

**Original Research Article**

# A comparative study between collagen and conventional dressing in case of abrasions and second degree burns

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## Abstract

**Background:** Abrasions and superficial burns are painful conditions that heal slowly and cause scarring. These are common entities found in clinical practice and dressings play a major role in the treatment of burns and abrasions. There is a need for a method in which there is early healing with minimal pain, discomfort, and scarring. The use of collagen for wound healing has drawn tremendous interest from scientists in the past few decades as it claims to help in healing wounds.

**Aim of the study:** A need is felt to study the effectiveness of collagen dressing in comparison to conventional dressing (povidone-iodine, silver sulfadiazine).

**Materials and methods:** Both inpatients and outpatients of Govt. Kilpauk Medical College and Hospital were included. 76 patients with 2<sup>nd</sup> degree burns and 76 patients of abrasions were studied. These patients were randomized into collagen or conventional group of 38 each one group managed traditionally with a topical antibiotic (povidone-iodine/ silver sulphadiazine) and the other with occlusive collagen sheet dressing. Abrasions, single or multiple, due to trauma, road traffic accidents, and sports/athletic activities and 2<sup>nd</sup> degree burn less than 15% total body surface area due to flame or hot liquids less than 24 hours old were included in the study.

**Results:** Results obtained were compared with various authors. In the case of abrasions, the average pain score in the range of 0 to 10 was 6.7 in conventional dressing whereas it was 1.9 in the collagen group. In burns, the average pain score in the range of 0 to 10 was 6.8 in conventional dressing whereas it was 2.4 in the collagen group. In abrasions, infection was present in 20% of patients in the conventional group and only 8% of the patients in the collagen group. In burns, infection was present

in 24% of patients in the conventional group and only 16% of the patients in the collagen group. In abrasions in the conventional dressing group healing was achieved on an average of 8.6 days whereas in collagen dressing it took 7.6 days. In burns in the conventional dressing group healing was achieved on an average of 17.7 days whereas in collagen dressing it took 12.2 days. In abrasions, 40% of patients in the conventional group had good scars and 92% of patients in the collagen group had good scars. In burns, 28% of patients in the conventional group had good scars and 80% of patients in the collagen group had good scars. In abrasions, patient compliance in the conventional group was good in 60% of cases whereas in the collagen group it was 96%. In burns, patient compliance in the conventional group was good in 56% of cases whereas in the collagen group it was 84%.

**Conclusion:** Collagen sheet promotes early healing, reduces pain and decreases the need for analgesics, and decreases associated complications like infection as compared to the conventional dressing. The morbidity of the affected patients is reduced as the resultant scar is better in the majority of the patients using collagen. Because of the simple application and good tolerance of the membrane, collagen membrane can be advocated as a temporary biological dressing material in 2<sup>nd</sup> degree Burns and Abrasions.

## Key words

Wound, Wound Healing, Dressing Material, Povidone-iodine, Silver sulphadiazine, Collagen, Collagen membrane.

## Introduction

Every properly planned scientific research has a rainbow around the corner. It is this which attracts thousands of investigators who, years ago, would have pushed off for unknown lands [1]. The possibility of an unexpected development which makes a pattern out of disorder, which would glamorize a drab array of facts, is the chief appeal of scientific research [2]. Abrasions and superficial burns are painful conditions that heal slowly and cause scarring. These are common entities found in clinical practice and dressings play a major role in the treatment of burns and abrasions [3]. There is a need for a method in which there is early healing with minimal pain, discomfort, and scarring. Collagen is the major fibrous protein of extracellular connective tissues, and it is also the most ubiquitous and plentiful protein in the animal kingdom [4]. The word collagen is derived from the Greek word kola (glue) plus gene [5]. They are the most abundant type of protein in the human body comprising 25% of the total protein and 70% to 80% of skin (dry weight). Proteins are natural polymers and makeup almost 15% of the human body and are essential for the process of wound healing [6].

The building blocks of all proteins are amino acids. The use of collagen for wound healing has drawn tremendous interest from scientists in the past few decades as it claims to help in healing wounds. Thus a need is felt to study the effectiveness of collagen dressing in comparison to conventional dressing.

## Materials and methods

In patients & out patients of Govt. Kilpauk Medical College Hospital were studied. 76 patients of 2<sup>nd</sup>-degree burns and 76 patients of abrasions were studied, these patients were randomized into collagen or conventional group of 38 each. Patients with less than 15% partial thickness burns were subdivided into 2 groups of 38 each and patients with abrasions were also subdivided into 2 groups of 38 each. One managed traditionally with a topical antibiotic (povidone-iodine/ silver sulphadiazine) and the other with occlusive collagen sheet dressing.

