

# Small Animal Bandaging, Casting, and Splinting Techniques

COPYRIGHTED MATERIAL



# 1 Basics of Bandaging, Casting, and Splinting

---

## Bandaging

### Purposes and functions of a bandage

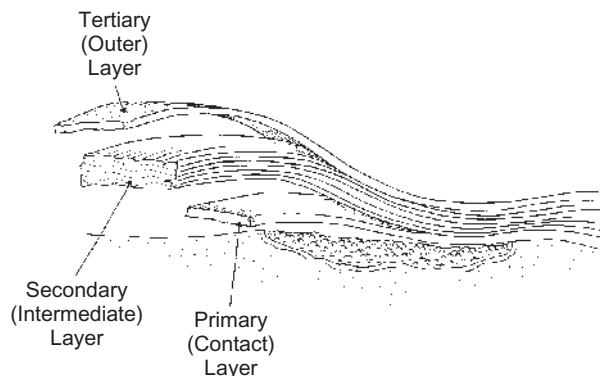
Bandages serve many functions in wound management (table 1.1). In general, bandages provide an environment that promotes wound healing.

**Table 1.1.** Properties of a bandage.

- 
- Provide an aesthetic appearance
  - Wound protection from environmental contamination
  - Prevention of interference from the patient
  - Prevention of tissue damage by desiccation
  - Provide a moist environment to promote healing
  - Retain heat and create an acid environment for oxygen dissociation to tissue
  - Provide pain relief
  - Immobilization of wound edges
  - Provide pressure to close dead space and reduce edema and hemorrhage
  - Deliver topical medications
  - Absorb exudate
  - Debride wounds
  - Help stabilize concurrent orthopedic injuries
- 

Sources: Williams, John, and Moores, Allison. 2009. *BSAVA Manual of Canine and Feline Wound Management and Reconstruction*, 2nd ed., pp. 37–53. Quedgeley, Gloucester, England: British Small Animal Veterinary Association.

Hedlund, Cheryl S. 2007. Surgery of the integumentary system. In *Small Animal Surgery*, 3rd ed., pp. 159–259. St. Louis, MO: Mosby, Elsevier.



**Fig. 1.1.** The three layers of a bandage: primary-contact layer, secondary-intermediate layer, and tertiary-outer layer.

## Components of a bandage

There are three components or layers of a bandage. These are the primary, secondary, and tertiary bandage layers (fig. 1.1).

### Primary-contact layer

The primary layer is also called the contact layer. It is directly in contact with the wound. Depending on the stage of healing, this layer can be used to debride tissue, absorb exudates, deliver medication, or form an occlusive seal over the wound. The primary layer plays a vital role in providing a wound environment that promotes healing rather than a layer that just covers the wound. The properties of primary dressing materials vary widely, and it is important to select a primary dressing that is appropriate to the wound in its current stage of healing and to change the type of dressing as healing progresses. Occlusiveness and absorption are important properties of the contact dressing.

#### *Highly absorptive dressings*

Highly absorptive dressings are indicated in the treatment of wounds that are heavily contaminated or infected, have foreign debris present, and/or are producing large amounts of exudate. Such wounds are generally in the early inflammatory stage of wound healing. Once a wound has entered the later inflammatory or early repair stage, another form of dressing is selected that will promote the progression of the healing process, for example, a moisture-retentive dressing.

*Gauze dressings* Gauze dressings are used in wet-to-dry and dry-to-dry bandages. These forms of bandage are older techniques for bandaging and provide a means of clearing a wound of exudates and necrotic tissue in the early days of wound management. For instance, dry gauze may be the most economical primary dressing in a highly productive wound where absorptive bandage changes are needed multiple times daily. However, after three to five days, a contact layer that will promote wound repair is indicated, for example, calcium alginate, hydrogel, or foam dressing.

With wet-to-dry dressings wide mesh gauze is wetted with sterile saline, lactated Ringers solution, or 0.05% chlorhexidine diacetate solution and is placed in wounds with viscous exudate or necrotic tissue. The exudates are diluted and absorbed into the secondary bandage layer. As the fluid evaporates, the bandage dries and adheres to the wound. When the dressing is removed, adhered necrotic tissue is also removed. Removal is usually painful. Thus, moistening the gauze with warm 2% lidocaine that does not contain epinephrine makes removal more comfortable. In cats, moistening the gauze with warm physiologic saline is indicated.

