

Training Manual: Traumatic Wounds and WoundStat™

TRAUMATIC WOUNDS

Traumatic wounds, especially those obtained in combat, have a number of unique characteristics that often make it difficult to achieve rapid hemostasis. These include:

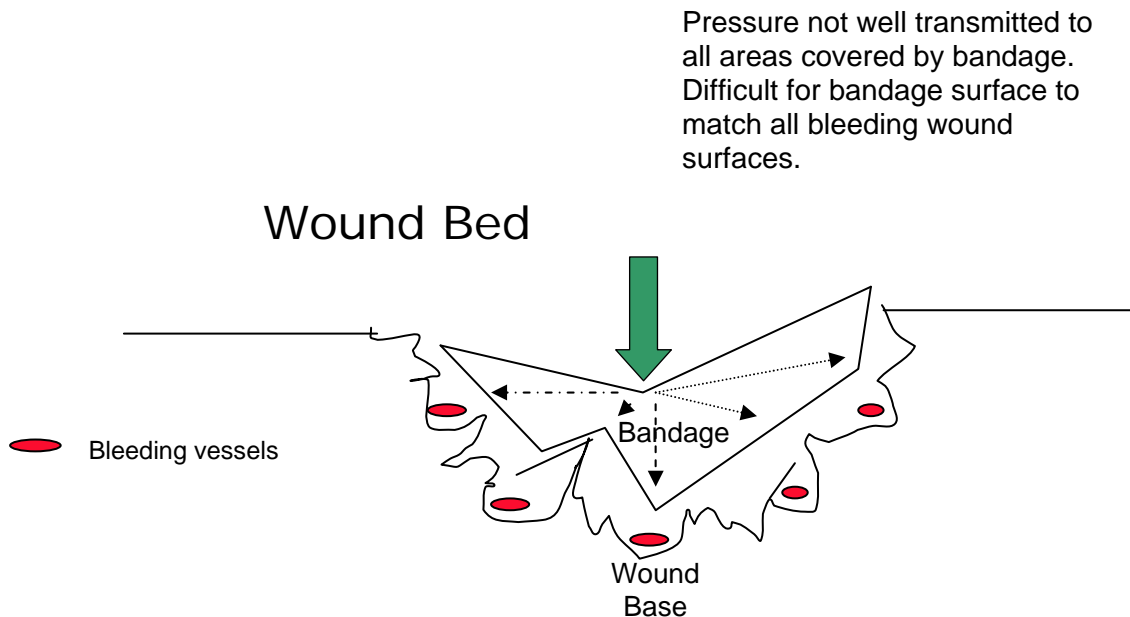
- 1) Complex geometry resulting in multiple layers of injured tissue
- 2) Lack of uniformity in the depth of the wound
- 3) Multiple bleeding sites throughout depth of wound (both venous and arterial)
- 4) Unclear visualization of the actual site of bleeding
- 5) Bleeding vessels (opening of vessels) located or positioned where direct contact with a hemostatic agent cannot be made.

BANDAGES FOR HEMOSTASIS

The characteristics of traumatic wounds make it difficult for bandages of uniform size to produce hemostasis. We have all noted casualties whose wounds were dressed with bandages and then pressure-wrapped, who presented with their bandages soaked with blood. This occurs in large part because bandages cannot match the enormous surface area wounds. Even when pressure-wrapped, the structure of bandages cannot come into contact with all surfaces of the wound.

Figure 1. Bandages and Wound Coverage

Bandages: Lack of Overall Pressure on Wound



It is difficult to transmit pressure uniformly through a flexible bandage product. Even if a bandage has sufficient adhesive properties to stick to a bleeding vessel, it must first make contact with that surface. Given the various depths of the wound and the possibility that the bleeding lumen of the vessel may not be clearly accessible from the wound cavity, bandage products face a significant challenge.

Lastly, when the bandage is moved, as occurs with patient movement, it may not be able to maintain its adherence to the wound or vessel surface. And, depending on the composition or contents of the bandage, it may not be hemostatically functional after the initial application and may need to be replaced.

