

Wound Care

The mainstay of EB care is daily, meticulous skin and wound care.

Through the use of specialized dressings and wound care products, caregivers strive to prevent new blisters and erosions, to heal existing wounds and to minimize complications, including infection, pain, scarring and contractures.

Prevention and Protection

- Clothing Recommendations
- Shoes and Socks Recommendations
- Bandaging for Protection
- Removing Adhesives
- Infection Precautions

Although it is not possible to completely prevent all blisters in people with EB, blistering can often be minimized through the use of special clothing, socks, and shoes. In addition, some children with EB blister less with the use of protective bandaging; that is, applying bandages and wraps to areas of the skin that are currently free of blisters. Areas such as the knees and elbows are often prone to blistering from trauma. Keeping these areas bandaged may minimize the effects of trauma on blistering.

In addition, sometimes adhesive bandages or tapes are applied to the skin, either accidentally or when there is no alternative to secure other medical devices. The use of special adhesive removers or the application of petrolatum ointments may be required to remove these adhesives with minimal damage to the skin.

Prevention of skin infection is an important part of EB skin care. Ways to minimize infection include careful attention to infection-control precautions during dressing changes, frequent use of hand sanitizers, and routine disinfection of wound care supplies and the bandaging area.

Clothing Recommendations

Many people with EB can wear regular clothing without developing blisters. However, clothing tags should be removed and clothing with tight elastic should be avoided. Soft, loose-fitting clothing is best for delicate EB skin. For those with particularly delicate skin, clothes may be worn inside-out so that the seams are on the outside of the clothing, where they will not irritate the skin and cause blistering.

Other helpful modifications to regular clothing include removal of the collar and cuffs from shirts. When these efforts do not prove to be successful, the use of bandages or soft cotton undergarments (t-shirts, leggings) may be necessary to protect the skin.

Shoes and Socks Recommendations

There is no one type of shoe that is best for people with EB, but these characteristics have been identified as essential:

- Roomy enough to accommodate bandages and/or protective socks, although not too loose and this may increase friction and blistering in unbandaged skin
- Soft
- Lightweight

The following footwear has been recommended for people with EB:

- [Adidas ClimaCool](#) (men and women): Athletic shoes with ventilation
- Ballet slippers (kids): Soft, comfortable, pliable
- [Bilby shoes](#) (kids and adults): Custom shoes for people with EB; soft leather tops and sponge lining are comfortable and protective. Go to www.bilbysshoes.com, click on Products and then Medical Grade for information on shoes for people with EB.
- [Elefanten](#) (babies and kids): Many soft, flexible styles available
- [Front Wrap by Outpost Sheepskin Specialties](#) (men and women): Sheepskin-lined shoes and liners. Top of the Front Wrap shoe opens completely for easy insertion and accommodates bandages. Adult moccasins also available.
- [L.L. Bean](#) (kids and adults): Fleece slippers and ankle cuff slippers (item number TA48940)
- [Moccasins](#) (kids and adults): Soft and supple and accommodate dressings. Minnetonka moccasins are among the many brands. Many vendors carry moccasins.
- [Nike Shox](#) (youth, men and women): Athletic shoes with ventilation; very soft
- [Pedors](#) (youth, men and women): Adjustable closure and soft, stretch uppers to accommodate bandages. May need soft insole for padding.
- [Preschoolians](#) (babies and kids): Many soft, flexible styles
- [Robeez](#) (babies and kids): Many soft, flexible styles
- [Swedish moccasins by Hanna Andersson](#) (kids): Leather-soled socks (Item # LD18611)
- [Tempur-Pedic® Comfort-Step slippers](#) (adults): Comfortable, conformable slippers that can be worn indoors or outdoors.
- [Ugg boots](#) (kids and adults): Sheepskin-lined boots, shoes and slippers
- Water shoes (kids and adults): Soft, stretchy, pliable
- [Arctic Shoe](#) (adults): Top of the Arctic Shoe opens completely for easy insertion and accommodates bandages.
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There are a variety of preferences for socks, depending on the type of EB and the amount of bandages worn underneath. Ensure that shoes are large and wide enough to accommodate socks and/or bandages without putting undue pressure on the foot. If bandages are worn on the feet, a thin sock or a trouser sock often is worn. Tights and pantyhose also are used. These help stabilize the bandages and are not too bulky. Gel insoles are also beneficial to some. They can be refrigerated for added comfort and pain/itch relief. For people with EB who do not wear bandages on their feet, thick, protective socks often are worn. These include:

- [Silipos® SoftSock](#): Reduces friction, abrasion and shear forces. Bottom of sock has a ¼-inch solid gel bottom. Cotton/nylon blend.
- [Thorlo®](#): Running socks that are thick and padded and reduce friction. They may require a ½ size larger shoe. Wear these when fitted with new shoes only.
- [SmartWool®](#): Running socks that wick moisture from the skin. Available in many sporting goods stores.
- [World's Softest™](#): Relaxed fit socks stay up without binding. Smooth seam to reduce rubbing; medium cushion acrylic foot bed helps keep feet dry and comfortable.

Bandaging for Protection

Use of protective bandaging may be considered in blister-prone areas such as arms, legs, hands and feet. Many people believe in the benefits of protective bandaging for preventing blister formation. Others are just as certain it inhibits the development of functional use of the hands and fingers and of balance and walking, increases the risk for developing contractures, and is miserably uncomfortable and hot. The choice of whether to use protective bandaging must be made by the individual or the caregiver. A reasonable recommendation is to evaluate the skin's response to being bandage-free. Try a small area, perhaps the forearm or upper arm. If no blisters occur when these bandages are removed, try removing more the next time. Many parents and caregivers report that when they finally decided to remove the protective bandages, the skin reacted surprisingly well, with little or no blister formation. Other caregivers, however, report an increase in blistering in the exposed areas with fewer blisters when protective bandages were again applied. No tape or adhesives should be applied to EB skin, as these may result in severe blistering when removed. Tape should only be applied to dressings and bandages, if needed. The use of a gentle, silicone tape such as [Mepitac®](#) (from Molnlycke) may be considered if tape must be applied directly to the skin. Maintaining a cool environment is helpful, because EB skin may be more fragile in the heat and humidity. Also, lubricating the skin daily with a non-medicated ointment such as Vaseline or Aquaphor will reduce trauma to the skin by reducing friction.

Removing Adhesives

Tape, adhesives and adhesive bandages should not be used on EB skin. More mildly affected individuals may be able to tolerate some adhesive strips or bandages, but most cannot. If tape or an adhesive bandage is applied in error, do not attempt to remove it. Pulling it off will cause injury and trauma and result in a blister or wound. Some people with EB have reported minimal or no damage when the adhesive is loosened with a non-irritating adhesive remover such as [AllKare Adhesive Remover Wipes®](#) (ConvaTec or [Uni-Solve Adhesive Remover Wipes](#) (Smith & Nephew)). Alternatively, generous application of an ointment such as Vaseline or Aquaphor will loosen the adhesive and facilitate removal. Baby oil has also been reported to be effective in adhesive removal. Clothing or bandages that have adhered to a wound must be soaked off. Pulling off such a bandage will damage the wound and cause bleeding and pain. Often, soaking the bandage with water or applying a wet compress will be enough to remove a bandage that is stuck. If this is not effective, apply an ointment such as Vaseline or Aquaphor and allow it to absorb until the dressing softens and can be easily removed.

Infection Precautions

With a skin disorder such as EB where bleeding and draining wounds are common, it is crucial to reduce the risk of spreading infection from contact with dirty, contaminated dressings. In order to protect family members, friends and caregivers, and the person with EB, it is important to maintain standard contact precautions. These are guidelines designed by the CDC (U.S. Department of Health and Human Services, Center for Disease Control and Prevention) to reduce the risk of transmission of microorganisms in hospitals, but the principles apply to home situations, as well. At this time, infection control guidelines for the home setting have not been developed by the CDC. Standard infection control precautions should be maintained when one comes in contact with:

- blood
- all body fluids, secretions and excretions except sweat, regardless of whether or not they contain visible blood
- non-intact skin
- mucous membranes

