ISSN: 2755-015X

Journal of Surgery & Anesthesia Research

SCIENTIFIC Research and Community

Research Article Open Access

Trapeze Flap for Correction of Post Burn Finger Flexion Contractures

Jalal Hamasalih Fattah

Abstract

Background and Objective: Scar flexion contractures of the fingers are a significant complication of burns of the hand, and they are a common cause of hand disability. Many reconstructive techniques are currently used however: the results are unsatisfactory in many of them. The objective is to evaluate the Trapeze flap for correction of post burn finger flexion contractures.

Materials and Methods: This is a Prospective study conducted at Rizgary teaching hospital and CMC private hospital in Erbil-Iraq from May 2013 to June 2018. The data of 48 patients [103 fingers] with post burn contractures treated with Trapeze flap were included. Follow-up results were observed from 6 months to 1 year after surgery. Full finger active flexion and active extension was regarded as a good result .

Results: Our study showed very high patient satisfaction rate about 96% (46 Patient out of 48]. Partial flap loss was a rare complication [in one patient 2%] and infection in one patient 2%. In both the wounds healed with conservative management. post-operative scars were nearly invisible with no hypertrophic scar and no keloid formation, and the flaps' surface texture was close to the texture of undamaged fingers. There was no recurrence of the contractures.

Conclusions: Trapeze flap is a reliable and effective local flap for reconstruction of fingers post burn flexion contracture with very high patient satisfaction and success rate.

Corresponding author: Jalal Hamasalih Fattah, Assistant Prof. in plastic surgery Head of plastic surgery unit, Department of surgery/College of Medicine / Khanzad street, beside Erbil teaching hospital, Erbil- Kurdistan region-Iraq. Tel: 009647504627251; E-Mail: jfattah64@gmail.com

Received: March 17, 2020; **Accepted**: March 23, 2020 ; **Published:** March 25, 2020.

Keywords: Flexion Contracture, Trapeze Flap, Flap Necrosis, Scar.

Introduction

Although each hand represents <3% of the total body surface area, burns of the hand is classified as major injuries. Burns of the hand have devastating consequences not only for the functional outcome but also for the esthetic appearance [1]. Burn reconstruction refers to the numerous and varied procedures performed on healed wounds or skin grafts. The overall goal of burn reconstruction is to improve both the appearance and function of the person who sustained a burn injury. The surgeon must accurately diagnose the problem including which types of tissue are deficient; identify which tissue is available for reconstruction, and then formulate a rational plan based on these findings [2]. Burn scar contractures have been classified by Mc Cauley as the following:

Grade I: Symptomatic tightness but no limitations in range of motion, normal architecture.
Grade II: Mild decrease in range of motion without significant impact on activities of daily living, no distortion of normal architecture.
Grade III: Functional deficit noted, with early changes in normal architecture of the hand.
Grade IV: Loss of hand function with significant distortion of normal architecture of the hand
Subset classification for Grade III and Grade IV contractures: A: Flexion contractures, B: Extension contractures, C: Combination of flexion and extension contractures [3].

Scar flexion contractures of the fingers are a significant complication of burns of the hand, and they are a common cause of hand disability. Flexion contracture of the fingers poses a challenge for plastic surgeons [4]. The task of surgical treatment consists of complete contracture elimination by lengthening the flexion surface of a finger and skin resurfacing, as well as the restoration of hand function without contracture recurrence To accomplish these tasks, various reconstructive techniques like Split thickness skin graft, Full thickness skin graft, Z plasty with its variations, combined z-plasty with V-Y flap, were used, However; The results were unsatisfactory in most of the cases [5]. Looking for a more effective method for treating such contractures, we used trapeze-flap to improve the outcome of postburn finger contracture reconstruction.

