



COLLAGEN DRESSINGS IN THE MANAGEMENT OF PAEDIATRIC FACIAL BURNS-OUR EXPERIENCE

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ABSTRACT

Background-Facial Burns in the paediatric Populations are very common in our society. Facial burns in paediatric age group are usually caused due to accidental spillage and scalding by hot liquids. These burns are usually partial thickness in nature. Collagen dressing have a better outcome in the management of partial thickness facial burns. Wound healing is important with the aim to minimize the deformity and a cosmetically acceptable scar. **Methodology-** Thirty patients 3-12 years of age were included in a retrospective study from September 2017 to September 2018. All patients were analyzed in terms of age and sex, Type of burn, duration of presentation, degree and percentage of burns, complications, cosmetic outcome. **Result-** Mean age of presentation 5.7yr. Ninety-six percent of children had burns secondary to scalding. Dry collagen sheet applied to all 30 patients. Ninety-three percent patients had satisfactory healing in 10 days. Ninety percent patients experienced no pain with collagen in situ. Ten percent patients had minor complications where all patients were very comfortable with collagen dressing. **Conclusion-** Collagen dressing is very useful in first and superficial second degree facial burns in paediatric populations. It is well tolerated, provides multiple benefits, and it has fewer complications and excellent cosmetic outcome as our study showed.

KEYWORDS : Facial burn injuries, Collagen, paediatric patients

INTRODUCTION :

Paediatric Burn injuries continue to be one of the major challenges faced by the developing countries. Burn injuries present a major public health problem in both adults and in children. The common causes of burn injuries are thermal burns, scalding or direct contact with hot surfaces. Healing in a burn wound is a natural process in a given favourable environment. Changes of dressings which are not non-adherent, traumatize the newly forming tissues leading to personal suffering and delay in healing in addition to the psychological suffering [1].

Burn injuries are common in children due to decreased awareness of the potential danger, lack of prompt response and also the thinner skin tolerates less heat at a shorter duration before full-thickness injury occurs [2]. Covering of superficial thermal burn wounds by collagen sheets is a common practice in the present times. By applying it over the wound, exposed dermis and free nerve endings get covered leading to reduction in pain and infection [3].

A deep partial thickness has the capacity to heal when maintained moist wound bed, adequate circulation and in the absence of infection. In the absence of the above factors a partial-thickness burn wound converts into a full thickness wound [4].

Ideal approach to the care of partial-thickness burns is to provide optimal conditions for wound protection and minimize the pain.

Most children suffer facial burns involving small surface area, 80% burns occur in children under 5 years of age, and the majority is due to hot liquid spillages [5].

One of the primary problems in the management of facial 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, non-immunogenic, non-pyrogenic, hypoallergenic, and pain-free. We discuss the management of paediatric facial burn wounds with collagen dressings.

Different collagen-based products including Biobrane, Integra and beta glucan collagen matrix (BGC) are used in the wound care protocols. Collagen is a natural component of the dermal matrix produced by fibroblasts and functions as protective scaffolding for migrating epithelial cells in the regenerating skin. Beta glucan stimulates macrophages that are essential in the inflammatory phase of healing by providing phagocytosis and secretion of chemokines that promote formation of new tissue [6].

The collagen in the collagen based dressings bind to the MMPs found in the extracellular fluid of the wounds and is an alternative collagen source, leaving the body's natural collagen available for normal wound healing [7]. Collagen allow maximum activity of wound to heal without retarding or inhibiting any stage of the process [8].

Collagen gives Best possible physiological interface between the wound surface and the environment and facilitates the body's reparative and immune systems to function effectively [9].

Aims of the study-

- 1) The aim was to achieve earlier and better healing of wounds.
- 2) Obviate the need for frequent change of dressings; which besides being painful, is quite troublesome in paediatric population which comprises of around 12% (in under-5 year age group) of the total burn patients who present in our hospital.
- 3) Reduction of pain
- 4) Acceptable cosmesis

METHODOLOGY

A retrospective, observational study was carried out including

30 paediatric facial burn patients up to 12 years from September 2017 to September 2018.

Patients with clean, first- and superficial second-degree Facial burns with burn surface <15% TBSA were included in the study [Figure-1]. Patients with full-thickness burns, surface area more than 15%, electric burns, burns over ear, genitalia, palm, and sole and with infected wounds were excluded.



Figure-1 (Paediatric patients with facial scald injury due to burn)

The patients were assessed clinically, and the percentage of burn was calculated by Lund and Browder formula. After initial stabilisation, 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. Dry 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. Adequate drying of collagen sheet was confirmed. In smaller children, to avoid displacements of sheet, a dressing was given by bandage [Figure-2].

Patients were managed with antibiotics and analgesics and intravenous fluids depending on the percentage of total body surface area. 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 days.

No complications of collagen application were noted. Patients who had delayed presentation developed infection under the sheet which warranted sheet removal only in three cases.

The small patches of Deep second-degree burns in otherwise superficial burn wounds had a delayed healing in two cases.



Figure- 2 (Collagen sheet application in facial scald injury and they are very comfortable with it)

All Patients of facial burn in my study with collagen sheet application were discharged and followed in the outpatient department. The collagen sheet dries up in the periphery and gets lifted up, is clipped off gradually till the wound heals

completely. This usually take 10 days. No potential complications of facial collagen application seen in our study. Patients were discharged home comfortably and followed up at OPD after 7 days. Patients were followed up after 7 days, 15days, 1month and 6month intervals. It has been shown that all patients of facial burn on whom we applied collagen dressings were very comfortable with it and had cosmetically very acceptable scar on follow up [Figure-3][Figure-4] .Till now no complications have been seen.