Contact precautions apply to individuals known or suspected to be infected or colonized (demonstrating the presence of bacteria, mold/yeast, or virus in or on the patient but without clinical signs and symptoms of infection) with microorganisms. These precautions include guidelines about:

- Hand hygiene: the single, most effective way to minimize the spread of infection. Remember to wash your hands with soap or other cleanser and water or use an alcohol-based handrub before and after handling dressings.
- Alcohol-based handrubs: significantly reduce microorganisms on skin and are fast-acting. These may be used in place of soap or cleanser and water, but gloves should still be worn when handling dressings.
- Use of gloves (hand washing or use of alcohol-based handrubs is still essential).
- Handling soiled linen, clothing and bandages properly; must be done in a manner that prevents contamination and transfer of microorganisms. In general, you should perform hand hygiene before and after handling dressings, wear gloves while handling dressings, and dispose of soiled dressings directly into a dedicated “dirty dressing” bag or bin.

Other recommendations include:

- Use paper towels rather than fabric towels after hand washing, as towels can easily become contaminated.
- Avoid “double-dipping” in jars of ointment. Use of a clean wooden tongue-depressor or plastic spoon or knife may be used to remove ointment from the jar.
- Avoid using your fingers to directly remove ointments and medications from tubes. Squeeze the ointment or medication onto a clean wooden tongue-depressor or plastic spoon or knife to remove ointment or medication from the tube.
- Use a smock or gown to cover your clothing when working with bleeding or draining wounds.
- Clean and disinfect surfaces, keyboards, phones and remote controls regularly.

- Cleanse humidifiers daily using soap and water, then rinse with a diluted bleach solution (1:10).
- Clean the bandaging area, bathtub, and supplies such as bandage scissors with disinfectant. Disinfectants kill most bacteria and may kill mold, yeast and viruses. Disinfecting the bandage changing area will help prevent the spread of infection.
- Change you or your child's toothbrush regularly, especially after the flu or a cold.
- Consider supplying "tools" for the child to take to school, i.e., his/her own crayons, markers, etc.

Wound Care and Healing

In many ways, wound care for EB is an individualized process. Individuals have their own preferences for bathing, ointments, and bandaging. There are some general principles, however, with regard to wound care that are important for all persons with EB:

- Blister management: Each care provider should become familiar with the procedure for draining blisters, which reduces pain and helps to prevent blisters from enlarging.
- Topical ointments: There are a variety of different ointments that may be used, including white petrolatum, Aquaphor, and zinc oxide.
- Medicated ointments: Ointments such as Mupirocin, Bacitracin, and Polysporin® should in general be reserved for wounds that appear to be infected.
- Bathing: In addition to water, the use of pool salts, bleach, or vinegar (acetic acid) may be recommended to soothe the skin or prevent infection.
- Bandages: There are many different types and brands of dressings, including contact layers, foams, and rolled gauze. Specific types of dressings may be required for different types of wounds. Caregivers usually try many different products before finding a small number they prefer.
- Itching: This is a common complaint among people with EB. There are many causes, and the treatment depends on the cause.
- Infection: Unfortunately, infection is common in EB. Mild infections may require only the use of topical antibiotics and/or bleach or vinegar (acetic acid) soaks; more severe infections may require the use oral or intravenous antibiotics.

Blister Management

EB blisters should be drained if they are tense or are ½ inch in diameter or larger, because the fluid inside the blister puts pressure on the surrounding skin. This pressure causes the skin layers to split further and results in a larger blister. A larger blister is more painful, takes longer to heal and is at greater risk for infection. When draining a blister, the side of the blister roof should be punctured using a sterile needle, lancet or manicure scissors. If using a needle, be sure the opening in the blister is large enough that it will not seal and refill. Every effort should be made to leave the blister roof in place, as this aids wound healing and reduces pain.

Ointments and Topicals

After the blister is drained, an ointment should be applied to reduce friction, soften crusting to maintain a moist healing environment, and act as a barrier to protect the wound. As long as the blister or erosion (open blister/sore) is not infected, personal preference will determine which ointment is most suitable.

