ORTHOPAEDIC IMMobilization Techniques

A STEP-BY-STEP GUIDE FOR CASTING AND SPLINTING

National Association of Orthopaedic Technologists

Samuel A. Brown MS, OTC | Frank Radja OTC

ORTHOPAEDIC IMMobilIZATION TECHNIQUES

A STEP-BY-STEP GUIDE FOR CASTING AND SPLINTING

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Established in 1982, the National Association of Orthopaedic Technologists (NAOT) is a non-profit membership association dedicated to the continued educational and professional development of orthopaedic allied healthcare professionals who specialize in casting, splinting, and bracing.

**MISSION STATEMENT**

NAOT is dedicated to the pursuit of excellence through education of orthopaedic technologists, and other related allied health care professionals, and the general public. NAOT believes that the profession of orthopaedic technology can only reach full potential and universal acceptance through widespread educational opportunities. Certification of all orthopaedic technologists underscores NAOT’s commitment to these professional goals.

**WHAT IS AN ORTHOPAEDIC TECHNOLOGIST?**

The Orthopaedic Technologist is a specialized physician extender who is an expert in casting and splinting immobilization techniques. Orthopaedic Technologists work under the direct supervision of the orthopaedic surgeon to manage the care of the orthopaedic patient in the clinic and sometimes perform as first assistant in the operating suite. Typical functions of an Orthopaedic Technologist include:

- Application and removal of all types of casts and splints
- Assist with history and physical assessment
- Assist with fracture and dislocation reduction
- Wound closure and care
- Patient education and follow-up care
- Assist in the operating suite

**NAOT HISTORY**

The National Association of Orthopaedic Technologists (NAOT) was founded on August 29, 1982, in Boston, Massachusetts. NAOT was originally conceived in the minds and hearts of a few members of the National Federation of Orthopaedic Technologists many years prior to 1982. The group recognized that strength is fostered in unity, and professionalism is rooted in the formulation of goals and standards. A core group of orthopaedic technologists committed themselves to the formulation of an independent, self-governing organization. They presented their concepts to the full membership of the Federation in Dallas, Texas in 1981. A vote was taken, and the decision was made to prepare to launch the new association at the 1982 convention. Representatives from the various regional, state, and local groups (members of the Federation) came together in Boston to adopt a charter and by-laws for a truly national organization. Officers were elected, and the Executive Board was established. NAOT was born, and the parent Federation became a thing of the past.
EDUCATIONAL OBJECTIVES

After reading this chapter, the reader will be able to

- explain philosophies and principals surrounding the proper use of orthopaedic casts (fiber-glass and plaster) and splints,
- select the proper supplies and specialty items used for casting and splinting, and
- describe and demonstrate the basic safety precautions associated with application and removal of cast and splints.

INTRODUCTION

The fundamentals of casting and splinting techniques are important for the safety and proper management of various orthopaedic conditions. Scholars and health care professionals collaborated on this chapter to highlight the philosophies and other key components that revolve around casting and splinting.

PROPER INJURY ASSESSMENT

Before applying a cast or splint, a qualified physician or qualified health care professional should complete a proper injury evaluation. A strong knowledge of anatomy, physiology, and biomechanics is essential. Following the injury evaluation, a qualified health care professional can then recommend the treatment options that may include the application of a cast or splint. This ensures that the proper cast or splint is applied for support and immobilization of the injury. Developing a thorough knowledge of casting and splinting is also imperative for the conservative treatment of orthopaedic injuries and conditions by the qualified healthcare professional.

PURPOSES OF SPLINTING

- Provides immobilization
- Protects the injury
- Prevents further injury
- Decreases pain
- Allows for easy application and removal compared to a cast
- Allows for swelling better than a cast

The use of a splint is indicated for a wide variety of orthopaedic injuries that include fractures, sprains, and postoperative immobilization. In particular, fractures and sprains are placed in splints in order to accommodate for frequent swelling associated with these injuries. Swelling is the body’s natural reaction to an injury and is the key reason why splints are used during the acute phase of an injury. Since splints are noncircumferential, they will accommodate for swelling. Casts are circumferential and therefore do not accommodate for swelling of the injury during the acute injury phase. Uncontrolled swelling can eventually progress to compartment syndrome, which can compromise the neurovascular integrity of the injured extremity.

All efforts should be made to minimize injury swelling. This is best accomplished by using the RICE (rest, ice, compression, and elevation) method after a splint has immobilized the injury.

After the initial swelling has subsided, the patient should transition into a cast for more definitive immobilization if indicated by a qualified healthcare professional.

PRESPLINTING PROCEDURE

Before applying any splint, an accurate diagnosis should be made by an orthopaedic physician or other qualified healthcare professional (physician, phy-
sician assistant, nurse practitioner) who orders the proper treatment for the injury. A complete neurovascular assessment should be performed before treatment.

Any wounds should be appropriately covered with a sterile dressing. The sterile dressing should be secured with the use of a rolled gauze.

For acute fractures, immobilize the joint above (proximal) and below (distal) the fracture when possible.

Gather all supplies necessary for completion of the splint. It is better to have more supplies than necessary rather than not have enough. This will prevent you from having to leave the patient in order to go get more supplies.

Explain the treatment to the patient so he or she will have a thorough understanding of the splinting procedure.

**PROPER SELECTION OF SPLINT SUPPLIES**

If you are using prefabricated splinting materials (Ortho-Glass®), the use of cast padding may not be necessary. Ortho-Glass® has a felt covering over the inner fiberglass that will protect the patient from fiberglass abrasions. The use of Ortho-Glass® without cast padding will decrease the overall bulk of the splint.

Be sure to consult the qualified healthcare professional who ordered the splint if they desire the use of cast padding. Cast padding should be utilized when the technician must fabricate a splint from separate materials. The cast padding will supply a barrier from the fiberglass/plaster that will protect the patient from abrasions.

Cast padding comes in three forms: cotton, synthetic, and water resistant. Cotton material is easy to apply, tears easily, and self-bonds to create a smooth, padded undercast surface. It provides excellent cohesion for custom padding around bony prominences. Synthetic material is nonabsorbent and does not hold moisture against the skin. Its conformable stretch allows narrow widths around small anatomies without cutting or tearing.

Water-resistant material should only be used with fiberglass cast tape. The water-resistant qualities of the material allow water to quickly drain from the cast, which allows patients to shower and swim in pools. This material should not be used for patients who swim on sandy beaches or in lakes. It should also not be used when wounds or abrasions may become infected when wet.

The width of the splint and cast padding is generally determined by the width of the patient’s hand (upper extremity) and foot (lower extremity).

Pediatric patients generally require smaller sized materials (1-in. to 2-in. cast padding and splint material), while adult patients require larger sized materials (3- to 4-in. cast padding and splint material). Even larger sized patients require the use of the largest sized materials (5-in. to 6-in. cast padding and splint material).

**STOCKINETTE**

*(define)* If swelling is present or anticipated, the use of stockinette is not advocated due to the compressive factors that may contribute to circulatory issues. Consult your healthcare professional on the use of stockinette with splint applications.

**FIBERGLASS**

Fabrication of a splint with the use of fiberglass cast tape allows for a faster setting time when compared to plaster. With this in mind, the time available for fabrication is decreased compared to plaster. Be sure to address the edges of the fiberglass tape by providing sufficient padding around all edges. A minimum of seven layers of fiberglass cast tape should be used if you are fabricating the splint.

**PLASTER**

Fabrication of a splint with the use of plaster cast tape will need additional time to set in order to become rigid. A minimum of 10 to 15 layers should be used if you are fabricating the splint.

**PREFABRICATED**

Prefabricated splinting materials have many advantages over having to fabricate a splint with raw materials. Prefabricated splints either come in a roll that can be custom measured for the patient or pre-cut strips at various sizes. The core of the prefabricated splint is typically fiberglass, so the handling time is the same as using traditional fiberglass.

**SPLINTING PROCEDURE**

**IF USING CAST Padding**

The correct sized cast padding should be selected and applied to the patient. The cast padding should start distally and proceed proximally. Overlap the first circumference by 100% in order to keep the cast padding from slipping. An overlap of 50% should be used to cover the extremity. The cast padding should be wrapped at a slight angle to prevent gapping in the cast padding. The proximal and distal ends should overlap 100% for three circumferences to ensure a comfortable cuff will be established.

Be sure to evaluate bony prominences (ulnar and radial styloids, olecranon, malleoli, calcaneus) to make sure they are adequately padded. This will pre-
vent the possible formation of pressure sores within the cast. Add additional strips of cast padding over bony prominences, such as the calcaneus, to prevent a bulky circumferential wrap. A minimum of three to four layers of cast padding should cover the entire extremity.

**WATER**

Use cool or lukewarm water near 70 degrees for saturating fiberglass, plaster, or prefabricated splinting materials. NEVER use hot or warm water! Warm water speeds the setting time and creates a more exotherm reaction that can burn the patient. Cooler water slows the setting time with less of an exotherm reaction. The technician should never repeatedly use the same water from splint to splint. Residue in the dip water acts as an accelerant and will cause splints to set quicker with more heat.

**PATIENT PROTECTION AND COMFORT**

Effort should be made to make the patient comfortable and protected during the splinting technique. The use of a drape will protect the patient from getting excessively wet during the procedure.

**PATIENT POSITION**

The patient should always be directly in front of the technician during the procedure. This will ensure that the correct anatomical position is monitored and maintained during the application.

**EXOTHERM**

The patient should be advised that a certain level of exotherm (heat) will be experienced during the setting of the splint. This exotherm will subside once the splint is fully set.

**SPLINTING**

Chapters 2 and 4 address specific applications for various splints.

**MOLDING AND SECURING THE SPLINT**

Once positioned, splints should be secured with an elastic bandage. Splints should be well molded to the body in order to maximize strength and increase the patient’s comfort. It is important to make sure the elastic bandage is NOT wrapped too tightly to allow for possible swelling.

Allow circulating air to cool the splint’s heat production (exotherm) when setting. Do not rest a fresh splint on a pillow or exam table that could trap the exotherm and potentially burn the patient. Be sure to wait until the exotherm has subsided before allowing the patient to leave. This will prevent burns and also ensure that the splint has achieved sufficient strength for proper immobilization.

If applying a splint that will go around a body part (e.g., sugar tong, lower leg with stirrup), make sure the splint does NOT completely encompass the body part. Be sure to leave at least a 1-in. gap between the edges of the splint. If the splint overlaps, it will become circumferential and therefore will NOT accommodate for swelling.

