

Splint Title: Upper Extremity Pre-prosthetic Adaptive Device

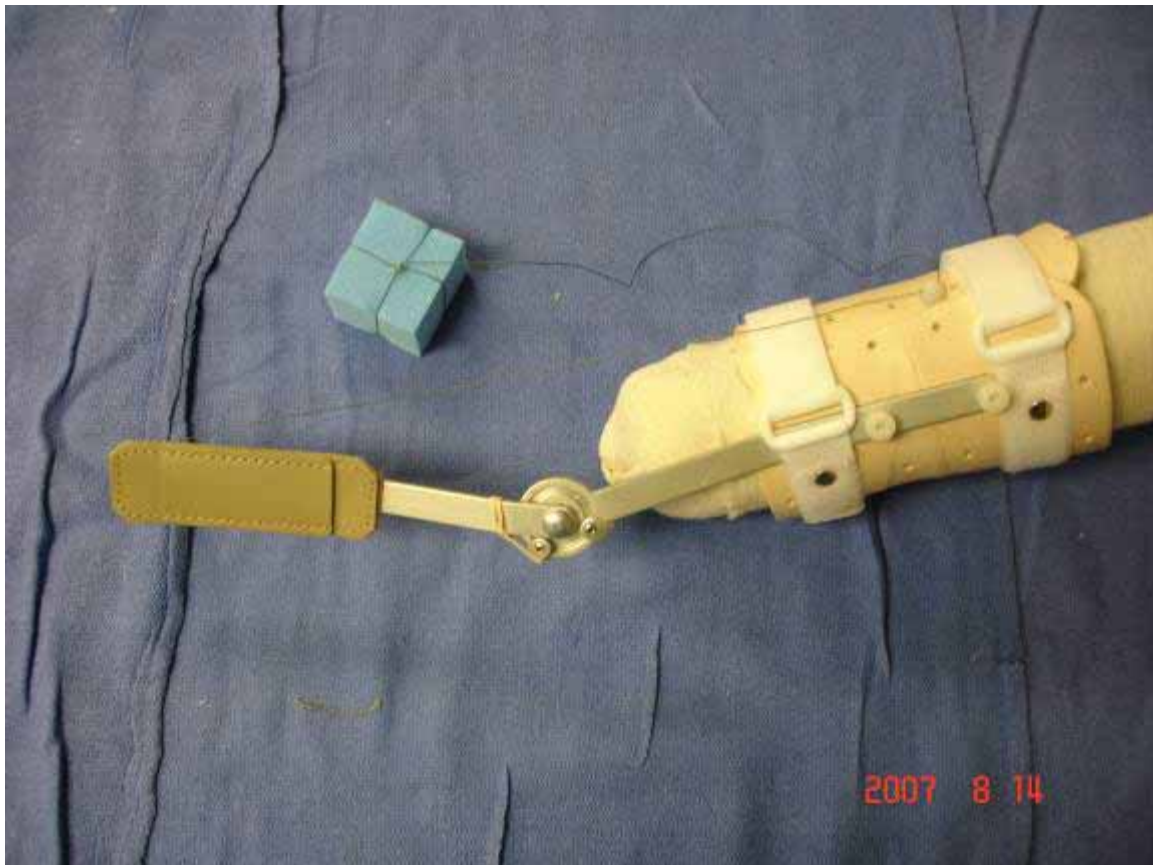
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Brief Description of Splint and the story behind how this splint came into development:

The idea for this device came about from working with a patient who suffered the loss of all four extremities as a result of his burns. He was unable to participate with any aspect of his care, and was growing increasingly frustrated as a result. Because his wounds wouldn't tolerate a typical socket-based device, I used a clamshell design for the base of the splint to allow the circumference to adjust with the changing sizes of his residual limb. Training the patient to use the device took less than 15 minutes, and by the end of the day he was able to use it to feed himself and brush his teeth. By the next day, he had requested multiple other terminal attachments, and was using the device to perform a multitude of small tasks for himself.