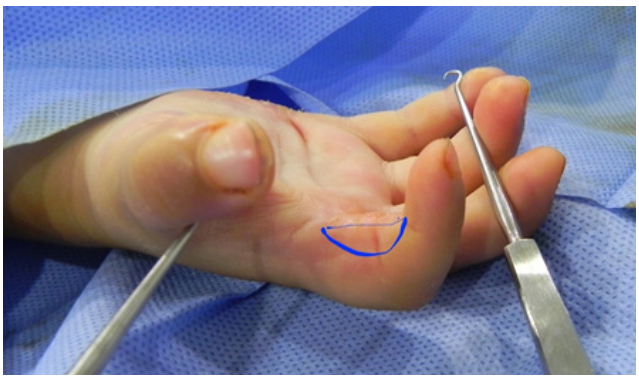
Materials and Methods

Design and Sample Collection

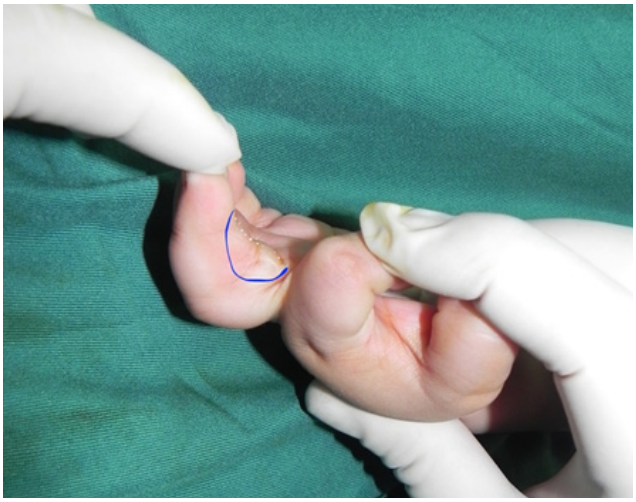
Between May 2013 and June 2018, Trapeze flaps were used for correction of postburn flexion contracture of fingers at Rizgary Teaching Hospital and CMC Private hospital in Erbil for 53 patients [112 fingers]. The mean age was [13.6 +_ 8.7 SD] Years, Ranging from 4-32 years. Male to female ratio was 2:3. A short history including patient's demographics, duration and mechanism of burn, hand dominance, type of post burn contracture, unilateral or bilateral, which fingers involved, severity of contractures and its effects on limitation of hand function, and associated hand deformities were recorded. Clinical examination including types of the post burn contracture, the side and the involved fingers, severity of the post burn flexion contracture defined as mild when incomplete Interphalangeal joint [IPJ] extension is 30 degree, Moderate when IPJ extension is 31-60 degree, and severe when incomplete IPJ extension is above 60 degree . The outcomes and possible complications have been discussed with patients or parents [in pediatric cases] and the Informed consent was signed by them. Preoperative photos have been taken.

Procedure

Finger flexion contractures caused by a scar fold located along flexion surface of fingers [Figure 1].



(A)



(B)

Figure 1: The crescent shaped fold is responsible for PB flexion contractures (A,B arrows).

The fold has a crescent shape. The main planning goal is to convert both sheets of the crescent fold from the crest of the fold to the joint axis level into trapeze-shaped flaps. The first line is drawn along the fold's crest. Then, several radial lines marked along the fold's full extent from the crest of the fold to the joint axis level. The end points of the incisions must be fish tailed [Figure 2]. The distance between the radial lines if measured at the fold's crest is about 1 cm. Since the fold was of a crescent form, the trapeze-shaped figures were formed. The fold itself was thus transformed into one or several pairs of these trapezoid flaps. According to the marked lines, the sheets are separated along the fold's crest and are then cross-

cut by radial incisions according to the markings. The flaps are mobilized from the fold crest to the joint axis level. The flaps included a fat layer [Figure 3].

Figure 2: Marking the first line is drawn along the fold's crest. Then, several radial lines marked along the fold's full extent from the crest of the fold to the joint axis level. The end points of the incisions fish tailed.

