

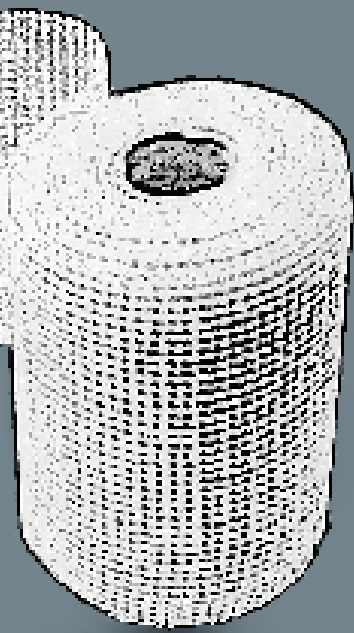
[*Semi-*] RIGID CASTS

Using Semi-rigid Cast Tape for Treatment of Metacarpophalangeal Joint Injuries

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INTRODUCTION

Semi-rigid casts (SRC) have been utilized for decades in sports. Initially, patients with soft tissue injuries needing further protection were fitted with these devices. In the 1970s, RTV-11 and other elastomeric polymers were used to combine layers of polymer and kling gauze to create orthosis for selected upper extremity injuries. The orthosis were commonly used for injuries of the metacarpophalangeal (MCP) joint and the wrist. Ulnar collateral ligament tears were a common culprit, leading to the fabrication of thumb spica splints to protect the MCP, joint from further injury by decreasing the joints normal range of motion and preventing injury to the corresponding ligaments. Other conditions of the MCP including related injuries such as Bennett's fracture and scaphoid fractures, were also considered for use with this device.



HISTORY OF THUMB SPICA TECHNIQUES

Splints are a good initial option for compliant patients, as the splint is able to be removed and adjusted to accommodate swelling and ice application. The splint is generally applied to the radial border of the thumb from the interphalangeal joint of the thumb extending proximally to the distal third of the forearm. Then, the splint is secured with an elastic wrap or cohesive tape. The radial gutter or thumb spica should be molded prior to the fiberglass cast setting.

A thumb spica splint or cast is designed to protect and immobilize the MCP joint. It is commonly accepted that spica wraps or splints utilize a larger part of the body to support a smaller part, as is seen with a hip spica using elastic wraps applied around the waist to support the affected groin or hip flexor. Other examples include a shoulder spica, where elastic wraps are applied around the thorax to support a strained or sprained shoulder; and the thumb spica, where tape or cast tape is based around the wrist to further support the MCP joint. These splints are used in emergency rooms and orthopedic surgeons' offices to aid in the healing of strains, sprains and minor fractures of the proximal thumb or wrist. With the thumb spica, protection can also be offered to the wrist by extending the splint proximally with a short arm cast combined with the thumb spica.

Many different hand injuries can necessitate a thumb spica splint as a form of primary treatment or temporary immobilization. In the case of sprains and strains, splinting the thumb is often the only primary treatment necessary to foster recovery. With the thumb joint protected and held in place, it can heal without worry of suffering another injury. Severe fractures and torn ligaments in the thumb also require splinting, though only as a means of temporarily protecting the joint until a patient can undergo surgery. In addition, a post-surgical thumb spica splint may be applied to encourage faster healing time after bones are set.

While thumb spica splints of semi-rigid material were popular for sports participants, they were very time consuming to construct. It was common for the splint to require 45 minutes of application time and up to eight hours to cure, become dry and be available for removal. Splints were custom to the patient, and featured molding to bony prominences and landmarks. Following ample time for curing, the orthosis was cut using bandage scissors with a longitudinal cut along the ulnar border to facilitate reapplication of the orthosis on a daily basis for practices or other sporting activities.

Part of the attraction to this orthosis in contact sports is the requirement that such splints with nonyielding material be covered with one-half inch thick slow recovery foam. This produces a significantly larger extremity and wearing such a device is difficult to perform sport-specific skills.

For casting, the thumb, wrist and forearm are fitted with a sleeve or stockinette to protect the skin (photo 1). The stockinette size is carefully selected to allow unrestricted coverage of the surface area. Appropriate padding is applied to protect the extremity and prevent circulatory or sensation compromise. The patient is instructed to maintain the proper position during the splinting or casting procedures. Cast tape (rigid fiberglass product) is applied. It is commonly accepted that two-inch products should be used for thumbs. Regarding application technique, it is encouraged to cut cast tape (rather than folding the cast tape) to allow low-profile application. (Photos 2 and 3 demonstrate the cuts to relieve tension during application and facilitate a low profile end product.) Cuts are made to relieve tension on the cast tape, and facilitate the low profile application. The technique utilizing folding cast tape can produce thick splints and often are the source of irritation post-application. As cast tape is applied, and following each layer, the position is reassessed and the cast molded to support bony landmarks.

