ORIGINAL ARTICLE

BURNS - A COMPARATIVE STUDY BETWEEN CONVENTIONAL AND COLLAGEN DRESSING

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ABSTRACT: BACKGROUND AND OBJECTIVES: Burns are complex in their occurrence, pathophysiology and management. It is a painful condition and topical management of burns is a challenging task. A topical dressing which allows faster healing with reduction of pain, prevents infection, which is cost effective and leads to a good scar formation is required. Over the period of time collagen has created an interest among scientists who have extensively researched about collagen and its properties have been utilized in topical management of wounds and burns. Thus there is a need to study the effectiveness of collagen dressing in comparison with conventional silver sulphadiazine dressing in terms of pain score, healing time and cost efficiency. **METHODS:** This prospective randomized comparative study includes patients with partial thickness burns, <40%BSA and not older than 48hrs, admitted in Burns unit of K.R. Hospital attached to MMC & RI, from January 2012 to July 2013. 60 patients were studied, these patients were randomized into collagen dressing or silver sulphadiazine dressing group of 30 each. **RESULTS:** The average pain score recorded using visual analog scale with range 0-10 was 4.5 in collagen group and 5.63 in SSD group on Day 1, 2.033 and 4.566 on Day 2, 1.366 and 3.533 on day 7 and 0.566 and 3.033 in collagen and SSD group respectively. Wound healing time in Collagen group was 13.2 days while in SSD it was 19.533 days. Infection rate was significantly lower, 13% in collagen group but 33% in the SSD group. Resultant scar was good in 87% of patients in collagen group while 53% in SSD group. Collagen Sheet is estimated to cost a little higher than silver sulphadiazine ointment. But when compared to the number of dressings and the total cost, the pain, prolonged hospital stay, burden to the accompanying person and loss of labor in patients in SSD group, collagen can be considered more cost effective. **CONCLUSION:** Collagen sheet is an ideal topical dressing agent in management of partial thickness burns. It forms a barrier over the wound helping in faster healing, lesser pain, decreasing infection rate and good scar formation. It's one time application and reduced hospital stay makes it more compliant and cost effective to the patients.

KEYWORDS: Burns management, Collagen dressing, Silver sulfadiazine vs. collagen.

INTRODUCTION: Burn injuries are extremely complex in their occurrence and pathophysiology and optimal treatment requires an understanding of the physiology and metabolic interactions among all the major organ systems, nutrition, immunology, psychological issues.[1]

The problems associated with burns management, treatment and healing have always been the main challenge. Therefore it is appropriate that the process and problems of wound healing should be considered seriously by all practitioners involved in the management of burned patients and in the development and use of new wound repair material.[2]

Previously the management of superficial burns was by method of exposure, but with the evolution of newer techniques impetus of management is towards closed dressing with newer type of dressings.[1]

The ideal management of a burn is an economical, easy to apply, readily available dressings or method of coverage that will provide good pain relief, protect the wound from infection, promote healing, prevent heat and fluid loss, be elastic and non-antigenic and adhere well to the wound and waiting for spontaneous epithelization of superficial partial thickness burns.[3]

Collagen is an endogenous substance, which forms an important structural component in connective tissue Biological dressings with collagen create the most physiological interface between the wound surface and environment and are impermeable to bacteria. Collagen dressings have other advantage over conventional dressings in terms of easy application and being natural, non-immunogenic, non-pyrogenic, hypoallergic and pain free.[4]

Introduction to burns: Twenty-first century optimal burn care consists of a specialized treatment scheme that incorporates early surgical wound closure, critical care management, and rehabilitation efforts. The success of burn treatment as a multidisciplinary model had fostered the organization of burn centers as regional resources for severely injured patients, including individuals with large open wounds.[5]

Types of Burns

Burns (thermal) injuries can be categorized as follows:

1. Scalds: The injury is caused by contact with a hot fluid (i.e., hot tea, soup and coffee). In most cases, these injuries, when cooled quickly, are partial thickness.
2. Flame: The injury is caused by exposure to flames (i.e. a house fire or with clothing catching fire). These burns are usually full thickness.
3. Flash: The injury is caused by very short exposure to a burning gas or vapour. The injury is usually partial thickness.
4. A Contact burn: The injury is caused by contact with a hot surface.
5. Electrical burns: This type of burn is caused by contact with or strike through of an electrical current.
6. Radiation: The injury is caused by exposure to heat radiation. The typical example of this type of burn is the sun burn. The injury is usually first degree.
7. Other-Radiation burns, Chemical burns, Frostbite.[6]

AIMS AND OBJECTIVES:

1. To compare the wound healing time in partial thickness burns with collagen and 1% silver sulphadiazine dressings.
2. To compare the effect on the morbidity in partial thickness burns with collagen and 1% silver sulphadiazine dressings.
3. To compare cost-effectiveness in partial thickness burns with collagen and 1% silver sulphadiazine dressings.

MATERIALS AND METHODOLOGY:

SOURCE OF DATA: This prospective randomized comparative study includes patients with partial thickness burns who are salvageable (40%BSA), admitted in Burns unit of K.R. Hospital attached to MMC & RI, from January 2012 to July 2013 who were taken for study considering the inclusion and exclusion criteria, after the clearance from the ethical committee was obtained.

METHOD OF COLLECTION OF DATA:

Sample size:

The size of the sample is 60 cases.

30 cases with collagen dressing group (group I)

30 cases with silver sulphadiazine dressing group (group II).

- **Inclusion criteria:**
  - All patients with partial thickness burns.
  - Patients who are salvageable (<40%BSA).
  - Patients with burn wounds not older than 48hours.

- **Exclusion criteria**
  - Patient with full thickness burns.
  - Patients who are not salvageable (>40% BSA).
  - Patient with electrical and other non-thermal burns.
  - Patient with burnt wounds older than 48 hours.

Total patients studied were 60 out of which 30 were treated with collagen dressings as experimental group and rest 30 patients were treated with conventional silver sulphadiazine ointment as the control group. The data were collected in prescribed Proforma.

All patients were assessed clinically as to

- % body surface area involvement – using Rule of Nine chart
- The degree of burns
- Mode of treatment – collagen dressings or conventional method

The patients were followed up on a daily basis in both test and control groups until complete epithelization occurred. The control group was subjected to alternate day dressings by conventional silver sulphadiazine dressing whereas the test group was subjected to collagen dressings and was left undisturbed until complete epithelization occurred. Dressings were reapplied if any infection of collagen dressing occurred.

Materials used:

1. Collagen sheets (contains sterile reconstituted type-1 collagen sheet)
2. 1% silver sulphadiazine
3. Dressings with cotton pads and roller guaze.

Xenogenous collagen membrane was used for the study.

The collagen used in this study is a purified reconstituted collagen. This reconstituted collagen is then cross-linked with tanning agents like gluteraldehyde or chromium sulphate; to improve its tensile strength, to make it insoluble, to decrease its rate of resorption and to lower its antigenicity.

The collagen membranes come in varying dimension of 5 x 5cms, 10 x 10cms and 25 x 25 cms, and its thickness is 0.6mm. It is sterilized by gamma irradiation.

Directions of use:

- Clean the application site thoroughly with povidone iodine or any other antiseptic.
- Peel open the pouch and directly apply the collagen on the cleaned wound after soaking it in normal saline foe 2-3 min.
- Do not try to over stretch the membrane.
- Repeat dressing is not required, unless the wound is infected.
- Collagen wound cover is transparent – hence we can monitor the healing without peeling off the membrane and thus avoid disturbing epithelization.
- The collagen peels off as the wound heals. However in some circumstances it may need to be moistened with saline before removal.
- In case of localized bulging of collagen after application due to fluid accumulation beneath, a small incision can be made at the site and exude the fluid. This incision can be sealed with additional small piece of collagen, which adheres firmly with the already applied collagen. Alternatively, to avoid such inconvenience, meshed type of collagen is also available, where the excess fluid is released automatically.