**POSTAPPLICATION PROCEDURE**

Be sure to evaluate the patient’s neurovascular status after the completion of the splint. The patient’s range of motion of nonsplinted joints on the injured extremity should also be evaluated to ensure the splint is not limiting the range of motion of those joints.

**PATIENT INSTRUCTIONS**

The patient should be advised of the basic symptoms of compartment syndrome and instructed to call a physician or visit an emergency room if the following symptoms occur:

- **Pain:** A steady increase of pain out of proportion to the injury. Pain sensation is greater than that experienced at the time of injury.
- **Pressure:** Splint has the sensation of “being too tight”
- **Paresthesias:** Sensation of tingling, burning or prickling
- **Pulselessness:** Weak or absence of distal pulse
- **Swelling:** Excess swelling below the splint

If any of these symptoms are present, the following steps should be taken:

1. Contact physician and outline the symptoms. If a physician cannot be reached, proceed to the closest emergency room for evaluation.
2. Elevate the extremity above the level of the heart.
3. In EXTREME cases, the qualified healthcare professional may advise to loosen the elastic bandage that is securing the splint. This should only be advised if the patient is en route to a healthcare facility. Loosening the elastic bandage may alter the reduction of the fracture.

The patient should avoid placing objects (pencils, pens, etc.) into the splint in order to scratch the skin. Avoid getting the splint wet during bathing by wrapping it with plastic and tape. Several commercial products are available to aid in the avoidance of getting the splint wet.
Also instruct the patient (especially pediatric) to avoid using the splint as a weapon. Do not use it to hit other children.

**PURPOSES OF CASTING**

- Provide immobilization
- Protect the injury
- Prevent further injury
- Decrease pain

The use of a cast is indicated for a wide variety of orthopaedic injuries that include fractures, sprains, and postoperative immobilization. In particular, fractures and sprains are transitioned into casts after the use of a splint during the acute injury phase. Acute injury swelling must be minimized prior to transition into a cast for more definitive injury management.

Casts are a circumferential form of immobilization that will not accommodate for swelling. If swelling occurs in a cast, the patient runs a high risk of compartment syndrome that can compromise the neurovascular integrity of the injured extremity.

All efforts should be made to minimize injury swelling. This is best accomplished by using the RICE (rest, ice, compression, and elevation) method after a cast has immobilized the injury.

**PROPER SELECTION OF CAST SUPPLIES**

The width of the cast tape and cast padding is generally determined by the width of the patient’s hand (upper extremity) and foot (lower extremity). Pediatric patients generally need smaller sized materials (1-in. to 2-in. cast padding and cast tape) while adult patients need larger sized materials (3-in. to 4-in. cast padding and cast tape).

**PRECASTING PROCEDURE**

Before applying any cast, an accurate diagnosis should be made by an orthopaedic physician or other qualified healthcare professional (physician, physician assistant, nurse practitioner) who orders the proper treatment for the injury.

A complete neurovascular assessment should be performed before treatment.

Any wounds should be appropriately covered with a sterile dressing. The sterile dressing should be secured with the use of a rolled gauze.

For acute fractures, immobilize the joint above (proximal) and below (distal) the fracture when possible.

Gather all supplies necessary for completion of the cast. It is better to have more supplies than necessary rather than not have enough. This will prevent you from having to leave the patient in order to go get more supplies.

Explain the treatment to the patient so that they will have a thorough understanding of the casting procedure.

**STOCKINETTE**

Stockinette generally comes in widths of 1 in., 2 in., 3 in., 4 in., and 6 in. Cut a longer piece of stockinette for a cast instead of one that “just fits” in order to have enough material to flip over the proximal and distal edges. The stockinette should fit snug against the skin but should not be tight. Any wrinkles in the stockinette should be addressed by smoothing them out to prevent unwanted skin irritation.

**CAST PADDING**

The proper sized cast padding should be selected and applied to the patient. The cast padding should start distally and proceed proximally. Overlap the first circumference by 100% in order to keep the cast padding from slipping. An overlap of 50% should be used to cover the extremity. The cast padding should be wrapped at a slight angle to preventing gapping in the cast padding. The proximal and distal ends should overlap 100% for three circumferences to ensure a comfortable cuff will be established when turning over the stockinette.

Be sure to evaluate bony prominences (ulnar and radial styloids, olecranon, malleoli, calcaneus) to make sure they are adequately padded. This will prevent the possible formation of pressure sores within the cast.

**CASTING PROCEDURE**

**WATER**

Use cool or lukewarm water near 70 degrees for saturating fiberglass. NEVER use hot or warm water! Warm water speeds the setting time and creates a more exotherm reaction that can burn the patient. Cooler water slows the setting time with a lesser exotherm reaction. The technician should never repeatedly use the same water from cast to cast.

**PATIENT PROTECTION AND COMFORT**

Effort should be made to make the patient comfortable and protected during the casting technique. The use of a drape will protect the patient from getting excessively wet during the procedure.
Chapter 1: Fundamentals of Casting and Splinting Procedures

PATIENT POSITION
The patient should always be directly in front of the technician during the procedure. This will ensure that the correct anatomical position is monitored and maintained during the application.

EXOTHERM
The patient should be advised that a certain level of exotherm (heat) will be experienced during the setting of the cast. This exotherm will subside once the cast is fully set.

CASTING
Chapters 3 and 5 address specific applications for various casts.

CAST TAPE
The cast tape should be applied in the same manner used for the cast padding. When wetting the cast tape, be sure NOT to use water in excess of 70 degrees (or manufacturer’s instructions) in order to prevent burning the patient.

ROLLING
Roll casts with an even distribution of the casting materials for uniform strength, not just with the idea of concentrating too much at the fracture site with weak ends of the cast.

Rub the layers of the cast that you just applied all over to laminate the layers into a solid cast. “Rub it like you love it” should be your motto! This gives the cast its greatest strength, makes it look good, and eliminates wrinkles that can cause pressure sores.

For upper extremity casts, keep the cast narrow in the web space between the thumb and index finger. Keep the palmar crease (define) free to allow for good motion of the fingers.

MOLDING
Once applied, the cast should be well molded to the body in order to maximize strength and increase the patient’s comfort.

Before the casting material sets, be sure to mold the cast for a good anatomical fit. Be patient when molding. Hold and mold. Don’t keep squeezing and letting go, or you will break the setting plaster instead of allowing it to set with your patient and deliberate molding of the cast. Use the palms and heel of your hands to mold as opposed to using your fingers. The use of fingers will leave unwanted indentions.

Use 3-point fixation to mold displaced fractures in long bones to obtain and maintain reduction of the fracture fragments.

SOFT SPOTS
Evaluate and address soft spots that may occur when applying the cast. Soft spots typically occur around the olecranon and calcaneus (define) and may be addressed by applying an additional roll of cast tape to this area.

POSTAPPLICATION PROCEDURE
Be sure to evaluate the patient’s neurovascular status after the completion of the cast. The patient’s range of motion of noncasted joints on the injured extremity should also be evaluated to ensure the cast is not limiting the range of motion of those joints.

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PATIENT INSTRUCTIONS

The patient should be advised of the basic symptoms of compartment syndrome and instructed to call a physician or visit an emergency room if the following symptoms occur:

- **Pain:** A steady increase of pain out of proportion to the injury. Pain sensation is greater than that experienced at the time of injury.
- **Pressure:** Cast has the sensation of “being too tight.”
- **Paresthesias:** Sensation of tingling, burning or prickling
- **Pulselessness:** Weak or absence of distal pulse
- **Swelling:** Excess swelling below the cast

If any of these symptoms are present, the following steps should be taken:

1. Contact a physician and outline the symptoms. If the provider cannot be reached, proceed to the closest emergency room for evaluation.
2. Elevate the extremity above the level of the heart.
3. The cast may be mono-valved (single longitudinal cut) or bi-valved (double longitudinal cuts) as a first step to address this issue (these techniques are addressed later in this chapter). If this does not eliminate the symptoms, the cast must be removed.

The patient should avoid placing objects (pencils, pens, etc.) into the cast in order to scratch the skin. Avoid getting the cast wet during bathing by wrapping it with plastic. Several commercial products are available to aid in the avoidance of getting the cast wet.

Also instruct the patient (especially pediatric) to avoid using the cast as a weapon. Do not use it to hit other children.

PROPER CAST REMOVAL

When removing or splitting casts, an electric cast saw or cast cutter is used. The typical cast saw blade does not move in full circular revolutions. The blade on the saw oscillates, or moves back and forth. When using this oscillating function properly, the blade can gently be applied directly to the skin without cutting the skin. Because of the blade’s back and forth movement, it can move the skin back and forth as well without cutting, if the skin is soft and supple and gentle pressure is used. Demonstrating this may ease the apprehension of nervous patients.

The proper cutting technique is to apply the blade to the cast and gently push it into the cast, and then proceed to cut along the cast in an “up and down” or an “in and out” motion, progressively extending the initial cut into a straight line. To facilitate the “in and out” motion, use the thumb or index finger to stabilize the hand and saw on the cast.

Then, cut “in” the cast and use the thumb/finger as a counter force to lift “out.” Use this stabilizing technique instead of stabbing at the cast without a controlled counter force. The worst technique is to push the blade into the cast and drag it through the cutting area without regard to the “in-and-out” technique. This negates the intended function of the oscillating blade. Never drag the blade through the cast!
ZIP STICK
A zip stick is a long (typically 2 ft. long by 1 in. wide) piece of plastic that may be inserted into the cast to form a barrier between the patient's skin and the cast blade. This may also ease the patient's apprehension during the removal process.

SPECIAL PRECAUTION
If the blade is used directly over a bony prominence, such as a styloid process or malleolus, it can seriously cut the skin. Cuts can also occur to nails, knuckles, or stretched skin. Friction between the blade and the cast can cause heat to develop. Keep the friction and heat to a minimum by gently pushing the blade into the cast. Don't be timid about cutting into the cast, thereby allowing the blade to rest on it. This creates more friction and heat. In other words, be slightly aggressive when cutting by carefully pushing the blade into the cast, or increased friction of the blade on the cast can actually burn the patient when the blade gets too hot. If the blade does get too hot from repeated cutting procedures or cutting through an overly thick cast, wipe the blade with an alcohol pad or cool cloth to decrease the heat.

When you are ready to begin your cast cutting procedure, follow these steps:

1. **Position your patient.** Ensure the safety of your patient by having him or her sit in a stable chair without wheels or lie down on an exam table in the case of lightheadedness or fainting. Apply gloves to your hands and drape the patient.

