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Original Article

Comparison of Collage Dressing with Sulfadiazine Dressing in Management of Partial-thickness Burns

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Abstract

Introduction: 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 fibers.

Aims: This prospective randomized controlled study was designed to compare the effectiveness of collagen dressing and silver sulfadiazine dressing in partial-thickness burns.

Materials and Methods: This study was conducted at Government Royapettah Hospital, Chennai. A total of 60 patients with partial-thickness burn wounds were included in this study, and they are divided into two groups. Group 1 consisted of 30 patients in whom collagen dressing was done. Group 2 consisted of 30 patients in whom silver sulfadiazine dressing was done. The variables analyzed were pain score, infection rate, the rate of healing of the wound, resultant scar, and patient compliance. Patients with partial-thickness burns involving <40% of the total body surface area and wounds not older than 24 h are inclusion criteria in the study, whereas patients with full-thickness burns, burns involving >40% of the total body surface area, wounds older than 24 h, and facial burns are the exclusion criteria for this study.

Results: The average pain score in the range of 0–10 was 7.10 in the silver sulfadiazine group and 2.87 in the collagen group. Infection was present in 40% of the patients in the silver sulfadiazine group, whereas it was only 13.3% in the collagen group. In silver sulfadiazine group, healing was achieved on an average of 17.77 days, whereas in the collagen group, it took 11.80 days.

Conclusion: Collagen sheet promotes early healing, decreases the need for analgesics, and reduces the incidence of associated complications such as infection. The morbidity of the patients is reduced as the resultant scar is better in the majority of the patients using collagen. Due to the simple application and good tolerance of the membrane, collagen can be advocated as a temporary biological dressing material in partial-thickness burns.

Key words: Collagen, Dressing, Partial-thickness burns, Silver sulfadiazine

INTRODUCTION

Wound healing is a dynamic process, which proceeds through overlapping phases of inflammation, epidermal restoration, wound contraction, and remodeling. This process relies on the dynamic interaction of cells, soluble factors, and the extracellular matrix (ECM) so that inflammation can rapidly be resolved to allow for the ingrowth of fibroblasts and keratinocytes.[1] Activation of platelets, secretion of inflammatory cytokines, migration of macrophages, fibroblasts, and keratinocytes, and expression of matrix metalloproteinases and growth factors are keys to promote wound contraction and closure, ultimately leading to mature ECM and the formation of functional neotissue. All burn injuries are painful. First-degree or very superficial partial-thickness burns may damage only the outer layers of the skin (the epidermis) but they cause mild pain and discomfort, especially when something such as clothing rubs against

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the burned area.[2,3] They are common entities encountered in our daily clinical practice. Dressings play a vital role in the management of burn wounds.[4] As burn injuries are common in developing countries, there is an urgent need for a method by which these injuries heal early with less pain, discomfort, and scarring. The major fibrous protein found among the extracellular connective tissues is the collagen. In the whole animal kingdom, collagen is the most plentiful and ubiquitous protein. The term collagen originated from the Greek word "kola," meaning glue plus gene. Of the total protein in the human body, 25% is constituted by collagen and it also constitutes about 70–80% of the skin.[5,6] In the past few decades, scientists have developed a remarkable interest in employing collagen for collagen. Hence, a need is felt to compare the wound healing process in collagen dressing and dressing with silver sulfadiazine.

Aim

This prospective randomized controlled study was designed to compare the effectiveness of collagen dressing and silver sulfadiazine dressing in partial-thickness burns.

MATERIALS AND METHODS

This prospective comparative study includes inpatients and outpatients with partial-thickness (1st and 2nd degree) burns of Government Royapettah Hospital. All patients were interviewed as per the pro forma, and a complete clinical examination was done. Patients with partial-thickness burns involving <40% of the total body surface area are assessed. Cases are allocated randomly into the test group and the control group. Cases in the test group were treated with collagen dressing. Cases in the control group were treated with silver sulfadiazine dressing. Groups are done taking into account, the confounding factors, which are matched. Cases are assessed for healing time, pain, healing quality, infection, and patient compliance. Inclusion criteria: All patients with partial-thickness burns, involving <40% of the total body surface area, and burn wounds not older than 24 h were included in the study. Exclusion criteria: Patients with full thickness burns, burns involving >40% of the total body surface area, electrical and other non-thermal burns, and burn wounds older than 24 h facial burns/perineal burns were excluded from the study. For collagen dressing: The collagen used for this study is purified reconstituted collagen. The collagen which is free from other components that are normally associated with it in its native state is referred to as purified collagen. Reconstitution is the process in which reassembling of the collagen into individual triple helical molecules with or without their telopeptide extensions is done. Then, it is brought into solution after which it is regrouped into the desired form. Cross-linking of this reconstituted collagen is then done with tanning agents such as chromium sulfate or glutaraldehyde, thereby improving its tensile strength to make it insoluble. Besides lowering its antigenicity, the cross-linking decreases its rate of resorption. The collagen membranes are available in various dimensions such as 5 cm × 5 cm, 10 cm × 10 cm, and 25 cm × 25 cm. The thickness of these collagen membranes is 0.6 mm. Sterilization of these collagen membranes is done by gamma irradiation and marketed in aluminum pouch packing, which contains a mixture of isopropyl alcohol and water. It has a shelf life of about 5 years at ambient temperature.