TECHNIQUE OF APPLICATION:

Control group: Thorough wash of the burn wound done using Normal saline. Silver sulphadiazine ointment was applied over the cleaned wound and occlusive dressing was applied with guaze-pad and roller bandage. The patients were asked to take bath with soap once in every 2 days and the dressings were changed along with the application of ointment.

Experimental group: Thorough wash of the burn wound done using Normal saline. Then the collagen sheet soaked in normal saline is directly applied over the burn wound and gently spread over the wound. The collagen dressing allowed drying. The collagen gets adherent to the skin wound in few hours. The patient was asked not to move till the collagen dries off.
The applied collagen was allowed to peel off by itself after the wound had fully epithelized and healed.

Antibiotics were prescribed to the patients according to the antibiotic schedule of our hospital.

Patients were followed up on days 1, 2, 7, 14, 21 and 28 or for more days in event of any adverse effects related to medication or aggravation symptoms or complications.

Patients were discharged once complete epithelization occurred. Time taken for complete epithelization in both the group was noted.

Figure 1: collagen

Patients were advised to review after a month in order to assess and manage any late complications like hypertrophied scar, contractures and keloids.

RESULTS OBTAINED WERE CALCULATED ACCORDING TO THE FOLLOWING CRITERIA:

1. Pain was measured using visual analogue score of 0 to 10.
   0 being no pain and 10 is the maximum pain tolerable by the patient. The pain scale was assessed on day 1, day 2, day 7 and day 14.
2. Infection as being present or absent by checking for any pus under the dressing visually.
3. Wound healing time will be measured by the number of days required for complete epithelialisation of 90% of the wound.
4. Resultant scar is compared between the collagen and conventional dressing group by accessing the scar contracture at the end of 4 weeks.

Contracture of the wound site is noted as being:

Good (<50%)
Bad (> 50%)

Figure 2: Superficial burns after debridement of necrotic tissue

Figure 3: Resultant scar after 2 weeks of silver sulphadiazine dressing

Figure 4: Superficial burns at presentation

Figure 5: Healed scar after 2 weeks of collagen sheet application

Cost analysis for each group done individually in each patient taking into account the direct cost, which is easily measurable and indirect cost, which is difficult to measure and also depends on the result of the study.

The mean wound healing time, pain and cost was calculated and compared for both groups. The variables were compared using the Unpaired Student's t-test. A P value <0.05 was considered significant.

OBSERVATIONS AND RESULTS: The 60 patients admitted with partial thickness burns, <40% BSA were divided into two equal and comparable groups. Patients subjected to collagen dressings were classified under Group I and those who underwent 1% silver sulphadiazine dressings [SSD] were classified as Group II.

After application of collagen dressing on day1, 80% of patients had pain score less than 5. Comparison of pain in both the groups on day 1 showed a significant difference with p value <.0001, inferring that pain in collagen dressing is significantly less compared to that in silver sulphadiazine dressings on day1. With SSD dressings, 43.3% of patients had pain less than 5. Comparison of pain in both the groups on day 7 showed a significant difference with p value <.0001, inferring that pain in collagen dressing is significantly less compared to that in silver sulphadiazine dressings on day 7.