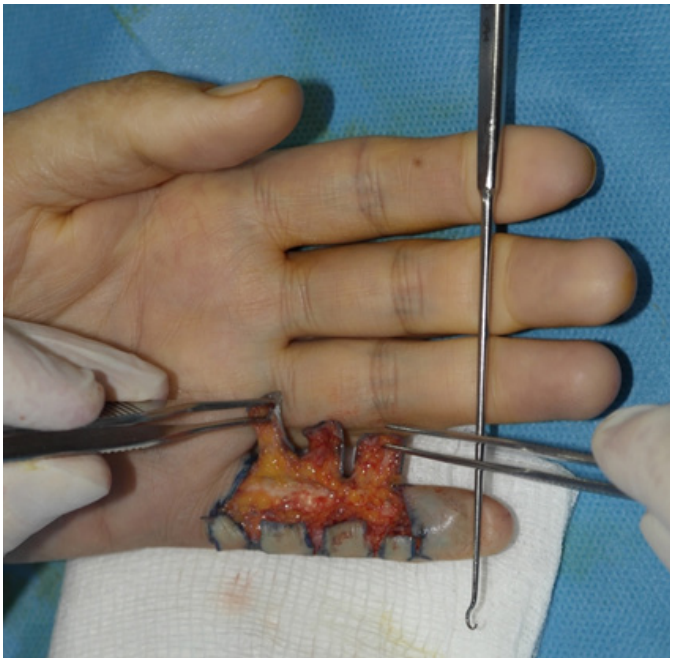
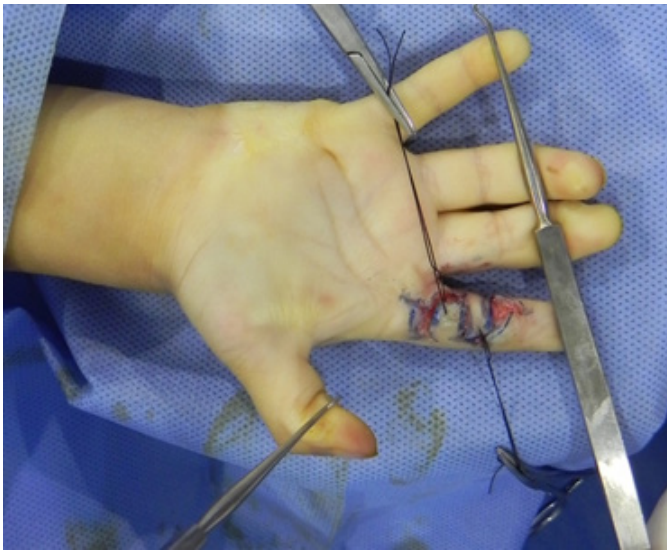
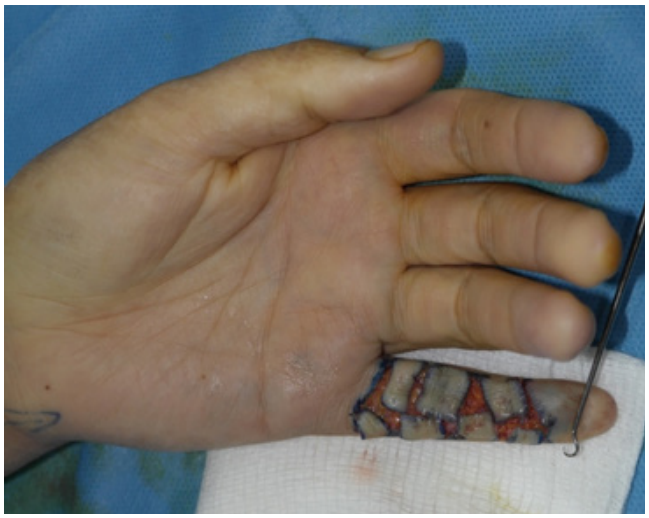


Figure 3: The flaps are mobilized from the fold crest to the joint axis level. The flaps included a fat layer.

The neurovascular bundles stay in situ. The tendon sheet is not exposed. The first pair of trapezoid flaps is mobilized in the central part of the fold, usually against the PIP joint. Similar flaps are mobilized along the fold. As a result of flap mobilization, the contracted finger flexion surface is delivered from scars up to the joint axis level. Depending on the fold length, one, or several pairs of flaps are mobilized [Figure 4]. The longer the fold, the more pairs of flaps may be formed.



(A)



(B)

Figure 4: Depending on the fold length, one, or several pairs of flaps are mobilized . The longer the fold, the more pairs of flaps may be formed (A,B).