- Bacitracin, Polysporin® or other over-the-counter antibiotic ointments serve as a topical antibiotic to prevent infection; act as a protective barrier; and maintain a moist wound environment to facilitate healing. If topical antibiotic ointments are used, they should be rotated every month or so to minimize the risk of developing resistant bacteria. Products that contain neomycin should be used cautiously as they may result in the development of an allergic reaction.
- Petroleum jelly (White Petrolatum, Vaseline®) probably is the least expensive ointment. It acts as a protective barrier and maintains a moist wound environment to facilitate healing.
- Aquaphor® (ingredients: petrolatum, mineral oil, ceresin, lanolin alcohol) is more expensive than petroleum jelly. Like petroleum jelly, it acts as a protective barrier and maintains a moist wound environment. Some people report that it feels less greasy than petroleum jelly.
- Zinc oxide products are widely used and reportedly promote healing, protect the wound and surrounding area and reduce drainage of fluid from particularly moist wounds. These are often used in the diaper area and on other parts of the body. Product choices include Triple Paste, Dermagran®, Desitin®, A&D with Zinc Ointment® and Balmex®.
- Sunflower oil contains several compounds that are good for the skin. They include oleic acid, vitamin E, sesamol, and linoleic acid. Linoleic acid helps maintain the skin's natural barrier, supporting its ability to retain moisture and also has an anti-inflammatory effect when used topically making it effective for protecting skin against bacteria and germs. Sunflower oil is a non-comedogenic carrier oil that's good for any skin type. Organic, cold-pressed oil may be the best kind to use for skin.
- Emu oil has been a popular choice for years. Many people report it reduces inflammation, decreases scarring, facilitates healing and diminishes pain. It sounds too good to be true, but there are those with EB who swear by it.
- Vegetable oils such as Crisco® and olive oil have been used as emollients but are not generally recommended.
- Aloe vera products can be soothing and cooling. Some data suggests that aloe vera products decrease inflammation, aid wound healing, and have antimicrobial properties. There are rare reports of aloe vera causing contact dermatitis due to irritation or allergy.

Some products work better for some people more than others. Many people with EB report the best results when they rotate products; when one seems to stop being effective, they switch to another. Personal preference will determine which ointments you feel work best and which you choose to use on a given day.

Bandaging

There is wide disagreement about how much to bandage. Bandaging for protection only has its advantages and disadvantages. A blister, erosion or wound should be bandaged in the presence of these circumstances:

- The wound requires protection from further trauma or contact and friction from clothes.
- The wound is draining or bleeding.
- The wound requires topical treatment for infection.
- The wound is painful, and a dressing will improve comfort.

It would be ideal if one dressing was effective for every wound every time. Unfortunately, different wounds are at different stages of healing at any given time. Individual wound care products are designed for specific types of wounds in specific stages of healing. To optimize healing, each wound should be assessed during the dressing change, and product selection should be made based on these features:

- The dressing must be non-adhesive. No tape or adhesives should be applied to EB skin.
- Moisture balance is essential for healing.
- A dry wound will need moisture added with a dressing that hydrates or adds moisture to the wound.
- A moist, heavily draining wound will need the drainage removed from the wound bed by an absorbent dressing.
- An excessively draining wound may benefit from an alginate or a specialty absorptive dressing.
- An infected wound may benefit from a silver or other antimicrobial dressing (treatment is necessary for infected wounds; see section about infection).
- Personal preference matters greatly. If you do not find a particular dressing comfortable, then don't use it.

After you have determined the condition of the wound, choosing the proper dressing becomes easier.

Itching

Itching is common in EB and can interfere with the ability to concentrate, work, play and sleep. There are many causes:

- Wound infection
- Medication side effect
- Sensitivity from exposed wound/nerve tissue
- Iron-deficiency anemia
- Heat and sweating under bandages
- Presence of irritant or allergic sensitizers in ointments

When possible, treat and eliminate the underlying cause of itching. Often, however, that is not possible, and one must be creative in addressing the problem. Basic recommendations for managing itching include:

- Avoid harsh soaps and perfumed products.
- Eliminate wool and rough clothing.
- Launder clothing and linens in mild detergents and avoid use of fabric softeners.
- Run laundry through an extra rinse cycle.
- Bathe with mild soaps such as Dove or mild cleansers such as Cetaphil.
- Take lukewarm (not hot) baths and rinse thoroughly
- Add oatmeal (Aveeno® oatmeal bath) or cornstarch to the bath
- Add ½ cup table salt to bath water (standard bathtub, half-filled)
- Avoid prolonged exposure to heat and humidity
- Take up a hobby or activity that distracts from the itching
- Replace one sensation with another: Gently tap the area, or apply cool compresses
- Have wounds evaluated by a physician, and treat infection (bacterial, fungal, yeast) if present.
- Apply a soothing emollient or other product after the bath: Eucerin ®Calming cream, Emu Oil, Aveeno® fragrance-free moisturizing lotion, Aquaphor ®ointment
- Keep cool by maintaining a cool environment (air conditioned); refrigerating creams and ointments; applying refrigerated hydrogel sheet (Nu-gel®, Cool Magic®, etc.)

Medications are an option, as well. Consult your physician to discuss use of any medication:
Antihistamines

- Antihistamines such as diphenhydramine (Benadryl®), hydroxyzine (Atarax®) and cyproheptadine (Periactin®) may be effective. These drugs are categorized as first-generation antihistamines and may cause sedation, drowsiness and impaired thinking (more prevalent in adults than children). Alcohol and tranquilizers will increase sedation and should be avoided. Many people find it most helpful to take a sedating antihistamine before bedtime to help them sleep.
- Antihistamines such as Loratidine (Claritin®) or Cetirizine (Zyrtec®) are second-generation antihistamines. They are usually not as sedating as the first-generation antihistamines and may be effective for itching. Cetirizine has been reported to be especially effective for daytime use when taken at higher dosages. You should always consult with your doctor regarding any medication dose.
- Some individuals have reported decreased itching when taking a non-sedating antihistamine (such as Cetirizine) in the morning, and then taking a sedating antihistamine (such as hydroxyzine) in the evening.

When used regularly over time, antihistamines often lose their effectiveness, and higher doses may need to be given or a different one may need to be tried. Although no clinical studies have been done with the following medications for the treatment of pruritus (itchy skin) in EB patients, they have been reported to help in some situations:

- Doxepin is a tricyclic antidepressant but also is a potent antihistamine. Many people with EB have achieved relief or improvement in pruritus when the medication is taken at bedtime. (Topical doxepin cream [Zonalon] is not recommended, as it has been reported to cause allergic contact dermatitis and may lead to overdose when applied to large areas or open skin.)

If none of the aforementioned options are effective in treating pruritus, the patient should ask his or her physician to discuss the use of alternative medications with an EB specialist. Gabapentin (neurontin), ondansetron(Zofran), thalidomide are sometimes effective in treating severe pruritus. In addition, several antidepressant medications, including amitriptyline (Elavil), paroxetine (Paxil), and mirtazapine (Remeron) have been used to treat pruritus. Use of antidepressant medications in patients with EB may be very helpful in relieving not only the associated itching but may also be helpful in managing anxiety and depression. These medications should be prescribed only by physicians experienced in their use with regards to dosing, side effects, and appropriate monitoring.

Infection

The best treatment for infection is prevention. A clean environment, especially where dressing changes take place, is essential. This includes keeping the dressing-change location free from pets and cleaning it regularly with a disinfectant. Good hand hygiene is the single most important aspect of preventing infection. Alcohol-based hand sanitizers such as Purel are very effective. They provide fast, antimicrobial efficacy against many bacteria, including the antibiotic-resistant organisms MRSA (methicillin-resistant staphylococcus aureus) and VRE (vancomycin-resistant enterococci). If large jars of ointments are used, be certain to avoid “double-dipping” during dressing changes. Use a plastic spoon or knife or a wooden tongue-depressor to transfer a small amount of ointment into a plastic container or plastic bag. If you happen to contaminate the ointment, dispose of that portion. Everyone carries bacteria on their skin. The bacteria can live and multiply (colonize) without causing injury or infection. Under the right circumstances, these bacteria invade the skin, multiply, and cause infection. Circumstances that can increase the risk of infection include the following:

- Wound area: Larger wounds are more susceptible.
- Necrotic (dead or dying) tissue: Crusts, scabs and non-viable tissue should be softened and removed. This may be accomplished by irrigating the wound with water or saline or using a dressing such as a hydrogel.
- Malnutrition: Protein and numerous vitamins and minerals are required for wound healing.
- Poor blood flow to wound: Blood carries oxygen and nutrients.
- Every effort must be made to maintain good overall health to decrease susceptibility to infections.

