



A comparative study of collagen dressing and silver dressing in partial thickness burns

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ABSTRACT

Burn injuries present a major public health problem in both adults and children. The common causes of burn injuries are thermal burns, scalding, or direct contact with hot surfaces. Burn injuries are common in children as thinner skin tolerates less heat at a shorter duration before full-thickness injury occurs. Biological dressings like collagen are impermeable to bacteria and create the most physiological interface between the wound surface and the environment. Collagen dressings have other advantage over conventional dressing's interns of easy application and being natural, non-immunogenic, nonpyrogenic, and hypo-allergic and pain free. The present study has been conducted to compare the efficacy of collagen dressing with that of conventional dressing materials like silver sulfadiazine, in the management of burns. During the period of study, the data were collected and analyzed regarding the age and sex of the patient, type of burns, time period for presentation, degree and percentage of burns, and complications. Results are analysed and discussed. This study concludes that the collagen dressing is more cost effective than conventional silver dressings in partial thickness burns patients.

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INTRODUCTION

Burn injuries present a major public health problem in both adults and children. The common causes of burn injuries are thermal burns, scalding, or direct contact with hot surfaces. Burn injuries are common in children as thinner skin tolerates less heat at a shorter duration before full-thickness injury occurs.^[1] A deep partial thickness injury has the capacity to heal if a moist wound bed and adequate circulation are maintained and there is no infection. In the absence of the above factors, a partial-thickness burn wound converts into a full thickness wound.^[2]

Biological dressings like collagen are impermeable to bacteria and create the most physiological interface between the wound surface and the environment. Collagen dressings also have other advantages over conventional dressings in terms of ease of application and being natural, nonimmunogenic, nonpyrogenic,

hypoallergenic, and pain-free. Collagen is an endogenous substance, which forms an important structural component in connective tissue and is of special importance in the skin. The importance of collagen in healing has been appreciated for many years for the simple reason that the end result of wound healing is always a scar which is composed of collagenous fibres.[3] Biological dressings with collagen create them physiological interface between the wound surface and environment and are impermeable to bacteria. Collagen dressings have other advantage over conventional dressings interns of easy application and being natural, non-immunogenic, nonpyrogenic, hypo-allergic and pain free.[4]

The present study has been conducted to compare the efficacy of collagen dressing with that of

conventional dressing materials like silver sulfadiazine, in the management of burns.

Methodology:

A retrospective, observational study was carried from 2016-2018 in which 120 burn patients were included in the study. Patients with clean, first- and second-degree burns with burn surface <50% were included in the study. Patients with full-thickness burns, surface more than 50%, electric burns, and with infected wounds were excluded from the study. Patients with burns over ear, genitalia, palm, and sole were also excluded from the study. The patients were assessed clinically, and the percentage of burn was calculated by Lund and Browder formula. A total of 120 cases were included, of which 60 were treated with collagen sheets and 60 with silver sulphadiazine ointment application with regular dressings.

After initial stabilization, wound dressing was done. The affected area was thoroughly cleansed for the removal of any external contamination under strict aseptic condition. The blisters were deroofed by excision of the blistered skin. Collagen sheet of bovine origin available in sterile preserving medium were used. These sheets are available in size from 5 cm × 5 cm up to 20 cm × 40 cm. The size of sheet selected depending on the size of the burn wound.

Collagen sheets were washed with normal saline before application to remove all traces of preservation fluid and then were applied firmly over the burn areas. Over stretching of the sheets was avoided. All air bubbles between the wound and the collagen sheet were pushed out using the back of the forceps. It was ensured that circumferential burn areas, especially in the extremities when dressed with collagen sheets have a linear gap in the entire length of the extremity. This was done to avoid compression effect secondary to oedema. Adequate drying of collagen sheet was confirmed. To avoid displacements of sheet, a dressing was given.

In the other group, after wound cleansing as mentioned above, patients were treated with silver sulphadiazine ointment daily after giving saline wash.