2. **Prepare your patient and earn his trust.** Ask the patient if he has ever had a cast removed before and if he knows what to expect. If it is the first time, reassure the patient about the safety of the saw by turning it on and gently touching it along the relaxed palm of your hand to gain trust. Tell children that the saw might tickle them.

3. **Inspect the cast.** Ask the patient if she removed any of the padding from inside the cast. Inspect the cast for damage, sufficient padding on the edges, moisture, or unusual odor. If a patient has removed the cast padding under the cast prior to cast removal, the cast can still be safely removed by sliding a plastic strip or aluminum finger splint under the cast where the cast saw blade would be used. Gently pushing the cast on the opposite side where it will be cut creates a small space between the cast and the skin so the cast can be cut more safely without the skin touching the blade. Be sure to be very deliberate in using the “in-and-out” cast cutting motion, using a very sensitive cutting technique. Emphasize to the patient that she should not remove the cast padding from casts in the future.

4. **Plan your cuts strategically.** Assess where to make cuts on opposite sides of the cast at its widest part, while avoiding bony prominences. So, if you are cutting around the ankle of a lower extremity cast, make one full-length cut behind the medial malleolus (define) and into the widest part of the foot, and another full-length cut in front of the lateral malleolus (define) and into the widest part of the foot to facilitate removal. If both cuts are posterior to both malleoli, the anterior half of the cast will not lift off the leg because it is molded behind both malleoli. If someone else bi-valved the cast behind both malleoli and you must now remove it, simply cut a triangular-shaped piece around one malleolus so the anterior shell of the cast can freely be lifted off of the leg.

5. **Stabilize the cast and begin cutting.** Once you have determined where to make your cuts, stabilize the cast with one hand and begin cutting from the center of the cast (judging its thickness) and continue cutting to an edge. Then, return to the center and cut to the other end. Turn the leg and cut the other side. Don’t force the blade to cut all the way to the edge of a cast through thick padding and stockinette because it may be difficult for the blade to cut these soft materials. The blade might even “jump off” the edge and onto the adjoining skin.
6. **Release the cast.** Insert the cast spreaders and spread apart the two halves of the cast. The spreaders can break through the cast material under the thick padding and stockinette on the edge.

Use scissors to cut the stockinette at each end of the cast. Pull the anterior half of the cast away from the posterior half, then cut the cast padding from end to end with scissors. Stabilize and lift the leg out of the posterior mold. Be careful not to twist or rotate the injured extremity when lifting. Remove the posterior mold and gently lower the leg so it can be cleaned and prepared for any other possible procedure like suture/staple removal.

Frequently, a cast is removed for evaluation of an injury, so the patient is sent to radiology for imaging. The posterior mold of the split cast can be used with an elastic bandage to stabilize and protect the patient if he is in pain when the cast is removed. When the patient is in radiology, the elastic bandage and splint can be removed, imaging can be obtained, and the patient replaced into the splint and bandage for safe transport back to the cast room. Be sure to order removal of the splint when ordering the images and to have the radiology tech ask for your help if needed to manage the splint removal and reapplication in the radiology area.

**SPECIFIC CAST-CUTTING PROCEDURES**

**MONOVALE/UNIVALE**

Making a single cut along a full length of a cast is called a monovalve or a univalve. This is done to relieve or to prevent circulatory constriction in a cast where swelling is present or anticipated, like when a fracture reduction takes place. After a monovalve cut is made in the cast, it should gently be spread apart to keep the space open between the edges, creating greater volume in the cast, which allows for better circulation. Plaster casts usually stay open better than fiberglass casts because they are not as strong in the early “green” stage of drying. Commercially available plastic wedges can be inserted into the space of the monovalve to maintain the open space, especially with fiberglass casts. The patient should be instructed to report any problems in circulation or to return if necessary.

**BIVALVE**

Making two cuts on opposite sides of a cast is called bivalving a cast. Casts are bivalved for many reasons, including the following:

- Immediate removal when a cast is too loose, dirty, broken, has lost its fracture reduction, for evaluation of fracture healing, or when the cast is no longer needed.

- Immediate removal to relieve circulatory constriction or compartment syndrome. All encircling bandages are cut down to the skin and removed to properly assess circulatory and neurological status. The posterior mold may be left on the patient, if possible, to protect the fracture during assessment, but it should be removed if it compromises a thorough evaluation of neurovascular status. It is better to lose a fracture reduction by completely removing the cast for evaluation than to permanently lose the function of a compartment or limb due to Volkmann’s Ischemic contracture (define). Make a neurovascular assessment using the “7 Ps” (pain, pallor, paraesthesia, paralysis, poikilothermia, pressure, and puffiness). Immediately report your findings to the attending physician.

- Removal at a later time, such as when a patient’s cast will be bivalved in the clinic, on the hospital ward, or in the ER prior to a visit to the operating room. The cast is minimally spread open on both sides. The padding and stockinette remain intact. It is wrapped with elastic bandages that are removed later in the OR along with the cast. This allows the surgeon to avoid using the cast cutter in the OR so dust is not circulated in the surgical suite prior to the procedure, and it saves time for the OR staff. This delayed removal is also used when a physician orders it post-op or post-fracture reduction instead of a monovalve procedure. It allows for the cast to be loosened or removed if it becomes too tight.
• Immediate removal to convert a cast into a night splint. After a bivalve, both shells are removed. The circumferential padding is completely stripped and replaced with longitudinal strips of padding. Tape the padding over the edges of the shell and insert each shell into a separate stockinette, which is then folded over the end and taped. The patient is placed into the posterior shell first and then covered with the anterior shell. Both are overwrapped with elastic bandages and then worn at night to maintain a position usually achieved by serial casting or post clubfoot casting.

When taking an order from the orthopaedist about bivalving a cast, make sure you understand his/her objectives of treatment, especially when there are concerns about circulatory constriction or compartment syndrome.

**WINDOW**

A window may be cut into a cast for the following reasons:

• Wound care
• Investigating a complaint like a pressure sore
• Checking a pulse
• Breathing window in a body cast
• Ultrasound bone stimulator

When applying a cast over a wound that will need a window, apply extra 4 x 4 gauze sponges in a stack over the wound to be windowed. With each layer of stockinette, cast padding, and plaster/fiberglass rolls, mold around the contour of the 4 x 4 sponges to clearly outline their location. Apply extra plaster/fiberglass in the area of the cast around the window to make it strong enough to withstand the weakening effect of the window in the cast.

When the cast has set sufficiently and the exotherm has subsided, mark the edges of the window with a pencil, and then cut the window slightly larger than the 4 x 4 sponges. Try cutting the window edges at a 45-degree angle so the window won’t fall into the cast later when repositioned. Be sure to cross-cut all the corners of the window for a clean cut that will easily detach the window from the cast without damage to it. Remove the rigid window covering. Carefully lift and cut the padding in the center down to the 4x4 bundle below. Cut the cast padding from the center to the four corners of the window and peel the padding over each edge of the window until the 4 x 4 stack can be removed to expose the wound. Make sure you can visualize the entire wound. Replace the 4 x 4 stack, turn back the cast padding to the center of the window, and always return the rigid window cover to prevent window edema. If the window drops into the cast, a felt pad can be cut and placed over the cast padding and then covered with the rigid cover. Overwrap the window cover with an elastic bandage to change the dressing in the future. Cover it with more casting material if the window will not be used again in the future.

**OPEN AND CLOSED WEDGING**

Casts are wedged to correct for unwanted angulation of long bones, joints, or the spine that have already been casted. There are two types of cast wedging procedures, open and closed.

**Open wedge.** Open wedge procedures are more common than closed wedge procedures because they are easier to perform. For example, a midshaft fracture of the tibia with varus (lateral) angulation requires a cut about two-thirds around the cast at the level of the fracture on the medial side of the cast. One third of the cast is left uncut on the lateral side of the cast to provide stability for fracture reduction. The medial cut is gently spread open with the spreaders until the fracture is reduced to the anatomical position. Check the cast padding in the opening to ensure there is acceptable layering of padding without any gaps. Add more padding if necessary. Open wedge procedures require a piece of plastic, cork, wood, or casting material to hold the spread cast open so it can maintain the reduction. Confirm the reduction with X-ray or fluoroscan images, and then overwrap the wedged section of the cast with more casting material. There are commercially available sets of plastic cast wedges in different sizes for a variety of open wedge reductions.
**Closed wedge.** Closed wedge procedures are less commonly performed than open wedge procedures. To treat a mid-shaft fracture of the tibia with lateral (varus) angulation using the closed wedge technique, you must make a wedge-shaped cut on the lateral side of the cast at the level of the fracture and then remove the cut wedge. The greater the angulation of the fractured leg, the larger the size of the wedge that should be cut out of the cast. Manipulate the cast with a valgus force across the wedge cut in the cast, closing the open wedge (bringing the cut edges of the cast closer together), which should reduce the fracture to the anatomical position. Be very careful when closing the wedge, so you do not pinch the skin and cause a pressure sore. Check the cast padding to ensure that there is not an unacceptable amount of bunching, which could also cause a pressure sore. Fix the bunched padding, if necessary. Confirm the reduction with X-ray or fluoroscan images, and then over wrap the wedged section of the cast with more casting material.

Cast wedging procedures can be very difficult manipulations that obtain reductions in multiple combinations of the AP and mediolateral planes and can compromise soft tissue structures. Cast wedging requires an experienced orthopaedist who will supervise the anesthesia, the reduction, the subsequent interpretation of imaging and neurovascular exam.

**TRIMMING**

Casts are trimmed when their edges are too long and/or unpadded. A common area for trimming is in the popliteal area behind the knee of a short leg splint/cast, which has been applied too proximal. The cast should be marked with a pencil about 2 in. below the popliteal crease and then trimmed to create more room to increase knee flexion. Be sure that there is sufficient cast padding on the trimmed edge of the cast/splint. Add more padding as necessary, using the technique described as *petaling* in the next paragraph.

