Small Animal Bandaging, Casting and Splinting Techniques

Steven F. Swaim, Walter C. Renberg and Kathy M. Shike






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VETERINARY WOUND MANAGEMENT SOCIETY

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Dedication

This book is dedicated to the veterinarians, veterinary technicians, residents, interns, veterinary students, and especially the animals that will benefit from its use.

Veterinary Wound Management Society Mission

“The mission of the Veterinary Wound Management Society is to advance the art and science of animal wound management, thus promoting excellence in the field.”

Foreword

Bandage application is a daily activity in most small animal practices. Challenges arise due to variations in size, shape, injury type and location, activity level, and desire (or lack thereof!) to keep a bandage in place posed by our veterinary patients. Successful bandaging is both an art and a science. *The art:* thinking outside the box for creative solutions to protect injuries in even the most awkward of locations. *The science:* selecting bandage components that work positively with the biology of wound healing and use the laws of physics to advantage. This book successfully incorporates both.

As so aptly stated in chapter I, sound clinical judgment is important when applying and modifying bandages. The authors of this book have a wealth of expertise in managing wounds in veterinary patients and are major contributors to the research that backs up these techniques. Indeed, Dr. Steven F. Swaim's name is synonymous with wound management in veterinary medicine; veterinary patients worldwide are the beneficiaries of his extensive scholarship in the field and his passion for teaching with which he so successfully educates members of the veterinary profession. Dr. Walter C. Renberg is a veterinary surgeon and teacher with wide-ranging clinical and research experience who brings his specialized knowledge of orthopedic injury and biomechanics to the subject of bandaging. Ms. Kathy M. Shike has extensive hands-on bandaging experience as a small animal surgery technician and instructor for veterinary students and has contributed to many research projects in the field. The clinical and research experiences of the authors are translated here into a format that the reader can use to make sound bandaging decisions for his or her own patients.

Step-by-step illustrated instructions on a range of bandaging techniques are a unique component of this book and provide a very practical, visual guide. Specific instructions on bandage application are rounded out by clearly organized information on the indications, aftercare, safe removal or modification, and potential complications of each bandage type. This material is further enhanced by plenty of helpful tips stemming from the extensive personal experiences of the authors. Throughout the text there is an emphasis on patient comfort and selecting a bandage type that will best support healing in each individual.

As current president of the Veterinary Wound Management Society, I would like to say that the VWMS is exceptionally pleased to endorse *Small Animal Bandaging, Casting, and Splinting Techniques*. The authors have expertly integrated the art and science of bandaging into a very clinically applicable text. This book will be a frequently used and most welcome resource for practitioners and trainees alike in the veterinary profession.

Bonnie Grambow Campbell, DVM, PhD, Diplomate ACVS

Veterinary Wound Management Society, President

Clinical Assistant Professor of Small Animal Surgery,
Washington State University

Preface

Veterinarians are often presented with animals that have wounds of varying severity and orthopedic injuries of a like nature. A major part of the therapy of these conditions is the bandaging, casting, and splinting necessary in their treatment. To be effective, these applications must be properly constructed, securely held in place, and protected from molestation. The purpose of this book is to describe in text and pictures techniques that the authors have found effective in applying these structures. In addition, for each bandage, cast, or splint, the indications, aftercare, and advantages and complications are presented.

Acknowledgments

We acknowledge the work of Dave Adams and Chris Barker for their photographic contribution to the book. The word processing skills of Mrs. Barbara Webster are appreciated, and gratitude goes to Brooke Grieger for the artwork in the book.

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

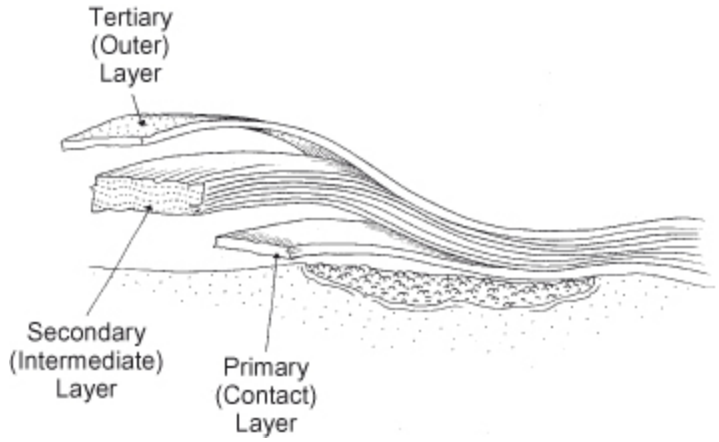
Hedlund, Cheryl S. 2007. Surgery of the integumentary system. In *Small Animal Surgery*, 3rd ed., pp. 159–259. St. Louis, MO: Mosby, Elsevier.

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.

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).

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



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

Gauge 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 exudating 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, 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.

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

*MRDs will vary in their possession of these advantages.

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.

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, semiocclusive (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 amorphorus 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.