Patients were managed with antibiotics and analgesics and intravenous fluids depending on the percentage of total body surface area involved. Dressing if given was changed after 48 h. Patients with small areas of collagen sheet application were

discharged and followed in the outpatient department. The collagen sheet dries at the periphery and peels; it is then clipped off gradually till the wound heals completely. This usually takes 10–14 days.

Data collection: During the period of study, the data were collected and analyzed regarding the age and sex of the patient, type of burns, time period for presentation, degree and percentage of burns, and complications.

Results:

Patients subjected to collagen dressings were classified under Group I and those who underwent 1% silver sulphadiazine dressings were classified as Group II. Patients demography Age at Presentation In this study the age of the patients ranged between 21 years to 65 years. 34% of the patients were in 21–30 age group. This includes 30% in group I and 43% in Group II. In this study 56% of the patients were males, as compared to females who made 44% of the total cases. Type of burns in this study in most of the cases were flame burns constituting 83%, And the rest were flame burns which were 17%. Most of burns in 3.6% of cases were accidental in nature i.e 96.4% were intentional accidents. The p-value being less than 0.0001 implies statistically significant reduction of pain in Collagen group as compared to those in silver dressing group. Healing time is the time taken for more than 90% epithelialisation of the wound. The study by Gupta et al recorded an average healing time of 14 days in patients treated with collagen dressing while Mukund B Tayade et al recorded 12.64 days in collagen group and 18.44 days in the silver sulphadiazine group [7,8]. Marilyn Kwolek et al, in his study observed median time to heal was 7.2 days in the collagen group versus 14.5 days in silver sulphadiazine [SSD] group[9]. In these study patients with burns < .0001, inferring that pain in collagen dressing is significantly less compared to that in silver sulphadiazine dressings on day 1. Pain assessment on Day 2: On day 2, in collagen dressing group, 100% of patients had pain score less than 5, whereas with SSD dressings, 80% of patients had pain less than 5. Comparison of pain in both the groups on day 2 showed a significant difference with p Value.

Wound healing time showed a significant difference with p value of 0.0001. Indicating faster healing time in collagen dressing is statistically significant. 87%

of patients with collagen dressing had no infection. Infection collagen dressing is much lower than with SSD Patients in Group I had good wound healing with healthy scar formation in 87% after 4 weeks compared to group II. Cost analysis: During this study it was seen that the healing time of wounds dressed with collagen dressings was much lower than that with SSD dressing. Moreover collagen dressing was done only one time in comparison with the SSD dressings which were multiple. On the basis of this cost estimation was done with an example of 30% burns in each group.

The cost of collagen dressing is less compared that of silver sulphadiazine group in a patient with 30% burns but it is not statistically significant (p value > 0.05). In SSD Dressing in addition to the actual dressing cost many other cost like, the prolonged hospital stay as a result of delayed wound healing, the additional doses of analgesics and antibiotics needed with SSD group as a result of increased pain, delayed wound healing and increased infections, loss of labour and time and money spent every time for the accompanying person taking care of the patient, time spent by the doctor to perform the dressing. If all these taken in to consideration collagen dressing, is significantly more cost effective than SSD dressing

Discussion:

Burn injuries produce coagulative necrosis of the skin and underlying tissues which are very painful and are associated with complex local and systemic pathology and a high mortality. Superficial burns, i.e., first-degree burns heal in 5–7 days without any scarring. While superficial dermal or deep dermal burns, i.e., second-degree burns take 2–4 weeks to heal and are extremely painful. Second-degree burns if not treated promptly and properly may get infected and converted into third degree, i.e., deep burns resulting in scarring and contracture formation. The goal of burn therapy in children is to prevent infection, limit pain, decrease metabolic demand, promote healing, and minimize disability. The use of a biologic wound covering in pediatric burns reduces the number of dressing changes and minimizes all components of standard burn therapy. By protecting the wound, a biologic dressing may accelerate healing and decrease the development of a hypertrophic scar [10].