For dry-to-dry dressings, dry gauze is placed in a wound that has low-viscosity exudate. The exudate is absorbed and evaporates from the bandage, leaving the dressing adhered to the wound. Removal of the dressing removes necrotic tissue. Moistening the gauze with warm 2% lidocaine makes removal more comfortable. Moistening the gauze with warm physiologic saline should be done in cats.

These gauze dressings have several disadvantages: (1) Both healthy and unhealthy tissue are removed at dressing change. (2) The dry environment does not favor the function of cells and proteases involved in healing. (3) There is danger of exogenous bacteria wicking inward toward the wound with a wet gauze, and if the dressing is maintained wet tissue maceration can occur. (4) Dry gauze can disperse bacteria into the air at bandage change. (5) Fibers of the gauze can remain adhered to the wound to induce inflammation. (6) The adherent dressings are more painful to wear and to remove. (7) Removal of wound fluid with the dressings removes cytokines and growth factors essential for optimal healing.

*Hypertonic saline dressings* These dressings are a good choice for infected or necrotic, heavily exudative wounds that need aggressive debridement. Their 20% sodium chloride content gives them an osmotic effect to draw fluid from the wound to decrease edema and thus enhance circulation. The osmotic action also desiccates tissue and bacteria. These dressings are changed every one to two days until necrosis and infection are under control. The debridement of this osmotic dressing is nonselective in that both healthy and necrotic tissue are removed at dressing change. The dressings are used early in wound treatment to convert a necrotic sloughing wound to a moderately exuding granulating wound. At this time the primary dressing is changed to a calcium alginate, hydrogel, or foam dressing.

*Calcium alginate dressings* These hydrophilic dressings are indicated in moderate to highly exudative wounds, that is, wounds in the inflammatory stage of healing. However, their placement over exposed bone, muscle, tendon, and dry necrotic tissue is not recommended. Neither should they be used on dry wounds or those covered by dry necrotic tissue. They are available as a feltlike material in pad or rope form. The calcium alginate, which is derived from seaweed, interacts with sodium in wound fluids to create a sodium alginate gel that maintains a moist wound environment.

Attention should be paid to the hydration of wound tissues when using calcium alginate dressings. To help maintain a moist environment, the dressing can be overlaid with a vapor-permeable polyurethane sheet. However, if too much exudate is being produced in the presence of the dressing, it can be covered with an absorptive foam dressing. Because it is so absorptive, it can dehydrate a wound as the healing progresses and exudate decreases. If it is left in a wound too long, it dehydrates and hardens to form a calcium alginate eschar that is difficult to remove. Rehydrating it back to a gel with saline aids in its removal.

These dressings aid in the transition from the inflammatory to the repair phase of healing by promoting autolytic debridement and granulation tissue formation. The dressing can be premoistened with saline to promote granulation tissue in wounds without considerable exudate. Additional benefits of this dressing include a hemostatic property and entrapment of bacteria in the gel that can be lavaged from the wound at dressing change.

*Copolymer starch dressings* This type of highly absorptive dressing is indicated for necrotic infected wounds that are moderately to highly exudative. If an occlusive cover is needed to hold them in place or retain some moisture, they can be overlaid with a hydrocolloid dressing. At dressing change, the polymer is removed by lavage.

It is important to observe the exudate level in wounds being treated with copolymer starch dressings. If exudate levels become too low, the dressing adheres to the wound. This can result in tissue damage when it is removed and inflammation if fragments of dressing are left in the wound.

### *Moisture-retentive dressings*

Moisture-retentive dressings (MRDs) provide a warm, moist environment over a wound in which cell proliferation and function are enhanced in the inflammatory and repair stages of healing. In addition,

**Table 1.2.** Advantages of moisture-retentive dressings (MRDs)\*.

- Barrier against exogenous bacteria
- Prevent tissue desiccation
- Improved concentration of systemically administered antibiotics
- White blood cells stay in the wound with their enzymatic activity for autolytic debridement
- Low oxygen tension to lower pH and deter bacterial growth, favor collagen synthesis, enhance angiogenesis, and attract white blood cells
- Maintain physiologic temperature to support cell function, proteases, and growth factors
- Comfort when in place and when removed
- Waterproof against urine and other fluids
- Decreased bandage changes and cost
- Decreased scarring
- Less aerosolization of bacteria at bandage change

Source: Campbell, Bonnie Grambow. 2006. Dressings, bandages, and splints for wound management in dogs and cats. *Veterinary Clinics of North America: Small Animal Practice*. 36(4):759–91. Philadelphia: Saunders/Elsevier.