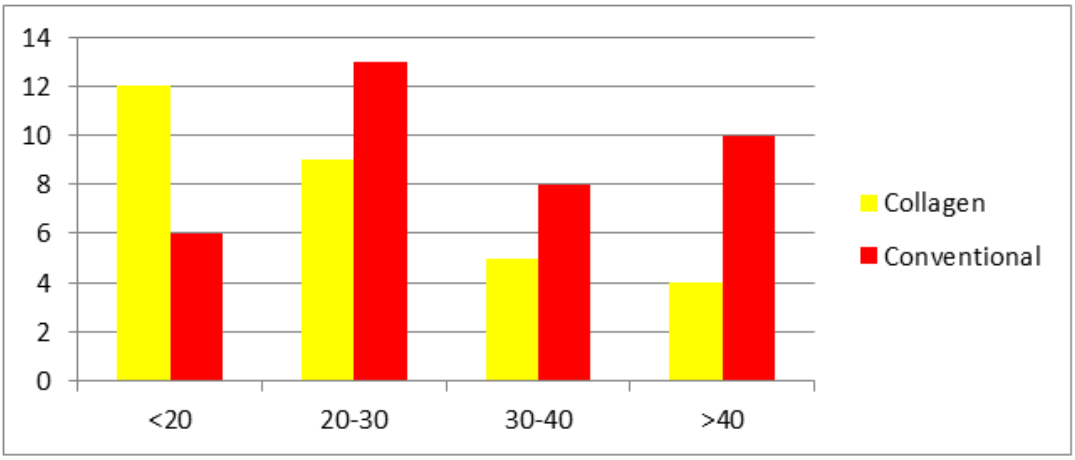
A significant difference with p value <.0001 was seen on day 14, inferring that pain in collagen dressing is significantly less compared to that in silver sulphadiazine dressings.

OBSERVATIONS AND RESULTS:

PATIENTS DEMOGRAPHY:

Age group (in years)	No. of Patients	Percentage (%)	Group I n=30 (%)	Group II n= 30 (%)
< 20	18	30	12	6
21 – 30	22	36	9	13
31 - 40	13	22	5	8
>40	7	12	4	10

Table 1: Age at Presentation

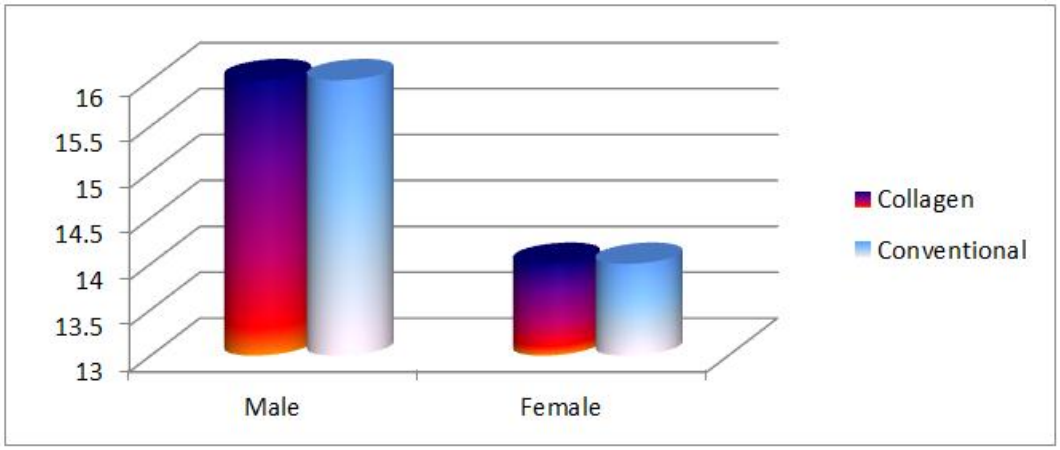


Graph-1

In this study the age of the patients ranged between 6 years to 65 years. 36% of the patients were in 21 – 30 age groups. This includes 30% in group I and 43% in group II.

