

## BANDAGES, SPLINTS, AND CASTS

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*The following is a lecture outline discussing the types of wounds, principles of wound healing and the use of bandages, splints, & casts in veterinary medicine. As veterinary technicians, it is important for you to understand these concepts especially when you are assessing wounds and assisting in applying bandages, casts, and splints. If you have any questions, please feel free to Email our hospital at [cecomment@westbridgevets.com](mailto:cecomment@westbridgevets.com).*



**Wounds-** In order to understand why we use bandages, splints or casts it is advantageous to know a little bit about wound healing.

There are several types of wounds:

- **Surgical Incision**- A scalpel (or laser) cut represents the ideal wound repair situation. Hopefully the area was properly prepared prior to surgery, and therefore is uncontaminated by bacteria, dirt or other debris. When the incision is opposed with sutures each tissue layer will become re-established and re-vascularized leaving only a minimal scar.
- **Laceration**- If the wound is fresh and has been caused by a sharp object, then these wounds can be similar to surgical incisions, but there are bound to be a greater number of bacteria present and some degree of wound debris. The body will exert every effort to remove all foreign organic matter (including bacteria) before healing can take place. Every effort we make to atraumatically reduce the foreign material will hasten healing time. Infected wounds do not heal. This is a very important point and guides us in our choice of external wound treatment. Once a fresh wound has been gently but thoroughly cleansed it can be repaired by using sutures or staples to oppose the tissue layers. Drainage may be left in the most dependent portion allowing fluid and remaining debris to exit the wound.
- **Degloving wounds**- These wounds result when there is an extensive loss of skin from a limb, usually the result of severe trauma, but can also occur with thermal injuries or chemical injuries. In this type of injury there is not sufficient viable skin left to close the wound. Even though bandaging techniques will play a critical role in healing, it is still essential to reduce the amount of dead, injured, or contaminated tissue as soon as possible. The body will not begin to heal a wound until the foreign material has been eliminated.
- **Bite wounds and other puncture wounds**- These wounds are characterized by a small external wound, but a penetration into deeper soft tissues of bacteria and debris. These wounds can almost never be sutured directly because of the strong likelihood of trapping bacteria and debris in the wound.
- **Toxic wound**-. Brown recluse spiders, stinging insects such as bees and wasps, and (rarely) snakebites can all result in injured or necrotic tissue. These wounds can

result in a severe tissue loss and an open wound. Again the body will not begin to heal these wounds until necrotic tissue is eliminated. In this situation we must also prevent infection from developing while there is an open wound.

- **Gunshot wounds-** This type of injury results in a severe combination of bacterial contamination, foreign material presence and injured or dead tissue. These wounds generally represent a severe challenge.
- **Decubital ulcers-** These injuries are the result of chronic pressure of soft tissue (skin) between a bony prominence and a hard surface. They are most often encountered when pets are recumbent for long periods due to other injuries or orthopedic conditions.

There are certainly other types of wounds that occur in unusual circumstances (radiation burns, for example), and many wounds are combinations of two of the above types. For example dog bites are often combinations of punctures and lacerations.

## Healing- there are several different categories of healing

- **Primary closure-** Surgical incisions and fresh lacerations are examples of wounds that can heal by primary closure. Sutures or staples are used to oppose tissue layers and hold them together until the wound heals. This often happens within 10-14 days although the skin may not regain full tensile strength for 21-30 days.
- **Delayed Primary Closure-** If there is debris or infection in a wound, then closure can be delayed until a combination of surgical, chemical and bandaging techniques can be used to clean the wound. Usually 3-5 days later a primary closure can be undertaken.
- **Secondary Closure-** If the infection or debris cannot be controlled within 5 days the body will begin to form a pink vascular tissue known as granulation tissue in the parts of the wound that have been sufficiently cleaned. Generally the granulation tissue fills the bottom of the wound

first. Once contamination is eliminated the wound (which has now been reduced in size by granulation tissue) can be closed with sutures or staples.

- **Second Intention Healing-** In this situation a severely contaminated wound is allowed to continue to granulate until the defect is filled without sutures or staples. There will be a hairless area in such healing with a scar (cicatrix) present. There may also be some “contracting” of the wound in healing.

**We will now see how bandages, casts & splints play an important part in the healing process.**

Definitions: Bandages, casts and splints are all said to be coaptation devices from the word “coapt” - to approximate.

- **Bandage-** Bandages are non-rigid materials formed into the shape of the part being covered. Usually cotton (or synthetic cotton), gauze, and some type of tape are used to form bandages.
- **Cast-** Casts are rigid molded tubular structures applied to a limb. If the cast were removed it would be in the shape of the limb being protected.
- **Splint-** Splints are more rigid than bandages, but not as rigid as a cast. They are made from a firm material (plastic, wood or metal) and usually applied to one aspect of a limb rather than in a tubular fashion. They are often applied over a bandage.