WOUNDSTAT

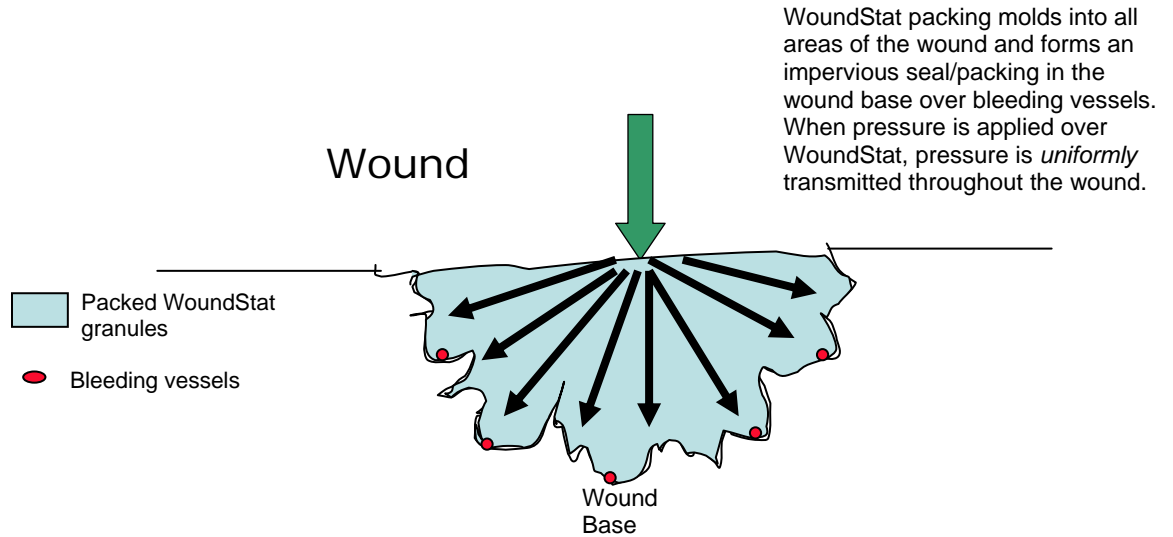
A proprietary blend of special mineral compounds, WoundStat possesses a variety of properties that make it suitable as a hemostatic agent for complex traumatic wounds.

These properties include:

- 1) Granular formulation heavy enough to sink to the bottom of high pressure bleeding wounds
- 2) Able to absorb large amounts of blood or other fluids from the wound
- 3) Able to conform to all surfaces of the wound, forming a pliable cast when mixed with blood and packed into the wound.
- 4) Able to seal all surfaces of the wound rapidly.
- 5) Repairable if re-bleeding occurs by remolding and further packing into the wound without removing WoundStat.
- 6) Conforms to all surfaces of the wound, allowing pressure from pressure dressings over the bed of WoundStat to be transmitted uniformly to the wound surface
- 7) Fills the wound and conforms to the wound surfaces, making initially non-compressible wounds compressible.
- 8) Special chemical characteristics of the product promote natural clotting.
- 9) WoundStat is an inert material that causes no exothermic reaction in the wound.

Figure 2. WoundStat Formation in the Wound

Benefit of WoundStat

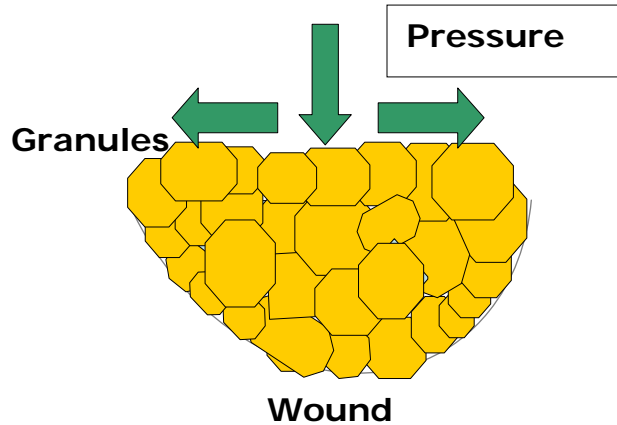


These properties make WoundStat a truly versatile hemostatic product. Many of these characteristics allow WoundStat to create hemostasis in large irregular wounds even when the site of bleeding cannot be identified. It is not necessary for WoundStat to make direct contact with the bleeding vessel due to its sealing properties. Hemostasis can be achieved even when the bleeding vessel(s) are covered by other tissue or vessels or if they are retracted and recessed from the surface of the wound cavity.

Figure 3. Granules Fill the Whole Wound

Benefits of Granules

Granules form a hard surface on top of the wound. When pressure is applied, the **whole wound** receives uniform pressure.

