LIMITATIONS FOR
EVIDENCE-BASED WOUND DEBRIDEMENT

by

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TO THE FACULTY OF WASHINGTON STATE UNIVERSITY:

The members of the Committee appointed to examine the Intercollegiate College of Nursing research requirements and manuscript of DENNIS RYAN HUNT find it satisfactory and recommend that it be accepted.

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Abstract

Limitations for evidence-based wound debridement

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Chair: Dr. Lorna Schumann

Wound healing problems are common in health care and cost the health care system billions of dollars each year. The choices in wound care product use should be guided by scientific research. With more than 150 companies selling between 200 - 300 different brands of wound dressings, there is need to have scientific research pointing to the most cost effective wound dressing. Currently, there are very few studies or randomized clinical trials that compare one wound dressing to another.

This manuscript reviews wound types and their impact on the health care system and explores the limitations of current research-based evidence for wound debridement methods. Efficient and cost-effective wound treatments are increasingly important to save human and financial health care resources. More studies are needed to ensure that the best, most efficient and cost-effective care is being provided.
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Introduction

Wound healing problems are common in health care and cost the health care system billions of dollars each year. Estimates of the number of people developing pressure ulcers each year range from 1.7 million to 2.5 million (Briones & Whittington, 2004; Hanson, Hunter, Langemo, Melland, & Olson, 2000). Health care expenditures to treat pressure ulcers range from $1.3 to $3.6 billion annually in the United States (Briones & Whittington; Dodd et al., 2004). Pressure ulcer treatment failures have been estimated to cost from $1000 to more than $50,000 per pressure ulcer (Bruce & Cali, 1999). In 1995, Medicare spending just on patients with lower extremity ulcers totaled approximately $6.16 billion (Corea, Harrington, Klitenic, & Zagari, 2000). In this environment of prospective payment, efficient, cost effective products are needed to minimize the costs involved in caring for wound patients.

The choices in wound care products should be guided by scientific research rather than subjective clinician choice (Boudreau, Cuddigan, Mosher, & Thomas, 1999). There are more than 150 companies that sell between 200 and 300 different brands of wound dressings in the United States and more are being introduced each year (Dobal, Jacox, Pieper, & Templin, 1999). Although each company has case studies and research that demonstrate their products’ effectiveness, few studies or randomized trials have been done to compare one dressing to another. In those instances where comparative studies have been done, the “newer” product has been compared to wet to dry dressings only. Even in these comparative studies, cost is rarely discussed.
Statement of Purpose

The state of comparative studies in wound debridement is examined by analysis of the literature obtained from a search of Medline and ProQuest. Wound types and their impact on the health care system are reviewed. Limitations of the current research-based evidence on debridement are explored and recommendations for future research are provided.

Wound Types

Most wounds can be classified into seven broad categories: pressure ulcers, venous leg ulcers, diabetic neuropathic ulcers, ulcers due to arterial insufficiency, surgical wounds, traumatic wounds, and wounds from other causes (Dobal et al., 1999; Dodd et al., 2004). Dodd et al. found that (1994-1998) the cost for just four of these categories of wounds in the New Mexico Medicaid fee-for-service system was $11.6 million dollars. If each state had the same cost to their Medicaid systems during those 5 years, these four categories of wounds would have cost the Medicaid systems of the country $580 million. It is important that these wounds be properly assessed, diagnosed, and have appropriate, cost effective plans of care developed to control overall cost and enhance clients’ quality of life (Dobal et al.).

Pressure Ulcers

Pressure ulcers are a common problem in all health care settings (Bergquist & Frantz, 1999). Approximately 2.5 million pressure ulcers are treated in acute care settings each year (Briones & Whittington, 2004). Long-term care facilities estimate pressure ulcer incidence from 6% to 28% each year (Ayello, Berlowitz, & Cuddigan, 2001; Baumgarten et al., 2003). Pressure ulcers are not limited to adults. Pressure ulcer
incidence rates in pediatric intensive care units are estimated at 16.9% to 26% each year (Baldwin, 2002). As previously noted, pressure ulcers cost the health care system $1.3 billion to $3.6 billion annually in the United States (Briones & Whittington; Dodd et al., 2004).