**CAST CONVERSION**

Cast conversions are performed when a long arm cast is cut down into a short arm cast. This allows the patient to begin moving the elbow and forearm while still protecting a wrist fracture. Long leg casts can also be converted into short leg casts. To make an accurate cut, wrap a piece of string or a tape measure around the cast at the level where the cast should be cut, mark it with a pencil, and then cut around the mark. Bivalve the proximal portion to be removed and take it off. Trim the remaining padding and stockinette so it is about two inches from the edge of the short arm cast. Flip this padding over the edge and secure it with tape, coban (define), or casting material. If the cast padding on the edge needs to be replaced, then a “petaling” procedure needs to be done. Position the patient so you can comfortably wrap cast padding around the proximal part of the cast, which has no padding on it. Wrap three or four layers of cast padding around the proximal edge so that half of the padding is on the cast and half of the padding goes over the edge onto the skin. Fold the cast padding that is on the skin so it is now tucked inside the cast and is padding the edge. Use a tongue depressor for tucking the padding inside the cast if your fingers are too big. Add more layers if necessary to make it fit snug. Finish the petaling by overwrapping the cast padding outside the cast with tape, coban, or more fiberglass/plaster.

**OTHER IMPORTANT CONSIDERATIONS**

- Be sure to read the manufacturer’s product guide, which is provided with the cast saw.
- The use of a vacuum system attached to the cast cutter for collecting cast dust when cutting is highly recommended for health and environmental issues. Consider using a mask for yourself and your patient when cutting casts without a vacuum.
- Familiarize yourself with the correct technique in the changing of a dull or damaged cast saw blade. Sharp blades will prolong the life of your cast saw. Dull blades may cause more heat to develop from friction. Inspect blades and change them when dull.
- Practice electrical safety when using cast saws around water buckets.
• After using a cast saw on a patient, move the saw away from areas where you or the patient walk so there is no tripping hazard present.
• Clean the cast saw and blade frequently for good hygiene.
• Change vacuum dust bags/filters on a regular schedule.
• Eye and ear protection (glasses, goggles or a shield, ear plugs) should be considered during the cast removal process.
**EDUCATIONAL OBJECTIVES**

After reading this chapter, the reader will be able to do
- identify anatomical landmarks critical for correct splinting procedures;
- describe the purpose for the applications of upper extremity splints;
- select the proper supplies and specialty items used for splinting injuries to the upper extremity;
- explain the steps in preparing the body for splint applications; and
- describe and demonstrate the purposes, clinical indications, anatomical position, supplies, presplinting technique, splinting technique, posttechnique assessment, and proper removal of splints.

**INTRODUCTION**

Splinting techniques for upper extremities can be meaningful when injuries occur to the shoulder, elbow, and wrist/hand. Therefore, a basic foundation in understanding the area is important for acute care. Chapter two highlights the terminology and splinting techniques for anatomical structures of the upper extremity.

**TERMINOLOGY**

**AC joint.** A gliding joint located between the acromion and the clavicle

**Antecubital crease.** In front of the elbow; at the bend of the elbow

**Axilla.** The armpit

**Cast padding.** A cotton or synthetic roll of material used to pad orthopaedic casts and splints

**Compression wrap.** A stretchable bandage used to create localized pressure and secure orthopaedic splints

**Humeral epicondyles.** The distal aspect of the humerus that flares from the shaft

**Olecranon process.** A large process on the ulna projecting behind the elbow joint and forming the bony prominence of the elbow

**Ortho-Glass®.** A fiberglass splinting system that provides strength and durability in a padded splint

**Palmar crease.** Flexion creases normally found on the palm of the hand, occurring proximal to the metacarpophalangeal joints

**Radial deviation.** Physiological movement of the wrist, where the hand including the fingers move towards the radius

**Stockinette.** A stretchy, knitted fabric used as a barrier between skin and cast padding

**Ulnar deviation.** Physiological movement of the wrist, where the hand including the fingers move toward the ulna

**Volar.** The preferred term for reference to the palm of the hand

**SPLINTING TECHNIQUES**

The splinting techniques presented are the fundamental techniques. A strong knowledge of anatomy, physiology, and biomechanics is essential. It is imperative that the qualified health care professional develop a thorough knowledge regarding the fundamentals about the application of splinting techniques. It is recommended that Chapter 1 be reviewed before the application of any technique.
## Short Arm Volar Fiberglass

| Purpose | Temporary immobilization of the wrist joint and stabilization of the hand and distal forearm |
| Clinical Indications | Temporary immobilization for acute wrist and metacarpal fractures, carpal fractures (excluding scaphoid or trapezium), wrist sprains, post-operative procedures, carpal tunnel syndrome Other indications as ordered by physician |
| Anatomical Position | Wrist in 10 to 15 degrees of extension, no radial or ulnar deviation. Position may vary on diagnosis. |
| Supplies | One or two rolls of 2-in. or 3-in. cast padding Ortho-Glass® or similar splinting material (determined by the width of the patient's palm) One roll of 2-in. compression wrap Clean towel Water for splinting material Drape Scissors Gloves for splint application |
| Presplinting Technique | Any wounds such as abrasions or surgical incisions should be covered with a sterile dressing. If the patient is sitting, cover the lap with a drape to prevent the patient from getting wet during the application. |

### Splinting Technique

1. Starting distally at the wrist joint, roll the cast padding by overlapping 100% for the first circumference around the wrist. Proceed distally toward the hand at an angle that will eventually accommodate passing through the first web space of the hand.

![Image 1](http://example.com/image1)

2. Proceed proximally up the forearm by overlapping the cast padding by 50% until you are 1/2-in. distal from the antecubital crease. The cast padding should be wrapped at a slight angle to prevent gaps in the padding.

![Image 2](http://example.com/image2)
3. The proximal, distal, and thumb edges should have a minimum of three layers of cast padding overlapping 100% to establish a comfortable cuff.

4. Measure the patient’s arm length 2 in. distal from the antecubital crease to the palmar crease in order to determine how much Ortho-Glass® you will need; width is determined by measuring the width of the patient’s palm.

5. Cut Ortho-Glass® material to the length determined in your measurements from step 4. Stretch the covering felt over the edges of the fiberglass and fold over to prevent irritation from the fiberglass edges.

6. Saturate the splint with water and wring out as much water as possible.

7. Place clean towel on the countertop and roll up the splint material with the towel to remove even more moisture from the splint (this step will ensure that excess water is removed from the splint).

8. Place the splint on the volar aspect of the wrist. Distal end should stop at the palmar crease. Proximal end should stop 2 in. distal of the antecubital crease. The proximal and distal edges of the cast padding should be folded over to prevent splint abrasions.

9. Starting at the wrist, use the compression wrap to secure the splint. Wrap the compression dressing in the same pattern used for the application of the cast padding. Be careful not to wrap the compression wrap too tightly. Secure the compression wrap with either the tabs provided or tape if the dressing does not have an adhesive strip.

10. Hold the extended wrist position until the splint is set.

11. Place patient in a sling if appropriate.

**POSTTECHNIQUE ASSESSMENT**

- Wrist at 10 to 15 degrees of extension with no ulnar or radial deviation.
- Splint terminates distally on the palmar crease on the volar aspect (allowing finger MCP joint flexion). Splint terminates proximally 2 in. distal of the antecubital crease (allowing for elbow flexion).

**PROPER REMOVAL OF SPLINT**

Unwrap the elastic bandage that is securing the splint. Remove splint and cut padding with bandage scissors.
Measure a 10-layered 5-in. x 30-in. plaster splint from the palmar crease to a mark 2 in. distal to the antecubital crease. To allow for thumb motion, measure the width of the patient’s palm at the level of the palmar crease, and use the measurement to cut the width of the splint from the distal end to the wrist (about 5 in. or 6 in.). If you need to reinforce the splint for a bigger, stronger, or more active patient, you should reinforce it along the entire length with several more layers of plaster, not exceeding 20 layers in total.
2. Take the 6-in. cast padding and measure 1 in. distal to the distal edge of the plaster splint and roll it 1 in. proximal to the proximal edge of the plaster splint. Fold it on to itself and repeat this end-to-end rolling of the padding. After the third layer, lift the layers of padding and roll around the end of the edge of the stack of padding to enclose the edge of padding. Continue rolling around the entire length and the ends until five or six layers of padding are obtained. Tear the roll in the center and place the plaster splint centered on this side of the padding. There should be a 1-in. border on the proximal and distal ends so trim the other edges so they also have a 1-in. border of padding over the edges of the plaster.

3. Saturate the splint with water and gently squeeze out much of the water. Rub the plaster splint between your hands until it is smooth and creamy. Place it in the center of the cast padding and fold over the proximal and distal edges of padding and press them to stick to the plaster. Take the remaining cast padding previously used and apply a single layer of padding over the exposed plaster to keep the elastic bandage from sticking into this exposed plaster.

4. Place the splint on the volar aspect of the wrist with the six-sided padding next to the patient’s skin. The distal end should stop at the palmar crease. The proximal end should stop 2 in. distal of the antecubital crease.

5. Starting at the wrist, use the compression wrap to secure the splint. Proceed wrapping from the wrist to the hand and repeat rolling back to the wrist and then back to the hand. Continue wrapping back to the wrist, to the forearm, and cover the proximal edge of the splint. Be careful not to wrap the compression wrap too tight. Secure the compression wrap with either the tabs provided or tape if the dressing does not have an adhesive strip.

6. Hold the extended wrist position until the splint is set. Allow the exothermic heat to fully escape before leaving the patient.

7. Place patient in a sling if appropriate

**POSTTECHNIQUE ASSESSMENT**

- Wrist at 10 to 15 degrees of extension with no ulnar or radial deviation
- Splint terminates distally on the palmar crease on the volar aspect (allowing finger MCP joint flexion)
- Splint terminates proximally 2 in. distal of the antecubital crease (allowing for elbow flexion).
- Elastic compression wrap can be removed, the splint can then be removed. The patient can rewrap the splint after cleaning, therapy or dressing change.
### RADIAL GUTTER/THUMB SPICA

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Immobilization of the thumb, wrist joint, and distal forearm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical Indications</td>
<td>Temporary immobilization of the thumb's carpometacarpal (CMC) and metacarpophalangeal (MCP) and interphalangeal joint. Commonly used for fractures, soft tissue injuries as well as postoperative procedures of the thumb region. Other indications as ordered by physician.</td>
</tr>
<tr>
<td>Anatomical Position</td>
<td>The thumb is commonly in the position of function. The wrist is in 10 to 15 degrees of extension, and the thumb is abducted from the palm so the patient can pinch the index finger to the thumb. They can also grasp with the fingers against the thumb as if they were holding a can of soda. Position may vary on diagnosis and physician orders.</td>
</tr>
<tr>
<td>Supplies</td>
<td>One or two rolls of 2-in. cast padding. 3-in. padding may be used with larger patients. Ortho-Glass® or similar splinting material (width to be determined by the size of the patient). One or two rolls 2-in. compression wrap (elastic bandage). Clean towel. Water to wet splint material. Drape. Scissors. Elastic wrap. Gloves for splint application.</td>
</tr>
<tr>
<td>Presplinting Technique</td>
<td>Any wounds such as abrasions or surgical incisions should be covered with a sterile dressing. With the patient sitting, cover the lap with a drape to prevent the patient from getting wet during the application.</td>
</tr>
</tbody>
</table>

The following application utilizes Ortho-Glass® splint roll, a product of BSN Medical. The use of Ortho-Glass® does not require the additional use of cast padding prior to splint application but is optional. Not using cast padding allows for a less bulky splint while maintaining acute fracture stability. **Below, steps 1 and 2 describe the proper technique for using cast padding. If you are using Ortho-Glass® without cast padding, proceed to step 3.** Consult your qualified health care professional regarding whether or not to use cast padding prior to applying the splint.