\*MRDs will vary in their possession of these advantages.

the retained fluid provides a physiologic ratio of proteases, protease inhibitors, growth factors, and cytokines at each stage of healing. Thus, exudate can be beneficial in healing. Clinical judgment should be used in deciding whether treatment should begin with one of the highly absorbent dressings first and then change to an MRD or whether treatment can begin with an MRD. In general, a highly absorptive dressing should be considered initially if there is a great amount of necrosis, foreign debris, infection, and exudate.

The wound environment under an MRD provides several advantages in the progression of wound healing (table 1.2). There are disadvantages of MRDs in that retained fluid can cause maceration (softening caused by trapped moisture) and excoriation (damage caused by excess proteolytic enzymes) of the periwound skin.

*Polyurethane foam dressings* The dressings are soft, compressible, nonadherent, highly conforming dressings. They are highly absorptive by wicking action and are designed for use in moderate to highly exudative wounds. The foam dressings maintain a moist environment and support autolytic debridement. In addition, they can promote the formation of healthy granulation tissue and have been reported to promote epithelialization. Thus, they are a dressing that can be used in both the inflammatory and the repair stages of healing. An alternative way to use the foam is to saturate it with liquid medication for delivery to the wound.

The frequency of bandage change with foams is related to the stage of wound healing. It can vary from one to seven days, with the shorter times between changes being in the early stages of management when there is considerable fluid production.

*Polyurethane film dressings* These film dressings are thin, transparent, flexible, semioclusive (permeable to gas but not water or bacteria) sheets. They have an adhesive perimeter for attaching them to periwound skin, and their transparency allows wound visualization. They are nonabsorptive and should be used on wounds with no or minimal exudate. For instance, they are suited for dry necrotic eschars, or shallow wounds, such as partial-thickness wounds like abrasions. They can also be used on wounds in the advanced repair stage of healing where there is need for a moist environment to promote epithelialization. Another use of the films is as a cover over other contact layers to support moisture retention and to provide a bacteria and waterproof cover.

The films should not be used on wounds that have high levels of exudate, are infected, or have fragile periwound skin. Neither should they be used on wounds over exposed bone, muscle, or tendon or on deep burns.

The dressings do not adhere well to areas with skin folds or unshaved hair. Hair growth on the periwound skin can push the adhesive attachment of the dressing off of the skin. However, adherence can be improved around the perimeter of the wound with vapor-permeable film spray.

With this type of dressing, the cloudy white to yellow exudate that accumulates under the dressing should not be interpreted as infection. It is just wound surface exudate. Infection will present as heat, swelling, pain, and hyperemia of the surrounding tissues.

*Hydrogel dressings* Hydrogels are water-rich gel dressings that are in the form of a sheet or an amorphous hydrogel. Some hydrogels contain other medications that can be beneficial to wound healing, such as acemannan, a wound healing stimulant, and metronidazole or silver sulfadiazine, antimicrobials.

Because they donate moisture to a wound, the hydrogels can be used in wounds with an eschar or dry sloughing tissue to rehydrate the tissues. To assure that wound moisture is transferred to the tissue and not the secondary bandage layer, the hydrogel can be overlaid with a nonadherent semioclusive dressing or vapor-permeable polyurethane foam. Some hydrogels have an impermeable covering as part of the dressing. Conversely to donating fluid to wounds, some hydrogels are able to absorb considerable fluid and can be used in exudative wounds. These dressings can also be used in necrotic wounds to provide a moist environment to promote autolytic debridement and aid in granulation tissue formation.

In noninfected full-thickness wounds, the dressings are generally changed every three days. However, if a hydrogel containing a wound healing stimulant or antimicrobial is being used, daily change may be indicated to maintain their activity in the wound. With abrasions that have minimal exudate, hydrogels may be changed every four to seven days. At dressing change, the hydrogel is removed from the wound with gentle saline irrigation.