Pressure ulcers are areas of local tissue necrosis that are formed when soft tissue is compressed between a bony prominence and an external surface for a prolonged period of time (Cristini et al., 2004). Risk factors for developing pressure ulcers include impaired mobility, urinary and fecal incontinence, malnutrition, age, hypoalbuminemia, dry skin, anemia, neurologic abnormalities, smoking, moisture, and friction/shear forces (Bergquist & Frantz, 1999; Cristini et al.). Pressure ulcers are most commonly found over the sacral/coccyx area, hip, buttocks, malleolus, and heel, however they can occur over any bony prominence (Aloe et al., 2003; Dobal et al., 1999). Figure 1 summarizes common sites of pressure ulcers. Pressure ulcers are staged according to the extent of tissue necrosis that has occurred. These stages are labeled Stage I, Stage II, Stage III, and Stage IV. According to the National Pressure Ulcer Advisory Panel, or NPUAP (1994), a Stage I pressure ulcer is an observable pressure-related alteration of intact skin whose indicators, as compared to an adjacent or opposite area on the body may include changes in one or more of the following: skin temperature (warmth or coolness), tissue consistency (firm or boggy feel), and/or sensation (pain, itching). The ulcer appears as a defined area of persistent redness in lightly pigmented skin, whereas in darker skin tones, the ulcer may appear with persistent red, blue, or purple hues (NPUAP, 1994). A Stage II pressure ulcer includes partial thickness skin loss involving epidermis, dermis, or both. The ulcer is superficial and presents clinically as an abrasion, blister, or shallow crater.
A Stage III pressure ulcer includes full thickness skin loss involving damage to, or necrosis of, subcutaneous tissue that may extend down to, but not through, underlying fascia (NPUAP, 1994). The ulcer presents clinically as a deep crater with or without undermining of adjacent tissue (NPUAP, 1994). Finally a Stage IV pressure ulcer includes full-thickness skin loss with extensive destruction, tissue necrosis, or damage to muscle, bone, or supporting structures (e.g., tendon, joint, capsule) (NPUAP, 1994). Undermining and sinus tracts may also be associated with Stage IV pressure ulcers (NPUAP, 1994). See Figure 2 for the progression of pressure ulcer stages. As a pressure ulcer heals it is never “reverse” staged (Ayello et al., 2001). This means that once an ulcer has been staged at a Stage III, it can never be staged at Stage I or II, but remains a Stage III.

Several different types of dressings are noted in the literature as being used on pressure ulcers. These dressings range from hydrocolloids, transparent film, alginates, and foam to nerve growth factor (Aloe et al., 2003; Dobal et al., 1999). Also important to pressure ulcer healing is relief from the source of the pressure with pressure relief cushions and mattresses (Kearney & Kramer, 2000).

Prevention, however, remains the best treatment for pressure ulcers and the NPUAP have stated that 50% reductions in pressure ulcer incidence rates are possible (Ayello et al., 2001). The NPUAP has set guidelines of prevention points to reduce the incidence of pressure ulcers. These points are risk assessment, skin care and early treatment, mechanical loading and support surfaces, and education (NPUAP, 1992). Risk assessment includes considering all people that are bed bound or that have limited mobility to be at risk for pressure ulcers, the use of a method for risk assessment, such as
the Braden Scale, assesses all at-risk patients upon admission to a care facility and at regular intervals thereafter, and identifies all individual risk factors (moisture, incontinence, decreased mental capacity, poor nutrition) and modifies care to treat these factors (NPUAP, 1992). Skin care and early treatment includes inspection of the skin daily, bathing, treating incontinence, moisturizers, avoidance of rubbing over boney prominences, positioning, decreasing/avoidance of friction forces, nutritional support, rehabilitation to increase mobility, and documentation of interventions and outcomes (NPUAP, 1992).