### SPLINTING TECHNIQUE

1. Starting distally at the wrist joint, roll the cast padding by overlapping 100% for the first circumference around the wrist. Proceed distally toward the hand at an angle that will eventually accommodate passing through the first web space of the hand at least 1 in. distal to the palmar crease. Once the web space is wrapped, proceed toward the thumb, overlapping by 50%. While wrapping the base of the thumb, you may need to circle the hand or first web space to ensure the base is completely covered. Once covered, circle the thumb, overlapping by 50% until you are 1/2 to 3/4 in. past the interphalangeal joint.

2. Proceed proximally up the forearm by overlapping the cast padding by 50% until you 1/2 in. distal from the antecubital crease. The cast padding should be wrapped at a slight angle to prevent gaps in the padding. The proximal and distal ends should have a minimum of three layers of cast padding overlapping 100% to establish a comfortable cuff and prevent rough edges. Check to make sure the bony prominences (radial styloid) is well padded.

3. Measure the patient’s arm from the distal tip of the thumb to approximately 2 in. distal from the antecubital crease.

*If swelling is present or anticipated, the use of stockinette is not advocated due to the compressive factors that may contribute to circulatory issues.*
4. Cut the Ortho-Glass® material to the length determined in step 6. Stretch the covering felt over the edges of the fiberglass and fold over to prevent irritation from the fiberglass edges.

5. When choosing the appropriate width of the splinting material, keep the shape of the radial gutter in mind. The splint should be wide enough to form a gutter that covers the thumb. Keep in mind the thumb should NOT be completely enclosed to allow for swelling. The splint should be open like a gutter. If swelling is not an issue, choose a wider splint material to enclose the thumb forming a thumb spica splint.

6. Saturate the splint with water and wring out as much water as possible.

7. Place clean towel on the countertop and roll up the splint material with the towel to remove more moisture from the splint (this will ensure that excess water is removed from the splint).

8. Place the splint in a “U” (gutter)-shaped fashion around the distal thumb; do not place the splint further than the tip of the thumb.

9. Proceed with the splint proximally in this “U” (gutter)-shaped fashion until you are 2 in. distal of the antecubital crease.

10. Fold over the proximal and distal edges of cast padding to prevent splint abrasions to the patient.

11. Wrap the compression dressing in the same pattern used for the application of the cast padding. Be careful not to wrap the compression wrap too tightly.

12. Place patient in a sling if appropriate.

**POSTTECHNIQUE ASSESSMENT**

- The wrist is in 10 to 15 degrees of extension and the thumb is abducted from the palm so the patient can pinch the index finger to the thumb.
- Splint terminates proximally 2 in. distal of the antecubital crease (allowing for elbow flexion)
- Splint terminates distally at the tip of the thumb

**PROPER REMOVAL OF SPLINT**

Unwrap the elastic bandage that is securing the splint. Remove splint and cut padding with bandage scissors.
### Ulnar Gutter

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Immobilization of the fourth and fifth digits, hand, wrist joint, and distal forearm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical Indications</td>
<td>Temporary immobilization of the fourth and fifth digits for an acute fracture (boxer's fracture), postoperative immobilization (open reduction internal fixation), ligament and tendon injuries to the fourth and fifth digits</td>
</tr>
<tr>
<td></td>
<td>Other indications as ordered by physician</td>
</tr>
<tr>
<td>Anatomical Position</td>
<td>Wrist in 20 to 30 degrees of extension, no radial or ulnar deviation. Fourth and fifth digits in intrinsic plus position (70–90 degrees of flexion at the MCP joints, 0–10 degrees at PIP and DIP joints)</td>
</tr>
<tr>
<td></td>
<td>Position may vary on diagnosis</td>
</tr>
<tr>
<td>Supplies</td>
<td>One or two rolls of 2-in. cast padding. 3-in. padding may be used with larger patients</td>
</tr>
<tr>
<td></td>
<td>Ortho-Glass® or similar splinting material (width to be determined by the size of the patient)</td>
</tr>
<tr>
<td></td>
<td>One roll of 2-in. compression wrap (elastic bandage)</td>
</tr>
<tr>
<td></td>
<td>Clean towel</td>
</tr>
<tr>
<td></td>
<td>Water to wet splint material</td>
</tr>
<tr>
<td></td>
<td>Drape</td>
</tr>
<tr>
<td></td>
<td>Scissors</td>
</tr>
<tr>
<td></td>
<td>1 non-sterile 4 X 4 pad</td>
</tr>
<tr>
<td></td>
<td>1/2-in. adhesive tape</td>
</tr>
<tr>
<td></td>
<td>Elastic wrap</td>
</tr>
<tr>
<td></td>
<td>Gloves for splint application</td>
</tr>
<tr>
<td></td>
<td>If swelling is present or anticipated, the use of stockinette is not advocated due to the compressive factors that may contribute to circulatory issues.</td>
</tr>
<tr>
<td>Presplinting Technique</td>
<td>Any wounds such as abrasions or surgical incisions should be covered with a sterile dressing. With the patient sitting, cover the lap with a drape to prevent the patient from getting wet during the application.</td>
</tr>
</tbody>
</table>

The following application utilizes **Ortho-Glass®** splint roll, a product of **BSN Medical**. The use of Ortho-Glass® does not require the additional use of cast padding prior to splint application but is optional. Not using cast padding allows for a less bulky splint while maintaining acute fracture stability. **Below, steps 1 and 2 describe the proper technique for using cast padding. If you are using Ortho-Glass without cast padding, proceed to step 5.** Consult your qualified health care professional regarding whether or not to use cast padding prior to applying the splint.

### Splinting Technique

1. Fold the 4 X 4 pad so that it can be placed between the fourth and fifth digits. Trim any excess of the pad that may extend past the fifth digit. Wrap 1/2-in. adhesive tape in a circumferential manner around the proximal and distal phalanges. This step will aid in the prevention of skin maceration between these digits.

2. Starting distally at the wrist joint, roll the cast padding by overlapping 100% for the first circumference around the wrist. Proceed distally toward the hand at an angle that will eventually accommodate passing through the first web space of the hand at least 1 in. distal to the palmar crease. As you approach the fourth and fifth digits, use a figure of eight pattern to wrap around the digits and hand. Repeat this pattern by overlapping 50% until the cast padding is at the tip of the fifth digit.

3. Proceed proximally up the forearm by overlapping the cast padding by 50% until you are 1/2-in. distal from the antecubital crease. The cast padding should be wrapped at a slight angle to prevent gaps in the padding. The proximal, dis-
tal and thumb edges should have a minimum of three layers of cast padding overlapping 100% to establish a comfortable cuff and prevent rough edges. Check to make sure the ulnar styloid is well padded. Check that the fourth and fifth MCP joints (knuckles) are well padded when flexed at 90 degrees.

4. When choosing the appropriate width of the splinting material keep the shape of the ulnar gutter in mind. The splint should be wide enough to form a gutter that covers the fourth and fifth digits from the volar side around to the dorsal side. Keep in mind the distal fingers should NOT be completely enclosed to allow for swelling. The splint should be open like a gutter between the third and fourth digits.

5. Measure the patient’s arm from the distal tip of the fifth digit to approximately two inches distal of the antecubital crease.

6. Cut Ortho-Glass® material to the length determined in your measurements from step 8. Stretch the covering felt over the edges of the fiberglass and fold over to prevent irritation from the fiberglass edges.

7. Saturate the splint with water and ring out as much water as possible.

8. Place clean towel on the countertop and roll up the splint material with the towel to remove more moisture from the splint (this will ensure that excess water is removed from the splint).

9. When applying the splint, have the patient’s arm vertical with ulnar aspect of the hand facing you. Place the splint in a “U” (gutter-shaped) fashion around the distal fingers; do not place the splint further than the tip of the fifth digit.

10. Fold over the proximal and distal edges of cast padding to prevent splint abrasions to the patient.
11. Wrap the compression dressing in the same pattern used for the application of the cast padding. Be careful not to wrap the compression wrap too tight. Secure the compression wrap with either the tabs provided or tape if the dressing does not have an adhesive strip.

12. Mold the fourth and fifth digits into the intrinsic plus position.
Place your index finger slightly distal to the palmar crease at the junction of the fingers and hand (this will prevent a crease from forming when bending the fingers which may cause a pressure sore), bend the fourth and fifth digits into the intrinsic plus position.
Hold this position until the splint is set.

13. Place patient in a sling if appropriate.

**POSTTECHNIQUE ASSESSMENT**

- Wrist in 20 to 30 degrees of extension
- Fourth and fifth digits are in the intrinsic plus position with adequate padding between the digits, fifth digit fingertip must be visualized for neurovascular status evaluation
- Splint terminates proximally 1.5 in. distal of the antecubital crease (allowing for elbow flexion)
- Proximal end of splint should not come in contact with distal bicep while the elbow is flexed at 90 degrees
ADJUNCT SPLINTING PROCEDURE

If there are injuries to the second or third fingers that need to be immobilized, a splint can be made in the intrinsic plus position for this purpose. Follow the same steps listed for the fourth and fifth fingers, but apply them to the index and long fingers regarding the placement of padding and measurement of the splint.

Before wetting the splint, measure and cut out a hole for the thumb so the splint can then be wet, dried, and placed with the thumb positioned through the hole and positioned over the index and long fingers.

Wrap accordingly with the compression wrap and mold into the intrinsic plus position. Be sure to stretch and fold over the felt padding around the thumb to prevent abrasions. This splint is referred to as the “teardrop” splint because of the shape of the cutout around the thumb.