*Hydrocolloid dressings* Hydrocolloid dressings are a combination of absorbent and elastomeric components that interact with wound fluid to form a gel. Some dressings have an adhesive layer of hydrocolloid that contacts the wound and an outer occlusive polyurethane film. The hydrocolloid adheres to the periwound skin, and the dressing over the wound interacts with wound fluid to produce an occlusive gel. The gel may have a mild odor and yellow purulent appearance. However, this should not be interpreted as infection. Infection of the wound will be manifested by heat, swelling, pain, and hyperemia of the wound and periwound tissues. The gel is usually more tenacious than just exudate or the gel associated with hydrogel dressings.

Although the dressings are available in a paste as well as granular and powdered form, they are generally used as the sheet form that provides a thermally insulated moist environment which is impermeable to fluid, gas, and bacteria.

Hydrocolloids can be used in partial or full-thickness wounds with clean or necrotic bases, including pressure wounds, minor burns, abrasions, or graft donor sites. They can be used in both the inflammatory and repair stages of healing. In the inflammatory stage of healing they promote autolytic debridement. In the repair stage of healing they stimulate granulation tissue, collagen synthesis, and epithelialization. However, their adherence to periwound skin may delay wound contraction. The dressings should not be used in heavily infected wounds or wounds producing large amounts of exudate. The large amounts of exudate can lead to maceration and excoriation of periwound skin.

For application, the skin around the wound should be clipped. The pad is warmed between the hands and cut to be about 2 cm larger than the wound. After removing the backing, it is placed over the wound. The tacky nature of the dressing allows it to stick to the periwound skin. At about two to three days, the dressing should be changed when it feels like a fluid-filled blister over the wound and before the underlying gel leaks from around the edges. After removal of the dressing, the gel is lavaged or gently wiped from the wound and periwound skin, respectively. Use of the dressing should be discontinued when the wound is fully epithelialized.

*Nonadherent semioclusive dressings* These dressings have a low absorptive capacity. They are porous and allow fluid to move through them into the secondary bandage layer where it can evaporate. This porosity could also allow exogenous bacteria to penetrate toward the wound.

These dressings can be either a wide mesh gauze impregnated with petrolatum or an absorbent material encased in a perforated nonadherent material. Although they are classified as nonadherent, they are actually low adherent. With the petrolatum-impregnated gauze, the granulation tissue or epithelium can grow into the meshes and thus adhere to the wound, resulting in tissue damage when they are removed. With the perforated nonadherent material, the pad can adhere to the wound when the wound dries and exudate dries in the perforations. Granulation tissue and epithelium can also enter the perforations if they are large enough.

If the petrolatum-impregnated gauze is used in the repair stage of healing, it should be used in the early repair stage, and it should be changed often enough so the granulation tissue does not grow into the meshes. Because petrolatum may interfere with epithelialization, its early use will prevent its interference with epithelialization. Once epithelialization starts, the perforated nonadherent material with absorbent filler should be used.

If the perforated nonadherent material with absorbent filler is used, its purpose is to retain some moisture over the wound to promote epithelialization and allow excess fluid to be absorbed into the secondary layer. It should be used on superficial wounds with low to moderate levels of exudate. They are often used in the latter part of the repair stage when exudate levels are low. They are also a good primary layer for sutured wounds.

### *Antimicrobial dressings*

Antimicrobial agents such as iodine, silver, polyhexamethylene biguanide, activated charcoal, and antibiotics have been incorporated into dressings. These dressings are indicated to treat infected wounds or wounds at risk for infection. The dressings are not moisture retentive. Thus, covering them with a polyurethane film dressing may keep them from drying out.

Dressings containing cadexomer iodine release iodine into the wound without having a negative effect on wound cells. The slow release of iodine is designed to maintain adequate levels of active iodine for about 48 hours.

Silver ions in dressings have a broad antimicrobial effect and can be effective against otherwise antibiotic-resistant organisms to include some mycotic organisms. Such dressings are available in various forms to include gauze, gauze roll, low adherent, hydrocolloid, hydrogel, and alginate dressings.