Mechanical loading and support surfaces include repositioning at least every two hours, use of a repositioning schedule, use of pressure reducing mattresses and cushions, proper positioning in wheelchairs, teaching those persons who are able, to shift their weight in the wheelchair every 15 minutes, use of lifting devices to reduce dragging people during transfers, use of pillows to prevent boney prominences (such as ankles) from touching, use of devices to totally relieve pressure on the heels, avoidance of positioning people directly on the greater trochanter, and avoidance of lifting the head of the bed above 30 degrees, as much as possible (NPUAP, 1992).

Finally education includes instructing health care providers, patients, family, and caregivers about the etiology and risk factors of pressure ulcers and prevention techniques (NPUAP, 1992). Prevention of pressure ulcers and decreasing their incidence to the goal of 50% less could save the health care system $1.8 billion each year (Briones & Whittington, 2004). Beyond the monetary factors, prevention of pressure ulcers would also save those people who never get the pressure ulcers from the complications that can arise because of the pressure ulcer. These complications include cellulitis and abscess
formation, bacteremia and sepsis, osteomyelitis, and amputation, and even death (Bruce & Cali, 1999).

**Diabetic Neuropathic Ulcers**

Sixteen million people in the United States in 2002 had diabetes, and of those, 15% can expect to develop at least one foot ulcer at some point in their lives (Allen-Taylor, Berlin, Hoffstad, & Margolis, 2002; Birke, Horswell, Patout, & Pavich, 2002). Each episode of foot ulcers in people with diabetes can cost over $14,000 (Corea et al., 2000). Above this cost, an estimated 85% of the 80,000 people with diabetes that have lower extremity amputations in the United States each year start with a foot ulcer (Berlin, Kantor, Margolis, Santanna, & Strom, 2000; Corea et al.). Lower extremity ulcers significantly affect patient resource use and costs for people with diabetes (Berlin et al., 2000).

Diabetic ulcers are mainly due to neuropathy (Allen-Taylor et al., 2002; Berlin et al., 2000). Other causes of diabetic wounds that can be present on their own or in conjunction with diabetic neuropathy are lower limb arterial insufficiency and local trauma (Allen-Taylor et al.; Berlin et al., 2000). Risk factors for development of diabetic ulcers increase in those who have had diabetes for more than ten years, are male, have poor blood glucose control, or have cardiovascular, retinal, or renal complications (American Diabetes Association, 2004). Treatment for diabetic neuropathic ulcers generally consists of debridement, use of a moist wound dressing, and the use of a device to protect the wound area from pressure or trauma (Allen-Taylor et al.).

Once again, prevention is the best treatment for diabetic wounds. The American Diabetes Association, (ADA) (2004) recommends that all people with diabetes should
have annual foot examinations to identify high risk foot conditions, such as decreased protective sensation, alteration in foot structure and biomechanics, alterations in vascular status, and alterations in skin integrity. Those people with neuropathy should have a visual inspection of their feet at every visit with their health care professional (ADA). People with diabetes should be instructed to wear well-fitting shoes at all times and use regular self foot inspection and care (ADA). Screening for peripheral arterial disease by obtaining a history for claudication, assessing for pedal pulses, and by obtaining an ankle-brachial index (ABI) is required annually (ADA). Once risk factors develop the person with diabetes may need referral to a podiatrist, orthopedic surgeon, or rehabilitation specialist for further management (ADA).

Venous Leg Ulcers

Approximately 12% of people in the United States in 1988 who were age 65 and older had venous leg ulcers and this number is expected to reach 22% by the year 2030 (Conn et al., 2000). Venous ulcers account for approximately 80-90% of all leg ulcers (Brooks, Cherry, McGuckin, & Williams, 2001). Venous ulcers are estimated to cost the health care system between $2.5 and $3 billion dollars each year in the United States (Brooks et al.).