## Inclusion criteria

- Abrasions due to trauma, road traffic accidents, and sports/ athletic activities less than 24 hours old.
- 2<sup>nd</sup> degree burns due to flame or hot

liquids less than 24 hours old.

#### Exclusion criteria

- Wound/ Burns with exposed bone, tendon, or joint.
- Concurrent illness that may interfere with healing (carcinoma, diabetes mellitus)

Xenogenous collagen membrane (KOLLAGEN) supplied by EDUCARE pharmaceuticals private limited; Chennai was used for the study. The collagen used in this study is purified reconstituted collagen. Purified collagen refers to collagen, which is free from other components normally associated with it in its native state. Reconstituted collagen refers to collagen, which has been reassembled into individual triple-helical molecules with or without their telopeptide extensions, brought into solution, and then regrouped into the desired form. This reconstituted collagen is then cross-linked with tanning agents like glutaraldehyde or chromium sulfate; to improve its tensile strength, make it insoluble, decrease its rate of resorption, and lower its antigenicity. The collagen membranes come in varying dimensions of 5 x5 cm, 10 x 10 cm, and 25x 25 cm, and their thickness is 0.6 mm. It is sterilized by gamma irradiation and is marketed in FFS Aluminium pouch packing containing a mixture of Isopropyl alcohol &

water; it has a shelf life of over 5 years at ambient temperature. For Conventional Dressing managed by topical Silver ointment containing chlorhexidine gluconate 0.2% w/w, silver sulfadiazine 1% w/w for 2<sup>nd</sup>-degree burns, and Purdue Pharma's brand of consumer-available povidone-iodine (PVPI) Betadine containing 10% povidone-iodine in water was used for dressing abrasions. Thorough wash of the abrasion or the burn wound is done using normal saline. Dead skin and necrotic tissue were removed from the burn wound. Under aseptic precautions after thorough wash with normal saline to wash off the preservative agents, collagen dressing is applied over the wound trimming it with scissors to cover the entire area. The membrane dries and becomes adherent to the wound within an hour. A thorough wash of the abrasion or the burn wound is done using normal saline. Dead skin and necrotic tissue were removed from the burn wound. For abrasions dressing was done using gauze soaked with Betadine solution. In the case of 2<sup>nd</sup>-degree burns, the dressing was done using the Silver ointment. Patients of both groups were also given broad-spectrum antibiotics and analgesics.

#### Results

Results were tabulated as per **Table – 1 to 12**.

**Table - 1:** Age distribution.

Age (Years)	Group 1(Collagen)		Total	P Value Chi <sup>2</sup> test
	No (%)	No (%)		
21-30	16(42.1)	15(39.5)	31	0.715
31-40	9(23.7)	13(34.2)	22	
41-50	9(23.7)	6(15.8)	15	
51-60	4(10.5)	4(10.5)	8	
Total	38	38	76	

**Table - 2:** Distribution of number of dressings.

Dressing	Group 1 (Collagen)		Total	P-value
	No (%)	No (%)		
1-5	38(100)	7(18.4)	45	0.001*
6-10	0	31(48.7)	31	
Total	38	38	76	

**Table - 3:** Rate of infection.

Infection	Group 1 (Collagen)	Group 2 (Conventional)	Total	P value
	No (%)	No (%)		
Negative	35 (92.2)	30 (81.6)	65	0.001*
Positive	3 (7.8)	8 (18.4)		
Total	38	38	76	

**Table - 4:** Compliance.

	Group 1 (Collagen)	Group 2 (Conventional)	Total	P value
	No (%)	No (%)		
Bad	1(2.6)	16(42.1)	17	0.001*
Good	37(97.4)	22(57.9)		
Total	38	38	76	

**Table - 5:** Scar.

	Group 1 (Collagen)	Group 2 (Conventional)	Total	P value
	No (%)	No (%)		
Bad	4(10.5)	22(57.9)	26	0.001*
Good	34(89.5)	16(42.1)		
Total	38	38	76	

**Table - 6:** Mean comparison of pain.

	Group 1 (Collagen)	Group 2 (Conventional)	P value
	Mean ± S.D.	Mean ± S.D.	
Pain	1.92 ± 0.71	6.76± 0.75	0.001*

**Table - 7:** Mean comparison of rate of healing.

	Group 1 (Collagen)	Group 2 (Conventional)	P value
	Mean ± S.D.	Mean ± S.D.	
Healing	7.58 ± 0.79	8.6± 0.75	0.001*

