

Case Report

The Effectiveness of Silicon Wound Dressing for the Healing Process of Contaminated Abrasions

Efektivitas *Silicone Wound Dressing* untuk Proses Penyembuhan Luka Abrasi yang Terkontaminasi

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ABSTRACT

Wounds are skin disorders caused by pathological processes. Abrasion wounds are a type of acute injury. One of the contributing factors is traffic accidents. More than 1.2 million people died as a result of traffic accidents, while 20-50 million others suffered injuries. Choosing the proper dressing can determine wound healing. This case study aims to determine the effectiveness of silicone wound dressing in the healing process of contaminated abrasion wounds. Contaminated abrasion wounds are contaminated by dirty materials, which potentially cause infection. This case report describes four patients, Mrs. W, Mrs. K, Mr. Y, and Mr. M., who suffered abrasions on the face. Their wounds were cleaned in the operating room under general anesthesia. A silicone wound dressing is applied as the primary dressing. The secondary dressing depends on the amount of the exudate. On the 3rd day after the surgery, the wounds looked dry, so they were cleaned and reapplied with the silicone dressing. On the 7th day, after applying silicone wound dressing, the wound had epithelialized. Silicone wound dressing is a modern type of dressing that is effective for acute wounds as it provides a barrier against external contamination. Our sample shows that wound are abrasion contaminated. The result of silicone wound dressings applied was shown accelerate the wound healing process. Modern dressings accelerate wound healing 20% to 40% faster than conventional dressings, such as tulle or gauze.

Keywords: Abrasion, contamination, silicone wound dressing

ABSTRAK

Luka merupakan kelainan pada kulit yang disebabkan oleh proses patologis. Luka abrasi merupakan jenis luka akut. Salah satu faktor penyebabnya adalah kecelakaan lalu lintas. Lebih dari 1,2 juta orang meninggal akibat kecelakaan lalu lintas dan antara 20-50 juta orang mengalami luka. Pemilihan dressing yang tepat dapat menentukan penyembuhan luka. Tujuan dari studi kasus ini adalah untuk mengetahui efektivitas penggunaan *silicone wound dressing* pada proses penyembuhan luka abrasi terkontaminasi. Luka abrasi terkontaminasi merupakan luka yang terkontaminasi oleh material kotor sehingga berpotensi menyebabkan infeksi. Studi kasus pada penelitian ini melaporkan, 4 orang pasien yaitu Ny. W, Ny. K, Tn. Y, dan Tn. M yang mengalami luka abrasi pada wajah, luka dibersihkan di ruang operasi dengan pembiusan total. Kemudian dilakukan pemasangan *silicone wound dressing* sebagai balutan primer. Balutan sekunder yang digunakan tergantung dari jumlah eksudat yang dihasilkan. Pada hari ke-3 setelah operasi, luka tampak kering. Luka dibersihkan dan *silicone wound dressing* diaplikasikan kembali. Pada hari ke-7, luka telah mengalami epitelisasi. *Silicone wound dressing* merupakan salah satu jenis *modern dressing* yang efektif untuk luka akut karena mampu memberikan penghalang terhadap kontaminasi eksternal. Pada penelitian ini, keempat kasus yang dilaporkan adalah pasien dengan luka abrasi yang terkontaminasi. Hasil yang didapatkan, penggunaan *silicone wound dressing* mampu mempercepat proses penyembuhan luka. *Modern dressing* terbukti dapat mempercepat penyembuhan luka, 20% hingga 40% lebih cepat dibandingkan dengan *conventional dressing* seperti kasa atau tulle.

Kata Kunci: Abrasi, kontaminasi, *silicone wound dressing*

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DOI: <http://dx.doi.org/10.21776/ub.jkb.2024.033.02.16>

INTRODUCTION

Wounds are damage to normal skin resulting from internal or external pathological conditions that cause a break in skin continuity (1). Wounds can be classified into acute and chronic based on their characteristics and time spent on the healing process. Acute wounds are skin damage that depend on their depth, size, extent, and predicted healing time. Mechanical damage (abrasions, lacerations, penetrating wounds, or surgical wounds), contact with radiation, electricity, corrosive chemicals, and direct contact with heat sources are the main causes of acute injuries (2). Chronic wounds are more difficult to treat than acute wounds as they require more time to heal and can result in significant problems that need tissue removal (3). Both acute and chronic wounds have detrimental impacts on the healthcare system and the world economy (4).