Venous ulcers (Figures 3, 4, & 5) are mainly due to venous disease and edema (Berlin et al., 1999; Conn et al., 2000). Some predictors of venous ulcers are diabetes mellitus, congestive heart failure, and peripheral vascular disease (Conn et al.). Edema management is necessary to heal venous ulcers and this can be achieved by compression wraps or compression stockings (Barwell et al., 2004; Berlin et al., 1999; Brooks et al., 2001; Conn et al.; Junger, Kohnen, Rabe, & Wollina, 2004).
Arterial Insufficiency Related Wounds

Arterial insufficiency ulcers occur when there is claudication of the arteries of the lower extremity. These ulcers are painful and well circumscribed (Messina, Pak, & Tierney, 2003). The ulcers generally occur over pressure points on the foot or ankle (Messina et al.). Prevalence data for arterial insufficiency related wounds was not found during the literature search except in conjunction with venous ulcers. Thus assessment of the cost and frequency of this particular type of wound is difficult to ascertain.

Treatment of arterial insufficiency ulcers involves the treating of the underlying cause of the ulceration. Ankle-brachial index measurements are useful in gauging the degree of arterial insufficiency (Messina et al., 2003). Treatment starts with the limiting of risk factors and initiating of an exercise program (Messina et al.). Risk factor reduction includes tobacco cessation, using lipid-lowering medications, using anti-hypertensives, controlling blood glucose in people with diabetes, and initiating a weight loss program (Messina et al.). Some medications are available to treat claudication, primarily to prevent platelet aggregation or to prevent clot formation in the area of occlusion (Messina et al.). With severe disease, surgery becomes a consideration and the patient should be evaluated by a vascular surgeon for further intervention (Messina et al.).

Surgical Wounds

Surgical wounds (Figure 6) include closed incisions, open incisions, and stab wounds, as well as skin graft and donor sites (Dobal et al., 1999). Dobal et al. reported that 46.5% of the patients from 13 home care agencies in Lower Michigan had surgical wounds. Delayed healing of surgical wounds can lead to prolonged recovery from
surgery, deep wound infection, increased morbidity and mortality, and increased costs (Georgeu et al., 2004). Reductions in the risks of delayed healing are of optimal benefit to treat surgical wounds (Georgeu et al.). Georgeu et al. reported findings demonstrating that using subcuticular vicryl sutures statistically decreased the risk of complications when compared to metallic skin staples and was therefore the preferable method for wound closure.

Traumatic Wounds

Traumatic wounds (Figures 7, 8, & 9) include burns, animal and human bites, gunshot wounds, knife wounds, shrapnel wounds, cuts, and other alterations in skin integrity caused by trauma. An estimated 1.5 million burn injuries occur in the United States each year (Copstead, Hoover, & Kravitz, 2000). An estimated 900 dog bite injuries occur each day in the United States. Animal and human bites account for an estimated 1% of all emergency room visits in urban areas (Jacobs, 2003).

Treatments of traumatic wounds vary according to the type and cause of the wound. For example burn treatment involves removing the source of the burn, fluid resuscitation if needed, protection of the airway if needed, nutritional support, skin grafting if needed, and meticulous wound care to cleanse, debride, and protect the wound (Copstead et al., 2000). Bite wound treatment includes vigorous wound cleansing and irrigation, x-rays to look for fractures and foreign bodies, suturing if needed for a non-infected wound, prophylactic antibiotics for wounds not showing signs/symptoms of infection, antibiotics for infected wounds, tetanus/rabies prophylaxis if needed, and dressings to protect the wound from further infection (Jacobs, 2003).
Other Wounds

All wounds that do not fit into any of the other categories are in this category.