Polyhexamethylene biguanide (PHMB) is an antiseptic related to chlorhexidine. It has been incorporated in gauze sponges and roll gauze to provide an antimicrobial dressing. It is bactericidal, and bacteria do not develop a resistance to this broad-spectrum compound. It is tissue compatible and does not have any apparent effects on wound healing. The PHMB has a prolonged antibacterial effect; it prevents bacteria on the wound from contaminating the environment and stops exogenous bacteria from penetrating the bandage.

Activated charcoal dressings provide a moist wound environment. They also absorb bacteria, prevent exuberant granulation tissue formation, and reduce wound odor.

Gentamicin-impregnated collagen sponges of type I bovine collagen provide high levels of antibiotic at the site of placement, while serum levels remain below toxic levels. These dressings have also been reported to have a hemostatic effect.

### *Extracellular matrix bioscaffold dressings*

Extracellular matrix dressings (ECMs) are acellular biodegradable sheets with a three-dimensional ultrastructure. They are derived from porcine small intestinal submucosa or porcine urinary bladder submucosa matrix. The dressings contain structural proteins, growth factors, cytokines, and their inhibitors. Over the first two weeks of its presence in a wound, there is degradation of the scaffold, with the degradation products being chemotactic for repair cells. The repair cells enter the wound as stem cells that deposit a site-specific matrix. In other words, if the dressing has been placed in a skin wound, the matrix will be like that of skin/dermis. By 30 to 90 days, the entire bioscaffold is replaced by site-specific tissue.



ECMs are unique in the way they are applied. The wound must be thoroughly debrided and free of topical medications, cleaning agents, and exudates. Infection should be eliminated or well controlled. The sheet is cut to a size slightly larger than the wound, rehydrated with saline, tucked beneath the skin at the wound edge, and sutured in place. If drainage is expected, it can be fenestrated. A nonadhesive or moisture-retentive dressing is placed over the ECM. At the first bandage change in three to four days, all parts of the bandage are changed except the ECM. It will have a degenerated yellow to brown appearance. A second piece of dressing is placed over this degenerating first piece without removing it. The outer bandage is replaced with the next dressing change, four to seven days later. After two to three applications of ECM dressing, no new dressings are added. Typically, a granulation tissue bed is present with the presence of a site-specific matrix that will guide the healing of the wound with tissue like that in the surrounding area. Wound management is continued with appropriate bandaging of the granulating wound as healing progresses.

### Secondary-intermediate layer

The main function of the secondary bandage layer is absorption. Thus, it should have good capillarity properties to provide for the collection of blood, serum, exudate, debris, bacteria, and enzymes from the wound. Additional functions of the secondary layer are to pad and protect the wound from trauma, prevent movement, and hold the primary layer against the wound.

Materials that can be used for the secondary layer include specific loose-weave absorbent wrap materials, cast padding, and absorbent bulk roll cotton. One author (SFS) prefers to use the first of these as the secondary layer for bandaging wounds. The latter two have the advantage that it is difficult to apply them too tightly because they tear under low levels of extension. However, they have the disadvantage that if they contact a wound surface, they can adhere to it and be left unrecognized as the bandage is removed. This leaves foreign material on the wound surface. Self-adherent gauze roll or tubular gauze can be placed over the secondary wrap as part of the intermediate layer to provide support and rigidity.

This layer should be applied in a wrapping fashion with about 50% overlap of layers. When wrapping a limb, the wrapping should progress from distal to proximal. The secondary layer should be applied with enough pressure to hold the primary layer in contact with the wound and to have good contact between it and the primary layer. However, excessive compression when applying this layer should be avoided since it could impair absorption, blood supply, and wound contraction.

The bandage should be changed frequently (at least daily) on heavily draining wounds to remove exudate that has been absorbed into the secondary layer. Bandage change should be before exudate soaks through to the tertiary layer. This could result in exogenous bacteria wicking inward toward the wound. To help prevent this potential for wound contamination, antimicrobial gauze roll can be used as the secondary layer. When less fluid is absorbed into the secondary layer (e.g., with use of an MRD or as healing progresses), the secondary layer bandage is changed less often.

### Tertiary-outer layer

This layer's main function is to hold the other bandage layers in place and protect them from external contamination. Materials that are used for this layer are porous surgical adhesive tape, occlusive waterproof tape (e.g., duct tape), elastic adherent or self-adherent material, and stockinette.