Sex	No of patients	Percentage (%)	Group I	Group II
Male	32	53	16	16
Female	28	47	14	14

Table 2: Distribution of study subjects according to Gender

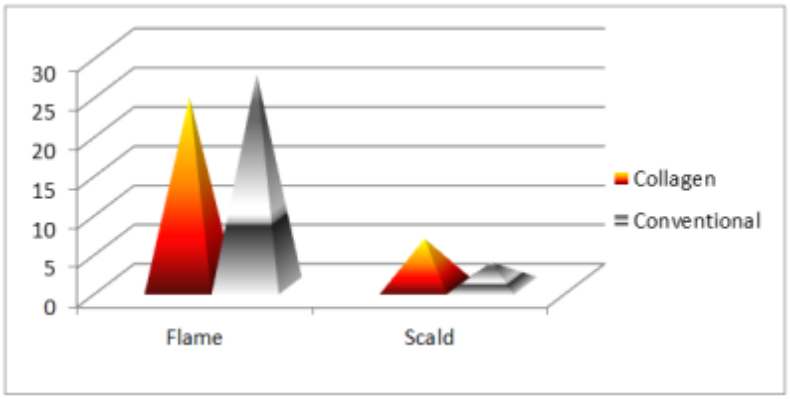


Graph-1

In this study 53% of the patients were males, as compared to females who made 47% of the total cases.

Type of burn	No of patients	Percent	Group I	Group II
Flame burns	51	85	24	27
Scald burns	9	15	6	3

Table 3: Type of burns



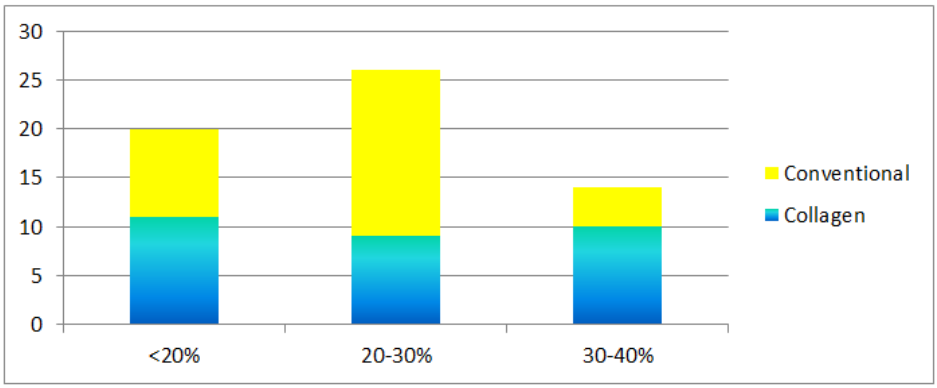
Graph-3

Type of burns in this study in most of the cases was flame burns constituting 85% and the rest were flame burns which were 15%.

Most of burns in this study were accidental in nature i.e. 96.6% and suicidal in 3.3% of cases.

% of BSA burns	No of patients	Percentage	Group I	Group II
<20%	20	33%	11	9
21-30%	26	44%	9	17
31-40%	14	23%	10	4