Debridement

In general for wounds to heal they must first be debrided, after debridement appropriate dressings should be applied to manage drainage or add moisture to the wound bed and promote healing. Debridement methods can generally be put into four broad types, which are sharp, enzymatic, autolytic, and mechanical (Boudreau et al., 1999). There are dressings that do not fit into just one of these categories, such as TenderWet® that debrides by both autolytic and mechanical means. No matter what debridement type is used, for the wound to heal a healthy wound bed, free of non-viable tissue, is the optimal outcome. Although, the need for debridement of wounds is well known and multiple studies have been done on single debridement methods with different types of wounds, very few studies have been completed to compare one debridement method to another (Boudreau et al.). As the costs of health care continue to rise, the optimal choice of debridement methods should be based on evidence provided by studies comparing methods of debridement. Comparison of debridement methods will hopefully identify which method promotes the best healing, with the greatest speed and comfort for clients with varying types of wounds thereby decreasing wound care costs.

Framework

The Interaction Model of Client Health Behavior (IMCHB) is a conceptual model that guides studies to examine multiple factors that lead to health outcomes. The three main elements of the IMCHB are client singularity, client-professional interaction, and
health outcome. In this framework, the client is seen as an individual with background variables (including demographics, social group, previous health care experiences, and environmental resources), motivation, “cognitive appraisal”, and “affective response” that affects their health care and health outcomes. Cox (1982, p. 48) stated, “It is this unique combination of person and environmental characteristics that must be attended to by the health care professional in determining an interactional approach and plan of intervention.”

The IMCHB “identifies the client-professional interaction as a major influence on health care” (Cox, 1982, p. 51). The interaction includes providing health information, supporting client’s views, allowing the client to have some decisional control, and the technical competency of the professional. The client depends on the health care provider to deliver needed information and to have competency with the various treatment options in order to make decisions regarding the course to take to improve their health. With all the various methods of debridement that are available, it is important that the health professional have evidence-based information about these options to make informed decisions on how to proceed with treating the client’s wound.

Review of Debridement Related Literature

Most wound related research has centered around one individual intervention and this holds true with debridement methods. Little research has been done comparing two or more debridement methods to each other. Boudreau et al. (1999) used a non-experimental, computer modeling and decision analysis methodology to look at the outcomes from four methods of debridement. Boudreau et al. used a hypothetical elderly
female resident of a nursing facility with a new full-thickness pressure ulcer for their study. The debridement methods used were collagenase, fibrinolysin, autolysis, and wet-to-dry dressings. Results from their analysis showed that after two weeks there was a clean wound bed 70% of the time for collagenase, 57% of the time for fibrinolysin, 50% of the time for autolysis, and 30% of the time for wet-to-dry dressings (Boudreau et al). The study gives a theoretical basis for comparing wound debriding methods. The study, however, is limited by design and lack of human participation. The use of a hypothetical client instead of real clients limits the ability to generalize the findings. Outside variables and unique client characteristics are not fully accounted for due to the hypothetical nature of this study design.

Alvarez et al. (2000) reported on a comparative study of two enzymatic debriding agents. In this study a collagenase formulation and a papain/urea (Panafil®) formulation were compared to see which was most effective in removing “devitalized” tissue and promoting granulation tissue in pressure ulcers requiring debridement. Alvarez et al. used a prospective, three site, parallel group, comparative trial design. In all, 21 people were randomized and treated for four weeks during the study. Findings demonstrated that the papain/urea ointment was 2.6 times more effective than the collagenase ointment in debriding the wounds of devitalized tissue. The study was limited to only enzymatic debriding agents and did not compare these agents with any other debriding methods.

In two other studies, the investigators reported the benefits of early or rapid surgical debridement on the overall outcome of wound healing without infection (Aultman, Bilton, Mcmillan, & Zibari, 1998; Herndon, Low, Sanford, Spies, & Wolf, 2001). Aultman et al. retrospectively compared two groups of clients with necrotizing
fasciitis. One group had delays in early surgical debridement of their wounds and the other received prompt early debridement of their wounds. The group that received early surgical debridement had less complications and shorter hospital stays. The retrospective study done by Herndon et al. evaluated the treatment of 15 children with confirmed cases of toxic epidermal necrolysis. The study found that early surgical debridement of the affected area led to improved outcomes and lower rates of infection. Both of these studies, however, were limited to the surgical debridement of the wounds as this is the normal treatment for these conditions. The study performed by Herndon et al. was also limited to a small sample size due to the rare condition being studied.

