# Positioning and Range of Motion for the Prevention of Contractures

#### Gay Lynn McCrady, OTR

Joint contractures are one of the most challenging aspects of burn management and are the main source of disability for burn patients. Proper positioning of the patient, range of motion exercises and splinting are vital in bringing about the best functional outcomes in the rehabilitation of the patient. Proper positioning and range of motion exercises should be initiated from the beginning. Initial edema may make movement difficult, but the patient should be encouraged to do daily exercises.

Normally burn contractures only occur in patients with full-thickness burns (third degree burns) but they can occur in superficial burns that get infected and convert to full-thickness and take longer to heal.

### **Positioning:**

Positioning is very important in the prevention of contractures and deformities. For burn patients, the "position of comfort" is the position that most leads to contractures. Scar contractures tend to occur more in areas where skin is loose or more pliable. Because scars continue to mature over a long period, it is critical to continue the positioning long enough to prevent the contractures. Scars in adults do not reach maturation for 6-24 months and in children, the time period is 12-24 months.

In the African context, it is the family members who are available and provide most of the daily care of the patient. It is most beneficial to explain to the family the proper positioning for the patient and then encourage them to help follow through during the day. There are basic items available to help position the patient that the family can use. They can use a rolled up towel to place behind the neck to keep the neck in extension if the burn is over the anterior portion of the neck. They can put pillows at the end of the bed between the patient's feet and the foot board to help keep the ankles at 90 degrees. They can use pillows or a rolled up blanket to put between the arm and the body to help keep the shoulder in abduction. Proper positioning of burn patient:

Area Affected	Position to Prevent
	Contracture
Anterior neck	10-15 degrees extension
Anterior axilla	90 degrees Shoulder
	abduction
Posterior axilla	Shoulder flexion
Elbow/forearm	Extension/forearm neutral
Wrists	15-20 degrees extension
Hands	
MCP's	70-90 degrees flexion
IP's	Full extension
Thumb	Palmar abducted and
	opposed
Palmer	All joints full
	extension/thumb radially
	abducted
Hips	Extension, 10 degrees
	abduction, neutral rotation
Knees	Extension
Ankles	90 degrees dorsiflexion

### <u>Splinting:</u>

Splinting is very important in the prevention of contractures and ensuring the best possible functional gains for the burn patient. Contractures are easier to prevent than to fix. In the African context, where surgical treatment is limited, range of motion and splinting can make a big difference to the patient's outcome. Splinting is usually initiated when the development of skin tightness is noted over a joint causing limitation of movement. In full-thickness burns of the upper extremities, it is recommended that the splinting and elevation is begun immediately after the burn and before skin grafting. With early edema and inadequate burn therapy, contractures begin early. If skin grafting of



hands is delayed three weeks or more, there will be early contractures. Below are pictures of contractures secondary to deep burns and lack of splinting.

Fig 1 There are certain joints that are much more susceptible to contractures and would benefit

from splinting along with range of motion exercises. The axilla (armpit) is the most susceptible joint for a contracture and is also the most challenging for splinting. "Airplane splints", which can be made out of various materials, are the most beneficial. The airplane splint keeps the shoulder abducted at 90 degrees and the forearm positioned in neutral. The easiest and most readily available material to make the splint from in Africa is foam. It is cut in a triangle shape with the point of the triangle in the armpit and one side extending the length of the arm down to the wrist and the other side extending down the side of the body. The arm is strapped to the piece of foam. The airplane splint can be made from plaster or casting material which is available in Africa but the fabrication of the splint is a bit challenging and the casting material is heavy. The splint is constructed by making a plaster slab that starts at the middle of the trunk, goes up and curves under the armpit and runs down to the wrist. After the plaster slab has dried, it can be attached to the body and arm with an ace wrap or crepe bandage. It is good to periodically reposition the arm in the splint to avoid compression of the brachial plexus which could lead to neuropathy. The foam splint is excellent and light weight and good when he patient is in bed.



These contractures may have been prevented by aggressive therapy, splinting and exercises. Most come in to the medical centers with fixed contractures.

The wrist, MCP and PIP joints of the hand are also very susceptible to contractures. The wrist tends to get stuck in flexion, the MCP joints stuck in hyperextension and PIP joints stuck in flexion. Splinting of the wrist and hand in a static positioning splint is very effective in preventing these contractures as seen in Fig 4. The static positioning splint can be made from plaster or casting material that fits on the volar aspect of the hand as in Fig 5. It should position the wrist in 15 degrees extension, the MCP joints in 70-90 degrees flexion and the thumb palmar abducted and opposed. This splint can be placed over the dressing and secured with a crepe bandage. The splint should be removed two times a day to do range of motion exercises.



Fig 4

Fig 5

Many patients develop elbow flexion contractures, as the position of comfort when lying down and walking is with the elbow flexed. A simple plaster slab placed over the elbow joint and secured with a crepe bandage is helpful in preventing a contracture. Sometimes even a flat piece of wood that is padded can be placed over the elbow joint and then wrapped on with a crepe bandage.



