WOUND MANAGEMENT techniques have changed drastically over the last 30 years. It was once thought that acute wounds should be cleansed with antimicrobial solutions and dressed with sterile gauze or adhesive strips/patches or left open to form a scab. Practices also included daily cleansing and dressing changes, without regard to the healing progression of the wound. Research has shown that these techniques impede the healing process and increase the risk of cross-contamination and bacterial colonization from staphylococcus and streptococcus pathogens. The development of occlusive dressings during the early 1960s provided a method for maintenance of a moist wound environment that is currently considered the standard of care in the medical community; however, evidence-based guidelines for management of sports-related skin lesions are limited, and clinical decisions are often based on ritualistic practices (i.e., use of hydrogen peroxide, sterile gauze, or no dressing) or anecdotal clinical experiences.

The purpose of this report is to review current evidence regarding appropriate cleansing, debridement, and dressing techniques for management of acute skin lesions (i.e., abrasions, avulsions, blisters, incisions, lacerations, and punctures).

Cleansing

Wound cleansing is defined as the delivery of a fluid to the wound surface by a mechanical force to remove debris, dressing residue, and excess exudate; reduce the bacterial count; and rehydrate the wound. Wounds that are clean, actively healing, and have minimal exudate, are normally red in color and can be damaged by routine cleansing. Three common techniques for the cleansing of wounds include whirlpool baths or soaks, scrubbing or swabbing, and irrigation. Whirlpool baths or soaks consist of immersion of the affected body part into a tub or container and are used to loosen and remove contaminants as well as necrotic tissue from the wound bed. Although this technique is painless, a risk of cross-contamination, damage to tissues, and a delay in healing can result from contaminants, water additives, and turbulence. Scrubbing and swabbing involves direct mechanical contact with the wound bed to remove gross contamination. A soft brush, sponge, or gauze pad moistened with a cleansing solution is moved in a circular pattern across the wound bed. Several authors have demonstrated that this technique simply redistributes bacteria in the wound bed and causes damage to the
tissues from the mechanical contact. Gauze fibers can be shed into the wound, resulting in an inflammatory response, increasing the risk of infection and delaying healing. Most experts agree that scrubbing and swabbing should not be used on the wound bed but can be used on the surrounding (periwound) tissues. Irrigation is the controlled delivery of a fluid into the wound to remove contaminants, excess exudate, loose tissue and debris, and dressing residue, and to reduce bacterial colonization without causing damage to the tissues. A 35-mL syringe and 19 gauge needle, hub, or plastic cannula will deliver a solution to the wound bed at a pressure between 7 to 11 psi without damage to the tissues. Irrigation is the preferred method of cleansing for most acute wounds, but needle-stick injury, splash-back, and exposure to disease are concerns. For cleansing, place the individual in a seated, supine, or prone position on a table. Prepare the area with towels to catch excess body fluids and cleansing solution drainage. When irrigating the wound, the clinician should place a cupped, gloved hand above the wound bed to lessen splash-back from the stream. For all wound management procedures, Occupational Safety and Health Administration guidelines must be followed.

Cleansing solutions range from tap water to antimicrobial agents, and the selection of a solution should be based on its cleansing effectiveness and cytotoxicity to the tissues. Sterile 0.9% saline is generally regarded as the most appropriate cleansing solution, which can be used on acute wounds without damage to healing tissues. Tap water has been used for centuries without a high incidence of infection, but few investigations have assessed its effectiveness as a cleanser. Some suggest that water from a properly functioning treatment plant, supplied through non-contaminated pipes and tap nozzles, and allowed to run a few minutes prior to use, is appropriate for wound cleansing. The limited number of investigations comparing saline and tap water as cleansing solutions have found no differences in rates of infection, but additional studies are warranted. The value of antimicrobial agents for wound cleansing has been questioned for years. Research has demonstrated that some agents are cytotoxic to tissues, inactivated by body fluids, hard water, and cellulose products and are often not in contact with the wound bed long enough to significantly lessen bacterial count. Overall, research findings suggest that povidone-iodine, hydrogen peroxide, and sodium hypochlorite are cytotoxic to human fibroblasts and macrophages and should not be used for cleansing of the wound bed, but are appropriate for the periwound tissues. Cleansing solutions should be delivered to the wound bed at body temperature. A decrease in the temperature of the wound bed (< 37° C or 98.6° F) can delay cellular and chemical processes associated with healing up to 3-4 hours. Further research is needed to determine the effects of different cleansing procedures and solutions on rates of healing and infection of acute wounds.