Bichucher et al. (1999) and Church, Courtenay, & Ryan (2000) examined the use of maggots to debride wounds. Bichucher, et al. studied the “efficacy of (maggot therapy) in 25 hospitalized clients with nondiabetic chronic leg ulcers and pressure sores” (p. 623). The clients received treatments in a hospital in Jerusalem. According to reported results, the maggots completely debrided the wounds treated in 10 days and that these wounds healed faster than those treated with “only conventional dressings.” Findings included that “esthetic and psychologic aspects” were the main disadvantages of this debridement method along with pain in some instances. Church et al. studied the use of maggots as a debridement method in a hospital setting. They also reported that the maggots effectively debrided the treated wounds and did so in a “relatively rapid and very precise” way (p. 74). Pain was reported in one third of the cases studied. Maggot therapy may not be feasible in less controlled outpatient settings and the findings cannot be generalized to other settings.
Flemister (2000) reported on a case study of an 89 year old female with a foot wound covered by necrotic tissue that was treated in a wound clinic with TenderWet® dressings. The case study showed that by the 22nd to 30th day of treatment, the wound was debrided and had closed appreciably. It is important to note that the client studied had significant co-morbid disease processes including peripheral vascular disease, hypertension, and a history of deep vein thrombosis.

In another case study report, Flemister (2001) described three case studies that used TenderWet® dressings on three different clients with various wound etiologies. One wound occurred from a skin tear, another from a crush injury, and the third came from a fall. All three wounds had necrotic tissue or other debris in the wound that required debridement. In each case, TenderWet® dressings were shown to be effective in debriding the wounds and promoting the healing process. These case study reports are all limited in that they looked at individual subjects and used only one product. As a result, findings cannot be generalized and it cannot be determined if this product is more effective than any other product.

Summary Discussion of Debridement Research

The Interaction Model of Client Health Behavior (IMCHB) guided this evaluation of the wound debridement literature and uncovered serious limitations in the available evidence. Research has focused on the importance of getting a healthy wound bed to facilitate healing and prevent infection. However, there were no reports of experimental studies comparing the use of various debridement methods in the literature (Table 1). Most studies evaluated one type of debridement method and did not compare the
effectiveness and efficiency to any other debridement method. When comparison studies were done, they generally only compared the newer debridement method with wet-to-dry gauze dressings. Because new debridement methods have demonstrated consistently better results than wet-to-dry dressings, the science of wound debridement needs to move to comparisons between other, newer modalities. Only when comparative studies are done will the health care provider have the evidence-based information to give to patients to guide decisions about appropriate debridement methods.

Further, current research pays little or no attention to clients' background variables and unique characteristics, which may influence the type of method that will be acceptable. For example, surgical debridement has been shown to be the fastest way to debride a wound and is necessary in some situations and for some types of wounds. However, surgical debridement can be very painful to the patient and not all patients are surgical candidates. Similarly, maggot therapy has been shown to be a viable treatment, especially in cases where surgery is not possible or has failed to produce the needed results. Maggot therapy has been shown to be a quick, cost-effective alternative for debridement in a hospital setting. Unfortunately, patients' visual and mental perceptions of maggot therapy are a serious limitation and make the treatment unacceptable to many people. In addition, nearly one third of patients receiving maggot therapy reported associated pain and the use of maggots has not been proven as an option in uncontrolled outpatient settings. Future research must include measures of patient-specific variables to begin to build knowledge that links debridement methods with client characteristics.

Methodological limitations of the wound debridement literature also hampers effective clinical decision making. In general, the studies were done without benefit of a
theoretical or conceptual framework and had small, non-representative samples recruited from a single setting. Quantitative approaches were primarily used with lack of attention to specific client characteristics that may impact wound care choices and outcomes. In conclusion, analysis of the wound debridement literature via the lens of the Interaction Model of Client Health Behavior reveals many serious flaws about the available evidence and provides direction for further research.

