



EXTERNAL COAPTATION DEVICES (ECD) IN DOGS

Veterinary Science

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ABSTRACT

External coaptation is defined as the use of bandages, splints, casts, or other materials to aid in stability and support for soft and osseous tissues. Furthermore, external coaptation can help manage wounds and control edema. External coaptation can be used as either: Primary fixation for a fracture, ancillary fixation to provide additional support, or temporary fixation for an open fracture and/or until definitive surgical correction can take place. External coaptation should only be used in fractures distal to the elbow and stifle, as correct application requires immobilization of the joints above and below the fracture. Certain splints, such as spica splints, can help immobilize more proximal injuries (humerus and femur). A cast extended to the level of the proximal portion of the tibia caused less pressure at the level of the calcaneus and the proximal cranial edge of the cast. Reducing the amount of pressure at these locations may minimize the potential for pressure sores and other soft tissue injuries (Iodence et al. 2018).

KEYWORDS

Coaptation devices, Dogs, Splint, Cast, Bandage.

HISTORY OF EXTERNAL FIXATORS

Earlier to 1920's orthopedic patients were mostly only fracture cases managed with plaster of paris. The first use of plaster of Paris as a cast for injured limbs took place through a technique known as *plâtre coulé* that became popular in Europe at the beginning of 19th century. From 1940-1960 many fractured bones were stabilized with metallic materials such as piano wire, bicycle spokes wire, stainless steel rod and tantalum and processed animal tissues such as bovine bone and tendon were tried in the medullary cavity (Sundararajan, T. 2006). The use of external fixators to treat human injuries was first reported in 1897 and a fixator specifically for veterinary use was designed in the late 1940s by Ehmer, based on a human design.

PRINCIPLES OF EXTERNAL COAPTATION FOR FRACTURE MANAGEMENT

1. Patient assessment: Components of patient assessment include signalment, history, and physical examination. Animals younger than 1 year of age generally heal quickly, limiting time in coaptation, and therefore are ideal candidates for external coaptation as a primary method of fracture repair.

2. Fracture assessment: Radiographic evaluation is necessary to accurately categorize the fracture and should include mediolateral and craniocaudal views.

3 Fracture Reduction: Minimally displaced, nonarticular, stable fractures are well suited for external coaptation as a primary method of repair. The "50% rule" states that cortical positioning of fracture ends should have 50% contact to expect fracture healing.

4 Fracture Alignment: Proper rotational alignment between the joints proximal and distal to the fracture is imperative to limb function.

5 Standing Position: Joint stiffness is not uncommon after trauma, surgery, and immobilization of a limb. If coaptation is performed at an abnormal angle, loss of function may result. Maintaining a neutral standing position during application of bandages, splints, and casts will encourage weight bearing during and after coaptation.

6 Joints Proximal and Distal: Immobilization of the joints proximal and distal to a fracture is a basic principle in external coaptation. Splints and casts can generally meet this criterion for fractures distal to the elbow and stifle joints.

TECHNIQUE FOR APPLICATION OF ECD

1. BANDAGES:

1.1 Carpal Flexion Bandage.

Indication:

- To relieve the tension of flexor tendons after repair.
- To prevent weight bearing of the forelimb after other orthopedic repair.

Technique:

- Placed the carpus in moderate flexion and wrapped it with **cast padding**.
- Begin at the level of the toes, and continue to apply the cast padding proximally to the level of the mid-antebrachium.
- Gauze is applied over the cast padding. With the carpus held in the desired flexion.

- Adhesive or elastic tape is then applied over the entire bandage.



Fig. 1: Carpal Flexion Bandage

1.2. Robert Jones Bandage (bulky bandage)

Indication:

- Limited to injuries at or distal to the elbow or stifle joints (fractures, dislocations/luxations, and strains and sprains)
- Temporary method of stabilization for fractures or dislocations present at or distal to the elbow or stifle joint and is unsuitable for primary fracture fixation.
- After surgical intervention to address postoperative swelling.

Technique:

- Strips of adhesive tape (stirrups) of appropriate width are applied to the dorsal and palmar (or plantar) aspects, or medial and lateral aspects, of the limb.
- Prepare the cotton by unrolling, and rerolling to a desired width depending on the size of the patient.
- Apply the cotton beginning at the level of the second and fifth digits, while leaving the toenails of digits three and four exposed.
- Apply from distal to proximal, while overlapping the previous layer by 50% with each successive layer.
- Continue to the midhumerus or midfemur, and then return distally in the same fashion.
- If the injury is just distal to the level of the elbow or stifle joint, the bandage should extend proximally to the axilla or groin
- Repeat until sufficient bulk is achieved—4 to 8 cm thick
- At least two to three layers of rolled gauze should be applied with even pressure so that the cotton is compressed by 40% to 50%.
- The tape stirrups should be separated, inverted, and applied to the gauze layer of the bandage.
- The outer layer of elastic tape or self-adherent tape is applied in the same manner as the two previous layers.
- The completed bandage should be smooth in appearance and should reveal the distal aspect of the toes and toenails of the third and fourth digits.