The mobilized flaps were fixed by sutures and pulled apart to the sides. Using moderate pressure, the finger was gradually completely extended, then the finger fixed in the extended position by K-wire. The oppositely located mobilized flaps were transposed one towards another with mild tension. The end of one flap usually reach the opposite flap's base. Firstly, the oppositely transposed flaps covered the PIP joint flexion zone, then the other flaps counter transposed, fully or par-

tially covering the wound surface. Any remained raw area covered with full thickness skin graft [Figure 5].

(A)

(B)

Figure 5: Shows that after Flap transposition, any remained raw area covered with full thickness skin graft (A,B).

After correction of the involved fingers, circular dressing applied on the fingers in two layers, the inner layer is paraffin impregnated gauze and the outer layer with betadine impregnated gauze wrapping around the reconstructed fingers with mild compression. Dry gauze applied to the web spaces, then the entire hand up to mid forearm wrapped with soft cotton and overlied with full POP using fiber glass. Finger tips remained exposed to serve as an indicator of proper blood circulation.

The first dressing change done after one week from the date of the operation. After that all of the patients were examined 2 weeks,1 month, 3 months, 6 months, and One year after the first dressing change. Data including viability of the flaps, skin graft take, and any complications such as wound breakdown, Flap necrosis (Partial or complete], skin graft loss, hypertrophic scar, keloid, recurrence of contracture were recorded. Also, surgeon/Patient satisfaction were recorded.

Exclusion Criteria

Exclusion criteria were burn less than six-month duration, Finger flexion contracture associated with extensive syndactyly or extension contracture of the hand, Destroyed IPJ, Patient unfit for general anesthesia. Five patients were excluded from the study because of lack of adequate follow up, therefore; only the remaining 48 patients [103 fingers] were included in the analysis.

Ethical Considerations

The study protocol was approved by Medical Ethics Committee of the College of Medicine of Hawler Medical University. Informed consent obtained from all parents (for children below 18 years old] and from the patients above that age.

Statistical Analysis

Data were analyzed using the statistical package for social science SPSS V. 19. Chi square test of associates was used to compare between proportions. Fisher exact test was used when the expected count of more than 20% of the cells of the table was less than 5. A P-value of less or equal to 0.05 was considered statistically significant.

Results

Severity of PBC	Number of the fingers affected				
	One finger	Two fingers	Three Fingers	Total No of patients	Total No of fingers
Mild	1	1	6	8	21
Moderate	8	12	6	26	50
Severe	3	4	7	14	32
Total	12	17	19	48	103

Table 1: Shows the severity of Post burn contractures and the number of the fingers affected by the contracture

Severity of PBC	Type of repair			P Value
	Trapeze flap alone	Combined Trapeze flap and skin graft	Total No of patients	
Mild	8 [100%]	0	8	0,00
Moderate	16 [61.5%]	10 [38.5%]	26	
Severe	0	14 [100%]	14	

Table 2: Shows the type of repair used versus severity of contractures.
In all cases with severe flexion contractures (14 cases) the trapeze flap combined with skin graft, the p value with Fisher exact test is less than 0.05 which is statistically highly significant.

Severity of PBC	Patient Satisfaction			P Value
	Satisfied	Unsatisfied	Total	
Mild	8 [16.6%]	0 [0%]	8 [16.6%]	0,92
Moderate	25 [52.1%]	1 [2.1%]	26 [54.2%]	
Severe	13 [27.1%]	1 [2.1%]	14 [29.2%]	
Total	46 [95.8%]	2 [4.2%]	48 [100%]	

Table 3: Shows Patient satisfaction according to severity of PBC.

The Trapeze flap gained very high patient satisfaction rate (96%) for all grades of severity of flexion contractures, the p value with Fisher exact test is 0.92 which is statistically not significant.