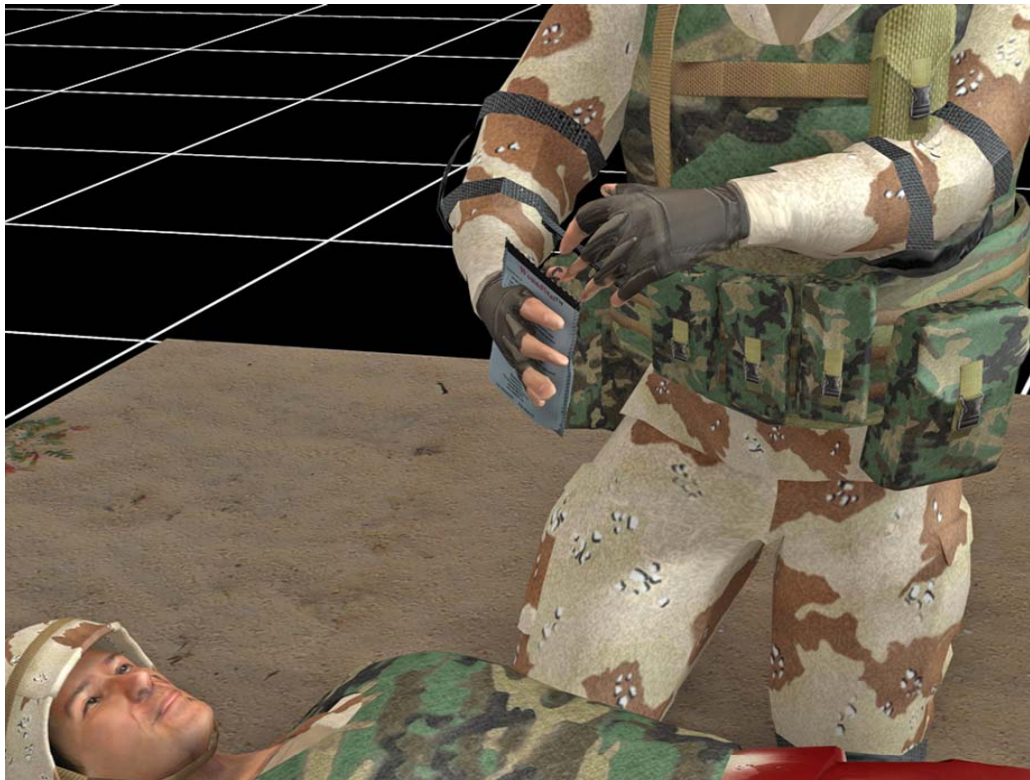


The principles above can be summed up by the 4 P's:

POUR - - PACK - - PRESS - - PRESSURE

DETAILED INSTRUCTIONS

- Apply tourniquet if possible.
- Expose wound and tear open WoundStat packet at perforations.



- **Pour WoundStat into wound to fill the wound cavity.**
- **Do not remove blood from wound or attempt to identify site of bleeding.**



- Once the wound is filled, begin firmly packing WoundStat into all areas of the wound.
- Do not hesitate to mix WoundStat with the blood in the wound.
- Press WoundStat firmly into the wound until it feels that no further packing can be done.



- **If possible, immediately place a gauze/pressure dressing on top of the molded WoundStat and create a pressure dressing over the wound.**
- **If the wound is deep, add additional WoundStat to create a mound above the surface of the wound. This will allow for better transmission of pressure into the wound bed from any pressure dressing or wrap placed on top of the wound. This helps make an initial non-compressible hemorrhaging wound into a compressible wound.**



- If placement of a pressure bandage cannot be done, apply manual pressure to the WoundStat packing for up to 3 minutes. Alternatively, shorter packing and pressure times can be performed with re-inspection of the wound for breakthrough bleeding at short intervals.
- If rebleeding is noted, **DO NOT REMOVE WOUNDSTAT.**
- Perform additional pressing and packing of the WoundStat already in the wound, especially over areas where bleeding is noted.
- **If necessary, more WoundStat can be added** to the wound and pressed and packed into the wound.
- If a tourniquet is applied, slowly remove tourniquet and monitor wound for bleeding.
- Even for less severe or shallow wounds, WoundStat can be poured over the wound, followed immediately by placement of a pressure dressing using gauze and wrapping. WoundStat granules will conform to and seal all bleeding surfaces and should be held in place simply by a secured gauze dressing.