Materials used/needed:

- * Hydrocollator
- * Polyform® splint material
- * Rotary hole punch
- * Heat gun
- * 50lb test monofilament
- * Large Phoenix Hinge kit
- * 2 rubber band posts
- * Universal cuff
- * Therasponge
- * Super Glue
- * 2 motion stops
- * Scissors
- * Straight outrigger bar
- * Screw with wing nut
- * Speed rivets
- * Hammer/mallet
- * Eyelet
- * Flathead screwdriver
- * Buckle Straps
- * Moleskin
- * Small rubber band

Fabrication Instructions:



1) Using the Polyform®, fabricate a clamshell splint on the patient's residual limb. The lateral/posterior half should overlap the medial/anterior half by approximately ½ to one inch.

2) Velcro straps with buckles are attached to the lateral/posterior half of the clamshell and holes punched with the rotary punch through the Velcro strap and Polyform®, then secured in place with speed rivets.



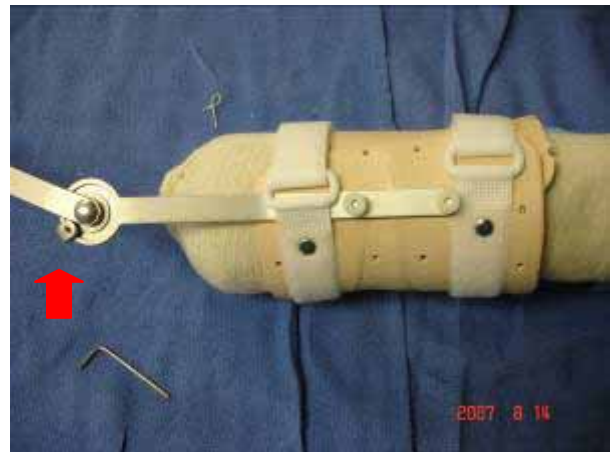
3) Use small squares of moleskin to pad any sharp or protruding edges from the rivets.



4) Place the splint on the patient's residual limb and align the static arm of the Phoenix Hinge along the midline of the humerus. The hinge should extend ~ one to two inches below the distal end of the residual limb. Using the holes in the arm of the hinge as a guide, mark on the splint where to punch the holes for attachment of the Phoenix Hinge.

5) Use the rotary punch to place holes in the Polyform® where the static arm will be attached. Realign the arm of the Phoenix Hinge so the holes match up and attach with the two rubber band stops, ensuring the screws are flush with the plastic on the inside of the clamshell.

6) Place the first motion stop behind the mobile arm to prevent hyperextension of the hinge (see red arrow).



7) Use the rotary punch to place a hole on the bottom half of the clamshell, between the two Velcro straps. Attach an eyelet and thread the end of the monofilament through the eyelet with the loose end towards the distal end of the mobile arm of the Phoenix Hinge. Leave the monofilament attached to the spool.

8) Tie the loose end of the monofilament to the distal hole on the mobile arm of the Phoenix Hinge.

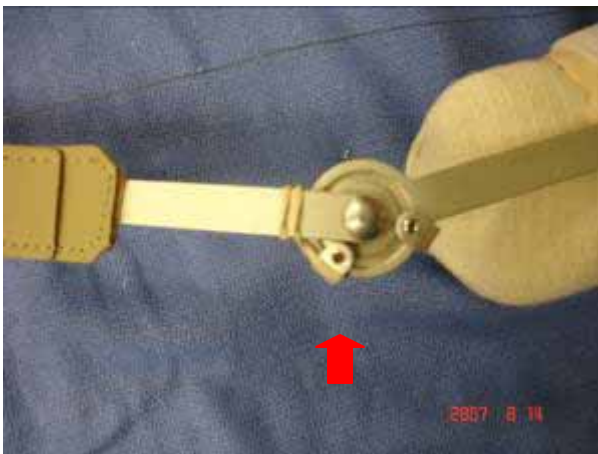




9) Measure the monofilament to a length that will reach approximately 6 – 12 inches past the patient's waist and cut the monofilament.