The incidence of injuries continues to increase every year. Globally, more than 1.2 million people died from traffic accidents, and 20-50 million others suffered from injuries. The most common causes of injury are pressure ulcers (21%), leg ulcers (28%), and trauma (48%). In the last few decades, there has been an increase in traffic accidents in Indonesia, resulting in a high number of injuries. From January 2016 to March 2017, the Acute Surgical Care Unit of Dr. Soetomo Regional Hospital of Surabaya treated 147 orthopedic patients with injuries; four out of five are males, and 90% have traumatic injuries (1). The Malang Police Traffic Unit recorded 793 traffic accidents throughout 2022. In 2023, every day, 1 to 2 accidents took place in the city. At Lavalette Hospital, 65 patients have been treated due traffic accidents in the last three months, and nearly 90% of them have had contaminated abrasions.

Abrasions are acute wounds that are often overlooked during patients' arrival at the emergency room. This is understandable because the first thing to do is emergency treatment. However, after the emergency was resolved, the patients started to complain about abrasions, which were in the form of thick eschar, tattoos, and abnormal scar tissue. Abrasions occur when the skin rubs against a non-sharp object, causing it to peel. Contaminated wounds include open, fresh wounds, and especially accidental wounds. Therefore, appropriate management is needed to avoid complications or adverse effects from contaminated abrasions.

Wound management is a major challenge worldwide as it

affects the financial burden of governments in any country (5). Wound management is the administration of comorbidities and sequelae that may occur after injury. It requires changing the dressing and cleaning the wound. Conventional methods of wound care, which employ tulle and gauze, are the most widely used ones. It has several disadvantages, such as frequent dressing changes and lengthy healing time, which increase treatment costs. In addition, wounds treated with this method often create discomfort because they tend to stick to the dressing (1).

Wound dressings can facilitate healing (5). The choice of dressing determines the healing and the integrity of the patient's skin. Ideally, dressings aim to speed healing and prevent further tissue damage. They provide appropriate moisture levels and serve as a barrier against bacterial invasion. Their usage has many advantages in terms of thermal isolation, debridement, growth factors and enzymes supply, gas exchange, and protection for free nerve endings to reduce pain (6).

Modern dressings have improved biocompatibility, degradability, pain-relieving trait, and retention to moisture as well as serve to facilitate wound function. Some modern dressings currently used in clinical practices are hydrocolloid, alginate, hydrogel, foam, and film dressings (4). Silicone wound dressings are synthetic compounds made from long-chain polymers. This compound rarely causes negative reactions because it has a very low level of toxicity and cannot be absorbed by the skin. Silicone wound dressings have a soft, hydrophobic silicone coating that is sticky and non-drying. It has stable chemical properties and good flexibility and softens the stratum corneum (7). Silicone wound dressing has one of the main advantages that distinguishes it from other dressings. Silicone wound dressings can help maintain optimal moisture in the wound area and provide a barrier against external contamination. Silicone is also known for accelerating the epithelialization process and minimizing the risk of infection and scarring (8). Therefore, silicone wound dressings are one of the main choices for patients with contaminated abrasions. This case study aims to determine the effectiveness of silicone wound dressings in healing contaminated abrasions.

CASE REPORT

This case study involves four patients: Mrs. W, Mrs. K, Mr. Y, and Mr. M. The specific criteria for the selection of the four patients were based on patients who have had traffic



Figure 1. Patient with initial Mrs. W (A) Abrasion on the face contaminated (B) Using of silicon wound dressing (C) Seven days after silicone wound dressing application



Figure 2. Patient with initial Mrs. K (A) Abrasion on the face contaminated (B) Using of silicon wound dressing (C) Seven days after silicone wound dressing application



Figure 3. Patient with initial Mr. Y (A) Abrasion on the face contaminated (B) Using of silicon wound dressing (C) Seven days after silicone wound dressing application