Typical features of infection include:

- Delayed healing
- Increased exudate (drainage)
- Increased redness

- Increased pain
- Increased swelling
- Increased warmth of skin compared with surrounding area
- Malodorous (unpleasant odor)
- Easy bleeding

Wound infections are common. Use of oral antibiotics is best avoided, if possible, because EB is a lifelong disorder, and wound infections are a lifelong occurrence. If oral antibiotics are used indiscriminately, resistant bacteria may develop, and the individual ultimately may require IV antibiotics when treatment is required. Therefore, topical treatments are utilized as a first step. In any infected wound that is not improving with the use of topical therapy in 2-3 days should be evaluated by a physician. A wound culture may need to be performed in order to determine the cause of the infection and the antibiotics to which the microorganism is susceptible, and oral antibiotics may be required. Commonly prescribed topical antibiotics include: Mupirocin (Bactroban) cream or ointment: Mupirocin is effective against MRSA and other *Staphylococcus aureus* strains, Group A *Streptococcus*, and *Candida*. In general, this medication should be applied three times daily. However, most people with EB will not apply an ointment three times a day because doing so would involve dressing changes. Even if applying this medication only once per day, patients should seek medical consultation and treatment if there is no improvement in the infected area within three days. Please note that although Mupirocin is a topical medication, it still should be considered a potent antibiotic and should not be used casually or indiscriminately. It only should be used when an infected lesion is present. Resistant bacteria may develop from regular use of this medication. Silver sulfadiazine (Silvadene®): Silver sulfadiazine is an antibacterial and antifungal cream. Application occurs daily with dressing changes. The appeal of this medication and other silver products is that bacteria do not become resistant to silver. There are many questions about the safety of long-term use of silver products, in particular topical antibiotic creams. Until clinical trials prove they are safe on a regular long-term basis, individuals should use the products cautiously and for limited periods of time. Other topical treatments for infection include: Topical antifungal creams such as ketoconazole, econazole, and naftifine may be used if there is growth of yeast, most commonly *Candida albicans*. *Y Mupiroic*east are commonly found on the skin and do not usually cause infection. In the setting of recent or frequent exposure to antibiotics, however, which may reduce the population of normal, “good” skin bacteria, *Candida* species may overgrow and cause skin infection. Bleach is a sanitizer and disinfectant for a wide range of bacteria, fungi and viruses. A dilute bleach solution (two teaspoons of bleach per gallon of water) can be mixed and used as a compress or as a soak for heavily draining wounds or infected wounds. Bleach baths (1/8 to 1/4 cup of bleach in the bathtub) may be helpful when there are multiple infected wounds or frequent recurrences if the child can tolerate sitting in the bathtub. Acetic acid compresses or soaks are useful in treating *Pseudomonas aeruginosa* infections, which are resistant to many antibiotics. These bacteria are common inhabitants of soil and water, so they literally are everywhere. This is a bacterium that thrives in warm, moist environments but is unable to survive in an acetic environment. It has a characteristic fruity odor and blue-green color. Acetic acid can be bought or mixed at home from vinegar and water: If using 3 percent vinegar mix, create a 1:12 solution (1 part vinegar, 11 parts water) If using 5 percent vinegar mix, create a 1:20 solution (1 part vinegar, 19 parts water) When infection extends beyond the margins of the wound, or when a fever is present, the primary care practitioner should evaluate the individual and possibly prescribe an oral antibiotic. If oral antibiotics

are being prescribed, a wound culture should be obtained from the skin in order to determine the cause of the infection and the antibiotics to which it is susceptible. All of the antibiotic should be taken as prescribed. If doses are skipped, or the medication is discontinued because the area looks and feels better, some bacteria may survive and resist future antibiotic treatment.