Debridement

Wound debridement is the process of removing necrotic or devitalized tissue and metabolic waste from the wound bed until only soft and well-vascularized tissue remains. Debridement should be performed as soon as possible with all acute wounds to reduce bacterial growth and lessen the risk of infection. The absence of necrotic tissue and infection facilitates progression of normal wound healing. Common techniques of debridement include sharp, mechanical, and autolytic procedures. These techniques can be used individually or in combination. Sharp debridement is highly selective in removing tissue and waste and is performed in a non-sterile environment, with or without local anesthesia. Place the individual in a seated, supine, or prone position on a table and remove nonviable tissue along the border with viable tissue using a scalpel, scissors, forceps, and/or tweezers. Mechanical debridement utilizes whirlpool baths, irrigation, and wet-to-dry and wet-to-moist gauze dressings. Whirlpool baths remove loose tissue and debris, but the potential for cross-contamination and tissue damage are concerns. Irrigation will also remove loose tissue and debris from the wound bed. Gauze dressings are the most commonly used method of mechanical debridement. Wet-to-dry dressings are nonselective, employing avulsion to remove nonviable tissue and waste, but also removing some amount of healing tissue. Sterile gauze is moistened, placed on the wound bed, then covered with additional gauze and allowed to completely dry. The dressing is then lifted off of the wound surface, removing the tissue and waste adhered to the gauze. Although this procedure is effective in removing tissue and waste, pain and damage to healing tissues occurs with the avulsion mechanism. The wet-to-moist method is similar,
but the gauze placed on the wound bed must remain moistened. This method is less effective in tissue and waste removal, but results in less pain and damage to healing tissues. Autolytic debridement is the softening and digestion of devitalized tissue and waste by the body’s own mechanisms in a moist wound environment that is maintained by a semi-occlusive or occlusive dressing. Autolytic debridement is painless and less labor intensive than other techniques but should not be used for wounds that have not been thoroughly cleansed. Research comparing the effectiveness of debridement techniques is limited and additional investigations are warranted.

**Dressings**

Wound dressing is the application of materials to the wound surface to maintain an optimal environment for facilitation of the healing process. The characteristics of an ideal dressing include maintenance of a moist wound environment, removal of excess exudate from the wound bed, allowance for gaseous exchange between the wound and external environment, thermal insulation for the wound, impermeability to bacteria, and avoidance of additional trauma to tissues during its removal. The dressing should be sterile, nontoxic, nonallergic, and nonadherent to the wound surface.

The selection of a dressing should be based on the type of wound, the purpose of the dressing, and the activity level of the individual. A single “best-dressing” does not currently exist. Wound dressings can be categorized into three groups: (a) woven, (b) skin tapes, and (c) semi-occlusive/occlusive. Woven dressings include dry gauze, impregnated gauze, and paraffin gauze. Dry gauze is the most frequently used dressing and often erroneously considered the standard of care. Dry gauze does not maintain a moist wound environment; it allows drying and cooling of tissues, it adheres to the wound bed, it requires frequent changes, and it causes pain and tissue damage upon removal. Furthermore, dry gauze does not provide a physical barrier to the environment, thus increasing the risk of cross-contamination and infection. In vitro, bacteria have been found to penetrate through 64 layers of dry gauze. Dry gauze is inappropriate for direct contact with the wound bed but can be used as a secondary dressing to absorb exudate. Impregnated and paraffin gauze maintain a moist environment, they form a protective barrier, and they do not adhere to the wound bed. These dressings are used in the treatment of puncture and cavity wounds to wick exudate away from the wound bed. Skin tapes are used for the closure of superficial, linear lacerations with minimal static and dynamic tension. The application of skin tape is quick and painless, and it has been demonstrated to have a lower rate of infection and tissue damage when compared to traditional thread suturing.

