Bandaging in Dogs and Cats: External Coaptation*

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ABSTRACT: Indications for external coaptation include protecting wounds, immobilizing fractures, and decreasing postoperative limb swelling. The type of bandage selected for external fixation is often dictated by the animal’s injury. This article discusses some of the most commonly used bandages, including the Robert-Jones and modified Robert-Jones bandages, rigid and soft casts, carpal and Ehmer slings, and metal and fiberglass splints.

In veterinary medicine, many different bandaging options are available. To provide the best external coaptation for a given injury, practitioners should be aware of the indications and contraindications for using these bandages. This article reviews the most commonly used bandages, including the Robert-Jones and modified Robert-Jones bandages, soft and rigid fiberglass casts, Ehmer and carpal slings, and metal and fiberglass splints. The indications, contraindications, required materials, and application techniques for applying these bandages are discussed.

ROBERT-JONES BANDAGES

The bandage used most often in veterinary orthopedics is the Robert-Jones bandage and its modifications.\(^1\)\(^2\) The Robert-Jones bandage should be used for certain wounds, fractures, or dislocations at or distal to the elbow and stifle. This bandage is indicated when severe inflammation is expected in a patient with a stable, nondisplaced, or nonarticular fracture but is also used if surgery is delayed in patients with an unstable, displaced, or articular fracture.\(^1\) The goal of the Robert-Jones bandage is to provide temporary support of a fracture through immobilization while maintaining even compression over the entire limb.\(^1\)\(^2\)\(^3\)

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This bandage should not be used as primary fixation of a fracture because the padding can loosen over time and, therefore, it will not provide the rigid fixation needed for fracture healing.1

Materials required include two pieces of 0.5- to 1-inch white adhesive tape and a tongue depressor for stirrups, a nonadherent dressing (if indicated), one to three 1-lb rolls of 12-inch cotton, one to three rolls of 3- to 4-inch roll gauze, and one to two rolls of 3- to 4-inch self-adherent stretch tape (Table I).

Tape stirrups, which help prevent bandage slippage, should be applied either to the medial and lateral surfaces of the leg or the dorsal/palmar or plantar surfaces (Figure 1A). The stirrups should extend from the carpus or tarsus to approximately 3 to 6 inches distally from the toes.1 A tongue depressor should be placed between the adhesive surfaces to help facilitate separation of the tape near the completion of bandaging. Alternatively, the tape can be stuck directly to itself. It is important to tab the ends first to allow easier separation at the end. Cotton padding should be applied, starting distally at the toes and working proximally to the midfemur/midhumerus (Figure 1B). The cotton should continue to be unrolled proximally and distally, overlapping 50% per pass until sufficient bulk is achieved.1 The third and fourth digits must be visible to evaluate limb swelling after bandage placement. Roll gauze should be applied next, beginning with the toes, working proximally, and overlapping each pass by 50% (Figure 1C). The gauze layer should apply strong and even pressure to compress the cast padding by 40% to 50% but should not extend beyond the layer of cast padding. The tape stirrups should be separated and taped proximally up the bandage. Finally, the outer layer