Figure-3 (Follow up at two weeks after collagen application)



Figure-4 (Follow up at six month after collagen application showing acceptable cosmesis)

Result analysis

Mean age of presentation was 5.7years,range being 3-12 years [Figure-5]. There were 25 males and 5 females.



Figure-5 (Pie chart showing age wise distribution of patients)

Majority were scald injury seen in 94% of children and 6% of children had contact burn and had different aetiologies [Figure-6].

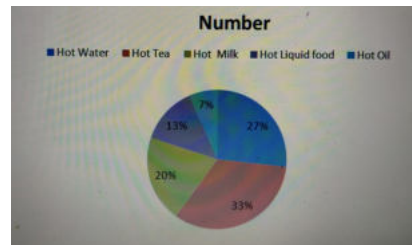


Figure-6 (Pie chart showing different aetiologies of facial scald burn)

Eighty-three percent(83.3%) of the patients presented within 24 hours of burns (fresh burns);Sixteen percent (16.6%) had a longer duration of presentation ranging from 48 hours to 72

hours [Table-1]. Dry Collagen sheet was applied on the Facial burn wounds of all the patients(30) after thorough cleansing having 10-15% of Total Body Surface Area burn. The presence of granulation tissue, slough or discharge underneath the collagen sheet, spontaneous peeling of the sheet, decrease of oedema around the wounds, and the early epithelisation were assessed at regular intervals. All patients (30) were very comfortable with collagen dressings [Figure-2].

27 patients (90%) showed good healing at 10 days during first dressing change, 3 patients (10%) had poor healing due to presence of infection and patchy deep second degree burn, that mandated removal of applied collagen sheet early[Table-2].

28 patients (93.3%) had no pain, where 2 patients (6.6%) experienced mild pain [Table-3] as assessed by Visual Analogue Scale.

Table-1 (Duration of presentation)

Duration of presentation	No of patients	percentage
Within 24 hours	25	83.3%
48-72 hours	5	16.6%

Table-2 (wound healing)

Wound healing	No of patients	percentage
Good	27	90%
poor	3	10%

Table-3 (Post Dressing pain)

Pain	No of patient	percentage
NO Pain	28	93.3%
Mild Pain	2	6.6%

DISCUSSION

Burn-related injuries are the leading cause of morbidity and mortality in children. In India, paediatric burns account for 17–25% of the total burns admissions [11]. 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 like first-degree burns heal in 5–7 days without any scarring. While superficial dermal or deep dermal burns, like 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 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 paediatric 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 [12]. Collagen is the major insoluble protein (fibrous protein) in the extra-cellular matrix and in connective tissues. More than 80% of the skin is composed of collagen. It is also the main component of the ligaments and tendons. Over the years collagen implant solutions for a number of clinical applications include general surgery, burn surgery, neurosurgery, plastic and reconstructive surgery, oral surgery, and peripheral nerve and tendon surgery [13]. Collagen is a chemically distinct macro-

molecular protein that aids wound healing by Chemotaxis to cellular elements of healing such as granulocytes, macrophages and fibroblasts while providing scaffold for more rapid transition to mature collagen production and alignment and provide a template for cellular attachment, migration and proliferation [14].

The main type of collagen in the skin is Type-I collagen[15]. 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 sheets are very useful in first- and second-degree burns. The cost factor comes down, and the pain associated with dressing can be avoided [15].

Daily dressing in paediatric age group is painful and requires sedation. The cost of multiple dressings can be avoided by a single collagen dressing. It also decreases psychological trauma to the child and parent.

Biologically, the collagen sheet is non inflammatory, 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 [15].

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 [15]. 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 metalloproteinase. 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 [15]. Moreover, it is easy to apply and has the additional advantage to stop bleeding.

collagen sheet is retained in the tissue and gradually absorbed by inflammatory cellular activity. The fibrous tissue is then replaced by fibroblasts. Granulation tissue developed at a normal rate and the cellular events are similar to the events occurring in normal wounds.

Deamination of collagen makes it a useful and important biopolymer in the field of bio-material engineering. Deamination results in a collagen with improved solubility as well as swelling properties, which are the prerequisites for a bio-material [9].

Deamination collagen has high viscosity and very high

hydroxyproline content, like native collagen [10]. Collagen sheets are very useful in first-and second degree facial burns [9].

Advantages of collagen Dressing

- 1.Reduced cost of treatment
2. Pain associated with dressing can be avoided
3. Especially in children the trauma of dressing is avoided
4. Protects against infection
5. Avoids evaporative water loss
6. No threat of HIV or Hepatitis infection as bovine material is obtained from countries free of bovine spongiform encephalopathy(BSE)
7. Long shelf-life(5 years) under normal storage conditions
8. Low antigenicity
9. Ensures non-toxicity to the biological environment where it is applied

CONCLUSION

In conclusion, the collagen sheets used in selected patients with superficial facial burns has several advantages over the conventional dressing method. This method is easy to perform, no need for frequent dressing changes, prevents evaporative skin loss of water and electrolytes and free from pain of frequent dressing change especially in children. The chances of infection is also minimal since the collagen forms a protective cover. The wound healing process is quick and the scar formed is cosmetically acceptable.

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