Within five minutes, the fiberglass cast tape will be hardened. Following application, a recheck of neurovascular supply and appropriate motion should be conducted. Clinicians should look for the presence of altered skin color or temperature and the presence of paresthesia in the digits.

MATERIALS USED TO FABRICATE THUMB SPICA SPLINTS

Thermoplastic material is commonly used to fabricate temporary splints and braces, corrective bracing devices, and supportive braces. It is a moldable product, obtained in sheets. When heated, the thermoplastic material becomes malleable, with an almost rubbery texture, and it can be molded around the area being braced or splinted. As it cools, maintains its form, and a brace which fits perfectly is created. Thermoplastic material has been used for a long time by sports medicine professionals.

Today many thermoplastic products are available and often much more economical. The product has been further applied to sport activity, as patients with pathology needing further protection but approved for activity if the injury could be protected. Thus the sports medicine team of professionals have copied the practices of occupational therapists to create devices to protect the injuries while participating in activity. The thermoplastic material product is rigid, and must be covered with one-half inch slow recovery foam according to the rules of their sports.

IMPLICATIONS OF SPORT ORGANIZATION RULES FOR PROTECTIVE EQUIPMENT

The common theme among contact sports organizations is to limit the use of splints or casts made from “non-yielding” materials.¹⁻³ The materials are allowed provided they are covered by one-half inch of slow recovery foam. The NCAA specifically addresses use of illegal equipment. Hard or unyielding substances are permitted, if covered, only to protect an injury.³ According to the 2011 and 2012 NCAA Football Rules and Interpretations, hand and arm protectors (covered casts or splints) are permitted only to protect a fracture or dislocation.³

The NHSFS specifically addresses the following items related to Pads and Padding: No hard and unyielding items (guards, casts, braces, etc.) on the hand, wrist, forearm, elbow, or upper arm unless padded with a closed-cell, slow-recovery foam padding no less than one-half inch thick.²

SEMI-RIGID CAST TAPE: INSTRUCTIONS FOR USE

Semi-rigid cast tape's indications include to be used when support is needed, but rigid immobilization is not required (such as in a wide variety of athletic injuries), pediatric corrective serial casting, secondary and tertiary casting for various orthopedic problems, and as a compressive wrap to control swelling. Specific application suitability should be the responsibility of a qualified, on-site medical professional.

The product consists of a knitted fiberglass fabric impregnated with a polyurethane resin. Exposure to moisture or water initiates a chemical reaction that

causes the roll to set. Once exposed to air, semi-rigid cast material will be activated and will set in fifteen minutes with no water applied. The finished wrap will retain its shape while remaining resilient to the touch. Each roll of semi-rigid cast material is packaged in a sealed foil pouch. Care should be taken to avoid puncturing the pouch as this will cause the roll to cure prematurely in the package. semi-rigid cast material should be stored in a cool, dry storage area. Extremes of temperature and humidity should be avoided.

The uncured polyurethane resin in semi-rigid cast material will adhere to unprotected skin and clothing. Protective examination or surgical gloves should be worn while applying the roll. Care should be taken to avoid contacting unprotected areas of skin of the patient during application. In the event resin gets on the skin, swabbing lightly with alcohol may help remove the resin.

APPLICATIONS OF SEMI-RIGID CAST MATERIAL

There are many indications for use of semi-rigid cast material. Many of the treatment options are based on professional training and philosophy of products. The goal of this article is to expose this concept and show possible indications and applications for use of semi-rigid cast material to injuries of the upper extremity.

METACARPOPHALANGEAL JOINT SPRAIN

Sprains of the ulnar collateral ligament and general MCP sprains are very conducive to thumb spica casting using semi-rigid cast material. The application of the orthosis is fairly easy to administer once the principles are understood.

APPLICATION INSTRUCTIONS:

Apply one layer of stockinette over the affected body part. When using as a compression wrap, apply cast padding over the entire area to be wrapped. No soft roll or cast padding is generally used for sports applications as this is intended to be a short wear-time of three hours or less. Gloves must be worn while applying semi-rigid cast material, since the resin will transfer or adhere to the skin. Open

only one roll of semi-rigid cast material at a time, as room humidity will initiate cure. Immerse the roll in room temperature water (70-75°F).