When applying this layer, certain factors should be kept in mind. First, the tertiary layer should be applied under the proper tension. It should hold the primary layer in contact with the wound and the secondary layer in contact with the primary layer.

Second, care should be taken that it is not applied too tightly. This can limit the absorption of the secondary layer. In addition, overtight application on the head and extremities can result in respiratory and circulatory problems, respectively. To help prevent this, one author (SFS) applies porous surgical adhesive tape and occlusive waterproof tape as pretorn strips, rather than rolling the tape directly off of the roll

onto the bandage. Each strip is applied with about 1/3 to 1/2 width overlap with the previous strip. For application of the elastic tapes, the tape is applied off of the roll. To reduce the danger of applying it too tightly, the tape is secured near the bandage with one hand while pulling it off of the roll. Another guideline for applying the tape is to apply it so that the textured pattern of the tape is distorted but still visible.

A third factor to keep in mind is the occlusiveness of this layer. Porous tape allows fluid evaporation and promotes dryness, which can impede bacterial growth. However, if this layer gets wet, bacteria can wick inward toward the wound. When an occlusive waterproof tape is used, it protects the underlying bandage from exogenous fluid, but it may also lead to excess moisture retention and the need for more frequent bandage changes. This is particularly true of paw bandages in which sweat from the pads in addition to wound exudate results in considerable moisture. It should also be remembered that any fluid that gets into a bandage covered with waterproof tape remains in the bandage.

Other forms of protection are available to hold bandages in place and protect them. These include premade dressing holders, which are breathable, nonwoven polypropylene fabric with Velcro fasteners. They are washable, reusable, and nonconstrictive. They are available in different sizes for the elbow, hip, shoulder, head, abdomen, thorax, and legs. Lycra body suits provide a breathable bandage cover for bandages on the thorax, abdomen, and limbs.

## Special considerations in bandaging, casting, and splinting

### Frequency of changes

With bandages, the frequency of bandage changes decreases as wound healing progresses. During the early stages of healing when exudate production is greatest, wound observation is very important, and strike-through prevention is necessary, frequent bandage change may be indicated. However, with MRDs that support autolytic debridement, bandages may be left in place up to three days. Conversely, dressings with high absorptive capacity (e.g., gauze) may need to be changed at least daily and possibly more often, depending on the amount of exudate production.

Once a healthy bed of granulation tissue is present and exudate levels are low, the time between bandage changes is expanded. With nonadherent semiocclusive dressings, the time may be extended to three or four days. With some of the other MRDs, the time may be expanded to five to seven days between bandage changes.

There are times when unscheduled bandage, cast, or splint changes are necessary. These include when there has been slippage, strike-through, wetness, external contamination, and damage to the bandage, cast, or splint. Odor, swelling, or hypothermia of tissues adjacent to the bandage (e.g., digits left exposed from a limb/paw bandage) and constant licking or chewing at a bandage, cast, or splint are also indications for a change.

### Security

For a bandage, cast, or splint to be effective, it must be secured in place. Security is a challenge in that animal conformation is quite variable (e.g., a chihuahua vs. a great dane), and tolerance of a bandage, cast, or splint can vary between animals. In the following chapters, application of bandages, casts, and splints will be covered to include techniques to help assure security of these applications. Based on the above-mentioned variables, the veterinarian or veterinary technician may need to occasionally modify a technique and use it in combination with some type of restraint to maintain a secure bandage, cast, or splint. However, if a modification is done, an adage should be remembered: "First, do no harm." Sound clinical judgment is important in applying bandages, casts, and splints.

## Pressure relief

Prevention of pressure from bandages, casts, and splints is important from two standpoints. First, there must be prevention of pressure-induced injury from a bandage, cast, or splint being placed too tightly. This is particularly important in placing bandages on extremities and the head, especially when elastic taping material is used. Techniques for helping prevent such pressure are described in sections of this book (see pages 4–9 in chapter 1, Bandaging, Components of a Bandage, and Tertiary-Outer Layer; all of chapter 2; and page 56 in chapter 4, Basic Paw and Distal Limb Bandage).