### **General Uses of Splints, Casts and Bandages**

- Promote Wound Healing
- Protect Wounds from contamination and self trauma
- Reduce Pain
- Reduce edema
- Control Hemorrhage
- Prevent motion of bony and soft tissues
- Hold bony tissues in correct anatomical position
- Eliminate dead space
- Absorb exudates and debris

### **All About Bandages**

#### **Bandage components:**

- **Inner (Primary or Contact) layer-** This layer should (obviously) be sterile. The inner layer should stay in contact with the wound and be soft

enough to contour to the wound surface while the animal is at rest or moving. In most cases the inner layer should allow fluids from the wound surface to pass through the material and into the middle (absorbent) layer. The primary layer can aid the body in removing necrotic material that adheres to the dressing and is “lifted” from the wound. The primary layer can also allow fluid (such as a water soluble antiseptic) to pass into the wound. The contact layer also helps form an occlusive seal over the wound to protect the wound from contamination. It is not desirable to have granulation tissue become imbedded in the primary layer as this will result in damage when the dressing is removed. Commercial products such as Telfa® pads are readily available. Petroleum impregnated sterile gauze squares are favored by some veterinarians. BioDress® or Hydrabsorb® are specifically designed primary layers that aid in absorbing exudates.

- **Secondary (Intermediate) layer-** The fluids exuding from the wound site pass through the primary layer into the secondary layer. Serum, tissue debris, bacteria, pus, and small debris particles all can be kept away from the wound. Remember that a wound is not going to heal until the body rids itself of all non-viable tissue. In the first stages of wound healing there is usually a lot of fluid and debris and dressings need to be changed often. As healing progresses, the frequency of changes decreases. It is important that the secondary layer not become saturated because this may allow exogenous bacteria to travel towards the wound and cause contamination. Secondary layers should be bulky and have a fibrous nature to provide the maximum surface area for absorption. The bulk also helps to protect and immobilize the wound. There are dozens of products available for secondary layers, however cotton products have been the standard for many years.
- **Outer (tertiary) layer-** This layer does add some strength to the bandage, but the primary purpose is to hold the primary and secondary layers in place. Non-waterproof tape is used in most cases to form the outer layer. Waterproof tapes are available, but these trap fluid inside of the bandage. Fluid accumulation at the wound site delays healing. The tape should be applied tightly enough to hold the primary and secondary layers in place, but not so tight as to become a pressure bandage and decrease circulation.



## Bandage types

- **Simple bandage-** In clean surgical wounds or fresh (relatively) clean lacerations, a simple bandage composed of the three layers (e.g. a Telfa®

- pad, cotton wrap, and tape) may be applied to protect the wound. Little or no fluid accumulation is anticipated at the wound site.
- **Dry-to-Dry Bandages-** If a wound is badly contaminated with debris and infection (even after surgical debridement) a dry to dry dressing may be utilized. In this type of dressing a sterile coarse gauze pad is used as the primary layer. Debris can pass through the coarse gauze carried by the fluid discharges or be trapped within the gauze itself. The same is true of necrotic tissue debris. Secondary and outer layers are then applied. When the dressing is changed the wound site should be inspected once the outer and secondary layers are removed. If the contact layer gauze is not adhered to the wound it can be gently lifted off. If the contact layer is adhered, then gently irrigating with sterile saline. This type of dressing is most useful in the early stages of treating a contaminated wound. As healing begins to occur new cells (granulation tissue) can adhere to the dressing causing pain and bleeding when it is removed.
  - **Wet to Dry Bandages-** If a wound does not have a lot of necrotic tissue and debris, but is infected, then a Wet to dry bandage can be utilized. In this type of dressing a coarse gauze pad is applied directly to the wound as a contact layer after first moistening the gauze with saline or an antiseptic solution such as Novalsan®. Secondary layers and outer layers are then applied. The fluid in the dressing dilutes the pus and allows it to pass into the secondary layer. In badly contaminated wounds the usual sequence is to utilize dry-to-dry bandages until the debris is greatly reduced, then switch to wet-to-dry.
  - There are other systems of dressings such as calcium alginate pads, however because of expense these systems are not as commonly used in veterinary medicine

**Bandages used once wounds start to heal** (wounds that have granulation tissue present, no foreign debris, early skin healing, and a thin wound fluid.)

- **Non-adherent semi-occlusive bandage**- Essentially this is a simple bandage. Telfa® (or equivalent) or small mesh Vaseline impregnated gauze will not stick (a lot) to the wound and healing can take place under the primary layer. These dressings are considered to be semi-occlusive in that they keep the wound surface moist, but do not allow free passage of fluids from the primary to the secondary layers.
- **Non-adherent occlusive bandages**- Sterile wound dressings composed of a hydrocolloid material can be applied directly to a healing wound. The material reacts with tissue fluids to form a gel that completely occludes the wound. The gel provides a moist wound environment for healing and prevents any contact with exogenous bacteria. They can be left in place for 2-3 days. They are expensive.
- **Pressure bandages**- These bandages should only be used for a short time to control bleeding on an emergency basis. The obvious danger is that blood supply to bone and soft tissues can be cut off resulting in permanent damage and eventual amputation. Pressure dressings can also be used to help control limb edema, but the same danger exists.
- **Robert Jones bandage**- A bandage that is very bulky using large amounts of padding in the secondary layer. It is so bulky that it functions as a splint even though there is no rigid material used. It is comfortable and light, but its bulk makes it awkward for the patient to ambulate. They are used to stabilize injuries particularly at the elbow or below or at the stifle or below. They should not be left in place if there are contaminated wounds present. Properly applied they are said to sound like a ripe watermelon when tapped.