Semi-occlusive and occlusive dressings promote a moist wound environment. This category of wound dressings includes film, foam, hydrogel and hydrocolloid dressings, and dermal adhesives. Since the 1960s, numerous researchers have investigated the benefits of maintaining a moist wound environment in terms of healing rate and frequency of infection. A moist wound environment has been linked to enhancement of many cellular and chemical processes associated with healing. Wounds treated by occlusion have demonstrated an increased rate of healing and decreased occurrence of infection and pain, when compared to wounds treated by the use of either a woven dressing or no dressing. Table 1 summarizes the characteristics of semi-occlusive and occlusive dressings. Films, foams, hydrogels, hydrocolloids, and dermal adhesives possess the characteristics of an ideal dressing. Dressing changes are only required upon leakage of exudate from the dressing edges, drying of the dressing (hydrogel), or signs and symptoms of infection or skin inflammatory reaction. Because normal daily activities and athletic activities can be continued while wearing such a dressing, its use is associated with a high level of compliance. Daily inspection of the dressing and periwound tissues should be performed to ensure detection of infection and any adverse reaction.

**Conclusions**

There is limited research evidence available in the literature to guide the clinical management of acute skin trauma among athletes. Clinical decisions and wound care procedures that are based on ritualistic practices and/or anecdotal experiences are likely to impede the healing process. The available evidence supports the following guidelines for cleansing, debridement, and dressing of acute wounds.

- Irrigation with saline or tap water at body temperature will remove debris and reduce bacterial count without tissue damage.
• Sharp and mechanical (irrigation) debridement will remove necrotic tissue and waste from the wound bed and should be performed as soon as possible.

• Semi-occlusive and occlusive dressings promote a moist wound environment, increase rate of healing, decrease risk of infection, and protect the wound from further trauma.

More randomized controlled trials are needed to compare various types of cleansing, debridement, and dressing techniques in terms of healing rate and occurrence of infection and pain. Research is also needed to assess the relative cost-effectiveness of the various wound management procedures.

Table 1. Semi-Occlusive and Occlusive Dressings

<table>
<thead>
<tr>
<th>Dressing</th>
<th>Construction</th>
<th>Advantages</th>
<th>Disadvantages</th>
<th>Uses</th>
</tr>
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<tbody>
<tr>
<td>Film</td>
<td>Transparent polyurethane with an adhesive coating (BlisterFilm, Biocclusive, Tegaderm)</td>
<td>Possess elastic properties, resistance to shearing, tear, waterproof, allow for visual inspection of wound</td>
<td>Nonabsorbent, not for use with heavily draining wounds; adhesive coating may strip away newly formed tissue with removal.</td>
<td>Superficial-to-partial-thickness abrasions, blisters, lacerations, and minor burns; can remain on wound bed 1-7 days.</td>
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<tr>
<td>Foam</td>
<td>Polyurethane foam mesh with an outer membrane of polyester, silicone, or Gore-Tex (CURAFOAM, Allevyn, QuadraFoam)</td>
<td>Super-absorbent, ability to handle excessive wound drainage, provide thermal insulation and protection from trauma</td>
<td>No visual assessment of wound bed; most require a secondary dressing for adherence to periwound tissues.</td>
<td>Partial-to-full-thickness abrasions, blisters, lacerations, wounds with heavy exudate; can remain on wound bed 1-7 days.</td>
</tr>
<tr>
<td>Hydrogel</td>
<td>Transparent polyurethane membrane consisting of 80-90% water (CURAGEL, 2nd Skin)</td>
<td>Super-absorbent, ability to handle excessive wound drainage, allow for partial visual inspection of wound</td>
<td>Most require a secondary dressing for adherence; dressing will dry out; can support bacterial growth in presence of absorb wound drainage.</td>
<td>Partial-to-full-thickness abrasions, blisters, and lacerations, 2nd degree burns; can remain on wound bed 1-3 days.</td>
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<tr>
<td>Hydrocolloid</td>
<td>Gelatin and pectin mass in an adhesive matrix with an outer waterproof film or foam layer (ULTEC, DuoDerm, Tegasorb)</td>
<td>Waterproof, backed by adhesive, great adherence to periwound tissues, high compliance</td>
<td>No visual assessment of wound bed; removal may be difficult following 7 days on wound bed.</td>
<td>Superficial-to-full-thickness abrasions, blisters, and lacerations; can remain on wound bed 1-7 days.</td>
</tr>
<tr>
<td>Dermal Adhesive</td>
<td>Octylcyanoacrylate compound (DermaBond)</td>
<td>Short application time, less pain than sutures, used with, but not replace subcutaneous sutures</td>
<td>Use only with low tension wounds, risk of dehiscence.</td>
<td>Easily approximated wound edges from surgical incisions and simple traumatic lacerations.</td>
</tr>
</tbody>
</table>

References

5. Thomlinson D. To clean or not to clean? Nurs Times. 1987;83:71-75.


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