Type of Repair	Patient Satisfaction			P Value
	Satisfied	Unsatisfied	Total	
Trapeze flap alone	24 [50%]	0 [0%]	24 [50%]	0,24
Combined Trapeze flap and skin graft	22 [45.8%]	2 [4.2%]	24 [50%]	
Total	46 [95.8%]	2 [4.2%]	48 [100%]	

Table 4: Shows Patient satisfaction according to the type of repair.
The p value with Fisher exact test is 0.24 which is statistically not significant.
The Trapeze flap alone or in combination with Full thickness skin graft gained very high patient satisfaction rate (96%),
The p value with Fisher exact test is 0.25 which is statistically not significant

Complications	Frequency	%
No complication	46	95.8
Infection	1	2.1
Partial flap necrosis	1	2.1
Total	48	100

Table 5: Shows the complications of Trapeze flap.

The complication rate was very low, only one case of wound infection and one case of partial flap necrosis. There were no hypertrophic scar and no recurrence of the contracture.

Discussion

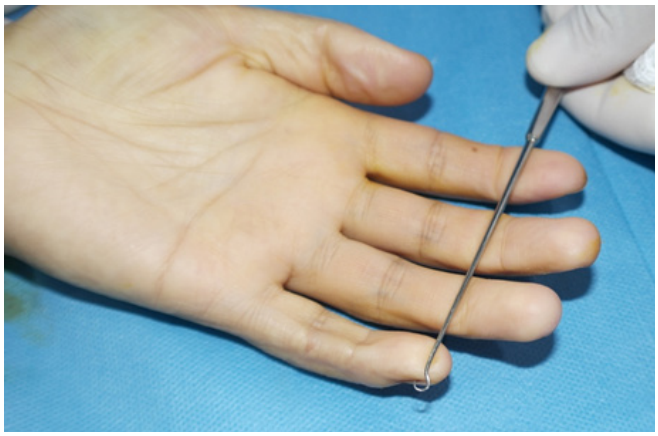
Many different methods are currently used for reconstruction of finger postburn flexion contractures with variable results, therefore, the search for a new, and more efficient method continues. Z-plasty is a frequently used procedure, in spite of the restricted possibilities of the technique [6, 7]. The draw back of this method is that the flaps are small sized with acute tip angles, and undergo rotation. Due to these features, the flaps often necrose and hence, the contracture may reoccur. According to Alexander et al. Z-plasty can eliminate a contracture only in 10% of the cases [8].
V–Y-plasty and its modifications have limited amount of advancement, hence, a combination of V–Y plasty with skin grafting and Z-plasty is recommended [9-12].

The subdermal pedicled rhomboid flap is merely a combination of V–Y and Y–V procedure. The lengthening is achieved by the change of the form of a rhomboid-shaped flap. Since a rhomboid flap is small and the lengthening is not sufficient, therefore, combination with Z-plasty is recommended [13].
There are many articles concerned with postburn finger flexion contracture reconstruction by skin grafting [14-16]. The scars are cross-cut in the zone of proximal interphalangeal (PIP) joint or in several places, or excised; the wound is covered with skin graft. The use of full-thickness skin graft yields better results than the split-thickness [17]. Follow-up observations showed that the contracture often recurred after skin grafting [18].

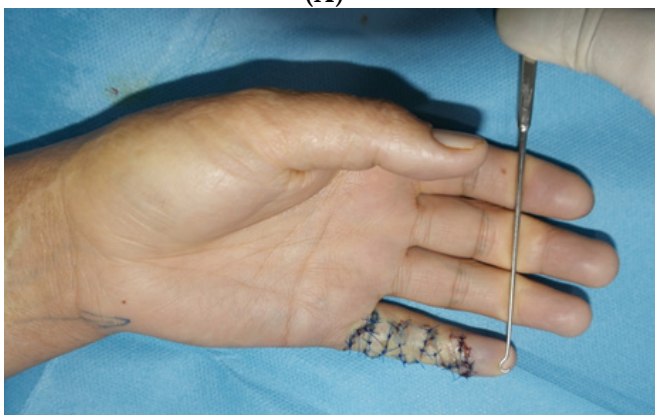
By careful analysis of the literature we can conclude that the above mentioned techniques are not the ideal method for correcting finger post burn contractures because they will not address the full use of the crescent shape scar fold which is the main cause of contracture with a lot of limitations like small flap size, acute flap tips with high chance of flap necrosis and high chance of recurrence.