Table 4: Percentage of burns

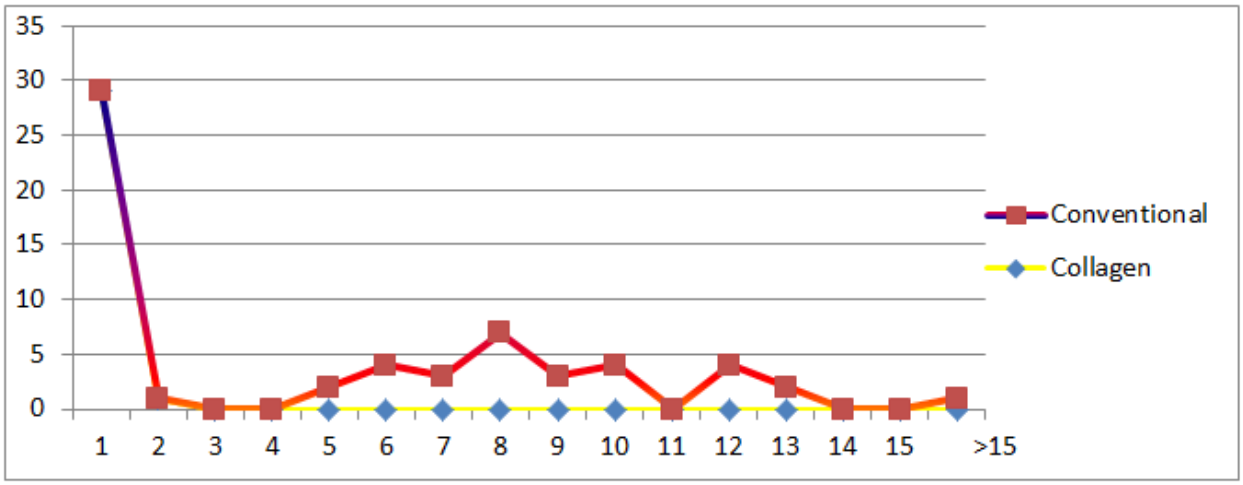


Graph-4

In this study patients with burns <40% BSA only were included. Majority of the patients had 21-30% BSA burns.

No. of Dressing	Group1	Group II
1	29	
2	1	
5		2
6		4
7		3
8		7
9		3
10		4
12		4
13		2
>15		1

Table 5: Number of Dressings



Graph 5: Number of dressings

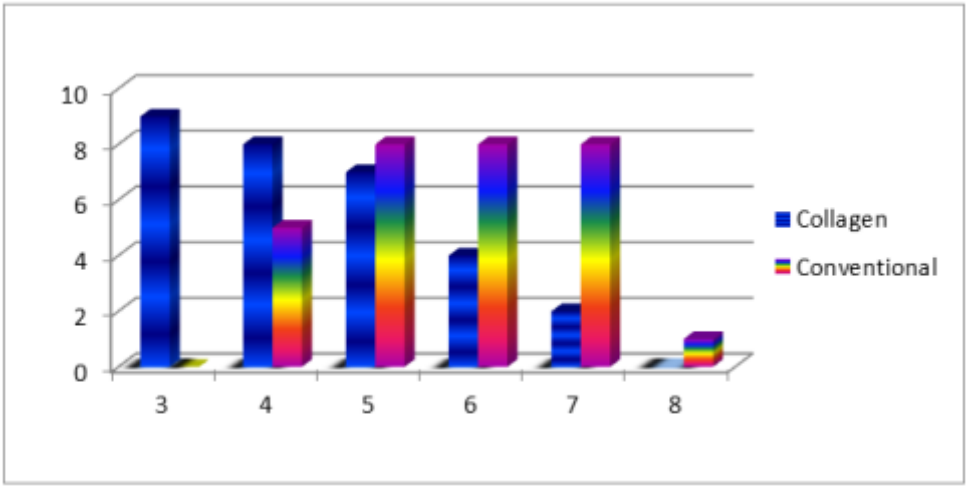
All patients in group I with collagen dressings required only one dressing, except in one patient who required 2 dressings, as a result of infection.

Pain: Pain assessment was done using visual analogue scale, on day 1, day 2, day 7 and day 14.

Score	Type of Dressing		Total
	Group I	Group II	
3	9	0	9
4	8	5	13
5	7	8	15
6	4	8	12
7	2	8	10
8	0	1	1
Total	**30**	**30**	**60**

Table 6: Pain assessment on day

After application of collagen dressing on day 1, 80% of patients had pain score less than 5, whereas with SSD dressings, 43.3% of patients had pain less than 5.