Figure 4. Patient with initial Mr. M (A) Abrasion on the face contaminated (B) Using of silicon wound dressing (C) Seven days after silicone wound dressing application

accidents during the predetermined period, which were then brought to Lavallete Hospital Malang. The patient had a contaminated abrasion wound on the face. They were given the same treatment using silicone wound dressings. The first treatment was carried out in the operating room under general anesthesia. The wound was rinsed and swept with a sterile brush until the contamination disappeared and the blood spots appeared. Then, a silicone wound dressing was applied as the main dressing. The amount of the produced exudate determined the choice of the secondary dressing. In this research, calcium alginate was used for the secondary

dressing.

On the third day after the surgery, the wound looked dry. After removing the dressing, it was cleaned using sterile gauze and bandaged again with 0.9% NaCl fluid and a silicone dressing. On the seventh day, the wound was evaluated, and it was found that the abrasion had epithelialized and become smooth.

Overall, all four patients received the same treatment. The four patients also did not dehiscence the wound during the healing process, so the time needed to reach the epithelialization phase only took seventh days.

DISCUSSION

Figures 1A, 2A, 3A, and 4A show that all of the patients experienced contaminated abrasions on the face, where the wounds affected the epidermis layer of the skin, making it look reddish. Contaminated wounds include open, recent, and accidental wounds. The possibility of wound infection is 10 to 17 percent. Abrasions are defined as superficial wounds that occur on the skin and visceral layers of the body, disrupting tissue continuity. They mostly occur due to frictions on the epidermis, causing epithelial and papillary layer losses, but usually do not cause significant bleeding. However, this type of wound is usually painful due to the exposure of the nerve endings in the reticular dermal layer. Most wounds heal without leaving a scar. However, if the abrasion is deep enough into the dermis, scar tissues can form during the healing process (9,10).

Based on their clinical and etiological factors, abrasions are classified into three types: linear, scratch, and patterned. In the four cases above, the wounds were classified as scratches. Scratch abrasions are caused by friction with a large, rough surface. They mostly occur following traffic accidents (9). As in this study, all four patients had 2nd-degree abrasion wounds that were contaminated with dirty materials, such as soil, sand, leaves, and other contaminants. Silicone wound dressing was the main choice with the aim of accelerating the epithelialization process in the wound.

Based on Figures 1A, 2A, 3A, and 4A, all four patients experienced the inflammatory phase, where hemostasis occurs involving blood vessel narrowing, platelet aggregation, fibrin net formation, and vascular reaction activation. In this phase, white blood cells destroy germs in the wound area and produce chemical compounds that repair damaged tissue. Then, new skin cells grow and cover the wound. According to Wallace *et al.*, during the inflammatory phase, hemostasis, chemotaxis, and increased blood vessel permeability occur, which helps close the wound, stop further damage, remove germs and cell debris, and trigger cell migration. This phase usually lasts for several days (11).

Figures 1B, 2B, 3B, and 4B show that the wound was cleaned first. This step is very important because the skin epidermis loss causes the body's outer protective layer to blister, increasing susceptibility for *Clostridium tetani* and *staphylococcus aureus* infections. The wound cleaning was performed using general anesthesia, a clean, sterile brush, and 0.9% normal saline. This liquid is considered to be the safest because it is isotonic, has minimal risk of triggering allergic reactions and irritation, and does not disturb the balance of normal flora in the skin (9).

After the wound was cleaned, a primary dressing was applied. The type and location of the wound, the likelihood of infection, and the volume of the produced exudate influence the dressing selection procedure. Since shallow wounds usually do not produce much exudate, semipermeable dressings can be used to treat them (10). The case management in this study prioritizes silicone wound dressing because the wound produces mild to moderate exudate, and silicone wound dressing has non-adhesive properties that can minimize trauma to newly formed tissues. So, it does not use other modern dressings with similar properties, such as hydrocolloids. Hydrocolloid dressings are made of hydrophobic materials

that come into contact with wound exudate, so these dressings are preferred for ulcer wounds (8). In the four cases above, a silicone wound dressing was used. It can be applied directly to the face area.