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**TABLE I**

**Bandage Types and Materials**

<table>
<thead>
<tr>
<th>Type</th>
<th>Materials Needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robert-Jones bandage</td>
<td>Two pieces of 0.5- to 1-inch porous adhesive tape and tongue depressor for stirrups</td>
</tr>
<tr>
<td></td>
<td>Nonadherent dressing (if indicated)</td>
</tr>
<tr>
<td></td>
<td>One to three 1-lb rolls of 12-inch cotton</td>
</tr>
<tr>
<td></td>
<td>One to three rolls of 3- to 4-inch roll gauze</td>
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<tr>
<td></td>
<td>One to two rolls of 3- to 4-inch self-adherent stretch tape</td>
</tr>
<tr>
<td>Modified Robert-Jones bandage</td>
<td>Two pieces of 0.5- to 1-inch porous adhesive tape and tongue depressor for stirrups</td>
</tr>
<tr>
<td></td>
<td>Nonadherent dressing (if indicated)</td>
</tr>
<tr>
<td></td>
<td>Several rolls of 2- to 4-inch cast padding</td>
</tr>
<tr>
<td></td>
<td>One to three rolls of 3- to 4-inch roll gauze</td>
</tr>
<tr>
<td></td>
<td>One to two rolls of 3- to 4-inch elastic adhesive tape</td>
</tr>
<tr>
<td>Cast</td>
<td>Rigid or fiberglass casting material</td>
</tr>
<tr>
<td></td>
<td>Nonadherent dressing (if indicated)</td>
</tr>
<tr>
<td></td>
<td>Two pieces of 0.5- to 1-inch porous adhesive tape and tongue depressor for stirrups</td>
</tr>
<tr>
<td></td>
<td>Several rolls of 2- to 4-inch cast padding</td>
</tr>
<tr>
<td></td>
<td>One to three rolls of 3- to 4-inch roll gauze</td>
</tr>
<tr>
<td></td>
<td>One to two rolls of 3- to 4-inch elastic adhesive tape</td>
</tr>
<tr>
<td>Slings</td>
<td>Nonadherent dressing (if indicated)</td>
</tr>
<tr>
<td>Carpal</td>
<td>One roll of 2- to 3-inch cast padding</td>
</tr>
<tr>
<td></td>
<td>One roll of 2- to 3-inch roll gauze</td>
</tr>
<tr>
<td></td>
<td>Some 1-inch porous adhesive tape</td>
</tr>
<tr>
<td></td>
<td>One roll of 2- to 3-inch elastic adhesive tape</td>
</tr>
<tr>
<td>Ehmer</td>
<td>Small amount of cast padding</td>
</tr>
<tr>
<td></td>
<td>One roll of 1- to 2-inch porous adhesive tape</td>
</tr>
<tr>
<td>Splints</td>
<td>Mason metasplint or fiberglass splint</td>
</tr>
<tr>
<td></td>
<td>Two pieces of 0.5- to 1-inch porous adhesive tape and tongue depressor for stirrups</td>
</tr>
<tr>
<td></td>
<td>Nonadherent dressing (if indicated)</td>
</tr>
<tr>
<td></td>
<td>Several rolls of 2- to 4-inch cast padding</td>
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<tr>
<td></td>
<td>One to three rolls of 3- to 4-inch roll gauze</td>
</tr>
<tr>
<td></td>
<td>One to two rolls of 3- to 4-inch elastic adhesive tape</td>
</tr>
</tbody>
</table>
should be applied in the same fashion as the first two layers (Figure 1D); however, care must be taken to avoid vascular compromise and swelling, which can occur if the final layer is applied too tightly. The finished bandage should be smooth in appearance (Figure 1D).

The primary difference between the Robert-Jones bandage and modified Robert-Jones bandage, or soft padded bandage, is the amount or type of padding (Table I). The modified Robert-Jones bandage uses cast padding instead of roll cotton and requires much less padding during its construction, making it considerably less bulky but still capable of providing compression and partial (as opposed to complete) immobilization (Figure 2). The modified Robert-Jones bandage is indicated when light compression is needed to reduce soft-tissue swelling but is not advised for any injuries that require rigid stability. The modified bandage is often used to minimize postoperative swelling or provide temporary stability to a limb before surgery.

CASTS

Rigid Casts

Using a rigid cast as a method of fracture management is a viable option in several instances. Case selection is important in determining the type of cast to be considered. The fracture must be closed and located below the elbow or stifle and should be amenable to a closed reduction in which at least 50% of the proximal and distal fracture ends are in contact. The bone should be stable in the cast. A cast should be used if the fractured bone is expected to heal quickly (e.g., fractures in young animals; greenstick fractures; radial or tibial fractures with an intact ulna or fibula, respectively). The cast must be used for the shortest amount of time possible to achieve healing and minimize the possibility of the patient developing fracture disease. Fracture disease is characterized by chronic edema, muscle atrophy, joint stiffness, and disuse osteoporosis. In extreme cases, these changes can lead to permanent joint dysfunction. To provide adequate stability for bone healing, the cast must include the joint above and below the fracture.