The second important factor in pressure relief is prevention of localized pressure wounds over prominences caused by a bandage, cast, or splint and prevention of paw pad wound pressure. Techniques for prevention of such wounds are described in sections of this book (see, in chapter 4, Forelimb Bandages, Casts, and Splints; Basic Soft Padded Limb Bandage [pg. 47]; Basic Paw and Distal Limb Bandage [pg. 56]; Paw Pad Pressure Relief [pg. 69]; Carpal Sling [pg. 75]; Spica Bandage and Lateral Splint [pg. 83]; Aluminum Rod Loop Elbow Splint [pg. 88]; and 90/90 Sling [pg. 104]).

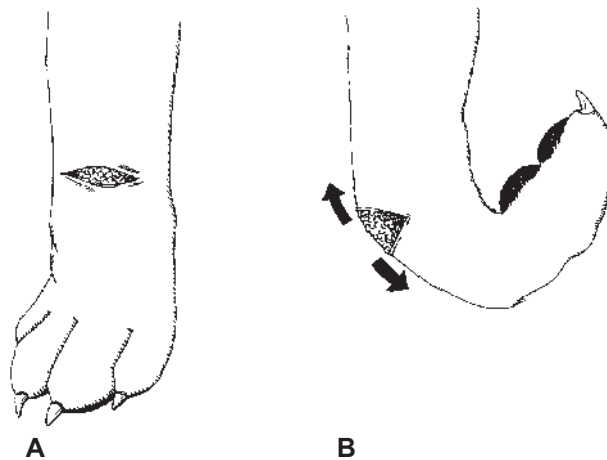
## Joint immobilization

Wounds over joints can have problems in healing due to joint movement. Thus, joint immobilization is indicated for optimal healing. Such immobilization is attained with a bandage, cast, or splint.

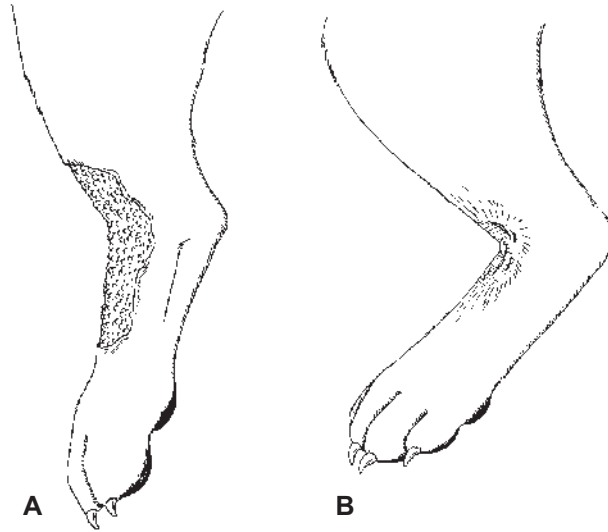
A wound over the extension surface of a joint is subject to separation of the wound edges as the joint is flexed (fig. 1.2). In a sutured wound, the tension of joint flexion could result in sutures pulling out of tissues. Thus, wound immobilization is indicated.

With a large open wound on the flexion surface of a joint, open wound healing could result in wound contraction ending in a wound contracture deformity, whereby the joint is pulled into a flexed position and cannot be extended (fig. 1.3). Immobilizing the joint in extension may help prevent this deformity. The wound may heal mainly by epithelialization and may need a skin graft or flap for a more durable cover, but contracture deformity has been avoided.

Prolonged joint immobilization may lead to disuse atrophy, joint stiffness, pressure wounds, and cartilage degeneration. At bandage changes, the clinician should not only care for the wound but also evaluate joints for problems.



**Fig. 1.2.** Wound disruption with flexion. (A) Wound over the extension surface of the carpus. (B) Carpal flexion results in separation of wound edges (arrows).



**Fig. 1.3.** Wound contracture with open wound healing. (A) Large wound over flexion surface of the hock. (B) Open wound healing with wound contraction, resulting in wound contracture deformity with limited hock extension.

## Maceration and excoriation

Maceration is basically overhydration of skin around a wound. It is caused by prolonged contact of the skin with wound exudate. This compromises the skin's barrier function.

Excoriations are skin abrasions caused by high levels of matrix metalloproteinases (enzymes) in exudate of chronic wounds. These also compromise the barrier function of the skin.