The silicone layer in contact with the wound has several properties and features, making it very suitable for treating abrasions (12, 13); a.) Reducing trauma during wound dressing changes. The type of adhesive used in the dressing is one of the most important aspects of wound care. Unlike acrylic adhesives, silicone adhesives do not dry out but remain sticky. This ensures easy removal as this type of adhesive does not adhere aggressively to the wound bed. b.) Flexible and adjustable. Skin tears can occur anywhere on the body such as face, knees and elbows because these body parts have protruding bones and increased movement, which can interfere with the position and the integrity of the dressing. Silicone dressings are made of a thin, flexible mesh, and this provides comfort and minimizes pulling on the skin around the wound. c.) Enabling innovative exudate management. The silicone layer's porous structure allows exudates to pass through the secondary dressing and be cleaned easily. This reduces the risk of maceration or infection and speeds up wound healing. d.) Providing better visual control. The silicone layer makes it easier for doctors or nurses to observe and monitor the skin tears. This can be done by removing any bandages or secondary dressings that may have been used to absorb blood or exudate and by ensuring the flap remains undisturbed.

Figures 1C, 2C, 3C, and 4C show that, after the silicone dressing was removed, the wounds of the four patients began to improve. The patient's wound epithelized, and the skin began to heal. The pictures also show that in the proliferation stage, the formation of new tissue has occurred. It was characterized by the formation of scar tissue on the wound. During this process, collagen production in the wound area increases. Collagen is a protein fiber that gives strength and elasticity to the skin. The presence of collagen makes the edges of the wound shrink and close.

Small blood vessels or capillaries then form in the wound to provide nutrition to the newly formed skin. Skin injuries that extend to the dermal and subdermal tissue, such as abrasions, can cause scar tissue formation that contracts strongly and, over time, can cause physical limitations. Therefore, scar prevention should be addressed early. According to Wallace *et al.*, granulation tissue formation, re-epithelialization, and neovascularization are the characteristics of the proliferation phase. This stage may last for several weeks (11).

The results of this study indicate that silicone wound dressings, which are used as the primary dressing, are effective in healing contaminated abrasions. The time required for the healing process is relatively shorter than the time needed in the research conducted by Shetty *et al.*. This study uses paraffin gauze as the primary dressing for facial abrasions. The time required for healing is around two weeks. However, this study is limited in terms of silicone wound dressing application, as it was only applied to abrasion wounds on the face. Future research is expected to examine silicone wound dressings in all abrasions and other types of wounds. Further, it is also necessary to carry out comparative research between silicone wound dressings and other dressing modalities. In addition, future research that can validate silicone wound

dressings' effectiveness can be seen from clinical and economic aspects. From the clinical aspect, research can be conducted on the long-term evaluation of silicone wound dressings, including potential risks and benefits. As for the economic aspect, cost-effectiveness evaluation research can be carried out so that the amount of the advantage of using silicone wound dressing can be known when compared to conventional dressings.

Silicone wound dressings can also reduce scars by increasing the occlusion and the hydration of the wound. Increased hydration and occlusion have a physiological effect on scars by helping the newly formed and underdeveloped stratum corneum maintain its ideal water levels. Well-dehydrated stratum corneum signals the keratinocytes in the epidermal layer of the skin to produce cytokines, which in turn signals the fibroblasts to produce excessive amounts of collagen to help with water retention (14). The occlusion degree of silicone wound dressings is comparable to that of normal skin, which may lead to decreased fibroblast and cytokine activity as well

as collagen production in the scar (15).

Based on the findings above, silicone wound dressings effectively treat contaminated abrasions wounds. They are recommended as a standard treatment for abrasions on other body parts and for other acute wounds. The limitations of this study are the limited number of respondents, so the data presented are only descriptive, which allows bias. The results cannot be generalized because this study did not compare conventional dressing treatment and control groups to determine the effectiveness of using silicone wound dressing on contaminated abrasion wounds.

ACKNOWLEDGEMENT

The authors would like to thank their colleagues for their contributions to the research and the writing of this article. Highest gratitude is also expressed to the patients and their family who have allowed the authors to report their case to them.

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