It is recommended to use three firm squeezes of the roll while submerged to give a set time of approximately three minutes. To lengthen the set time, immerse the roll and remove it immediately without squeezing. This technique will give a set time of approximately four minutes. Without squeezing the material at least once while submerged in the water, there may be a decrease in slipperiness. Warmer water shortens the set time while cooler water lengthens it. Wrap spirally, overlapping the previous layer by one-half to two-thirds the width of the roll.

Apply two-inch semi-rigid cast material as previously described. Avoid folding the cast tape, to provide a low profile orthosis. By cutting the cast tape in areas where tension is formed, pressure is released and the cast tape is applied in a low profile, comfortable manner. Further, as the cast tape is applied to the wrist, hand, and thumb, the layers are allowed to laminate together and the nature of the cast tape provides excellent support. The support is targeted at the MCP joint, and making sure the cast tape does not extend beyond the interphalangeal joint of the thumb. The amount of support desired can be determined by the number of layers used. The more layers used, the more supportive the wrap. Smooth and rub the surface to achieve good contact between layers. Soon after smoothing, the wrap can be molded. About three to five minutes after immersion in the water, semi-rigid cast material will have sufficiently cured to prevent further molding. Allow about 10 minutes before letting the patient resume activities.

Following use or when the product is amply dry (15 minutes) a cut can be made with bandage scissors. Be certain not to apply too tightly, as the orthosis will not be able to be reused. Simply apply the tape as it comes off the roll, avoiding any pulling. The orthosis can be reused by taping or creating a shoe lacing technique. Following use, the orthosis should always be cleaned.

The aforementioned traditional semi-rigid cast material which is cut with



bandage scissors in an anatomical location suitable for re-application of the orthosis. When referencing the thumb spica splint for ulnar collateral ligament disabilities, the removal cut would be a medial cut along the ulnar border. The challenge with the application of a re-applied orthosis is it is not as supportive as the original application of the orthosis. The re-application is an economical consideration because it may be reused for multiple sessions with only the initial financial investment. Another popular option is to cut the orthosis along the dorsum of the hand. A set of three to four holes is drilled into the orthosis along the cut, and a string is used to approximate the edges. It is important to note when applying the splint, that the cast tape is not applied to tightly, to facilitate re-application. If the orthosis is applied in a tight manner, it will impair circulation, cause pain, and may also decrease sensation and create friction along the cut seam.

A larger challenge of the re-applied device is it is often not as supportive and protective of accessory motion as the initially applied device. The original orthosis is very low profile and effectively protects the involved area. To ensure a snug fit, wrap with slight tension on the roll, taking care to avoid excessive tightness. Avoid stretching the last eight to 12 inches of material.

ADDITIONAL SUPPORT

In the event additional protection is needed to the specific joint being protected with semi-rigid cast tape, one can augment the semi-rigid cast tape with a couple of longitudinally applied rigid cast tape strips. It has been well-reported with the use of ther-

moplastic material as a splinting device for a myriad of injuries. If thermoplastic material is included in the semi-rigid cast tape, it does not laminate to the cast tape.

When fabricating this orthosis, stockinette may be substituted with thin, medical grade adhesive foam tape (Microfoam™ medical tape). A base layer is created with the adhesive side away from the skin. This enhances comfort with the addition of the rigid cast tape strips. Further, the adhesive foam tape should be applied without stress to avoid pulling away from the cast tape applied. Once the base of adhesive foam tape is applied, a base layer of semi-rigid cast tape is applied without wetting. Approximately one-half of the roll of semi-rigid cast tape is applied again covering from the distal third of the forearm to the interphalangeal joint of the thumb and distally to the palmar crease of the hand. Once in place, two strips of rigid cast tape are applied from the base of the cast longitudinally to the interphalangeal joint to maximize support. The remaining semi-rigid cast tape is now dipped in water with minimal squeezing. The entire orthosis is then covered with the remaining semi-rigid cast tape to incorporate the entire orthosis.

This enhanced version of the semi-rigid cast tape can also be cut with a dorsal cut or a cut along the ulnar border. To add to the economical value of this treatment, the brace can also be re-applied with the padding left in place. This cast should be cleaned following each use. §

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- ¹ NCAA. Sports Medicine Handbook. Eighteenth Edition ed. Klossner D, editor 2005.
- ² Colgate B. National Federation of High School Football Rules Book. Colgate B, editor: Robert B. Gardner; 2011.
- ³ Redding R. 2011 and 2012 NCAA Football Rules and Interpretations. 2012.

REFERENCED PRODUCTS

- 3M™ Microfoam™ Medical Tape
- 3M™ Scotchcast™ Plus Cast Tape
- 3M™ Scotchcast™ Soft Cast Casting Tape
- 3M™ Coban
- Orthoplast™

More information is available, including a video demonstrating this technique, at www.rodwalters.com.