A biological dressing like collagen is a unique protein with a triple helical structure, and each helix has over 1000 amino acids. The main type of collagen in the skin is Type I collagen. [11] Chemically, bovine collagen is very similar to the human form. Collagen sheets are produced from bovine tissues comprising mostly Type I and III collagens. For these reasons, collagen sheets are well qualified for use as an effective wound cover. Collagen sheet is prepared from a bovine collagenous tissue by treating tissues with a series of chemical and enzymatic procedures. This is followed by chemical crosslinking, packing, and sterilization. Granulation tissue developed at a normal rate and the cellular events were precisely the same as those occurring in normal wounds. [12] Collagen sheets are very useful in first- and second-degree burns. The cost factor comes down, and the pain associated with dressing can be avoided. [13] The cost incurred by both the parents and the hospital associated with multiple dressings can be avoided by a single collagen dressing. It is especially useful in children since the psychological trauma to the child and parents are minimized.

Biologically, the collagen sheet is noninflammatory, nontoxic, has low antigenicity, has minimal degradation, facilitates migration of fibroblasts and microvascular cells, and helps in synthesis of neodermal collagen matrices, thus minimizes scarring. Physiologically, it is elastic, soft, supple, and has good tear strength. It is impermeable to bacterial migration, modulates fluid flux from the wound, and has enough strength to be peeled off from the wound. [13] Collagen sheet has been found to be well tolerated in clinical trials. There have been no reports of clinically significant immunological or histological responses to the implementation of collagen sheet and no reports of rejection of collagen sheet. [14] There is no threat of HIV or hepatitis infections as bovine material is obtained from countries free of bovine spongiform encephalopathy and possesses a long shelf life under normal storage conditions. [15]

The use of collagen dressing has been found to inhibit the action of metalloproteinases. Collagen is a biomaterial that encourages wound healing through deposition and organization of freshly formed fibers and granulation tissue in the wound bed thus creating a good environment for wound healing. [16] Collagen

sheets, when applied to a wound, not only promote angiogenesis but also enhance body's repair mechanisms. Collagen serves as a template for the infiltration of fibroblasts, macrophages, and lymphocytes and attracts additional monocytes to the wound, thus increasing the amount of debris removed and capillaries forming the neovascular network. As healing progresses, collagen is deposited by the fibroblasts, replacing the collagen portion of the collagen sheet.^[16] Moreover, it is easy to apply and has the additional advantage of stopping bleeding.

A study done by Singh *et al.* has shown that the use of collagen dressings hastens the wound healing in various types of wounds, reduces scar contracture, and reduces the need for skin grafting. [17] In a study by Gupta *et al.*,^[7] collagen sheet cover was used in 32 cases of fresh burns and 26 cases of postburn contractures. It safeguards against exogenous infection, prevented exudation from the raw areas, and provided rapid epithelialization and healing. Gerding *et al.*, Barret, and Jaun *et al.* concluded that Biobrane therapy can significantly decrease pain, total healing time, and length of hospital stay with improved compliance.^[18,19] Demling and Desanti, *et al.* in their study concluded that a bioengineered skin substitute significantly improves the management and healing rate of partial thickness facial burns compared to the standard open topical ointment technique

Cost efficacy In the present study the average cost beared by a patient with 30% burns treated with collagen with an average healing time of 13.2 days was lower than those treated with SSD with average 9 dressings, with a p value greater than 0.05; it is not statistically significant. But the patients treated with SSD had to spend more due to prolonged hospital stay, more analgesic, antibiotic usage, including loss of time and labour of both the patient and the person accompanying.

Conclusion:

Collagen dressings helped to form a mechanical barrier between wound and environment thus preventing infections. The rate of wound healing was significantly faster in collagen dressing than SSD. This was due to the proper ties of collagen proving an optimum environment for early wound healing. The morbidity of patients too is less as the scar formation

is healthy in most of the patients using collagen owing to its properties of inducing granulation and epithelialisation. The collagen dressing is more cost effective than SSD.

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