PROPER REMOVAL OF SPLINT

Unwrap the elastic bandage that is securing the splint. Remove splint and cut padding with bandage scissors.
## Coaptation Splint

### Purpose
To support the humerus and prevent movement at the fracture site

### Clinical Indications
Temporary immobilization of mid-shaft humerus fractures
Other indications as ordered by physician

### Anatomical Position
Humerus resting on torso supported with sling. Elbow flexed to 90 degrees

### Supplies
- Two to three rolls of 3-in. or 4-in. padding
- Ortho-Glass® or similar splinting material
- Two to three rolls of 3-in. or 4-in. compression wrap
- Clean towel
- Drape
- Scissors
- Gloves
- Arm sling
- Elastic wrap
- Assistant to aid in the positioning of the patient

If swelling is present or anticipated, the use of stockinette is not advocated due to the compressive factors that may contribute to circulatory issues.

### Presplinting Technique
Any wounds such as abrasions or surgical incisions should be covered with a sterile dressing.
If the patient is sitting, cover with a drape to prevent the patient from getting wet during the application.

### Splinting Technique

1. Prepare by instructing patient to lean forward, keeping the humerus vertical as the patient holds the hand, while the elbow is at 90 degrees to allow access to axilla area and/or to prevent humeral angulation.

2. Using cast padding, start at the proximal third of the forearm to wrap the elbow joint in a figure of eight pattern in order to fully encompass and protect the soft tissues and bony prominences of the elbow. The figure of eight is rolled by making a loop around the proximal forearm and making a loop around the distal humerus. These loops forming the eight overlap over the olecranon process. Proceed up the humerus overlapping by 50% until you reach the level of the axilla.

3. Continue wrapping under the axilla and 3 in. proximal to the AC joint. Continuous padding should encompass the proximal third of the forearm and go proximal up the humerus 2 in. past AC joint. The proximal and distal edges should have a minimum of three layers of cast padding overlapping 100% to establish a comfortable cuff and prevent rough edges. Make sure adequate padding is over all bony prominences (olecranon, medial and lateral epicondyles of the elbow and AC joint).

4. Measure the patient’s arm length starting 2 in. proximal to the AC joint, going around the lateral elbow to medial aspect of elbow, and stopping 2 in. distal to the axilla.

The following application utilizes Ortho-Glass® splint roll, a product of BSN Medical. The use of Ortho-Glass® does not require the additional use of cast padding prior to splint application but is optional. Not using cast padding allows for a less bulky splint while maintaining acute fracture stability. Below, steps 1 and 2 describe the proper technique for using cast padding. If you are using Ortho-Glass® without cast padding, proceed to step 4. Consult your qualified health care professional regarding whether or not to use cast padding prior to applying the splint.
5. Cut Ortho-Glass® material to the length determined in your measurements from step 7, the appropriate width of splinting material is determined by the patient's size. Stretch the covering felt over the edges of the fiberglass and fold over to prevent irritation from the fiberglass edges.

6. Saturate the splint with water and wring out as much water as possible.

7. Place clean towel on the countertop and roll up the splint material with the towel to remove even more moisture from the splint (this will ensure that water from the splint does not get all over the patient).

8. Start the splint in axilla area. Proceed around elbow medial to lateral. Pass over AC joint. The cast padding at the AC joint and axilla should be folded over to prevent splint abrasions to the patient.

9. If you have access to an assistant, have him hold the ends of the Ortho-Glass® in the axilla and over the AC joint. Starting at the distal third forearm, use the elastic bandage to secure the splint. Wrap the elastic bandage proximal in the same pattern used for the application of the padding. Be careful not to wrap the elastic bandage too tight. Secure the elastic wrap with either the tabs provided or tape if the bandage does not have a velcro strip.

10. Move patient to anatomical position with humerus resting on torso, elbow to 90 degrees of flexion, mold splint as necessary to correct humeral angulation. Mold splint over AC joint to prevent splint from slipping due to gravity. Allow the splint to set while maintaining the proper position.

11. Apply an elastic wrap from the hand to the wrist and forearm to connect with the previously wrapped bandage to minimize swelling.
12. Apply sling to the patient and check neurovascular status.

**POSTTECHNIQUE ASSESSMENT**

- Position: Humerus resting on torso supported with sling
- Elbow flexed to 90 degrees
- Medial portion of splint should be 2 in. distal from axilla
- Lateral portion of the splint should be 2 in. proximal to the AC joint, well padded and molded
- Hand, wrist and forearm should be enclosed within an elastic wrap to limit swelling distal to the splint

**PROPER REMOVAL OF SPLINT**

Unwrap the elastic bandage that is securing the splint. Remove splint and cut padding with bandage scissors.

**AUTHORS’ NOTE**

Humeral shaft fractures have several caveats that should be understood by the orthopaedic technician. First, the natural tendency of nearly all humeral shaft fractures is to drift into varus angulation. This is due to a number of factors, not the least of which is deltoid lateral pull on the proximal segment and the naturally rounded nature of the lateral chest wall, particularly in women whose breast tissue creates a blockage to the arm remaining flush with the mid-axillary or anterior lateral chest wall. As such, achieving optimal alignment of the humeral shaft fracture through the usage of a coaptation splint nearly always requires a valgus reduction maneuver at the humerus.

In my 20 years of teaching orthopedic residents and in reviewing postsplinting radiographs, it is indeed a rare day when the humerus is not in varus post coaptation splint application. When in doubt, a little more valgus than what you think is necessary will serve you well. Additionally, it is an equally rare day when the splinting material is high enough in the axilla. While you do not want to encumber the axilla with too much material which is uncomfortable, it is also true that getting high enough on the medial humerus in postsplinting radiographs is almost never achieved without experience.

The second issue is that humeral shaft fractures are complicated by the presence of the radial nerve being closely approximated to the the fractured ends of the humerus (aka Holstein Lewis fractures.) As such, in order to decrease the incidence of radial nerve trauma, care should be taken with the humeral shaft fractures to limit the amount of manipulation and movement to the arm. Having the patient lean forward to allow gravity to assist in alignment is generally a good method to align without undo trauma to the radial nerve and soft tissues. Documenting radial nerve function both pre- and postsplinting is always a very good idea and should be communicated with the physician.
The following application utilizes Ortho-Glass® splint roll, a product of BSN Medical. The use of Ortho-Glass® does not require the additional use of cast padding prior to splint application but is optional. Not using cast padding allows for a less bulky splint while maintaining acute fracture stability. Below, steps 1 and 2 describe the proper technique for using cast padding. If you are using Ortho-Glass® without cast padding, proceed to step 3. Consult your qualified health care professional regarding whether or not to use cast padding prior to applying the splint.

**SPLINTING TECHNIQUE**

1. Starting distally at the wrist joint, roll the cast padding by overlapping 100% for the first circumference around the wrist. Proceed distally towards the hand at an angle that will eventually accommodate passing through the first web space of the hand at least 1 in. distal to the palmar crease. Proceed proximally up the forearm overlapping by 50% until you reach the mid level of the bicep. Make sure adequate padding is over all bony prominences (ulnar and radial styloids at the wrist; olecranon, medial and lateral condyles of the elbow).

2. Wrap the elbow joint in a figure of eight pattern in order to fully encompass and protect the soft tissues and bony prominences of the elbow. The figure of eight is rolled by making a loop around the proximal forearm and making a loop around the distal humerus. These loops forming the “eight” overlap over the olecranon process. Proceed up the humerus overlapping by 50% until you reach the mid level of the bicep. Make sure adequate padding is over all bony prominences (ulnar and radial styloids at the wrist; olecranon, medial and lateral condyles of the elbow).

3. Measure the patient’s arm length, starting at the metacarpal heads on the dorsal aspect, going around the posterior elbow, and stopping on the palmar crease of the hand. Do not choose a width that will overlap along the wrist and forearm. This overlap may cause circulatory compromise. A gap instead of an overlap will allow for swelling to occur.

---

**FOREARM SUGAR TONG**

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Immobilization of the wrist forearm and elbow to prevent wrist, forearm, and elbow motion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical Indications</td>
<td>Wrist and forearm fractures, postoperative procedures. Other indications as ordered by physician</td>
</tr>
<tr>
<td>Anatomical Position</td>
<td>Wrist and forearm in neutral, elbow in 90 degrees of flexion. Position may vary based on diagnosis and physician orders.</td>
</tr>
<tr>
<td>Supplies</td>
<td>Two or three rolls of 2-in. cast padding. 3-in. may be used with larger patients. Ortho-Glass® or similar splinting material (width to be determined by the size of the patient’s palm). One roll of 3-in. compression wrap (elastic bandage). Clean towel. Water to wet splint material. Drape. Scissors. Elastic wrap. IV pole finger traps with weights and cuff. Gloves for split application.</td>
</tr>
<tr>
<td>Presplinting Technique</td>
<td>Any wounds such as abrasions or surgical incisions should be covered with a sterile dressing. If the patient is sitting, cover with a drape to prevent the patient from getting wet during the application. If splinting a both bone forearm fracture, keep the forearm vertical with the fingers held from above by an assistant. If the patient is supine on the table with the elbow at 90 degrees, use finger traps or have an assistant hold the arm.</td>
</tr>
</tbody>
</table>

If swelling is present or anticipated, the use of stockinette is not advocated due to the compressive factors that may contribute to circulatory issues.

4. Cut Ortho-Glass® material to the length determined in your measurements from step 6; the appropriate width of splinting material is determined by the patient’s palm size. Stretch the covering felt over the edges of the fiberglass and fold over to prevent irritation from the fiberglass edges.

5. Saturate the splint with water and wring out as much water as possible.

6. Place clean towel on the countertop and roll up the splint material with the towel to remove even more moisture from the splint (this step will insure that excess water is removed from the splint).

7. Start the splint at the metacarpal heads on volar side.
   
   Go around the posterior elbow.
   
   Stop the splint at the metacarpal heads on the dorsal side.

8. Starting at the wrist, use the compression wrap to secure the splint.

   Wrap the compression dressing in the same pattern used for the application of the cast padding.

   Be careful not to wrap the compression wrap too tightly.

   Secure the compression wrap with either the tabs provided or tape if the dressing does not have a velcro strip.

9. Allow for the splint to set while maintaining the proper position. Mold splint as necessary to correct forearm angulation.