- Silver dressings and wound gels containing silver are popular because of their antibacterial and antifungal properties. Silver products are appealing because bacteria do not become resistant to silver. There are, however, questions about the safety of long-term use of silver products. Until clinical trials prove these products are safe on a regular long-term basis, individuals should use the products cautiously and for limited periods of time. Use for up to 7 days on a wound is generally considered safe; after this time, a non-silver dressing may be used. Examples of silver dressings include Urgotul™ Contact Layer-Silver (Urgo Medical) and Mepilex Ag Antimicrobial Foam Dressing (Molnlycke Health Care) Polymem Silver Non-adhesive Wound Dressing (Ferris Mfg. Corp.).
- Honey is an ancient remedy for infected wounds. It has been rediscovered in an age where conventional medicine is being challenged by the development of resistant bacteria. The medical literature validates the antimicrobial action of honey against bacteria and fungi, as well its wound-healing properties.

Jennie Hon, an EB nurse specialist in the United Kingdom, published an article in the British Journal of Nursing that detailed one patient's experience healing a 20-year wound in 15 weeks using a honey-impregnated gauze dressing. There are other anecdotal reports from EB patients about wound healing with honey. Some people, however, report that it stings when applied, and that it seems to make their dressings heavier and uncomfortable. Active Manuka Honey (www.manukahoneyusa.com) is raw honey that has not been over-heated or over-strained. The available honey-containing products are Medihoney®. Regular, store-bought honey should NEVER be applied to the skin, in particular in infants, as it may contain the spores of *Clostridium botulinum*, which may cause infantile botulism, a disorder of muscle paralysis.

Wound Healing

A wound occurs when there is a break or opening in the skin or mucous membranes. Wound healing is a complex process that starts the moment an injury occurs and can continue for weeks or months. There are three stages to wound healing:

- The inflammatory stage: This stage starts immediately after the injury occurs and lasts from two to five days.
- The proliferative stage: This stage will begin about two days after the injury occurs, and can last as long as three weeks.
- The remodeling stage: This stage will begin about three weeks after the injury, and can last as long as two years.

Remember that this process is somewhat different in EB because wounds are acute, not chronic in nature. Often, they do not reach the remodeling stage in areas of high friction, because these areas re-blister frequently. During the inflammatory stage, in response to immediate bleeding, the blood vessels narrow (vasoconstriction). Platelets collect in the wounded area (platelet aggregation), and a

clot forms with assistance from thromboplastin (clotting factor). Specialized inflammatory cells — neutrophils, macrophages and monocytes — are recruited to the wound site where they ingest cell debris, along with microorganisms, to clean the wound bed. In the proliferative stage, blood vessels are regrown and skin cells called fibroblasts make collagens, which are important structural skin proteins. The wound edges start to knit together, and there is regrowth of epithelial skin cells (epithelialization). In the remodeling stage, the new collagen forms a stronger, more formal structure. Epithelialization continues, and the wound is healed. When wounds are healing slowly or appear not to be healing, the condition of the wound bed should be considered. The first step is to assess the ability of the wound to heal. Consider these factors:

- Is the blood flow adequate?
- Is the person anemic or malnourished?
- Is the wound infected?
- Is the wound too wet or too dry?
- Are steroids being used (these may inhibit wound healing)?

Treat any infection with the use of topical antibiotics or antimicrobial silver dressings. Choose dressings that support the healing process. Non-adherent dressings are essential to the wound-healing process in EB. Choose dressings that are appropriate for the type of wound. Continue to monitor the size, location and appearance of the wound, and assess whether the wound looks better or worse. The type of dressing used may need to be changed as the wound improves as well as if it does not. Address nutritional requirements. Make sure caloric intake is appropriate, in particular protein intake. Many children with EB also take vitamin and mineral supplements to aid wound healing, including iron, zinc, and vitamin C. Treat any associated itching to prevent scratching, which can interfere with wound healing. If the wound care plan does not improve healing, different treatments may be needed. Your wound care specialist may consider the use of alternative therapies such as specialized biological dressings, including Dermagraft® and Apligraf®.

Wound Care Products

There are thousands of exceptional wound care products available, and many are suitable for EB wounds and skin. This chart lists product categories and their properties. Click on the product category name to learn about the quality products AdaptHealth Patient Care Solutions (AHPCS) can provide.