These patients would have done well with a splint as described above

Splinting can be helpful for the prevention of contractures in the lower limbs as well. The ankle can have contractures limiting movement in both directions. Burns and contractures to the dorsum are more common. The best position to splint the ankle is 90 degrees to prevent shortening of the Achilles tendon. The splint should be removed and dorsiflexion and plantar flexion exercises should be done to make sure a contracture at the ankle does not form. A static positioning splint can be made from plaster casting material and wrapped on the foot and leg with a crepe bandage. See Fig 8



Fig 8

Skin tightening can also happen on the back of the knees and the hips causing the knees and hips to remain more in a flexed position. If needed, you can make a plaster back slab that fits over the back of the knees and is attached with a crepe bandage, which helps keep the knees in extension. Lying in a prone position for short periods throughout the day can help stretch the hips in extension and prevent a hip flexor contracture.

Early weight bearing on the lower limbs is most beneficial in preventing contractures of the hips, knees, and ankles. Have the patient do standing activities while holding onto the back of a chair or being supported by a person on each side. This helps to stretch the hips and knees into extension and the ankles to 90 degrees. If the patient is bed-ridden, splinting and daily range of motion exercises is the best for prevention of contractures.

## Range of Motion Exercises

Range of motion exercises are imperative and should be part of the patient's care from the beginning. Range of motion is needed to prevent joint stiffness and contractures over the affected joints. Active motion, along with elevation can also help with edema in the early phase of recovery. The exercises can be very painful for the patient at the beginning and therefore requires continuous encouragement for the patient and the family member who is assisting the patient. In addition, mild analgesics are helpful initially to help the patient move and ambulate. As the patient continues to move and the skin stretches, the pain will slowly reduce, but without movement, the pain and limited mobility will persist and lead to a contracture.

At the beginning, movement is very painful and range of motion is limited due to bulky dressings. During this stage the most optimal time to do range of motion is during dressing changes when the patient is medicated and the bulky dressings are removed. It just takes a few minutes to move all the joints of the affected limbs through their full range before applying the new dressing. This is also a good time to detect which movements are becoming difficult and determine if splinting is needed to maintain a more prolonged stretch and prevent a contracture. It is important to splint the patient at the first thought of doing so, but the hands must be splinted in position of protection from the onset of the burn.

These are some basic range of motion exercises that should be performed two to three times a day on the affected limbs. The goal is to achieve full active and passive motion of the involved joints as much as possible. In the hand, isolated tendon gliding exercises for the fingers should also be included.





**DIP/PIP EXTENSION/MCP FLEXION** 

11-3-2

11-1-14



**ELBOW FLEXION** 

**ELBOW PRONATION** 







**ELBOW SUPINATION** 

SHOULDER FLEXION



II-5-1

11-5-46 SHOULDER ABDUCTION

WRIST EXTENSION

WRIST FLEXION



**HIP FLEXION** 



6

11-1-4

II-1-1

1

6 46

(16F6+

**KNEE FLEXION** 





### Exercise:

Exercise is an important part of the overall recovery of the burn patient. Often, in Africa the mindset is that the patient is sick and needs to rest in bed until they are better. However, for the burn patient, lying in bed only hinders their recovery. Sitting up and moving around in the bed helps prevent infection, optimize lung capacity, and helps with endurance and muscle strengthening. As soon as the patient is stable, a regular daily program of sitting up in the bed should begin. The patient should then progress to sitting on the edge of the bed followed by standing. Once the patient can tolerate standing, they should be encouraged to ambulate short distances throughout the day. The family should be instructed to encourage compliance with this. The ability to get out of bed and move around also helps the patient psychologically.

When tolerated, resistive exercise and activities that challenge finger dexterity should be added. Focus on functional activities so that the patient can regain independence in self-care.

n Africa there is a high death rate for children with burns, especially if the percentage of the body burned is 30% or more. Range of motion exercises should be started from the beginning, but the child should be monitored and an exercise program started only when the child is medically stable and physically able to handle an exercise routine.

### Compression

As soon as the burns have healed and/or the skin grafts have healed, compression garments can be made and worn as long as necessary to prevent hypertrophic or keloid scarring. See Chapter 33. If these cannot be made, then pressure on extremities can be carried out with Crepe or Ace bandages.

Other joint contractures that must be prevented by splinting and range of motion exercises:





Fig 9

Fig 10

These contractures could have been prevented by measures listed above: splinting the wrist in slight extension, MPJ in flexion and IPJ in extension



Prevented by proper splinting for palmar burns as described in table above



These neck contractures could have been prevented by early splinting with neck collars, lying with towel/pillow under neck to extend it and early skin grafting. Postop care also requires long term splinting when grafts are used.







Fig 15

Axillary contractures are difficult to splint well, see above. If the guidelines above are followed, these contractures can be minimized. Early hospitalization and grafting are important in prevention. Often these patients present late.



Fig 17

These knee contractures could have been prevented by a posterior splint, early range of motion and grafting. These burns were deep full-thickness burns and the patients presented late to the hospital. There are many causes for these contractures including lack of appreciation of the depth, long distance to hospital, inadequate care in local health center, lack of finances, etc.