10. Place patient in a sling.
Chapter 2: Upper Extremity Splints

**POSTTECHNIQUE ASSESSMENT**

- Wrist and forearm in neutral
- Elbow in 90 degrees of flexion
- Ulnar and radial areas of the splint should NOT come in contact with one another to allow for possible swelling.
- Splint terminates distally, at the metacarpal heads on the dorsal aspect and palmar crease on the volar aspect (allowing finger MCP joint flexion and extension)

**PROPER REMOVAL OF SPLINT**

Unwrap the elastic bandage that is securing the splint. Remove splint and cut padding with bandage scissors.

**AUTHORS’ NOTE**

As supination and pronation motion at the forearm are generally suboptimal for fracture alignment and maintenance of reduction, molding the splint both volar and dorsally is nearly always a good idea. In essence, by flattening the splint front and back, it turns the splint into a molded oval rather than a tube. In so doing, the arm is unable to be supinated or pronated.
### DOUBLE SUGAR TONG

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Temporary immobilization of the wrist, forearm, elbow, and distal humerus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical Indications</td>
<td>Temporary immobilization of the wrist, forearm, elbow, and distal humerus For acute fractures, dislocations, ligamentous injuries, postoperative procedures Other indications as ordered by physician</td>
</tr>
<tr>
<td>Anatomical Position</td>
<td>Wrist and forearm neutral, elbow at 90 degrees of flexion</td>
</tr>
<tr>
<td>Supplies</td>
<td>Two or three rolls of 3-in. cast padding Ortho-Glass® or similar splinting material (width to be determined by the size of the patient) Two or three rolls of 2-in. or 3-in. compression wrap Clean towel Water to wet splint material Drape Scissors Gloves for splint application Elastic wrap IV pole finger traps with weights and cuff One assistant to aid in positioning of patient</td>
</tr>
<tr>
<td>Presplinting Technique</td>
<td>Any wounds such as abrasions or surgical incisions should be covered with a sterile dressing. With the patient sitting, cover the lap with a drape to prevent the patient from getting wet during the application. If splinting a both bone forearm fracture, keep the forearm vertical with the fingers held from above by an assistant. If the patient is supine on the table with the elbow at 90 degrees, use finger traps or have an assistant hold the arm. If splinting a humeral fracture, instruct the patient to lean forward, keeping the humerus vertical to allow access to axilla area and/or to prevent humeral angulation.</td>
</tr>
</tbody>
</table>

The following application utilizes Ortho-Glass® splint roll, a product of BSN Medical. The use of Ortho-Glass® does not require the additional use of cast padding prior to splint application but is optional. Not using cast padding allows for a less bulky splint while maintaining acute fracture stability. Below, steps 1 and 2 describe the proper technique for using cast padding. If you are using Ortho-Glass® without cast padding, proceed to step 4. Consult your qualified health care professional regarding whether or not to use cast padding prior to applying the splint.

### SPLINTING TECHNIQUE

1. Starting distally at the wrist joint, roll the cast padding by overlapping 100% for the first circumference around the wrist. Proceed distally toward the hand at an angle that will eventually accommodate passing through the first web space of the hand. Proceed proximally up the forearm by overlapping the cast padding by 50% until you are 1/2 in. distal from the antecubital crease. The cast padding should be wrapped at a slight angle to prevent gaps in the padding.

2. Wrap the elbow joint in a figure of eight pattern in order to fully encompass and protect the soft tissues and bony prominences of the elbow. The figure of eight is rolled by making a loop around the proximal forearm and making a loop around the distal humerus. These loops forming the eight overlap over the olecranon process. Proceed up the humerus, overlapping by 50% until you reach the level of the axilla. The proximal, distal and thumb edges should have a minimum of three layers of cast padding overlapping 100% to establish a comfortable cuff and prevent rough edges. Evaluate the boney prominences (olecranon, medial and lateral epicondyles, radial and ulnar styloids) to ensure they are well padded.

3. The fracture location will establish which of the two splints should be applied first. If the fracture is distal to the elbow joint, apply the forearm splint followed by the humeral splint. If the fracture is proximal to the elbow, apply the humeral splint followed by the forearm splint.
4. Measure the patient’s arm length:
   1. First, measure the patient’s forearm length, starting at the metacarpal heads on the dorsal aspect, going around the posterior elbow, and stopping on the palmar crease of the hand.

2. Next, measure the patient’s humerus length, starting 2 in. distal to the axilla, go around the olecranon process of the elbow, stopping at the level of the axilla on the lateral humerus.

5. Cut the Ortho-Glass™ material to the lengths determined in your measurements from step 8; the appropriate width of splinting material is determined by the patient’s palm size. Stretch the covering felt over the edges of the fiberglass and fold over to prevent irritation from the fiberglass edges.

6. Saturate the splint with water and wring out as much water as possible.

7. Place clean towel on the countertop and roll up the splint material with the towel to remove even more moisture from the splint (this step will ensure that excess water is removed from the splint).

8. Depending on which splint is applied first (forearm or humerus), use the compression wrap to secure the fracture location of the primary splint. Use compression wrap to secure the secondary splint (not the fracture site).
Wrap the compression dressing in the same pattern used for the application of the cast padding. Be careful not to wrap the compression wrap too tightly. Secure the compression wrap with either the tabs provided or tape if the dressing does not have a velcro strip.

9. Allow the splint to set while maintaining the proper position.

10. Place patient in a sling.

**POSTTECHNIQUE ASSESSMENT**

- Wrist and forearm in neutral
- Elbow in 90 degrees of flexion
- Ulnar and radial areas of the splint should NOT come in contact with one another to allow for possible swelling.
- Splint terminates distally, at the metacarpal heads on the dorsal aspect and palmar crease on the volar aspect (allowing finger MCP joint flexion and extension).
- Splint terminates medially 2 in. distal to the axilla, laterally at the level of the axilla.

**PROPER REMOVAL OF SPLINT**

Unwrap the elastic bandage that is securing the splint. Remove splint and cut padding with bandage scissors.
The following application utilizes Ortho-Glass® splint roll, a product of BSN Medical. The use of Ortho-Glass® does not require the additional use of cast padding prior to splint application but is optional. Not using cast padding allows for a less bulky splint while maintaining acute fracture stability. Below, steps 1 and 2 describe the proper technique for using cast padding. If you are using Ortho-Glass® without cast padding, proceed to step 3. Consult your qualified health care professional regarding whether or not to use cast padding prior to applying the splint.

### LONG ARM POSTERIOR SPLINT

| Purpose | Temporary immobilization of the wrist, forearm, elbow, and distal humerus |
| Clinical Indications | Temporary immobilization of the wrist, forearm, elbow, and distal humerus to treat acute fractures, dislocations, ligamentous injuries, postoperative procedures |
| Other indications as ordered by physician |

| Anatomical Position | Wrist and forearm neutral, elbow at 90 degrees of flexion |
| Position may vary on diagnosis and physician orders |

| Supplies | Two or three rolls of 3-in. cast padding |
| Ortho-Glass® or similar splinting material (width to be determined by the size of the patient) |
| Two or three rolls of 2-in. or 3-in. compression wrap |
| Clean towel |
| Water to wet splint material |
| Drape |
| Scissors |
| Elastic wrap |
| Gloves for splint application |

*If swelling is present or anticipated, the use of stockinette is not advocated due to the compressive factors that may contribute to circulatory issues.*

| Presplinting Technique | Any wounds such as abrasions or surgical incisions should be covered with a sterile dressing. With the patient sitting, cover the lap with a drape to prevent the patient from getting wet during the application. If splinting a both bone forearm fracture, keep the forearm vertical with the fingers held from above by an assistant. Position the patient supine on the table with the elbow at 90 degrees. If splinting a humeral fracture, instruct the patient to lean forward, keeping the humerus vertical to allow access to axilla area and/or to prevent humeral angulation. |

**SPLINTING TECHNIQUE**

1. Starting distally at the wrist joint, roll the cast padding by overlapping 100% for the first circumference around the wrist. Proceed distally toward the hand at an angle that will eventually accommodate passing through the first web space of the hand. Proceed proximally up the forearm by overlapping the cast padding by 50% until you are 1/2 in. distal from the antecubital crease. The cast padding should be wrapped at a slight angle to prevent gaps in the padding.

2. Wrap the elbow joint in a figure of eight pattern in order to fully encompass and protect the soft tissues and bony prominences of the elbow. The figure of eight is rolled by making a loop around the proximal forearm and making a loop around the distal humerus. These loops forming the eight overlap over the olecranon process. Proceed up the humerus, overlapping by 50% until you reach the level of the axilla. The proximal, distal, and thumb edges should have a minimum of three layers of cast padding overlapping 100% to establish a comfortable cuff and prevent rough edges. Evaluate the boney prominences (olecranon, medial and lateral epicondyles, radial and ulnar styloids) to ensure they are well padded.
3. Measure the patient’s arm length (on the posterior aspect of the arm, 2 in. distal from the axilla to the palmar crease)

4. Cut Ortho-Glass® material to the length determined in your measurements from step 7. Stretch the covering felt over the edges of the fiberglass and fold over to prevent irritation from the fiberglass edges.

5. Saturate the splint with water and wring out as much water as possible.

6. Place clean towel on the countertop and roll up the splint material with the towel to remove even more moisture from the splint (this step will ensure that excess water is removed from the splint.)

7. Position splint on patient's arm, starting at the palmar crease of the hand, proceed past the posterior elbow until you are 2 in. distal from the axilla. Have either an assistant or the patient help hold the proximal end of the splint in place.

8. Starting at the hand, use the compression wrap to secure the splint.

9. Wrap the compression dressing in the same pattern used for the application of the cast padding. Be careful not to wrap the compression wrap too tightly. Secure the compression wrap with either the tabs provided or tape if the dressing does not have an adhesive strip. Mold the splint as necessary to support the injury.

10. Allow the splint to set while maintaining the proper position.

11. Place patient in a sling.
POSTTECHNIQUE ASSESSMENT

- Wrist and forearm in neutral position, elbow in 90 degrees of flexion
- Splint terminates 2 in. distal to the axilla and at the palmar crease

PROPER REMOVAL OF SPLINT

Unwrap the elastic bandage that is securing the splint. Remove splint and cut padding with bandage scissors.

AUTHORS’ NOTE

As the olecranon is a place of high skin tension, breakdown in this area is possible. Always be sure to pad the olecranon well, particularly in patients who have diabetes, vasculopathy, or poor skin quality.