## All About Casts

- Casts fit the limb well because they are ***molded directly*** to the affected limb.
- Correctly fitted casts will not rub against soft tissues causing “cast sores”.
- Casts are applied to limbs that have suffered bone or joint injuries
- Casts can also be utilized in soft tissue injuries such as following a tendon repair.
- Typically casts are applied to injuries from the elbow or stifle distally.



### Types Of Casts:

- **Plaster**- Plaster has been available for many years and is one of the oldest cast materials. It is available in extra fast set types that harden in 3-5 minutes. It has the advantages of being

inexpensive, easy to apply (in experienced hands), and very strong. The disadvantages are that it is heavy and therefore somewhat limiting to the patient and can soften if exposed to liquids such as urine. An interesting variation is the “half-cast”. In this technique the cast is applied and as soon as it is hardened it is cut in half with a cast saw by making cuts on the cranial and caudal surfaces. The lateral half is then attached to the leg in the same manner as a splint except that the cast is now an exact anatomic copy of the correct leg shape and the weight is reduced by half. Tape stirrups are applied to the limb and cotton is placed between the toes. “Stockinet” is applied to the limb and then a layer of rolled cotton such as “Webril” is applied. The plaster is then molded over the cotton leaving the foot- pads open. Slides will illustrate the technique.



- **Fiberglass**- Several brands of resin impregnated cast materials are now available. They are similar to plaster in that they can be molded to the limb. They have the advantage of being very strong while being very light and they will not weaken if wet. In the author’s opinion they cannot be molded as well to the limb as plaster. They are applied with similar padding, but the actual technique varies according to the manufacturer of the different types.

## All About Splints

- Splints are never applied directly to the skin
- Padding is first applied to the limb and then the splint is attached over the padding
- Splints are usually employed to stabilize bone or joint injuries, but may also be applied to soft tissue injuries

## Types of Splints

- **Conventional splint-** There are many materials used to form splints. The original technique involved tracing the patient's limb on a thin piece of plywood and tracing the outline. The splint was then cut out of the wood with a coping saw and applied to the limb over a padded layer. While this technique still would work well, the



development of plastic preformed splints has largely replaced wood. Aluminum preformed splints are also available. All of these materials can make effective support for injured limbs. The advantages are that they are relatively inexpensive, easy to apply and strong while being light. The disadvantage of preformed splints is that they may not fit the limb exactly and cause pressure sores to develop in areas where excess splint material rubs against soft tissues. In addition a splint that does not fit perfectly may allow motion at the affected part. The author feels this is particularly true of the plastic splints that are in a limb shape (as opposed to the channel splints for lower limb lesions.) Even though these

splints are available in left and rights and a variety of sizes, it is a rare patient that fits the splint exactly. These splints should be reserved for emergency stabilization and not permanent repair.



- **Schroeder-Thomas-** This is a hybrid splint that is part bandage and part splint. It is constructed of aluminum rods and is most commonly used to hold tibia/fibula fractures in correct alignment under extension. It takes a lot of experience to properly apply an S-T splint, but they can be very effective in preventing additional trauma to the limb until a definitive repair is made. They can also stabilize elbow, stifle, and radius/ulna fractures.
- **Ehmer Sling-** This is actually a type of bandage and is used to hold luxated hips in place or to prevent a patient from temporarily using a limb.
- **Velpeau sling-** Used to stabilize shoulder and scapula injuries.

**Splint cautions:**

- Do not leave splints on for long periods of time (usually two weeks is the maximum) without checking. Owners should check splints daily for position, dampness, color changes (blood or exudates seeping through), and odor.
- Listen to the patient! Excessive chewing at the splint doesn't necessarily mean a "bad dog", it usually means the splint is rubbing somewhere and it hurts.
- Tape strips can and should be applied parallel to the long axis of the limb to attach the splint to the leg. **DO NOT** apply tape in a tight circumferential manner directly to the leg as this may well cut off circulation.
- If the splint covers the toes, then cotton should be applied between the toes. Use a small amount.
- Do not struggle with the patient when changing or applying splints. Chemical restraint will prevent additional injuries to the patient and the technician!
- Use the correct amount of padding. Too much padding may result in a splint that does not stabilize the injured part and is likely to slip. Too little padding may result in pressure sores if the splint rubs against unprotected skin. Experience is the best teacher for how much is correct.
- Owners judge the quality of Hospital care by the quality (appearance and cleanliness) of splints and bandages. It takes no more time to do it right. A dirty or sloppy splint sends a very negative message.