As the finger flexion contractures caused by the crescent shape scar fold located along flexion surface of fingers. in Trapeze flap both sheets of the fold are completely converted in to flaps up to the joint rotation axis, therefore, all finger flexion surface up to IP joint rotation level is delivered from scars tension leading to complete contracture elimination. The achieved lengthening equaled the sum of the flaps' middle width distances of all flaps minus the length of the fold's crest that was transformed into flaps. The surface lengthening taking place was by approximately 150% [4]. The flaps are large contain fatty tissue , without acute angles and hence less chance of flap necrosis, mobile, undergo minimal rotation; they have steady blood circulation and continue to grow in children. Tendon sheets are not exposed, and neurovascular bundles stay in situ.

Trapeze flap can be used for correcting all grades of severity of finger flexion contracture [Table 1]. In mild and most moderate finger flexion contractures [61.5%] Trapeze flap alone is enough to cover the raw areas created by contracture release[Figure 6,7] , while in all severe contractures and some moderate contractures [38.5%] Trapeze flap in combination with full thickness skin graft [Figure 8] addressed the raw areas. [Table 2].



(A)



(B)

Figure 6: Mild PBC of little finger reconstructed with trapeze flap alone (A,B).

(A)

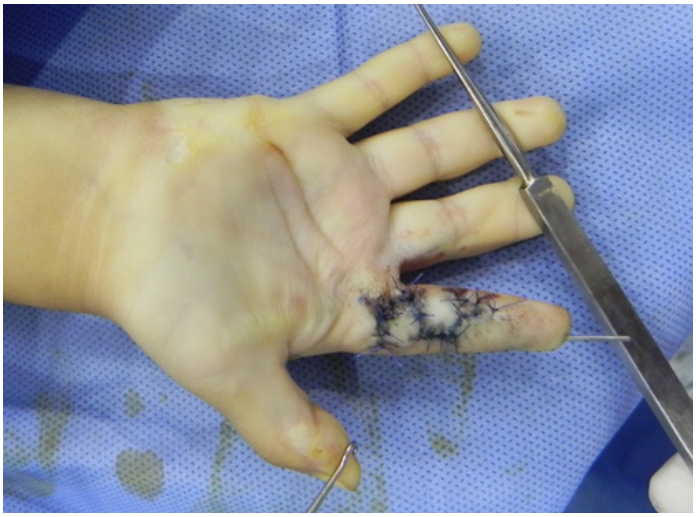
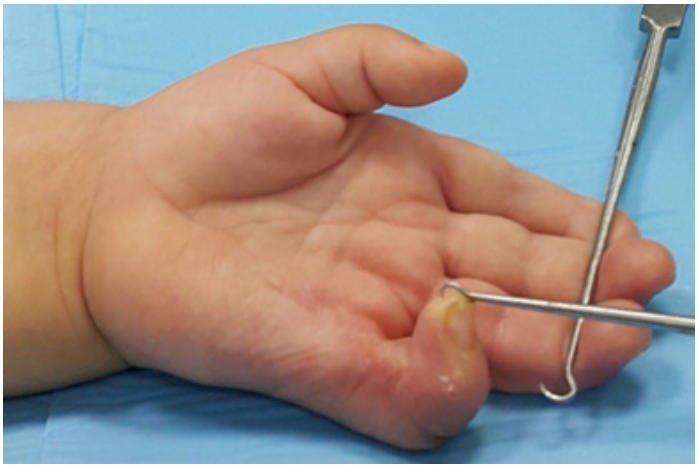


Figure 7: Moderate PBC of index finger reconstructed with trapeze flap alone (A,B).



(A)

Figure 8: Severe PBC of Little finger reconstructed with trapeze flap in combination with FTSG (A,B).

Our study showed very high patient satisfaction rate about 96% [46 Patient out of 48]. This agrees with V.M. Grishkevich who reported 98% patient satisfaction rate. Partial flap loss was a rare complication (in one patient] and infection in one patient. In both the wounds healed with conservative management. Post-operative scars were nearly invisible with no hypertrophic scar and no keloid formation, and the flaps' surface texture was close to the texture of undamaged fingers [Figure 9,10]. There was no recurrence of the contracture. Due to the advantages of trapeze flap mentioned above, the very high patient satisfaction and success rate of Trapeze flap in managing post burn finger flexion contractures, and its applicability to all grades of severity of the contractures with very low complication rate we can conclude that Trapeze flap alone or in combination with full thickness skin graft, is the best method for reconstruction of fingers post burn flexion contracture.