A second area where a competent orthopedic technologist can be of great value is to remain aware that splinting around an elbow has the potential to identify instabilities of the elbow. A good cast technician can oftentimes feel or suspect if the radial head is improperly aligned with the capitellum or if the ulnohumeral joint has subluxed or dislocated. Any signs of elbow instability or change in alignment of the humerus, as it relates to the proximal ulna or radius should be brought to the attention of the physician and checked with radiographs post splinting. In being another set of expert eyes within the emergency department or clinic, you become an ever increasingly valuable member of the medical staff.
**FINGER/WRIST FLEXION BLOCK SPLINT**

| Purpose | Temporary immobilization of the hand, wrist, and forearm following laceration or rupture of extensor tendons of the hand and wrist. The splint is applied to the volar or palmar side of the fingers, hand, and forearm to prevent flexion of the 2–5 fingers and wrist. |
| Presplinting Technique | Any wounds such as abrasions or surgical incisions should be covered with a sterile dressing. If the patient is sitting, cover the lap with a drape to prevent the patient from getting wet during the application. |
| Clinical Indications | Temporary immobilization of the hand, wrist, and forearm following lacerations or ruptures of extensor tendons of the hand and wrist both preoperative and post operative. It can also be used following tendon transfers or other indications as ordered by the physician. |
| Anatomical Position | Wrist is positioned in 30 degrees of extension and the 2–5 finger MP joints in 30 degrees of flexion, while the PIP and DIP finger joints are in full extension. Some authors prefer that the wrist and all finger joints are in neutral position. This author prefers the 30–30 position because the finger MP joint may become stiff if fully extended over a prolonged period. By flexing the MP joints slightly to 30 degrees and then extending the wrist, the surgically repaired tendons are not stressed. Position may vary on diagnosis. |
| Supplies | One or two rolls of 2-in. cast padding. 3-in. padding may be used with larger patients. Ortho-Glass® or similar splinting material (width to be determined by the width of the patient’s palm) One or two rolls of 2-in. compression wrap Clean towel Water to wet splint material Drape Scissors Gloves for splint application |

**SPLINTING TECHNIQUE**

1. Starting distally at the wrist joint, roll the cast padding by overlapping 100% for the first circumference around the wrist. Proceed distally toward the hand at an angle that will eventually accommodate passing through the first web space of the hand. Proceed proximally up the forearm by overlapping the cast padding by 50% until you are 1/2 in. distal from the antecubital crease. The cast padding should be wrapped at a slight angle to prevent gaps in the padding. The proximal, distal, and thumb edges should have a minimum of three layers of cast padding overlapping 100% to establish a comfortable cuff.

2. Measure the patient’s arm length 2 in. distal from the antecubital crease to the fingertips in order to determine how much Ortho-Glass® you will need; width is determined by measuring the width of the patient’s palm.
3. Cut Ortho-Glass® material to the length determined in your measurements from step 4. Stretch the covering felt over the edges of the fiberglass and fold over to prevent irritation from the fiberglass edges.

4. Saturate the splint with water and wring out as much water as possible.

5. Place clean towel on the countertop and roll up the splint material with the towel to remove even more moisture from the splint (this step will ensure excess water is removed from the splint).

6. Place the splint on the volar aspect of the wrist. Distal end should stop at the fingertips. Proximal end should stop 2 in. distal of the antecubital crease. The proximal edge of the cast padding should be folded over to prevent splint abrasions.

7. Starting at the wrist, use the compression wrap to secure the splint. Wrap the compression dressing around the wrist, the hand, and the fingers. Then wrap proximal to the forearm, securing the remainder of the splint. Be careful not to wrap the compression wrap too tightly. Secure the compression wrap with either the tabs provided or tape if the dressing does not have an adhesive strip.

8. Hold the extended wrist position at 30 degrees and then the finger MP joints flexed at 30 degrees with PIP and DIP joints in full extension until the splint is set.

9. Place patient in a sling if appropriate.

POSTTECHNIQUE ASSESSMENT

- Wrist at 30 degrees of extension with no ulnar or radial deviation
- 2–5 Finger MP joints flexed 30 degrees
- PIP and DIP joints are in full extension
- Splint terminates distally at the fingertips on the volar aspect
- Splint terminates proximally 2 in. distal of the antecubital crease (allowing for elbow flexion).

ADJUNCT SPLINT TECHNIQUE

The splint extends to the fingertips, but there are two ways to wrap the distal end with compression wrap. Some surgeons will wrap the forearm, wrist, and hand (metacarpals) to the splint, while some surgeons will wrap the forearm, wrist, hand, and fingers to the splint. If the wrap covers the fingers, place gauze or cast padding between the digits before wrapping with compression wrap to prevent skin maceration.
# Finger/Wrist Extension Block Splint

## AKA Clam Digger Splint

### Purpose

There are two different purposes for this splint:

1. Temporary immobilization of the hand, wrist, and forearm following fractures of the 2–5 metacarpals and proximal phalanges of the hand.

2. Temporary immobilization of the hand, wrist and forearm following laceration or rupture of flexor tendons of the hand and wrist for fingers 2–5.

The splint is applied to the dorsal or posterior side of the fingers, hand, and forearm to prevent extension of the 2–5 fingers and wrist.

### Clinical Indications

There are two different indications to use this splint:

1. Temporary immobilization of the hand, wrist, and forearm following fractures of the 2–5 metacarpals and proximal phalanges of the hand.

2. Temporary immobilization of the hand, wrist, and forearm following lacerations or ruptures of flexor tendons of the hand 2–5 and wrist both preoperative and post operative. It can also be used following tendon transfers or other indications as ordered by physician.

### Anatomical Position

1. For fractures of 2–5 metacarpals and proximal phalanges, the wrist is positioned in 30 degrees of extension and the 2–5 finger MP joints in 90 degrees of flexion, while the PIP and DIP finger joints are in full extension. This is known as the intrinsic plus position.

2. For flexor tendon lacerations fingers 2–5, the wrist is positioned in 30 degrees of flexion and the 2–5 finger MP joints are in 60 degrees of flexion. By flexing the wrist and MP joints in this position, the lacerated flexor tendons are not stressed.

Position may vary on diagnosis.

### Supplies

- One or two rolls of 2-in. cast padding. 3-in. padding may be used with larger patients.
- Ortho-Glass® or similar splinting material (width to be determined by the width of the patient’s palm)
- One or two rolls of 2-in. compression wrap
- Clean towel
- Water to wet splint material
- Drape
- Scissors
- Gloves for splint application

If swelling is present or anticipated, the use of stockinette is not advocated due to the compressive factors that may contribute to circulatory issues.

### Presplinting Technique

Any wounds such as abrasions or surgical incisions should be covered with a sterile dressing.

If the patient is sitting, cover the lap with a drape to prevent the patient from getting wet during the application.

The following application utilizes Ortho-Glass® splint roll, a product of BSN Medical. The use of Ortho-Glass® does not require the additional use of cast padding prior to splint application but is optional. Not using cast padding allows for a less bulky splint while maintaining acute fracture stability. **Below, steps 1 and 2 describe the proper technique for using cast padding. If you are using Ortho-Glass® without cast padding, proceed to step 2. Consult your qualified health care professional regarding whether or not to use cast padding prior to applying the splint.**

### Splinting Technique

1. Starting distally at the wrist joint, roll the cast padding by overlapping 100% for the first circumference around the wrist. Proceed distally toward the hand at an angle that will eventually accommodate passing through the first web space of the hand. Proceed proximally up the forearm by overlapping the cast padding by 50% until you are 1/2 in. distal from the antecubital crease. The cast padding should be wrapped at a slight an-
gle to prevent gaps in the padding. The proximal, distal, and thumb edges should have a minimum of three layers of cast padding overlapping 100% to establish a comfortable cuff.

2. Measure the patient’s arm length 2 in. distal from the antecubital crease to the fingertips in order to determine how much Ortho-Glass® you will need; width is determined by measuring the width of the patient’s palm.

3. Cut Ortho-Glass® material to the length determined in your measurements from step 4. Stretch the covering felt over the edges of the fiberglass and fold over to prevent irritation from the fiberglass edges.

4. Saturate the splint with water and wring out as much water as possible.

5. Place clean towel on the countertop and roll up the splint material with the towel to remove even more moisture from the splint (this will ensure that excess water is removed from the splint).

6. Place the splint on the dorsal or posterior aspect of the hand, wrist, and forearm.
Distal end should stop at the fingertips.

Proximal end should stop on the posterior forearm at a level 2 in. distal of the antecubital crease. The proximal edge of the cast padding should be folded over to prevent splint abrasions.

7. Starting at the wrist, use the compression wrap to secure the splint.
Wrap the compression dressing around the wrist, the hand, but not the fingers. Then wrap proximal to the forearm securing the remainder of the splint.
Be careful not to apply the compression wrap too tight.
Secure the compression wrap with either the tabs provided or tape if the dressing does not have an adhesive strip.
8. Based on the indications of either a fracture or of a tendon injury:

1. For metacarpal fractures of fingers 2–5, hold the extended wrist position at 30 degrees and then the finger MP joints flexed at 90 degrees with PIP and DIP joints in full extension until the splint is set. (Intrinsic plus position)

2. For flexor tendon lacerations of fingers 2–5, hold the flexed wrist position at 30 degrees and the flexed finger MP joints at 60 degrees with the PIP and DIP joints in full extension until the splint is set. In this flexed position of wrist and MPs, the flexor tendons are not stressed.

9. Place patient in a sling if appropriate.

**POSTTECHNIQUE ASSESSMENT**

For metacarpal fractures and proximal phalangeal fractures of fingers 2–5, wrist at 30 degrees of extension with no ulnar or radial deviation, finger MP joints flexed 90 degrees, PIP and DIP joints are in full extension.

For flexor tendon lacerations fingers 2–5, wrist at 30 degrees of flexion with no ulnar or radial deviation, finger MP joints flexed 60 degrees, PIP and DIP joints are in full extension.

Splint terminates distally at the fingertips on the dorsal aspect.

Splint terminates proximally on the posterior forearm at a level 2 in. distal of the antecubital crease.

Do not wrap the compression wrap over the fingers. When treating fractures, the use of this splint allows the fingers to flex and extend within the confines of the splint. This allows for prevention of joint stiffness in the fingers and assessment of hand function. When treating flexor tendon lacerations, there are many different complexities involving finger motion, either active or passive. Follow the orders of the treating physician for each specific flexor tendon protocol. If the treating physician orders the fingers wrapped to the back of the splint, be sure to place several layers of gauze or cast padding between the fingers to prevent skin maceration before wrapping the fingers to the back of the splint.