Casting materials include two pieces of 0.5- to 1-inch white adhesive tape and a tongue depressor for stirrups, a nonadherent dressing (if indicated), several rolls of 2- to 4-inch cast padding, one to three rolls of 3- or 4-inch cling gauze, one to two rolls of 3- or 4-inch self-adherent stretch tape, and rigid casting material (Table I).

With the fracture in reduction, the bandaging material should be applied the same as is done with a modified Robert-Jones bandage except with fewer passes of the cotton roll. The casting material should be applied over the gauze layer. The manufacturer’s directions can be followed for preparing the casting material for application. The material should be applied beginning at the foot and continuing...
proximally, overlapping each layer by 50%. Two rolls of casting material may be needed to provide adequate stability. Because creases can cause sores on the skin, the surface of the casting material must be consistently smooth. The cast should be covered with self-adherent stretch tape. A radiograph of the limb in the cast should be made to ensure that proper fracture alignment was maintained during application.

One benefit of using a cast is that it can be bivalved (by cutting it in half) when strict immobilization is no longer needed. One half can then be used as a splint for added support during the remainder of the fracture healing process.

**Soft Casts**

Soft casts composed of woven glass fibers impregnated with a polyurethane resin as the matrix are a relatively new type of external coaptation. After the material sets, it remains somewhat elastic and resilient to manual compression. Soft casts can be used to protect joints from excessive motion after joint surgeries (e.g., internal fixation of intraarticular fractures, ligament repair or replacement, reduction of joint luxations). In these cases, soft casts are beneficial because they allow some joint movement while protecting the repair. Soft casts are also more advantageous than rigid casts because the former may mitigate degeneration of cartilage and lessen or prevent decreased range of motion and joint contracture that commonly occur with joint immobilization.

Soft casts require the same basic materials needed for rigid casts. The manufacturer’s directions can be followed for preparing the soft casting material for application. As with a rigid cast, the material should be applied beginning at the foot and working proximally, overlapping each layer by 50%. Adequate reinforcement at the joints may be needed to ensure that the cast is sturdy enough to hold its shape.

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**SLINGS**

**Carpal Slings**

The carpal sling, or carpal flexion bandage, immobilizes the carpus. This bandage is used to maintain the carpus in flexion after tendon repair, thus relieving tension on the flexor tendons. This sling can also be useful when motion of the elbow or shoulder is desired without weight bearing after repair of selected humeral and elbow fractures.

Construction of a carpal sling requires cast padding, 2- to 3-inch gauze, 1-inch tape, and self-adherent stretch tape (Table I). The carpal sling should be applied with the carpus in flexion because bandaging the extended carpus will lead to bunching of the materials when the carpus is flexed. Cast padding and gauze should be placed beginning at toe level and working upward to the middle of the antebrachium (Figure 3A). The distal aspect of the third and fourth digits must remain exposed to allow monitoring for swelling. After the gauze layer has been placed, flexion can be maintained by wrapping 1-inch tape in a circular fashion around the paw and the distal radius. Another method of maintaining carpal flexion is by starting at the flexed portion of the carpus and applying 3 to 4 figure-of-eight loops of 1-inch tape (Figure 3B). Self-adherent stretch tape should then be applied over the entire bandage (Figure 3C). Permanent contracture of the carpus is possible. This can be avoided by allowing limited extension within 2 to 4 weeks after surgery by lengthening the 1-inch tape loops to enable partial extension.