Graph 6

Independent T test between Type of dressing and Visual Analogue Pain Scale on Day 1:

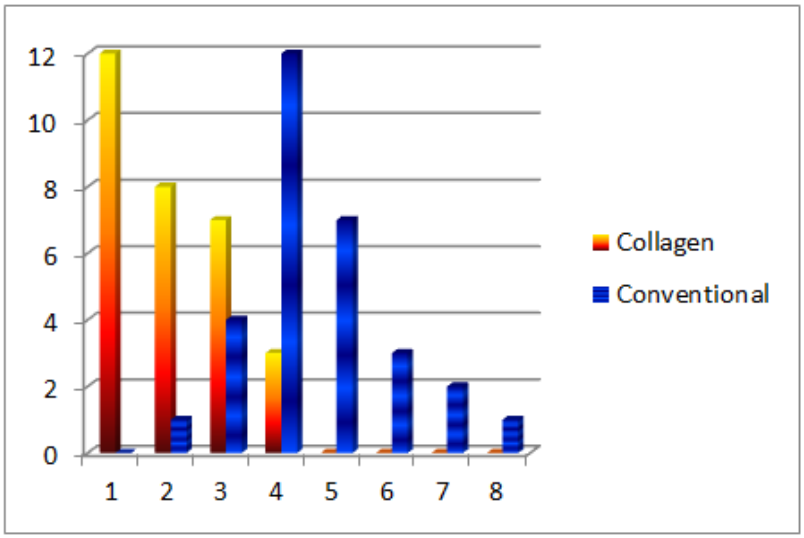
Type of Dressing	N	Mean	Std. Deviation	T value	df	P value
Group I	30	4.5	1.358	-3.334	58	<.0001
Group II	30	5.63	1.125			

Comparison of pain in both the groups on day 1 showed a significant difference with p value <.0001, inferring that pain in collagen dressing is significantly less compared to that in silver sulphadiazine dressings on day 1.

Score	Type of Dressing		Total
	Group I	Group II	
1	12	0	12
2	8	1	9
3	7	4	11
4	3	12	15
5	0	7	7
6	0	3	3
7	0	2	2
8	0	1	1
Total	30	30	60

Table 7: 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.



Graph 7

Independent T test between Type of dressing and Visual Analogue Pain Scale on Day 2:

Type of Dressing	N	Mean	Std. Deviation	T Value	df	P value
Group I	30	2.033	1.033	-8.2389	58	<.0001
Group II	30	4.566	1.331			

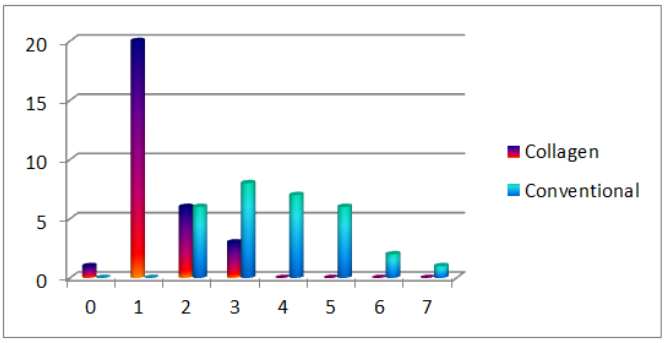
Comparison of pain in both the groups on day 2 showed a significant difference with p value <.0001, inferring that pain in collagen dressing is significantly less compared to that in silver sulphadiazine dressings on day 2.

Pain score	Type of Dressing		Total
	Group I	Group II	
0	1	0	1
1	20	0	20
2	6	6	12
3	3	8	11
4	0	7	7
5	0	6	6
6	0	2	7

7	0	1	1
Total	**30**	**30**	**60**

Table 8: Pain assessment on Day 7

On day 7, in collagen dressing group, 100% of patients had pain score less than 5, whereas with SSD dressings, 66 % of patients had pain less than 5.



