Avoiding Skin Tension Without Flaps

Daniel D. Smeak, DVM, Diplomate ACVS
College of Veterinary Medicine
The Ohio State University
Columbus, OH

Why is Skin Tension Clinically Important?
Excess skin tension creates many potential clinical problems, and increases the risk of local wound complications. This is why one of the most important basic principles of wound closure and reconstruction is to avoid tension. Closing wounds under tension particularly on extremities may create vascular and lymphatic compromise to distal areas or reduce perfusion to wound edges causing delayed healing or even complete wound disruption. Excessive extrinsic suture tension creates a high risk of suture cutout. In addition, this tension creates constant pain to the patient increasing the risk of self-trauma to the wound. For example, in a simple elective dewclaw removal (if excess skin is accidentally removed around the base of the digit), the wound is closed under tension, and this rather simple procedure winds up causing many problems such as pain, edema to the paw, infection, and wound disruption. These problems could have been avoided simply by reducing skin tension.

Preventing Skin Tension
Proper Patient Positioning
With proper preoperative planning, surgeons can avoid skin tension in their wound closures. Place the patient in a position during surgery to help free up surrounding skin, if possible.

Proper Planning of Incisions and Wound Closure
Especially in curvilinear wounds, plan the closure first by placing stay sutures in the middle or most difficult areas to close so that early suture placements do not restrict closure of more distant areas or create unnecessary dog-ear formation. Make incisions parallel to the natural lines of skin tension. This wound orientation reduces skin tension and also minimizes skin distraction during closure.

Managing Skin Tension
Pre-emptive Skin Tension Management
Presuturing is a method of stretching skin with the use of large mattress sutures. Large suture bites are taken on opposite sides of a problematic wound or lesion scheduled for surgical removal or closure. As the skin sutures are tightened, the skin is pulled toward the central surgical area; the neighboring skin is placed under tension. Within a day, small amounts of skin can be stretched, (by mechanical creep mechanism) to help in wound closure. Mechanical creep is the biomechanical property in which skin is capable of further extension beyond the limits of its inherent extensibility by applying a stretching force to the skin. Collagen fibers progressively align to the force applied as the surrounding interstitial fluid is slowly displaced from around the compacting collagen fibers. As a result, the skin can stretch or advance beyond its natural extensibility. We experience this often when an apparently tight wound closure appears to be under significantly less tension the day following surgery. This method does not recruit significant amounts of skin, and is primarily used in distal extremities where elastic skin is limited. These sutures are not adjustable and the high load dissipates as the skin stretches. Unfortunately, presuturing is often uncomfortable to the patient.

Skin Stretchers is a system that allows skin to be stretched in a variety of directions around a wound. Specially designed anchor pads are "glued" to the skin, and elastic cables are connected to the opposing pads using a Velcro hook system. Clinical research has shown that skin stretchers are most effective in closing wounds involving the trunk, neck, and head of the dog and cat. They may be effective in such clinical situations as: stretching skin prior to an elective surgical procedure (like a skin tumor excision) when closure is expected to be difficult, stretching skin in the later phases of open wound management, or application on opposite sides of a closed wound to prevent wound dehiscence. Skin is usually stretched sufficiently to close wounds within 2 to 3 days. Cable tension is increased in increments 4 times daily. After the stretching has occurred, the pads are removed manually or left in place to spontaneously separate within about a week after application.

Tissue Expanders are silicone elastomeric “balloons” inserted under the skin in the subcutaneous layer. They are inflated in stages by means of sterile saline infused through an adjacent injection port. Once fully inflated, the expander is removed and the recruited skin is moved to the adjacent defect. These expanders are quite expensive so their use in veterinary surgery is limited. Furthermore, the stretching process may take several weeks before skin can be employed for closure. Extra skin is created much like what happens to abdominal skin in pregnant animals. The stretched skin undergoes a process called intussusceptive growth, where microseparation in dermal elements is filled in with new collagen. Therefore, adnexal structures, such as hair or glands in the stretched skin will be distributed more sparsely as these microtears are filled in.

Immediate Skin Tension Reduction
For skin tension relief during primary wound closure, a number of different methods can be used to relieve tension. Generally, wound tension can be defined as static (constant) or dynamic (tension only during changes in position or movement). The type of technique used to reduce tension depends on the type and amount of tension encountered. For minor skin tension (the wound edges can be apposed but the skin tends to separate widely when released, subcutaneous or skin suture techniques alone are often successful.
Subcutaneous sutures are the most common mean of reducing tension on primary skin incisions. Simple interrupted sutures placed in healthy hypodermis effectively reduce tension on the primary skin closure. Undermining the skin edges will also help reduce this minor tension. Walking sutures are used to help distribute tension along an undermined skin edge or flap. If tension across the wound is found only under dynamic conditions, various skin suture techniques are often useful. These include, for example, vertical mattress sutures with tube stents, and far-far-near-near suture patterns. Do not rely on skin suture methods to relieve wounds under moderate to severe “static” tension, as they may interrupt blood supply to the wound edges or cut through the skin.

When skin is difficult to hold together with thumb forceps (moderate to severe tension), other means (in addition to methods listed above) of reducing skin tension may be required. Determine if the wound tension is broad (across the entire wound) or in a more narrow band. If wound tension is broad but minimal, undermining alone with subcutaneous sutures usually suffices. However, in wounds under more tension, undermining along with simple or mesh releasing incisions may be employed. Remember, releasing incisions should not be used on skin flaps or when skin adjacent to the wound is not healthy. Z plasty or, the more preferred V to Y plasty are used when tension is in a more linear direction, especially around body orifices such as the eye. If the wound cannot be closed reasonably with the mentioned tension relieving techniques, transferring skin, either by creating a flap or by grafting, should be considered.

Ongoing Skin Tension Management

In split shot wound management mattress sutures are placed on opposing skin margins (about 1–1.5 cm from the wound edges) and the sutures are re-tensioned several times daily adding an additional split shot to the suture ends to maintain progressive tension. Alternately, commercial skin stretchers as described above can be used. These methods are applied to open wounds or sutured wounds under tension to relieve incisional tension.

References