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MODERN APPROACHES TO THE MANAGEMENT OF POST-BURN SCAR CONTRACTURES OF THE SHOULDER AND ELBOW JOINTS IN CHILDREN.

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Annotation: The article compares traditional and modern surgical treatment methods for post-burn scar contractures of the shoulder and elbow joints in children. The study was conducted on 98 patients with post-burn scar contractures of the shoulder and elbow joints, who were treated in the Department of Maxillofacial and Plastic Surgery at the Andijan Regional Multidisciplinary Children's Medical Center. Among them, 47 patients were included in the control group, and 51 patients were included in the main group. In the main group, surgical correction of scar contractures of the shoulder and elbow joints was performed using a modern surgical technique involving a “double-humped” skin flap. The results demonstrated that the modern surgical method achieved favorable outcomes in 96% of cases in the treatment of post-burn scar contractures of the shoulder and elbow joints.

Keywords: burn, scar, scar contracture, “double-humped” skin flap, joint.

СОВРЕМЕННЫЙ ПОДХОД К ЛЕЧЕНИЮ ПРИ ПОСЛЕОЖОГОВЫХ КОНТРАКТУРАХ ПЛЕЧЕВОГО СУСТАВА И ПРЕДПЛЕЧЬЯ У ДЕТЕЙ МЕТОДОМ ПОЛНОСЛОЙНОЙ КОЖНОЙ ПЛАСТИКИ.

Аннотация. В данной статье приведены сравнение между современными и традиционными методами хирургических лечений послеожоговых рубцовых контрактур в области плечевого сустава и предплечья у детей. Исследование проводилось в Андижанской областной детской многопрофильной медицинском центре в отделении пластической хирургии и челюстно-лицевой хирургии у 98 пациентов с послеожоговыми рубцовами контрактурами плечевого сустава и предплечья. Из них 51 пациента были отобраны как оснавная группа и 47 как контрольная группа. У основной группы пациентов провели современный хирургический метод “двугорбовой” пластики. Результаты показали что при лечении современным хирургическим методом у больных с послеожоговыми рубцовыми контрактурами в области плечевого сустава и предплечья составило 96% хороших результатов.

Ключевые слова: ожог, рубцовые контрактуры, “двугорбовой” лоскут, сустав.

Relevance of the Topic. According to the World Health Organization (WHO), 294–384 individuals per 100,000 population suffer from burn injuries annually, with children accounting for 30–35% of these cases. Among all post-burn joint contractures, shoulder joint contractures comprise 10–37%, while elbow joint contractures account for 7–28%. These complications are associated with a high rate of disability in children, ranging from 22.8% to 40% [2,5,9,11,16]. Therefore, the rehabilitation of such patients has significant socio-economic importance and remains one of the pressing issues in modern medicine [1,6,8,9,12].

The rehabilitation and correction of post-burn joint deformities is considered one of the main and most complex directions in reconstructive surgery [7,9,10,15,16].

Various surgical techniques have been proposed to restore the function of joints affected by post-burn scar contractures, including Z-plasty, modified Z-plasty methods, autodermoplasty, non-free dermofascial flap transposition, and free dermofascial flap transplantation. However, the

application of certain techniques is limited due to the shape, localization, and severity of the contracture, and surgical outcomes are not always satisfactory [1,3,4,7,13,14,15].

In post-burn cases, not only the timely provision of medical care but also the prompt execution of reconstructive surgical procedures and the proper management of patient rehabilitation are of critical importance.

Objective of the Study: To develop an improved reconstructive and plastic surgical technique aimed at enhancing the treatment outcomes of children with post-burn scar contractures of the shoulder and elbow joints.

Materials and research methods. In 2018-2024, the history of the disease of 98 patients with post-burn scar contracture of the shoulder and elbow joints treated in the facial-jaw plastic surgery department of the childrens multidisciplinary medical center of the Andijan region was studied retrospectively. Of this, 47 (47.9%) patients were taken as the control group and 51 (52.1%) patients were taken as the main group.

Criteria for the selection of patients in polyclinics:

- in patients with post-traumatic stress disorder, skin and skin contractures;
- p. 3-17.;
- Christmas tree and tirsakty for patients who have received degrees II and III degrees;
- the patient and her father.

For children from 3 to 17 years old with vision problems (P>0.05) (1st table).

Table 1.

Distribution of sick children by age and gender

Age	Control group n=47				Main group n=51				Total n=98	
	Boys		Girls		Boys		Girls			
	abs	%	abs	%	abs	%	abs	%	abs	%
Ages 3–6	3	6,4	2	4,2	4	7,8	3	5,8	12	12,2
Ages 7–11	12	25,5	8	17,1	14	27,4	7	13,7	41	41,8
Ages 12–14	8	17,1	5	10,6	10	19,7	5	9,8	28	28,6
Ages 15–17	6	12,7	3	6,4	6	11,8	2	4	17	17,4
Total	**29**	**61,7**	**18**	**38,3**	**34**	**66,7**	**17**	**33,3**	**98**	**100**

The complex of research methods included: clinical-laboratory, ultrasound, dopplerographic analysis, skin thermometry, assessment of intact skin surface, radiological, morphological and statistical methods.