Silver sulfadiazine is available in a 1% solution suspended in a water-soluble base. 1% silver sulfadiazine cream is used for the topical application over the burn wounds.

Under strict aseptic precautions, under general anesthesia, the burn wound must be first washed thoroughly with normal saline. Necrotic tissue and dead skin are removed from the burn wound. To wash off the preservative agents, collagen should be thoroughly washed with normal saline, and then, collagen dressing is applied over the wound, trimming with the scissors so as to cover the entire area. Within 1 h, the membrane dries and becomes adherent to the wound.

RESULTS

In the present study, collagen was used as an alternative to silver sulfadiazine dressing to cover the raw areas during the initial phase of healing in 30 of the 60 patients included in the study. It was observed that xenogenous collagen membrane had good conformability in lining mucosa and skin, i.e., it was supple and adapted to the wound no matter what the contour is. The average pain score in the range of 0–10 was 7.10 in the silver sulfadiazine group and 2.87 in the collagen group. In this study, infection was present in 40% of the patients in the silver sulfadiazine group, whereas it was only 13.3% in the collagen group. $P < 0.05$ indicates a lower rate of infection with collagen dressing. In silver sulfadiazine group, healing was achieved on an average of 17.77 days, whereas in the collagen group, it took 11.80 days ($P < 0.05$). In this study, 36.7% of patients in the silver sulfadiazine group had good scars, whereas 83.7% of patients in the collagen group had good scars ($P < 0.05$). Patient compliance in the silver sulfadiazine group was good at 60%, whereas in the collagen group, it was 86.7% ($P < 0.05$) [Tables 1-3 and Figures 1 and 2].

DISCUSSION

The denuded areas of the skin pose a real challenge to surgeons, who treat traumatic wounds, abrasions, and burns. Raw areas of skin cannot prevent the loss of body

