Physiotherapy Approach to a Flexor Contracture in a Burned Hand After 30 Years

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CASE REPORT
SUMMARY
Introduction and Purpose: This case study describes the importance of postoperative rehabilitation program in case of contracture in the burned hand, several years ago. The purpose of this study is to report the results of kinesitherapy in restoring the functionality of burned hand, which is treated with various therapies and sessions such as: management of cicatrix, the amplitude of relocation in passive and active movements of affected joints, treatment for muscle atrophy, and coordination. Case Description: Our case study involves a 31-years old female, who after the release of flexor contracture by the plastic surgeon, was hospitalized with edematous hand, muscle hypotrophy, and limited amplitude of movement. Results: Improvements were noted in the amplitude of passive and active movements, and muscle strength. The assessment was performed according to Modified Strickland’s classification, where the total active motion (TAM) was 17.6% during the first month of treatment, however after five months of treatment, TAM reached up to 52.8%, which is assessed as positive result. Discussion: The aim of this case study is to demonstrate the importance of burned hand treatment and the necessity of an adequate treatment program in order to reach the most effective results in the relocation of hand’s functionality.

The keywords: Burn, hand, contracture, kinesitherapy, Strickland.

1. INTRODUCTION
Hand is especially a risky part in regards to the burns because of its exposure and the importance of its functionality. Even if the burned area is small, the thermal damage and contracture can affect the functionality of the hand. There is also a huge difference between the burns of an adult and that of a child. The risk of hypertrophic cicatrix and contracture are the dominating problems in children’s treatment. In the palmar aspect, the skin is very thick and offers better protection for the deep structures, but it has a very great tendency for flexor contractures. Epidemiology of injury after burns in children is different from that of adults (Sheridan et all; 1955). 75% of the children are under the age of 3. The main reason of injuries is the thermal burns, burnsings caused from direct contact with specific locations on the palmar aspect hand. The second and the most common reason are caused by injuries from hot liquids (1). According to Achauer, common distortions observed after hand combustion are: boutonniere deformity, palmar contracture of hand, hypertrophic cicatrix, and amputations (2). Desmogenic contracture and restriction of movement of joints are the result of the downsizing of connective tissue (3). The aim of the rehabilitation is to maintain mobility, prevent the development of the contracture, and to promote the functionality of hand and upper extremities (4). Physical therapy is a multidisciplinary approach that plays an essential role after the rehabilitation of a burned hand and the consequences occurred afterwards. The exercise program in patients, after the burning, may include exercises involving the amplitude of passive movements, passive assisting acts, and resistive exercises. Other techniques are practiced for management of cicatrix such as myofascial release massage and other various modalities such as fluidotherapy ultraviolet (UV), electro stimulation (5). The aim after the rehabilitation of a burned hand is to keep the deformities of the burned hand at the lowest degree possible.

2. CASE PRESENTATION
The patient L.H. 31 years old from Pristina, who was hospitalized for physical treatment for the inability of hand movements because of the limited movements in metacarpophalangeal joints (MCP), the proximal and distal interphalangeal articulations (PIP), distal interphalangeal articulations (DIP) of right hand. At the age of 9 months, the patient suffered from a burn in the dorsal part of the right hand and received only basic clinic treatment, and did not receive any physical therapy after the treatment of the burn. For 30 consecutive years, the injury has developed to flexor contracture of fingers II-V (Figure 1), in joints PIP and DIP. Due to the functioning constraints and aesthetics, the patient is hospitalized in the plastic surgery that indicated the necessity of a surgical intervention based on
anamnesis, clinical, radiologic, neurologic, and vascular examination (Figure 1).

On 16/10/2009, the patient underwent surgical intervention, where the release and correction of concentric and eccentric contractions was performed with multiple Z-plasty; the residual defects were covered with skin graft implants taken from left inguinal area and Kirschner wire fixation (KWF) was performed to four fingers (II-IV) because of the contractions in joints PIP (Figure 2).

3. REHABILITATION

The aims of rehabilitation:
- Reducing edema
- Management of cicatrix
- The relocation of passive amplitude of movements in affected joints
- The relocation of active amplitude of movements in affected joints and muscle power
- The coordination of movements

4. PHYSIOTHERAPY TREATMENT

Starting from the first day of the surgery until the fifth week of treatment, hand elevation was performed to the patient in order to prevent the edema and maintenance of surrounding nodes (art. R/C, art cubiti, and H/S), whereas the joints MCP, PIP, and DIP were not in the movement in order to protect the transplant and immobilization with K-wires. During the fifth week, the patient was put to physiotherapy treatment on 20/11/2009, after the K-wires were removed after the surgery (Figure 3). The right hand is 2.0 cm more edematous than the left hand; however the right forearm is 2.5 cm thinner than the left forearm. It is detected that the cicatrices of the joint level PIP are not fully healed in dorsal part of the hand. The assessment of amplitude of passive movements was performed with goniometric measurement on all of the finger joints II-V and the following results were achieved (Table 1).