**Table - 8:** Mean comparison of no of dressing.

	Group 1 (Collagen)	Group 2 (Conventional)	P value
	Mean ± S.D.	Mean ± S.D.	
Dressing	1.11 ± 0.31	6.1± 0.72	0.001

**Table - 9:** Distribution of number of dressings.

Dressing	Group 1 (Collagen)	Group 2 (Conventional)	Total	P-value
	No (%)	No (%)		
1-5	38(100)	0	38	0.001*
6-10	0	6(15.8)		
>10	0	32(84.2)	32	
Total	38	38	76	

**Table - 10:** Infection.

<b>Infection</b>	<b>Group 1 (Collagen)</b>	<b>Group 2 (Conventional)</b>	<b>Total</b>	<b>P value</b>
	<b>No (%)</b>	<b>No (%)</b>		
Negative	33(87)	30(78.9)	63	0.001*
Positive	5(13)	8(21.1)		
Total	38	38	76	

**Table - 11:** Compliance.

	<b>Group 1 (Collagen)</b>	<b>Group 2 (Conventional)</b>	<b>Total</b>	<b>P value</b>
	<b>No (%)</b>	<b>No (%)</b>		
Bad	7(18.4)	13(34.2)	20	0.118
Good	31(81.6)	25(65.8)		
Total	38	38	76	

**Table - 12:** Scar.

<b>Scar</b>	<b>Group 1 (Collagen)</b>	<b>Group 2 (Conventional)</b>	<b>Total</b>	<b>P value</b>
	<b>No (%)</b>	<b>No (%)</b>		
Bad	7(18.4)	28(73.7)	35	0.001*
Good	31(81.6)	10(26.3)		
Total	38	38	76	

## Discussion

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 & degree of contraction are considerably reduced when wounds are dressed with biological materials rather than left exposed or dressed with non-biological material during healing. The fact that grafted wound heals faster with less complication than an open wound has been realized for almost a century [8]. Povidone-iodine dressing for abrasions and silver sulphadiazine dressing for burns has been used as one of the standard dressing in many centers [9]. In the present study, collagen was used as an alternative to povidone-iodine or silver sulphadiazine dressing to cover the raw areas during the initial phase of healing in 50 out of the 100 patients included in the study [10]. It was observed that xenogenous collagen membrane had good conform ability in lining mucosa & skin i.e. it was supple & adapted to the wound no matter what the contour was. Abrasions and burns are painful conditions due to the exposed nerve endings and as a result of this reduction of pain significantly reduces patient morbidity [11].

Collagen when used over the raw area provides the coverage for sensitive nerve endings thereby diminishing the degree of pain significantly. The average pain score in the range of 0 to 10 was 6.7 in conventional dressing whereas it was 1.9 in the collagen group.  $P < 5\%$  which is a significant reduction in pain score [12]. The average pain score in the range of 0 to 10 was 6.8 in conventional dressing whereas it was 2.4 in the collagen group.  $P < 5\%$  which is again a significant reduction in pain. This result was by the study conducted by Sakiel S, et al. Infection of the wound is one of the most common complications because of the presence of necrotic tissue and tissue ischemia in burns and presence of dirt in abrasions as most of them are traumatic. Infection in turn leads to delayed healing of the wound. Decreasing the infection rate improves the quality of life. Infection was present in 20% of patients in the conventional group and only 8% of the patients in the collagen group.  $P < 5\%$  which indicates a lower rate of infection with collagen dressing [13]. Infection was present in 24% of patients in the conventional group and only 16% of the patients in the collagen group.  $P < 5\%$  which 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 by Khanna J N, et al. Rate of healing is measured by several days required for complete epithelialization of the wound. By decreasing the number of days required for healing patients can return to normal activities faster [14]. In the conventional dressing, group healing was achieved on an average of 8.6 days whereas in collagen dressing it took 7.6 days ( $P < 5\%$ ). In the conventional dressing, group healing was achieved on an average of 17.7 days whereas in collagen dressing it took 12.2 days ( $P < 5\%$ ). This shows that collagen dressing helps in decreasing healing time when compared to conventional dressing [15]. This was consistent with the study of Carlson BM, et al. which shows a healing time of range from 10-14 days. The appearance of the wound was restored to normal texture in about a month. The scar was assessed by the amount of scar contracture at the end of 4 weeks. A good scar is important for cosmetic reasons and particularly in the Facial region. 40% of patients in the conventional group had good scars and 92% of patients in the collagen group had good scars,  $P < 5\%$ , which is a significant value. 28% of patients in the conventional group had good scars and 80% of patients in collagen group had good scars,  $P < 5\%$ . Hence collagen helps in tissue remodeling and gives a better scar when compared to conventional dressing [16]. This is in concurrence with the study done by Moore KL, et al. 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 a one-time application unless there was an 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 [17, 18, 19, 20].

