SKIN is the first line of defense for all mechanical, environmental, and biochemical stresses placed on the body. Skin lacerations are common in athletics and they account for almost 25% of all emergency department visits. Goals for skin laceration management include control bleeding, minimize infection risk, and minimize the potential for scarring. Athletic trainers and therapists (ATs) must also consider the best method to safely and quickly return the physically active patient to sport or work activity. Basic wound assessment and three common methods for closing skin lacerations will be discussed: wound tape (e.g., Steri-Strips®), tissue adhesives (e.g., Dermabond®), and traditional sutures. ATs must consider wound characteristics, patient preference, and the relative strengths and weakness of each closure method (Table 1).

### Key Points

- Skin laceration is a common injury among athletes.
- Laceration management should minimize risk for infection and scarring.
- Wound severity is the most important consideration for selection of a skin closure method.

### Table 1. Closure Considerations for Simple Lacerations

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
</table>
| Wound Tape “Steri-Strips” | - Very quick and easy to apply anywhere and anytime  
                          - Very low infection rates  
                          - Excellent under splints or casts  
                          - Good for superficial lacerations with clean, straight edges  
                          - Skin must be dry and prepped, tincture of benzoin may help adherence.  
                          - Areas of low tension are good, but lax tissue may invert edges.  
                          - Don’t remain in place for very long  
                          - Should not be used in areas of high tension or movement |
| Tissue Adhesives “Dermabond” | - Requires some training, but then quicker and easier to apply than sutures  
                          - Can be done almost anywhere and anytime  
                          - Does not require removal  
                          - Good for simple lacerations with clean edges  
                          - Skin supposed to remain dry; however, may stand up to some sweating  
                          - Contraindications include jagged or irregular edges, bites, punctures, mucosal surfaces, axillae, perineum, joints, or areas of high motion  
                          - Dehiscence may be most important consideration.  
                          - More research required to determine best uses with physically active. |
| Sutures                | - Best choice for jagged or irregular edges  
                          - Best choice for areas of tension or motion, such as joints  
                          - Best choice in areas of excessive moisture, sweating, or high hair density  
                          - Often required for wounds with subcutaneous exposure |
**Wound Assessment**

Mismanagement of a relatively minor skin laceration may lead to infection, prolonged healing time, prolonged activity restriction, and scarring. Although rare, death is a possible consequence. Initial assessment of a laceration is similar to assessments of other injuries; first, determine what happened. ATs need to carefully consider a number of factors that influence the success of a given closure method (Table 2). What is the potential for embedded foreign objects within the lesion (e.g., dirt or rocks)? What is the risk of infection (e.g., proximity to dirty equipment)? What is the likelihood that bodily fluid exchange occurred (i.e., player-to-player contact)? The individual’s medical history should be acquired to identify any conditions that could adversely affect healing (e.g., diabetes). If the patient cannot remember when the last tetanus booster was administered, or if it has been longer than five years, he or she should receive a booster immunization within 72 hours.

The wound should be carefully examined in a sterile environment and under a bright light. Including a pen-light with medical supplies will facilitate wound assessment at sports events. Failure to recognize the presence of foreign bodies in lacerations is the fifth leading cause of litigation against emergency physicians. Given the excitement of competition and the suboptimal environment that exists on the sideline, ATs must recognize that thorough assessment and cleaning are vitally important, as is determining the depth and severity of the wound. If the laceration causes loss of sensation or motor function, or if the wound continues to bleed after 10-15 minutes with application of direct pressure, the individual should be referred for further medical evaluation. A thorough inspection of a wound will only take a few seconds, so a wound that appears to be minor should not be neglected.

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**Table 2. Factors to Consider during Initial Assessment of Skin Laceration**

1. What is the risk for embedded foreign objects?
2. What is the risk of infection?
3. What is the likelihood of bodily fluid exchange?
4. Any medical history which may delay healing?
5. Is a tetanus booster needed?

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**Options for Wound Closure**

**Wound Tape**

Wound tape (e.g., Steri-Strips”) works best for superficial, straight, low-tension lacerations or to temporarily close a laceration until it can be further evaluated and closed by another method. Wound tape is inexpensive and easy to apply anywhere. Wound tape can also be used to reinforce a healing laceration after sutures have been removed. Application of a small amount of liquid adhesive (e.g., benzoin tincture) to the cleansed skin that surrounds the laceration can dramatically increase the effectiveness of wound taping.

The primary disadvantage of wound taping is its ineffectiveness in maintaining laceration closure during physical activity. Steri-Strips” do not adhere well to skin that is oily or sweaty, and skin tension produced by sports participation tends to separate the adhesive bond between the wound tape and the skin. Dehiscence (i.e., wound opening) delays healing and increases risk for infection and scarring. Maintenance of wound closure with Steri-Strips” is almost impossible for athletes who participate in water sports and those who shower frequently.

