of Bactigras®. On the postoperative third week nonoperative treatment including massage, garments and cosmetic camouflage were used. The patients were advised to massage the grafted area with liquid vaseline at least once a day to prevent the grafts from becoming rough, dry and scaly for three months. All the patients were advised to use a pressure-applying garment. But this treatment modality was discontinued because of intensive itching. In 4 patients accompanying axillary contractures were released and they were treated with skin

grafts and local flaps (pedicled scapular flap and etc.). Intubation is more difficult in the patients with postburn neck contracture because of the lineer or limititating contracture. The major contracture bands are released under local anesthesia and intubation is performed subsequently. In cases that have deep burns, the adjacent structures of the neck are distorted and this makes the intubation harder, so tracheostomy is inevitable [3-9]. In most of the patients the areas adjacent to the neck are also affected so this leads to restricted local flap choice.

In the patients that had burn contractures resulting from suicidal attempts the donor sites for skin grafts are limited as well. The extent of the contracture necessitates the usage of split thickness skin grafting which doesn't approximate more closely to normal skin in texture, color and resilience. Split thickness grafts (as there is an inverse relationship between thickness of the dermis and graft contraction), contract more, compared with full thickness skin



Figure 3. Patient 2, Lateral preoperative view.

grafts [10, 11]. The advantage of skin grafts is that non-bulky skin is imported from a previously uninjured area of the body instead of traumatizing the scarred or compromised adjacent skin. Their disadvantage is that they have a tendency to contract, which necessitates further release. At this point full thickness skin grafts containing more dermis would be a better choice but the limited donor site and the extent of raw area makes this choice impossible. In 3 patients treated with split thickness skin grafts, a rerelease procedure was performed [12-16]. Another difficulty during the treatment period was the depressive mood seen in these patients which hinder the adaptation to physiotherapy and acceptance of the treatment. The depressed patients were especially reluctant to use splints.

Results

Ten patients with severe postburn neck contracture underwent Contracture release operations. **Figures 1-5** summarizes two patients

who were grafted, and 5 patients who were reconstructed with local flaps(z plasty, trapezius flap, deltoid flap), and 3 patients who were reconstructed with tissue expanders. The age of the burn injury ranged from 9 to 56 years.

The percentage of body surface burned ranged from 25 to 46 percent. The preoperative cervicomental angle degree could not be calculated because all of the patients had severe cervicomental synechia. Head extension was limited in all of the patients and because of this limitation upward gaze was minimal. The severity of the neck contracture also affected the movement of the neck to the left and right in almost all of the patients.

All the contractures were released as much as possible and thick split thickness skin grafting was performed. Mean hospital stay was 15 days. The patients were followed-up for a period ranging from 18 months to 24 months. They were seen at regular intervals ranging from 4 weeks to 3 months.



Figure 4. Patient 2, Peroperative view of the defect.

In one patient partial graft loss was seen. In one patient wound infection was seen (methicillin resistant staphylococcus aureus). This infection was treated with local antibiotics, dressings and systemic antibiotics. In three patients who discontinued to use cervical collar and didn't attend physiotherapy and recontracture developed because of secondary graft or flap contraction,. This led to restrictions in neck movement and a decrease in cervicomental angle degree. These patients were treated with a serial surgical procedures. **Figures 4 and 5** summarizes the postsurgical view presenting the cervicomental angle degrees varying between 75-95 degrees (average 85) were obtained in these patients. In most of the cases, acceptable results were achieved (**Table 1**).

Discussion

Postburn neck contractures generally arise from suicidal attempts and are caused by inflammable chemicals such as paint thinners;

so they are challenging problems for surgeons. A burn injury caused by such chemicals tends to be deep and affects large body surfaces.

A deep burn injury affecting the neck causes cervical hyperflexion, impairment in the lifting of the mandible and also distorts the adjacent anatomic structures. There can be tracheal distortion which disables intubation. The rigid scar tissue obscuring the mandibular and laryngeal anatomy and the presence of microstomia following the retraction of scar tissue are the reasons for difficult intubation. The neuro-vascular structures that are distorted due to contractures or hypertrophic scars could be harmed during dissection because of the altered anatomy.