The causes and severity of burns to the shoulder and elbow joints will depend to some extent on the age and sex of children [2,5,6,9]. When the etiological causes were analyzed, it was found that the main factors were burns with hot liquid (59.2%) and burns caused by fire (40.8%)..

Table 2

Distribution of Burns of sick children according to etiological factors.

Etiological factors	Control groupn=47		Main groupn=51		Total n=98	
	абс	%	абс	%	абс	%
Flame burn	19	40,4	21	41,2	40	40,8
Burn caused by hot liquids	28	59,6	30	58,8	58	59,2
Total	**47**	**100**	**51**	**100**	**98**	**100**

Figure 1. Distribution of burn injuries in pediatric patients according to etiological factors.

To determine the most appropriate surgical tactics and to assess the degree of functional impairment, the classification of contractures based on the limitation of shoulder and elbow joint movements proposed by V.M. Grishkevich was used [129].

According to this classification, pediatric patients with post-burn scar contractures of the shoulder and elbow joints were categorized as follows:

I. Based on the localization of retracting scars:

a) Marginal (unilateral and bilateral);

b) Central;

c) Total.

II. Based on the degree of functional impairment:

Grade I – limitation of the range of motion from 0° to 30°;

Grade II – from 31° to 60°;

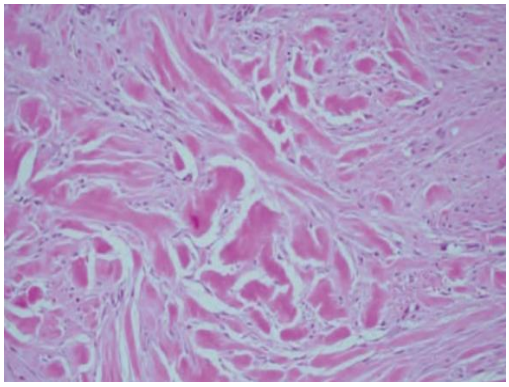
Grade III – more than 60°.

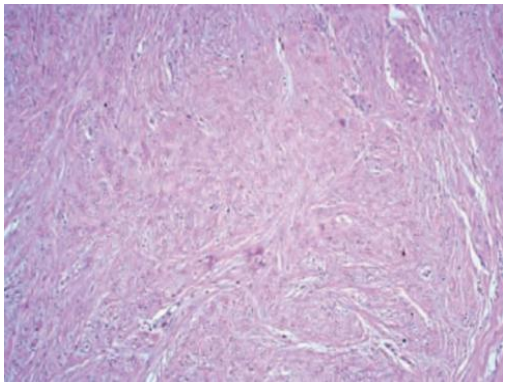
Table 3

Anatomical types of contractures	Control group n=47		Main groupn=51		Totaln=98	
	абс	%	абс	%	абс	%
Unilateral marginal contracture	14	29,8	17	33,3	31	31,6
Bilateral marginal contracture	9	19,2	11	21,6	20	20,5
Central	17	36,1	15	29,4	32	32,6
Total	7	14,9	8	15,7	15	15,3
Total	**47**	**100**	**51**	**100**	**98**	**100**

Table 3. Distribution of shoulder and elbow joint contractures in pediatric patients based on localization.

In order to assess the condition of tissues affected by post-burn scar changes, a morphological study was conducted prior to the surgical intervention (Figures 1a and 1b).





a

b

Figure 1. Distribution of pediatric patients with post-burn scar contractures of the shoulder and elbow joints by contracture severity.

a) Keloid scar (stained with hematoxylin and eosin, magnification ×40). Disorganized large eosinophilic and focally fragmented collagen complexes.
b) Hypertrophic scar (stained with hematoxylin and eosin, magnification ×40). Nodular formations of fibrotic collagen.

The obtained histological results indicate the presence of clearly expressed dystrophic fibrous dysplasia in the scar tissue. This condition is characterized by a reduced amount of cytoplasm and underdeveloped endoplasmic reticulum, resulting in the gradual loss of protein synthesis capacity by the cells and the development of sclerosis.

Morphological studies of scars are essential for differentiating between hypertrophic and keloid scars and for ensuring an appropriate treatment approach.

Based on the above findings, we optimized the surgical treatment strategy for post-burn contractures of the shoulder and elbow joints. The approach considered the specific characteristics of the scar contracture, its localization, size, degree, and the condition of surrounding tissue defects.