**Ehmer Slings**

The true Ehmer sling is a non–weight-bearing bandage of the hindlimb that is commonly used to treat disorders of the coxofemoral joint. The Ehmer sling is used to maintain closed reduction for craniodorsal...
coxofemoral luxations but can also be used following surgical correction of coxofemoral luxations and to prevent weight bearing after repair of acetabular and femoral fractures. The Ehmer sling will maintain the leg in a flexed position with the coxofemoral joint internally rotated and abducted. Internal rotation of the hip will enable the femoral head to seat beneath the dorsal rim of the acetabulum, and the abduction will help maintain reduction of the coxofemoral joint by forcing the femoral head into the acetabulum.\textsuperscript{1,5}

The Ehmer sling should make a figure-of-eight pattern around the distal limb and then wrap around the body to maintain abduction, prevent the bandage from slipping off the limb, and restrict motion of the coxofemoral joint. The Ehmer sling may be problematic for a male dog because the encircling portion, although cranial to the prepuce, can become soiled with urine and cause irritation. A modified Ehmer sling does not encircle the body and may slip off the cranial aspect of the thigh. The modified Ehmer sling, which is basically a non-weight-bearing sling, does not cause abduction and allows movement of the coxofemoral joint.

A small amount of cast padding and 1- to 2-inch adhesive tape are the only materials required for an Ehmer sling (Table I). Two to three layers of cast padding should be placed around the metatarsal/proximal phalangeal region (Figure 4A). The tape should then be placed over the padding and around the metatarsal region (Figure 4B). With the leg flexed, the tape should be continued up the medial aspect of the tibia, medial to the stifle joint, and medially over the thigh muscle with the adhesive surface of the tape always facing the skin (Figure 4C). The tape should be continued from medial to lateral over the quadriceps to pass distally caudal to the stifle joint, and medial to the distal tibia and hock and should pass under the plantar aspect of the metatarsals, medially to laterally (Figure 4D). Two or three wraps of tape should be continued in a similar manner. This completes the modified sling (Figure 4E). With the true Ehmer sling, the tape should be carried...
proximally, lateral to the stifle. The amount of tension on this vertical portion will dictate the degree of abduction created by the sling. The tape should circle the abdomen cranial to the tuber coxae. Only one to three circumferential layers should be needed (Figure 4F).

Owners should be instructed to check the bandage twice daily for complications. Three areas in particular should be pointed out as common locations for bandaging complications (e.g., swelling, rubbing). These areas include the pez, caudal aspect of the stifle, and inguinal region. If a true Ehmer sling is used on a male dog, the area at the cranial aspect of the prepuce should be examined for sores.

**SPLINTS**

Mason metasplints, which are preformed, and molded fiberglass cast splints are two of the most common types of splints used by veterinarians. Before these splints are placed, any existing wounds should be dressed. Tape stirrups should then be applied, followed by the application of cast padding. Less cast padding is used than with a soft padded bandage to avoid increased motion between the splint and the skin. A “donut,” or layered cast padding with a hole cut in the center, should be placed over any bony prominence (e.g., accessory carpal bone, olecranon, tuber calcanei). After one to two layers of gauze are applied over the cast padding, the splint should be placed on the limb. Another layer of gauze should be applied over the splint, followed by an outer layer of adhesive or elastic tape.

**Mason Metasplints**

The Mason metasplint is a preformed metal or plastic splint used to immobilize fractures and dislocations of the metacarpus and carpus (Figure 5A), including the distal radius and ulna, carpus or tarsus, and metacarpal or metatarsal bones or phalanges. The Mason metasplint will not immobilize the proximal radius and ulna or the elbow. The metal or plastic shoe should approximate the shape of the padded limb (Figure 5B). Extending the bandage above the elbow will help keep the bandaging in place (Figure 5C).

**Fiberglass Splints**

Fiberglass splints are molded splints that can be applied laterally to the thoracic or pelvic limb or the caudal aspect of the thoracic limb. The splint should approximate the shape of the limb to which it is applied. It can be used to immobilize the elbow and stifle joints and can stabilize less severe fractures of the radius, ulna, tibia, and fibula.

Limb positioning is important during application of a molded splint. The pelvic limb should be in a normal standing position with the hock slightly flexed. The thoracic limb splint should be applied with the carpus in slight flexion (15°) and deviated medially by 15°. Proper positioning of the thoracic limb is necessary to prevent valgus deformity, which may occur because of the normal laxity of the radial carpal joint or eccentric growth of the radius and ulna in immature patients.