Table 1: Cross-tabulation of infection between groups

Dressing	Infection		*P* value
	Absent	Present	
Collagen	26	4	0.02
SSD	18	12	

Table 2: Cross-tabulation of scar between groups

Dressing	Scar		*P* value
	Good	Bad	
Collagen	25	5	<0.0001
SSD	11	19	

Table 3: Cross-tabulation of compliance between groups

Dressing	Compliance		*P* value
	Good	Bad	
Collagen	26	4	0.02
SSD	18	12	

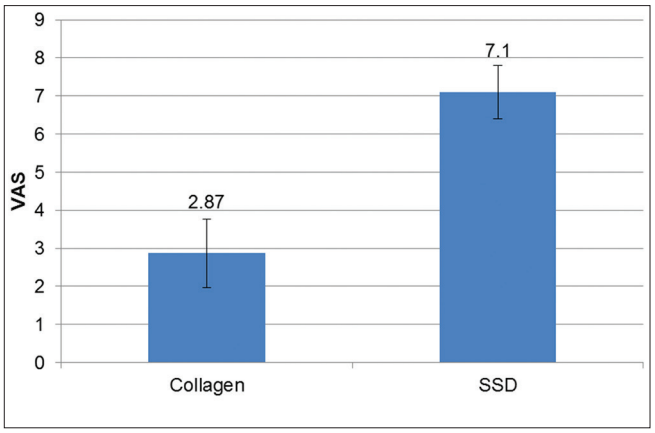

Figure 1: Distribution of pain score

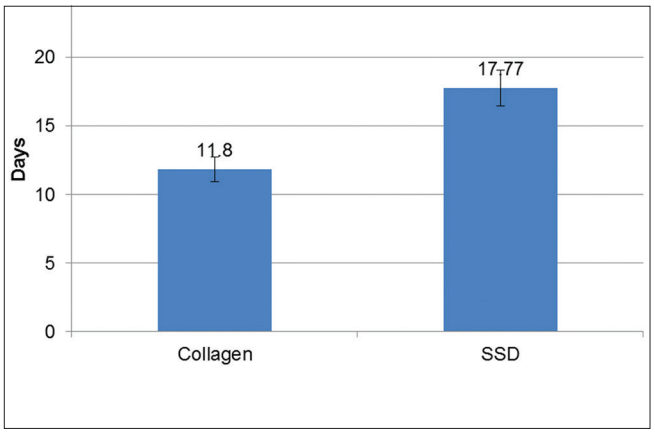

Figure 2: Distribution of healing

heat as the normal skin does by controlling vasodilatation and sweat formation. These areas continuously loose surface fluid and electrolytes, since the barrier of intact skin and keratin is not present to prevent the same. The keratin layer of skin is a very effective antimicrobial barrier. Denuded areas are devoid of this protection, thereby delaying wound healing by exposing vulnerable areas of subcutaneous tissues to infection. The orderly ingrowth of epithelium needs a layer of collagen to act as the scaffold on which it grows and arranges itself. Denuded areas are unable to provide this effectively, leading to the formation of extensive scars and even keloids. The intact epithelium provides a protective layer over cutaneous nerves; otherwise, these areas expose the nerves and cause pain and tenderness. It is for these purposes that denuded areas need a temporary cover until such times that the body is able to manufacture a cover of its own or until such times the surgeon is able to cover it by a skin graft. Wounds that are left uncovered are prone to infection and scarring with additional clinical problems. It has been well documented that the incidence of infection and degree of contraction are considerably reduced when wounds are dressed with biologic materials rather than left exposed or dressed with non-biologic material during healing. The fact that grafted wound heals faster with less complication than an open wound has been realized for almost a century. Silver sulfadiazine dressing for burns has been used as one of the standard dressings in many centers. Burn wounds are painful conditions due to the exposed nerve endings, and as a result of this reduction of pain, patient morbidity is significantly reduced. Collagen when used over the raw area provides the coverage for sensitive nerve endings, thereby diminishing degree of pain significantly. The average pain score in the range of 0–10 was 7.10 in the silver sulfadiazine group and 2.87 in the collagen group. $P < 0.05$ is a statistically significant reduction in pain. This result is in accordance with the study conducted by Desai and Shankaramba.[7]

Infection of the wound is one of the most common complications due to the presence of necrotic tissue and tissue ischemia in burns and the presence of dirt in abrasions as most of them are traumatic. Infection, in turn, leads to delayed healing of the wound. Reduction in the infection rate improves the quality of life.

In this study, infection was present in 40% of the patients in the silver sulfadiazine group, whereas it was only 13.3% in the collagen group. $P < 0.05$ indicates a lower rate of infection with collagen dressing. None of the cases showed any adverse reaction to the collagen, proving its safety as a biological dressing. This result is in accordance with Gupta *et al.*[8]

In silver sulfadiazine group, healing was achieved on an average of 17.77 days, whereas in the collagen group, it took 11.80 days ($P < 0.05$). This shows that collagen dressing helps in decreasing healing time when compared to dressing with silver sulfadiazine. This was consistent with the study of Gupta *et al.*, which shows a healing time of range from 10 days to 14 days.[9]

The appearance of the wound was restored to normal texture in about a month. Scar was assessed by the amount of scar contracture at the end of 4 weeks.

In this study, 36.7% of patients in the silver sulfadiazine group had good scars, whereas 83.7% of patients in the collagen group had good scars ($P < 0.05$). Hence, collagen helps in tissue remodeling and gives a better scar when compared to dressing with silver sulfadiazine. This is in concurrence with the study done by Demling and Desanti.[10]

Patients were asked to give feedback during follow-up regarding the comfortability of the dressing and the resultant scar after healing of the wound. Collagen dressing was considered comfortable as it was only 1-time application unless there was infection unlike conventional dressing in which the patient had to be subjected to dressings at regular intervals subjecting them to painful stimuli over the raw nerve endings. The resultant scar was good in a significant amount of patients in the collagen group when compared to the silver sulfadiazine group, and hence, there was better patient satisfaction.

Patient compliance in the silver sulfadiazine group was good at 60%, whereas in the collagen group, it was 86.7% ($P < 0.05$). Hence, there was a better compliance rate observed with collagen dressing. This result was in accordance with the study conducted by Gerding *et al.*[11]

CONCLUSION

Collagen sheet decreases pain, reduces the need for analgesics, aids in early healing, and limits the associated complications such as infection of the burn wounds as compared to the patients treated with silver sulfadiazine. As the resultant scar is better in the majority of the patients using collagen, the morbidity of the patients is also reduced to some extent. In view of the excellent tolerance and simple application of the collagen membrane, it can be recommended as an effective temporary biological dressing material in the management of partial-thickness burns.

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