Fig. 2: Robert Jones Bandage

1.3. Modified Robert Jones Bandage.

Indication:

- For light compression and partial immobilization of the limb at or distal to the elbow or stifle joint.
- It is useful for reduction or prevention of posttrauma or postoperative swelling, is contraindicated if severe inflammation is expected
- Is not appropriate for temporary support of fractures or dislocations.

Technique:

- Less padding is utilized in the modified Robert Jones bandage.
- Cast padding is used in place of cotton.



Fig. 3: Modified Robert Jones Bandage.

1.4. Reinforced Robert Jones Bandage

Indication:

- For temporary stabilization of a fracture before surgery or after a tenuous internal repair.
- May be utilized as primary fixation for stable fractures in young animals.

Technique:

- After the cast padding and rolled gauze have been used.
- The reinforcing material is then applied (aluminum rod, a pre-formed metal or plastic splint, or moldable materials such as thermomoldable plastics and other synthetic casting tapes)
- An additional layer of rolled gauze is applied over the splint to help hold it in place followed by the outer layer of elastic adhesive or self-adherent tape



Fig. 4: Reinforced Robert Jones Bandage

2 SPLINT:

1. Spica Splint.
2. Schroeder-Thomas Splint.

2. 1. Spica Splint.

Indication:

- Spica splint is used to immobilize the shoulder or hip joint

Technique:

- Cast padding and stretch gauze are applied to the limb and around the thorax.
- Fiberglass casting material is used to construct a splint that extends from the toes to beyond the dorsal midline (A splint rod or synthetic casting tape may be used to construct the splint).
- Self-adherent stretch tape is applied to secure the splint in place.



Fig. 5: Spica Splint.

2. 2. Schroeder-Thomas Splint: The Schroeder-Thomas splint is a

traction device constructed of a wire frame and soft bandage material.

Indication:

- It may be used as primary fixation for selected, minimally displaced, midshaft fractures of the radius, ulna, and tibia. Fractures of the distal third of the humerus, excluding condylar fractures.
- The splint does not adequately immobilize the shoulder or hip joint and is contraindicated for most humeral and all femoral fractures.

Technique:

- The limb is suspended within the frame, and when constructed and applied properly, this splint can counteract muscle forces and immobilize joints and certain fractures. Its use has been largely superseded by splints and casts.



Fig. 6: Schroeder-Thomas Splint.

3 CAST:

3.1 Casting material:

Previously, casts were primarily constructed with plaster of Paris or plaster-impregnated casting tape.

Synthetic casting tapes: Made of thermomoldable and fiberglass/resin materials

3.2 Application

- General anesthesia is generally necessary for closed fracture reduction and cast application.
- Bony prominences and protuberances should be covered with doughnuts constructed from cast padding.
- Cast padding is applied to the limb in the same fashion as the modified Robert Jones bandage.
- The tape is immersed in cold water.
- Squeeze and shake the roll to remove excess water.
- Begin application of the casting tape at the toes, leaving the bottom open for evaluation
- Toes should be enclosed by the cast, as any portion of the toes extending beyond the cast may suffer maceration during weight bearing.
- Continue applying the casting tape proximally with 50% overlap of the preceding layer.
- After one layer has been applied up to the proximal limit of the cast, the ends of the stockinet are reflected back over the cast, and the tape stirrups are inverted onto the cast.
- A second layer of casting tape is now applied in the same fashion, covering the stockinet and tape stirrups.
- When applied with 50% overlap in this manner, four layers of casting tape are created.

COMPLICATIONS AND POSTAPPLICATION CARE.

1. COMPLICATIONS

- A loose bandage might fall off the limb or slide up and down the limb.
- A bandage that is too tight can lead to pressure sores and irritation skin irritation.
- Bandages that end at the metacarpo- or metatarsophalangeal joint or proximal interphalangeal joint can constrict the digits, which can lead to hypothermia and swelling of the toes.
- Loss of Joint Mobility & Range of Motion.
- Abrasions (insufficient padding, or too much padding under a cast, the leg can slide inside the cast and this can cause abrasions).
- Mild dermatitis to limb- and life-threatening conditions such as fracture disease or necrosis secondary to swelling and vascular compromise

2. POSTAPPLICATION CARE

- Home monitoring for potential complications.
- Proper coaptation care, and diligent follow-up.

- In growing animals, the cast may need to be changed every 2 weeks; in adults the cast may last 4 to 6 weeks.

CONCLUSION

External Coaptation devices have several advantages, it provide excellent immobilization in Young and healthy patient with Simple, transverse, greenstick, minimal displacement fracture configuration that are situated distal to elbow and stifle joint. However Older or sick animal with Comminuted, oblique, very displaced fracture that are situated Proximal to elbow and stifle are not good candidate for External Coaptation technique.

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