**Tissue Adhesive**

Although cyanoacrylate adhesives have been available for more than 50 years, Dermabond® (octylcyanoacrylate) is the only tissue adhesive that has been approved by the U.S. Food and Drug Administration (FDA) for laceration closure. Tissue adhesive requires less than one-half the time that is necessary to close a wound by suturing, anesthesia is not generally required, and an AT can use this method in almost any environment. Cyanoacrylate tissue adhesive provides a result that is comparable to that derived from suturing in terms of infection risk and cosmetic appearance. Additionally, tissue adhesive provides a small degree of water resistance and a antimicrobial barrier over the wound.

Another cyanoacrylate adhesive that is inexpensive and readily available, Super Glue®, has been used by some as a cheaper alternative to Dermabond®. Adhesives that have not been approved by the FDA for laceration repair present risk for negative skin reactions. Such adhesives also increase risk for scarring due to a quick set-up time that can prevent optimal approximation of wound edges.
Ironically, the characteristics that make tissue adhesive convenient and user-friendly present disadvantages for maintenance of wound closure and healing. Because the strong polymer bond that holds the wound edges together is partially activated by moisture in the skin, areas of high moisture represent a contraindication for the use of tissue adhesive. Excessive moisture can cause the bond to weaken, which results in adhesive "peel off" from the skin. The Dermabond® manufacturer (Ethicon) recommends that wounds closed with the adhesive should be kept dry until the film covering falls off after 7-10 days (brief showers are deemed acceptable). This limitation presents a problem for the management of lacerations in athletes. A second limitation that appears to be controversial is the strength of the wound closure provided by Dermabond® immediately after its application. The manufacturer claims that Dermabond® is just as effective as sutures for management of wounds in athletes, thereby allowing immediate return to competition; however, there is also a recommendation for immobilization of skin areas that are subjected to high tension for a period of up to five days after application to ensure wound integrity and an acceptable cosmetic outcome. Wounds closed with Dermabond® may not achieve a wound strength that is equal to that provided by 5-0 sutures until 5-7 days after its application. Most studies that have favorably compared the dehiscence rate of adhesive to that for sutures were done with pediatric patients rather than athletes. The findings of two small studies that evaluated the use of Dermabond® for management of lacerations to hockey players indicated that it was effective for closure of small facial lacerations incurred during competition, with no dehiscence, despite immediate return to participation for most cases. Small facial lacerations are not typically subjected to high tension, but they are subjected to a high level of moisture. More research is needed to clarify the indications and limitations of tissue adhesive utilization in an athletic setting (Figure 1).

**Sutures**

A determination of whether or not sutures are necessary for effective closure of a wound is not always easy to establish. Consideration of a laceration’s length, shape, depth, and location provides a basis for an objective decision (Table 3). A laceration with jagged or irregular-shaped edges may need to be straightened by a physician. Proper healing with minimal scarring requires good approximation of the wound edges, which may be difficult to achieve when a laceration is not straight. Sutures may also be required if the wound is characterized by wide gaping of separated edges or skin has been avulsed. Skin tension at the edges of such wounds may be too great for wound tape or tissue adhesive to hold them together. A laceration that is deep enough to provide a view of underlying adipose tissue is likely to need both subcutaneous and superficial suturing. Skin that surrounds a joint, overlies a bony prominence, or covers a hand or foot is often subjected to tension, which makes sutures the most effective method for closure. Sutures provide the best option for closure of wounds in areas that are oily or hairy, and where the skin is subjected to repetitive contact with clothing (e.g., axilla and perineum).

The primary disadvantage to the use of sutures for wound closure in an athletic setting is frequent lack of easy accessibility to a physician (or other qualified clinician) to perform the procedure. If a laceration is not associated with motor or sensory nerve impairment and bleeding can be controlled, an athlete can finish
an activity with the protection provided by a temporary closure method. Although expert opinions vary, most physicians will suture a laceration that presents a low risk for infection within 12-19 hours post-injury.\(^2\)\(^8\)

**Conclusion**

Determination of the best method for closure of a laceration may be difficult for an inexperienced AT. Regardless of the closure method used, most simple skin lacerations will heal at about the same rate if the wound is undisturbed.\(^1\) Thus, the need for suturing primarily depends on a laceration’s length, depth, shape, and location. Because athletes are typically unable to keep a laceration undisturbed, clean, and dry for a period of 7-10 days, sutures provide the most secure wound closure method. Tissue adhesive may provide a good option for management of simple lacerations, but more research is needed to clarify the indications and limitations associated with its use in an athletic setting.\(^2\)

### Table 3. Laceration Characteristics That Require Sutures

<table>
<thead>
<tr>
<th>Shape</th>
<th>Depth</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jagged or irregular shaped edges</td>
<td>Deep enough or long enough to allow visualization of underlying subcutaneous or adipose tissue, muscle, or tendon</td>
<td>Around areas of tension or reduced blood flow, such as joints, bony prominences</td>
</tr>
<tr>
<td>Edges that cannot easily be approximated with light tension due to avulsions or flaps</td>
<td></td>
<td>Around areas of excessive oil or sweat production, or high hair density</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Axillae, perineum, and mucosal surfaces</td>
</tr>
</tbody>
</table>

**References**


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