## Conclusion

Collagen by its properties acts as a second skin to the burn wound and provides the ideal dressing in

2<sup>nd</sup> degree Burns and Abrasions. Pain was drastically reduced after the application of collagen dressing. Collagen dressing also controlled the infection rate by forming a temporary barrier between the wound and the environment. Majority of the patients healed with complete epithelisation at a rate faster than conventional dressing. The difference in the collagen group was accounted for by the fact that the collagen sheet provided an optimum environment for early healing. Thus, Collagen sheet promotes early healing, reduces pain and decreases the need for analgesics, and decreases associated complications like infection as compared to the conventional dressing. The morbidity of the affected patients is reduced as the resultant scar is better in the majority of the patients using collagen. Because of the simple application and good tolerance of the membrane, collagen membrane can be advocated as a temporary biological dressing material in 2<sup>nd</sup> degree Burns and Abrasions.

## References

1. Lazarus GS, Cooper DM, Knighton DR, et al. Definitions and Guidelines for Assessment of Wounds and Evaluation of Healing. Arch Dermatol., 1994; 130: 489-493.
2. John W. Madden, Arnold J Arem. Wound healing; biologic and clinical features. The biologic basis of modern surgical practice. Edition XIII; Vol I; Page 193.
3. Lazarus GS, Cooper DM, Knighton DR, et al. Definitions and Guidelines for Assessment of Wounds and Evaluation of Healing. Arch Dermatol., 1994; 130: 489-493.
4. Abbenhause J.L. Collagen sheets as a dressing for large excised areas. Surgical-alforum, 1965; 16: 477.
5. Mason R. Gand, Read M.S. Some effects of a microcrystalline collagen preparation on blood. Hemostasis, 1974; 3: 31.
6. Ponten B, Nordgaard. The use of collagen film (Cutycol) as a dressing for donor are as in split skin grafting. Scand J Plast Reconst

- Surg., 1976; 10(3): 237-40.
- 7. DeVore D.T. Collagen xenograft for bone replacement. The effect of aldehyde induced cross linking on dehydration rate. *Oral Surg Oral Med & Oral Path.*, 1977; 43: 677-683.
  - 8. Gupta, et al. Fate of Collagen sheet for artificially created wounds. *India Journal of Surgery*, 1978; 40: 641.
  - 9. Levin MP, Tsaknis PJ, Cutright DE. Healing of the oral mucosa with the use of collagen artificial skin. *J Periodontol.*, 1979; 50(5): 250-3.
  - 10. S.K. Bhatnagar, R. Krishnan, T. C. Goel. Utility of collagen sheetasaskin substitute. *Journal of Plastic Surg.*, 1981; 14: 11.
  - 11. P. R. Hyder, P. Dowell, G. Singh, A. E.Dolby. Freeze-Dried, Cross-Linked Bovine Type I Collagen: Analysis of Properties. *J Periodontol.*, 1992; 63: 182-186.
  - 12. Mian M, Beghe F, Mian E. Collagen as a pharmacological approach in wound healing. *Int J Tissue React.*, 1992; 14 Suppl: 1-9.
  - 13. Sariel S, Grzybowski J. Clinical application of new bovine collagen membranes as a partial-thickness burn wound dressing. *Polim Med.*, 1995; 25(3-4): 19-24.
  - 14. Khanna J N, Andrade, et al. Oral submucous fibrosis: A new concept in management. *Int. J. Oral and maxillofacial Surg.*, 1995; 24(6): 433.
  - 15. Purna Sai K, Mary Babu. Collagen-based dressings - A review. *Burns*, 2000; 26: 54.
  - 16. Carlson BM. Integumentary, skeletal, and muscular systems: Human Embryology and Developmental Biology. 1<sup>st</sup> 1994, p. 153-81.
  - 17. Moore KL, Persaud TVN. The integumentary system. In: Before We Are Born: Essentials of Embryology and Birth Defects. 5<sup>th</sup> edition, 1998, p. 481-96.
  - 18. Burns DA, Breathnach SM, Cox N, Griffiths CE, eds. *Rook's Textbook of Dermatology*, 7<sup>th</sup> edition, Wiley-Blackwell; 2004.
  - 19. Poblet E, Jiménez F, Ortega F. The contribution of the arrector pili muscle and sebaceous glands to the follicular unit structure. *J Am Acad Dermatol.*, Aug 2004; 51(2): 217-22.
  - 20. Prost-Squarcioni C. [Histology of skin and hair follicle]. *Med Sci (Paris)*., Feb 2006; 22(2): 131-7.