Results and Discussion. In the control group, consisting of 47 (47.9%) pediatric patients, post-burn scar contractures of the shoulder and elbow joints were eliminated using conventional surgical techniques such as Z-plasty and dermal-fat flap plastic surgery**.**

Z-plasty is recommended when the scar tissue is marginally located around the joint or when a narrow scar (up to 2 cm wide) causes contracture. In this technique, the contracted scar is excised in a Z-shape, creating two triangular flaps. These flaps are then mobilized, transposed, and sutured in place using atraumatic interrupted stitches.

A notable drawback of this method is the potential necrosis of the flap tips in some patients. Consequently, the wound may heal with coarse scarring, leading to recurrence of the contracture. This technique was applied in 24 (51%) patients of the control group (Figure 2a and 2b).

a **b**

Figure 2. Elimination of post-burn scar contracture of the elbow joint using the Z-plasty technique:
a–preoperativecondition;
b – postoperative condition.

Dermal-fat flap plastic surgery is a method used to eliminate scar contractures and deformities of the shoulder and elbow joints by utilizing dermal-fat flaps harvested from healthy skin areas adjacent to the joint. When the contractile scar over the joint is excised and the joint is redressed, a defect is formed. This defect is closed using a dermal-fat flap designed from adjacent healthy tissue with a slightly broader base, which allows sufficient vascular supply and proper wound closure. This technique was applied in 23 (49%) patients.

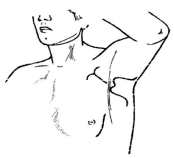
Results were analyzed during the follow-up period ranging from 2 months to 1 year. Among patients treated with Z-plasty for post-burn contractures of the shoulder and elbow joints, necrosis of triangular flaps occurred in 4 (16.7%) cases. In patients treated with dermal-fat flap plastic surgery, flap necrosis due to impaired vascularization occurred in 3 (13%) cases. In these patients, the wounds healed with scarring, and recurrent contracture was observed.

Taking into account the limitations of these techniques (including risks of flap tip necrosis and purulent complications), we have introduced a modern and improved method in our hospital — **the "double-hump" flap technique** — for eliminating post-burn contractures of the shoulder and elbow joints in pediatric patients. This method was applied in 52 children with moderate to total scar-related flexion contractures.

Surgical technique: An incision is made along the border between the scar and healthy tissue. A dermal-fat **"double-hump" flap** is prepared from the healthy skin-fat layer and mobilized. Hemostasis is ensured. The scar is excised, and redressment is performed. A socket is shaped in a "cradle" form for proper flap placement. Hemostasis is repeated, then the flap and wound edges are approximated using atraumatic interrupted sutures. A plaster splint is applied. After complete wound healing, physiotherapy and balneotherapy are conducted.

a **b**

Figure 3. Diagram of eliminating post-burn scar contracture of the elbow joint using the **"do**
a – i
b – i



a

b

Figure 4.

Elimination of post-burn scar contracture of the elbow joint using the "double-hump" flap technique:
a – preoperative view;
b – postoperative outcome

The outcomes were evaluated over a follow-up period ranging from 2 months to 1 year. When using the "double-hump" flap technique for the elimination of contractures in the shoulder and elbow joints, postoperative complications were observed in only 2 patients (4%), where necrosis affected only the upper one-third of the flap, leading to partial recurrence of the contracture and the need for reoperation. In 49 patients (96%), good functional and cosmetic results were achieved.

Table 4

Outcomes of surgical interventions for the treatment of post-burn scar contractures of the shoulder and elbow joints

Plastic surgery technique	**Total number of patients n=98**	**Unsatisfactory outcome**		**Good functional and cosmetic outcome**	
		abs.	**%**	**abs.**	**%**
Z-plasty	24	4	16,7	20	83,3
Skin-fat flap plasty	23	3	13	20	87
Double-humped flap plasty	51	2	4	49	96

Conclusion: In the control group, when Z-plasty was used to eliminate post-burn scar contractures of the shoulder and elbow joints in pediatric patients, good functional and cosmetic outcomes were observed in 20 (83.3%) cases, while unsatisfactory results were noted in 4 (16.7%) patients due to necrosis of flap tips and coarse scar formation at the surgical site. When dermal-fat flap plasty was applied, good functional and cosmetic outcomes were achieved

in 20 (87%) patients, whereas in 3 (13%) cases, impaired vascularization of the flap led to purulent complications, coarse scar formation, and recurrence of joint contracture.
In the main group, analysis of results in 51 patients showed that 49 (96%) of them achieved good functional and cosmetic outcomes. In 2 (4%) patients, necrosis of the “double-humped” flap tips resulted in coarse scar formation and partial recurrence of contracture.
The surgical treatment of post-burn scar contractures of the shoulder and elbow joints in children using the "double-humped" flap method is considered more effective compared to traditional techniques, achieving favorable treatment outcomes in 96% of cases.

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