



ORIGINAL RESEARCH PAPER

Plastic Surgery

COLLAGEN DRESSINGS IN THE MANAGEMENT OF FIRST AND SECOND DEGREE PEDIATRIC BURNS AVOIDING SKIN GRAFTING.

KEY WORDS: Collagen sheet, First and second degree, Pediatric burns

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ABSTRACT

BACKGROUND: Burns in the pediatric patients are usually caused due to accidental spillage and scalding by hot liquids. These are usually first degree and second degree superficial burns. Collagen dressings have a better outcome in the management of partial thickness burns. **METHODOLOGY:** Fifty patients <12 years of age were included in a retrospective study from September 2018 to 2020. Patients were analyzed in terms of age and sex of the patient, type of burns, duration of presentation, degree and percentage of burns, and complications. **RESULTS:** Ninety-eight percent of children had burns secondary to scalding. Collagen was applied for all patients. Ninety-two patients had no complication. Eight patients had minor complications. **CONCLUSION:** Collagen sheet is very useful in first- and second-degree burns in children. It is well tolerated, provides multiple benefits, and it has fewer complications.

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]

Most children suffer burns involving small surface areas; 80% burns occur in children under 5 years of age, and the majority is due to hot drink spillages. [3] One of the primary problems in the management of burns is a bacterial infection which delays healing, increases pain, and the risk of scarring.

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. We discuss the management of pediatric burn wounds with collagen dressings.



METHODOLOGY

A retrospective, observational study was carried from January 2013 to 2016 in which 100 pediatric burn patients upto 12 years of age 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. 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 edema. Adequate drying of collagen sheet was confirmed. In smaller children, to avoid displacements of sheet, a dressing was given.

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.

No complications of collagen were noted. Patients who had delayed presentation developed infection under the sheet which warranted sheet removal. The small patches of third-degree burns in otherwise superficial burn wounds had a delayed healing.

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

The mean age of presentation was 4 years, with range being 4 months to 12 years. Twenty-five patients were <1 years of age, 53 patients were in 1–6 years of age-group, and 22 were 6 years to 12 years of age. There were 67 males and 33 females.

The maximum were scald burns seen in 98% of children; two were cracker burn and flame burn. Eighty percent of the patients presented within 24 h of burns (fresh burns); 20% had a longer duration of presentation ranging from more than 24 h to 10 days. Thirty-six patients had <10% of affected surface area; 40 patients had affected areas of 10–20%; 17 patients had affected areas of 20% to 30%, and only seven patients had affected areas of more than 30%. Ten patients had patches of

deep burns. Collagen was applied on the wounds of all the patients after thorough cleansing. The presence of granulation tissue, slough or discharge underneath the collagen sheet, spontaneous peeling of the sheet, decrease of edema around the wounds, and the early epithelization were assessed at regular intervals. Ninety-two patients showed good healing at 7–10 days

Five patients who had a delayed presentation developed infection requiring early removal of collagen. All five had an uneventful healing. Three patients with patches of deep burns did not have good uptake of collagen over the patches. All three healed with small patches of scarring.



DISCUSSION

Burn-related injuries are the leading cause of morbidity and mortality in children. In India, pediatric burns account for 17–25% of the total burns admissions.[4] Approximately, 90% of burns are caused by household accidents. In children <3 years, scald burns are more common. Accidental burns are common in low socioeconomic class due to overcrowding and unsafe cooking habits and lack of adult supervision for the children. Scald burns usually occur when children unknowingly pull utensils containing hot liquids. In older children, flame burns or firecracker injuries are more common.

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.[5]

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.[6] 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.[6] 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.[6] Daily dressing in pediatric age group is painful and requires sedation. 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 is 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.[6] 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.[6] 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.[6]

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.[7] 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.[6] Moreover, it is easy to apply and has the additional advantage of stopping bleeding.

A study done by Singh *et al.*[7] 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. In a study by Gupta *et al.*,[5],[8] 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,[5],[9] 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,[5],[10]

In this study, the outcome of pediatric burns managed by collagen dressings was good in terms of early recovery and less pain. There were no side effects of collagen application.

CONCLUSION

Most pediatric burns are accidental and therefore preventable with adequate public education regarding safety methods. Management of pediatric fresh burns of first and second degrees with collagen sheet yields good recovery and avoids trauma and pain of the conventional dressings.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

REFERENCES

1. Helvig E. Pediatric burn injuries. AACN Clin Issues Crit Care Nurs 1993;4:433-42.
2. Mariappan N. Collagen dressing for thermal burns. Sch J Appl Med Sci 2015;3:58.
3. National Burn Care Review. Standards and Strategies for burn care 2001. Available from: <http://www.ncbg.nhs.uk/national-burn-care-review>. [Last accessed on 2016 Mar 30].
4. Kumar R, Parashar A. Special consideration in pediatric burn patients; Indian J

- Plast Surg 2010;43(Suppl 1):S43-50.
5. Rai R, Sudarshan SH, Dsouza R, Saldhana E, Aithala PS. Collagen dressing versus heparin dressing in burn wound management. *J Evol Med Dent Sci* 2013;2:9124-30.
 6. Lazovic G, Colic M, Grubor M, Jovanovic M. The application of collagen sheet in open wound healing*. *Ann BurnsFireDisasters*2005;18:151-6.
 7. Singh O, Gupta SS, Soni M, Moses S, Shukla S, Mathur RK. Collagen dressing versus conventional dressings in burn and chronic wounds: A retrospective study. *J Cutan Aesthet Surg* 2011;4:12-6.
 8. Gupta RL, Boo-Chai K. Role of collagen sheet covers in burns- A clinical study. *Indian Journal Of Surgery*1978;40:646.
 9. Gerding RL, Emerman CL, Efron D, Lukens T, Imbembo AL, Fratinanne RB. Outpatient management of partial thickness burns: biobrane versus 1% silver sulphadiazine. *Annals of Emergency Medicine* 1990;19:121.
 10. Demling RH, Desanti L. Management of partial thickness facial burns (Comparison of topical antibiotics and bioengineered skin substitutes). *J Burn Care and Rehabilitation*1999;25:256.