There are several ways to apply a fiberglass splint. Some veterinarians prefer to apply the splint directly to the leg while the fiberglass is wet (Figure 6A). Others prefabricate the splint either with it already wet or while it is dry with the intention of wetting it immediately before placing it on the leg (Figure 6B). It should be noted that fiberglass has a tendency to shrink slightly before it sets. The gauze and the final protective layer may be applied before the fiberglass has completely hardened as long as even pressure is maintained and no creases or other deformities are made (Figures 6C and 6D).

**BANDAGING AFTERCARE**

All bandaging should be kept clean, dry, and intact. Owners must examine the toes of their pet for signs of swelling, maintain bandage integrity, and commit to

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**Figure 5**—(A) The Mason metasplint can provide immobilization of the metacarpus and carpus. (B) The splint is applied between the roll gauze layers. (C) The bandage should extend beyond the elbow to help it stay in place.
bandage changes as scheduled. When the pet is outdoors, a plastic bag can be placed over the limb to protect the bandage from environmental elements. Owners should be instructed to return immediately for a bandaging change if drainage or a foul odor is coming from the bandaging, if loosening or other structural damage to the bandage occurs, or if the animal shows signs of obsessive licking or chewing at the bandaging. An Elizabethan collar may be needed to eliminate the opportunity for the pet to chew the bandaging.

REFERENCES


About the Authors

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ARTICLE #3 CE TEST

The article you have read qualifies for 1.5 contact hours of Continuing Education Credit from the Auburn University College of Veterinary Medicine. **Choose only the one best answer to each of the following questions; then mark your answers on the test form inserted in Compendium.**

1. Tape stirrups
   a. should only be used for the carpal and Ehmer sling bandages.
   b. should only be used on thoracic limbs.
   c. help prevent bandage slippage.
   d. are not needed for the modified Robert-Jones bandage.
2. A Robert-Jones bandage should be used
   a. as primary fixation of a fracture.
   b. to provide temporary support of a proximal radius/ulna fracture through immobilization while maintaining even compression over the entire limb.
   c. to provide temporary support of a femoral neck fracture through immobilization while maintaining even compression over the entire limb.
   d. to provide temporary support of a proximal humeral fracture through immobilization while maintaining even compression over the entire limb.

3. With the Robert-Jones bandage, the gauze layer should compress the cast padding by ___%.
   a. 10  
   b. 90  
   c. 70 to 80  
   d. 40 to 50

4. The primary difference between the Robert-Jones bandage and the modified Robert-Jones bandage is
   a. the number of outer layers.
   b. that tape stirrups are not needed for the modified Robert-Jones bandage.
   c. the amount or type of cast padding.
   d. that modified Robert-Jones bandaging has no intermediate layer.

5. A carpal sling should be used for
   a. rheumatoid arthritis in the carpus.
   b. injury to the flexor tendons.
   c. a carpal osteochondritis dissecans lesion.
   d. brachial plexus avulsion.

6. The true Ehmer sling
   a. is basically a non–weight-bearing sling that does not cause abduction and allows movement of the coxofemoral joint.
   b. maintains the leg in a flexed position with the coxofemoral joint internally rotated and abducted.
   c. is comprised of the typical three layers of bandaging material.
   d. maintains the leg in a flexed position with the coxofemoral joint internally rotated and adducted.

7. The true Ehmer sling is indicated after the repair of
   a. a ruptured cranial cruciate ligament.
   b. a brachial plexus avulsion.
   c. a craniodorsal coxofemoral luxation.
   d. fractured metatarsal bones.

8. The Mason metasplint may be used for
   a. a ruptured cranial cruciate ligament.
   b. a fractured humerus.
   c. a craniodorsal coxofemoral luxation.
   d. fractured metatarsal bones.

9. The thoracic limb splint should be applied with the carpus in
   a. slight flexion (15°) and deviated medially by 15°.
   b. slight flexion (15°) and deviated laterally by 15°.
   c. flexion (90°) and deviated medially by 15°.
   d. slight flexion (15°) and deviated medially by 90°.

10. During application of a molded splint to the pelvic limb, the hock should be
    a. flexed 120°.
    b. slightly extended.
    c. extended as much as possible.
    d. flexed slightly.