Summary

As wound care becomes more and more complex and as wound care products are developed, health care providers will be more and more challenged to know what wound care should be suggested for each client. Efficient and cost-effective wound treatments are increasingly important to save health care resources, both human and financial. Wounds are time consuming problems and ways to decrease the time from initiation of care to wound healing need to be identified. The only way that the goals of quick, cost-effective wound care can be achieved is by studying different products and comparing them to one another. More theoretically grounded research is required to facilitate quality efficient and cost-effective care based on each patient’s unique characteristics and needs.
References


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<tr>
<td>Surgical Debridement</td>
<td>Fastest method of debriding a wound. Wound can be completely debrided in one day.</td>
<td>Often painful. Some clients cannot tolerate any surgical procedure due to poor health. Non-selective method of debridement.</td>
<td>Varies with the size of the wound and the location, medications, and staff needed for the debridement.</td>
<td>Previous studies have shown surgical debridement to improve outcomes, less complications, and shorter hospital stays.</td>
</tr>
<tr>
<td>Enzymatic Debridement Agents (includes Panafil®, Accuzyme®, and Santyl® ointments)</td>
<td>Fastest of all non-surgical debriding methods. Work very well on eschar covered wounds. Generally non-painful for the client. Generally selective in debridement.</td>
<td>Often seem to debride slower on slough filled wounds. Tend to be more expensive than some methods. Can cause occasional stinging when applied.</td>
<td>Varies per agent used and pharmacy obtained from; approximately $80-100.00 per tube.</td>
<td>Previous studies have shown that enzymatic debriding agents effectively debride wounds of necrotic tissue.</td>
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<td>Autolytic Debridement (includes use of hydrocolloid dressing, occlusive paste, or other occlusive dressing)</td>
<td>Generally non-painful for the client. Uses the naturally occurring wound drainage to break down necrotic tissue.</td>
<td>Slow method of debridement. Maceration of the peri-wound skin can occur. Cannot be used with diabetic clients due to risk of pushing infection into the underlying tissue.</td>
<td>Varies per dressing used; approximate range $15-30.00 per dressing. Dressing changed every 1-3 days.</td>
<td>Previous studies have shown that autolytic debridement does debride wounds.</td>
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<tr>
<td>Method</td>
<td>Characteristics</td>
<td>Cost</td>
<td>Notes</td>
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<tr>
<td>Mechanical Debridement (such as wet-to-dry dressings)</td>
<td>Generally non-painful for the client. Can be used on all clients. Non-selective debridement.</td>
<td>Varies per dressing used; range from $3 to $10 per day.</td>
<td>Previous studies have shown that mechanical debridement does work, however is a non-selective and slower method of debridement.</td>
<td></td>
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<tr>
<td>TenderWet® Dressing (example of dressing that do not fit into only one category.)</td>
<td>Non-painful. Reported to be faster than autolytic or mechanical. Can be used on all clients. Selective debridement.</td>
<td>Relatively unstudied to this point. More expensive than mechanical or autolytic. Uncertain if it works as fast as enzymatic.</td>
<td>Varies some per where dressings are obtained; approximately $7-18 per dressing used. Previous case studies have shown that this dressing does effectively debride wounds and promote healing.</td>
<td></td>
</tr>
</tbody>
</table>
Figure 1: Areas Pressure Ulcers Occur

Areas with little fat and muscle over bony prominences are common sites of bedsores.

Figure 2: Progression Of Pressure Ulcers

Figure 3: Stasis Dermatitis

Figure 4: Venous Insufficiency

*Figure 5: Cellulitis*

Figure 6: Sutures

Sutures aid healing by holding a wound together until the healing process is established.

Figure 7: Animal Bite Wound

Figure 8: Human Bite Wound

Severe puncture wounds and bruising

Figure 9: Laceration and Puncture Wounds