The situation presented for evaluation before the intervention and rehabilitation (Fig.4). Evaluation of amplitude of active movements was impossible due to the limitations in movements and pain. The treatment started with exercises to relocate the amplitude of passive movements in finger joints MCP, PIP, and DIP, adding static exercises to improve muscle atrophy of the hand and forearm. During the sixth week, the abduction of fingers began; the eponym of thumb to other fingers was performed.

During the seventh and eighth week, all the wounds were fully healed; so that slow massages to newly formed cicatrix and movements in joints MCP, DIP, PIP began (the active movements in joints PIP and DIP were precise and carefully handled considering their long-term non-functionality). The therapy continued with previous exercises as well. Strengthening exercises for eccentric muscles were applied. During the tenth week, the exercises with electro stimulation to motor points of flexor digitorum profundus muscle were applicable. Improving amplitude active movements of joints MCP, PIP, and DIP with theraband exercises were gradually applied to achieve the muscle strength. During the rehabilitation, the patient is instructed to learn the exercises and to perform them at home.

<table>
<thead>
<tr>
<th>Amplitude Passive Movements of Finger Joints</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flx</td>
<td>Ex</td>
<td>Flx</td>
<td>Ex</td>
<td>Flx</td>
</tr>
<tr>
<td>MCP</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>-8</td>
</tr>
<tr>
<td>PIP</td>
<td>12</td>
<td>-12</td>
<td>32</td>
<td>-32</td>
</tr>
<tr>
<td>DIP</td>
<td>12</td>
<td>-12</td>
<td>22</td>
<td>-22</td>
</tr>
</tbody>
</table>

Table 1. The assessment of amplitude passive movements was performed with goniometric measurement on all of the finger joints II-V. Flx- Flexion; Ex- Extension; MCP- (metacarpofalangeal); PIP- (proksimalinterfalangeal); DIP- (distalinterfalangeal).
5. RESULTS

According to the evaluation of the plastic surgeon, before the intervention contracture in joint PIP finger V was 90 degrees, finger IV was 90 degrees, finger III was 86 degrees, whereas finger II was 66 degrees PIP flexion; and after the 6 months of intervention, the full extension of fingers in PIP joint level was achieved (Figure 5).

The assessment of total active right hand movements was performed according to the measurement Modified Strickland’s Classification and the results are shown in the below table (Table 2).

<table>
<thead>
<tr>
<th>Month/ Year</th>
<th>% 17.6</th>
<th>% 39.2</th>
<th>% 44.47</th>
<th>% 52.8</th>
</tr>
</thead>
<tbody>
<tr>
<td>December</td>
<td>2009</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>January</td>
<td>2010</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>February</td>
<td>2010</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Assessment of total active right hand movements according to the measurement Modified Strickland’s Classification.

The perimeters of the right forearm were measured with a measuring band, comparing with the left forearm and the following results were observed: in December, the perimeter of right forearm was 2.5 cm thinner than the perimeter of left forearm; however in March, the perimeter of both forearms did not change. On the other hand, the patient was able to fully perform daily life activities with right hand after the five months of therapy, which she was unable to perform past 30 years.

6. DISCUSSION

Burns represent serious injuries to children, which provide opportunities for serious deformities in the future. The primary purpose of the release of any of hand contractures is to restore its function and movement. There are many cases, in which the full amplitude of movement cannot be replaced. Madhuri’s case study in 1998 presents the deformity, which was improved in a period of six weeks, which is familiar to our case as well. However, this deformity was improved with the application of K-wires in 5 weeks. Bee Lan Ty’s study presents total active motion (TAM), which was reached after three months to a level of 47.7% of AL; in our case, TAM resulted in 44.5% of AL in 3-month rehabilitation and 52.8% of AL in a 5-month rehabilitation of the right hand. Exercises are the essential part to the rehabilitation after the burns and rehab programs are based on the characteristics of a patient and burns. The aim of the exercises is to maintain strength and condition, and to fight against contracture of cicatrix (5).

7. CONCLUSION

In this study, we conclude that the physical therapy plays a major role in improving the contracture of hand, preventing additional contractures, restoring the amplitude of movements, strength, and the functioning of hand. It is important to mention the psychosocial component that the patient is involved in activities related to work and society.

REFERENCES:
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