A contact bandage layer should be chosen that is appropriate for the amount of exudate being produced by the wound. In this way, a large amount of exudate is not held over the wound to cause maceration and excoriation. To help prevent maceration and excoriation when using MRDs, the dressing can be cut to the size and shape of the wound so that it does not overlap onto healthy surrounding skin.

## Need for sedation or anesthesia during bandage change

There are several ways to decrease the pain and discomfort associated with bandage changes. Autolytic debridement with nonadherent MRDs is less painful than the mechanical debridement that occurs with adherent wet-to-dry and dry-to-dry dressings. However, if the latter dressings are used, the last layer of gauze in contact with the wound can be moistened with warm 2% lidocaine for a few minutes before it is removed to provide comfort. In cats, warm physiologic saline is used for this purpose. To remove adhesive tape from the skin, it should be removed in the direction of hair growth, with counter traction provided by a hand on the skin. Ethanol or commercial adhesive remover can also be used to loosen adhesives. To prevent epidermal stripping when tape is removed from the skin, a hexamethyldisiloxane solution can be applied to the skin before applying the tape.

For some animals, sedation may be required for bandage changes, especially during early wound management when staged debridement and lavage are being done. Although there may be additional expense and risk with sedation, the animal is more tractable, wound management is accomplished better, and there is less stress on the animal and personnel. General anesthesia may be needed for aggressive surgical debridement and for bandage changes when a wound is painful or an animal is particularly aggressive.

## Casts and splints

### General information

Cast and splints rely on many of the same materials and layers used in other types of bandages, with a few exceptions. Generally, cast padding, gauze and various outer layers all provide the same purposes and are used in the manner described for each casting and splinting procedure. Because casts and splints may be in place for a prolonged period, and because they have an inflexible component, the need to prevent pressure wounds is critical. However, paying close attention to avoiding wrinkles, pressure on anatomic prominences, and motion within the cast or splint is also very important.

### Purposes and functions of casts and splints

The materials that set a cast or splint aside from other bandages are those that provide a degree of rigidity. The purpose may be to stabilize a fracture in order to allow boney union or merely to allow more comfortable transport of the animal. Splints and casts may protect surgical repairs or support soft tissue injuries. The rigidity of a cast will exceed that of a splint, and an intact cast provides more support than one that has been split (“bivalved”) and then reapplied. The rigidity may be achieved through the use of aluminum splint rods, commercial plastic and metal splints, plaster casting tape, fiberglass casting tape, or other materials that are of suitable size and stiffness, such as thermomoldable plastic.

### Materials

#### Splint rods

Splint rods are inexpensive, but they do not conform as well to the limbs as fiberglass tapes. They must be cut and bent to shape. Care should be taken to assure that the cut ends do not injure the animal.

#### Commercial splints

Commercial plastic and metal splints are available in a variety of sizes and shapes. Some will work better than others depending on the patient, location, and need. Generally, it is best to keep a variety of brands and sizes on hand in order to determine which will work best for a given case. The metal splints (e.g., Mason metasplints) can be cut with metal cutting shears to modify them if needed. Splints should be applied after a basic bandage is applied (i.e., a bandage consisting of a contact layer, cast padding as secondary bandage wrap, and gauze wrap) and then fixed to the limb with a nonelastic material such as porous adhesive tape.

#### Plastic splinting material

Thermomoldable plastic materials are available for molding splints. These are heated in hot water and are then manually molded to the conformation of the area being splinted. The materials can also be cut with shears when they are in their heated state. When cooled, they return to a rigid state.

#### Stockinette

Placing stockinette beneath casting material is not absolutely necessary, but it seems to help provide some degree of comfort in the authors’ opinion. When stockinette is applied longer than a cast, it can be folded back onto the cast to roll a small amount of cast padding over the edge of the cast to create a soft “bumper” that will protect the tissue from the sharp edge of the cast.

## Casting tapes

Casting tapes can be used to make a custom splint or a full cast. Fiberglass tape is preferable to plaster because it is light, durable, and water resistant. However, plaster is inexpensive and sets more slowly and at a lower temperature. When using fiberglass tape, care should be taken to avoid stretching the tape during application because it will slowly return to its original length. In a splint application, this will result in a splint that is too short. In a cast application, it will result in a cast that is too tight.