(A)

(B)

Figure 9: Above : Preoperative , Moderate PBC of right index finger, marking done for correction with Trapeze flap. Below : Six months postoperatively shows full correction of the contracture with invisible scars (A,B).

(A)

(B)

Figure 10: A : Preoperative , Moderate PBC of right little finger, marking done for correction with Trapeze flap. B : Nine months postoperatively shows full correction of the contracture with invisible scars.

Conclusion

Trapeze flap is a reliable and effective local flap for reconstruction of fingers post burn flexion contracture with very high patient satisfaction and success rate, it is applicable to all grades of severity of the contractures with very low complication rate and in my practice, it replaced other methods of reconstruction.

References

1. Hanumadass M, Kagan R, Matsuda T (1987) Early coverage of deep hand burns with groin flaps. J Trauma 27: 109-114.
2. Pereira C, Murphy K, Herndon D (2004) Outcome measures in burn care. Is mortality dead? Burns 30: 761-771.
3. McCauley RL (2000) Reconstruction of the Paediatric burned hand. Hand Clin.16: 249-259.
4. V.M. Grishkevich (2011) Flexion contractures of fingers: Contracture elimination with trapeze-flap plasty. Burns 37: 126-133.
5. Schneider JC, Holavanahalli R, Helm Ph, O'Neil C, Goldstein R, et al. (2008) Contractures in burn injury: investigating joints of the hand. J Burn Care Res 29: 606-613.
6. Smith MA, Muster AM, Spence RJ (1998) Burns of the hand and upper limb--a review. Burns 24: 493-505.
7. Mlakar JM, Dougherty WR (2002) Reconstruction of the burned hand. In: Herndon D, editor. Total burn care. 2nd ed., Philadelphia, PA: WB Saunders : 628-655.
8. Alexander JW, MacMillan BG, Martel L, Krummel R (1981) Surgical correction of post burn flexion contracture of the fingers in children. Plast Reconstr Surg 68: 218-226.
9. Ebbehoy J (1983) Y- to V instead Z- to N. Burns Incl Therm Inj 10: 121-123.
10. Cooper MA (1990) The multiple Y-V plasty in linear burn scar contracture release. Br J Plast Surg 43: 145-149.
11. Motamed S, Hasanpoor SE, Mosavizadech SM, Arasten E (2006) Treatment of flexion contractures following burns in extremities. Burns 32: 1017-1021.
12. Peker F, Celebiler O (2003) Y-V advancement with Z-plasty: an effective combined model for the release of post-burn flexion contractures of fingers. Burns 29: 479-482.
13. Findik H, Eroglu Ciloglu NS, Uzuismail A (2007) Third refinement in rhomboid release of contractures by adding four-flap Z- plasties. Ann Burn Fire Disasters 20: 35-39.
14. McCauley RL, Barret JP (1999) Management of extreme

burn hand deformities in children. Proc Am Burn Assoc 20: S.214.

15. Asuku ME, McCauley RL, Piazza RC (2005) Reconstruction of burned hand. In: McCauley RL, editor. Functional and aesthetic reconstruction of burned patients. Boca Raton: Taylor and Francis p.437-462.
16. Kola N, Isaraj S, Bella GJ (2006) Planning and technical details when treating a post-burn hand contracture. Ann Burn Fire Disasters 19: 208-211.
17. Pensler JM, Steward R, Lewis SR, Herndon DN (1988) Reconstruction of the burned palm: full-thickness versus split-thickness skin graft. Plast Reconstr Surg 81: 46-49.
18. Sungur N, Ulusoy MG, Boyacigil S, Ortaparmak H, Akyüz M (2006) Kirschner-wire fixation for post-burn flexion contracture deformity and consequences on articular surface. Ann Plast Surg 56: 128-132.