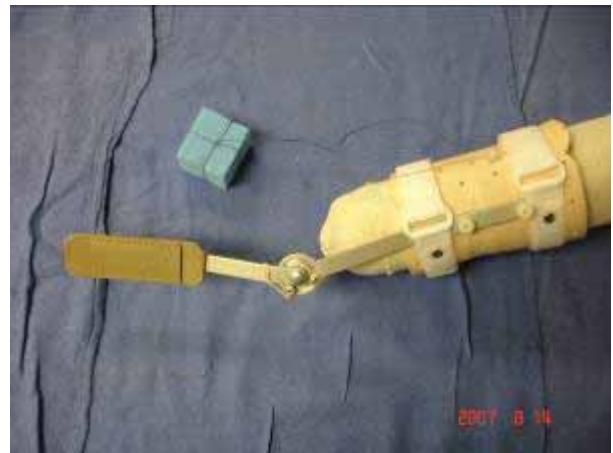
10) Tie the loose end of monofilament around a two inch square block of therasponge or foam block.

11) Cut the elastic band off of the leather portion of a Universal Cuff. Attach to the distal arm of the Phoenix Hinge with Super Glue, ensuring that the cuff covers both holes. Apply pressure and hold in place for approximately two minutes, or until Super Glue is dry and cuff is secure.



12) Secure a small rubber band around the mobile arm of the Phoenix Hinge and hook it over the extension motion stop. This aids with extension of the hinge during use. Place a second motion stop behind the static arm of the Phoenix Hinge to prevent hyper-flexion during use. (see red arrow)

13) Place the completed device on the patient's arm and tuck the foam block (shown here with blue therasponge) into the patient's torso dressing or waistband.



The main structure of the device is now complete. Various attachments now can be fabricated to meet the patient's needs. Shown below is a toothbrush and spoon attachment.

Toothbrush Attachment:

Materials needed – toothbrush with a hole drilled in the handle, outrigger bar, screw, wing nut.

Attach the toothbrush to the outrigger bar with the screw and wing nut as shown below:



Utensil Attachment (shown with spoon):

Materials needed – spoon with hole punched/drilled in handle, outrigger bar, screw, wing nut.

Attach the spoon to the outrigger bar with the screw and wing nut as shown below:



To place the attachments on the Upper Extremity Adaptive Device, slide the outrigger bar into the pocket of the Universal Cuff as shown below:



The splint is placed on the patient's residual limb as show in the pictures above. Tuck the sponge anchor into the patient's waistband, attach it to a belt-strap, or otherwise secure in the vicinity of the patient's waist. The device is operated by having the patient move his/her arm through shoulder flexion and/or abduction to flex the elbow and move the terminal device into the desired position for functional activities. The length of the monofilament can be adjusted to accommodate for increase or decrease in range of motion of the residual limb.

The motion stops can be secured in various positions to lock the elbow in one position in order to allow the device to be used for other activities, such as writing, typing, changing television stations, to name a few. Other terminal attachments can be created as necessary to fit the patient's needs.

Advantages: Can be used immediately post operatively for functional activities. The clamshell design allows the splint to be adjusted to accommodate edema, pain, and dressing changes. Shoulder motion required to power the device is similar to motion required for prosthetic use. Device is lightweight with minimal training time for patient use (approximately 10-15 minutes).

Disadvantages: Device can be used for lightweight tasks only. Fabrication can be somewhat time consuming (approximately 1 to 1 ½ hours).

Indications: Above elbow amputation with adequate residual limb length (4-6 inches of residual limb length or more) with the ability to actively move residual limb. Patient must be alert and able to follow directions.

Precautions/considerations: "short" residual limb (less than 4 inches), wounds, altered mental status, pain.

Level of Skill Required: Intermediate to advanced.

Total time required to fabricate this device: approximately 1 to 1 ½ hours, including 1-2 attachments. Additional time required to fabricate other attachments as indicated.

**This device is pending posting on the Burn Therapist website (<http://www.burntherapist.com>). Please check the website or email me at joy.nelson@us.army.mil for video clips of the device in use. Please feel free to email me with any questions regarding fabrication or use of this device.

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An invention disclosure has been submitted to the United States Army