The inhalation injuries accompanying the burn injury could cause tracheal stenosis which also constraints intubation [17-19]. In most cases these problems about intubation necessitate tracheotomy. And in these cases performing a tracheotomy is also difficult as a result of the distorted anatomy. So the dissection should be



Figure 5. Patient 2, Postoperative anterior view.

carried out carefully and some of the structures either neurovascular or musculoskeletal may be sacrificed [1, 6-9]. The treatment should

include the release of the contracture, restoration of the contour of the mentocervical angle and the prevention of the recontracture forma-

tion [20]. Reconstruction could be done with several methods including Zplasties, split thickness skin grafts, full thickness skin grafts, local or pedicled skin flaps with or without tissue expanders, free fasciocutaneous, musculocutaneous or free cutaneous flaps [21]. Angrigiani has described the total aesthetic neck reconstruction with the combined scapular- parascapular flaps, with excellent results [22].

The treatment of neck contractures, varies according to the severity of scarring and extent of scar tissue. If the scar tissue is limited or there are small contracture bands, excision of the scar tissue and reconstructing the defect either with grafts or local flaps is adequate. Also z-plasties can be used to revise and redirect scars or to provide additional length in the setting of scar contracture. If the scar tissue is large or whole anterior neck is affected and there is no local tissue available for reconstruction then long pedicled flaps such as pectoralis major myocutaneous flap, latissimus dorsi myocutaneous flap, trapezius flap can be used if distant flaps cant be used the skin grafts become the last choice. The areas adjacent to the neck are usually affected and the scarred skin or compromised skin near by could not be used for reconstruction as local flaps.

Because of these reasons skin that have similar color, thickness and texture and will provide better aesthetic results could not be used. The burn injury affecting large areas also restricts the usage of free flaps for the neck reconstruction. The vascular structures that would be used for anastomosing free flaps are also affected within the injury area and this necessitates long pedicled flaps. This situation restricts the usage of free flaps such as latissimus dorsi myocutaneous flap [23, 24], groin flap, scapular flap [25], combined scapular/ parascapular flap [26, 27], lateral thigh flap [28], occipito-cervico-dorsal flap [29], fasciocutaneous supraclavicular artery island flap [30] and longitudinal trapezius fasciocutaneous flap [31] that could be used in neck reconstruction. Another difficulty in the neck reconstruction is that it is not easy to adapt free or pedicled musculocutaneous flaps to fit the defect. Usage of the skin grafts as a last but a reliable and easy treatment choice. The advantage of skin grafts is that non-bulky skin is imported from a previously uninjured area instead of traumatising the scarred skin or compromised skin. But in

patients who had burned themselves with inflammable chemicals such as thinner had few donor sites for skin grafts. There are several disadvantages of the skin grafts such as contracture, discoloration, difficult resurfacing and donor site scarring. Another disadvantage is that prolonged periods of postoperative physiotherapy and splinting are required when grafts are used [31]. Full thickness skin grafts approximate closely to normal skin in texture, color and resilience than split thickness skin grafts. But there is limited donor site available for full thickness skin graft harvesting that enables the usage in large defects. Full thickness skin grafts contract much less than split thickness skin grafts as there is an inverse relationship between the thickness of the dermis and graft contraction. Another disadvantage reported by Iwuagwu et al is that fewer rereleases are seen when reconstruction is carried out with full thickness skin grafts, and the interval between the rerelease and initial treatment has been reported to be longer [32].

The usage of split thickness skin grafts produce no major donor site morbidity. The operation time compared with the other treatment choices is shorter and the follow up is easier. The postoperative hospitalization period is shorter. In a study performed by Adent et al, three techniques, grafts, free flap surgery and skin expansion were compared and in terms of morbidity, neck motility, skin elasticity, matching and scar recurrence, full thickness skin grafting was seen to be the most adequate technique. Another vital point in the post burn neck contracture release is to obtain a satisfactory cervico-mental angle which would allow the patient three-dimensional neck movement. The cervicomental angle has been reported to be between 90 to 121 degrees in various studies [6-9]. The correction of the cervicomental angle is important for the aesthetic outcome of neck contracture reconstruction. An obtuse angle will result in an unappealing aesthetic appearance as well as restrictions in three dimensional movement.

The intubation problems in severe post-burn neck contractures which could not be managed with conventional methods were solved by releasing the neck contracture under local anesthesia and performing intubation subsequently. By releasing the major bands the cervicomental hyperextension and free mandibular

lifting could be obtained. Following this, intubation could be done unless there was not any situation such as tracheal stenosis that created difficulty.

Obtaining a functionally and aesthetically pleasing cervicomenal angle are the major points in neck reconstruction. Functional outcome should be considered first to improve the patient's life standards. Besides aesthetic appearance must be acceptable.

Conclusion

Many techniques have been described for correction of neck contractures, including skin grafting, expanders, local regional flaps and free flaps. The treatment of choice should be modified for every patient.

Competing interest statement

The authors declare that they have no competing financial interests.

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Severe mentosternal synechia

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