Graph 8

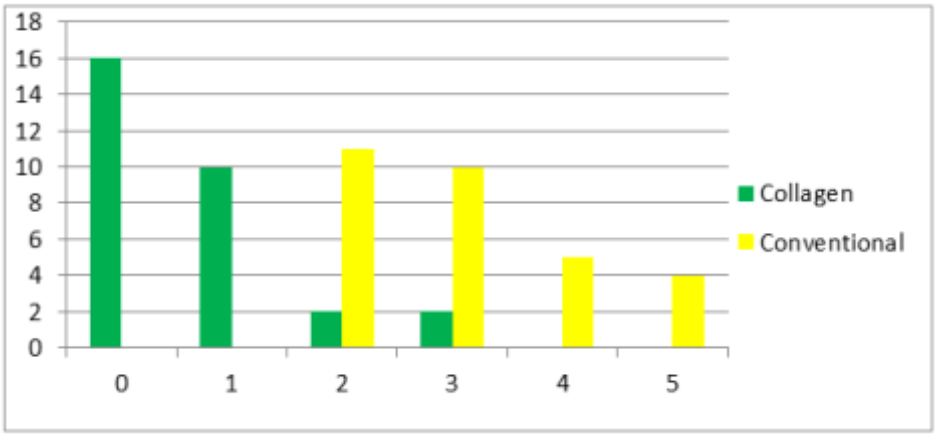
Independent T test between Type of dressing and Visual Analogue Pain Scale on Day 7:

Type of Dressing	N	Mean	Std. Deviation	T Value	df	P value
Group I	30	1.366	0.7184	-7.9625	58	<.0001
Group II	30	3.533	1.306			

Comparison of pain in both the groups on day 7 showed a significant difference with p value <.0001, inferring that pain in collagen dressing is significantly less compared to that in silver sulphadiazine dressings on day 7.

Pain score	Type of Dressing		Total
	Group I	Group II	
0	16	0	16
1	10	0	10
2	2	11	13
3	2	10	12
4	0	5	5
5	0	4	4
Total	**30**	**30**	**60**

Table 9: Pain assessment on Day 14



Graph 9

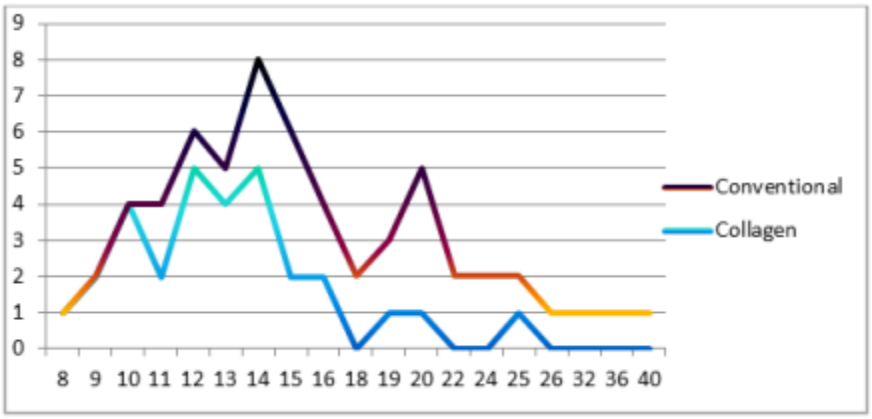
Independent T test between Type of dressing and Visual Analogue Pain Scale on Day 14:

Type of Dressing	N	Mean	Std. Deviation	T Value	df	P value
Group I	30	0.566	0.6789	-11.456	58	<.0001
Group II	30	3.033	0.9643			

A significant difference with p value <.0001 was seen on day14, inferring that pain in collagen dressing is significantly less compared to that in silver sulphadiazine dressings.

CWH	Type of Dressing		Total
	Group 1	Group II	
8	1	0	1
9	2	0	2
10	4	0	4
11	2	2	4
12	5	1	6
13	4	1	5
14	5	3	8
15	2	4	6
16	2	2	4
18	0	2	2
19	1	2	3
20	1	4	5
22	0	2	2
24	0	2	2
25	1	1	2

26	0	1	1
32	0	1	1
36	0	1	1
40	0	1	1
Total	**30**	**30**	**60**



Graph 10

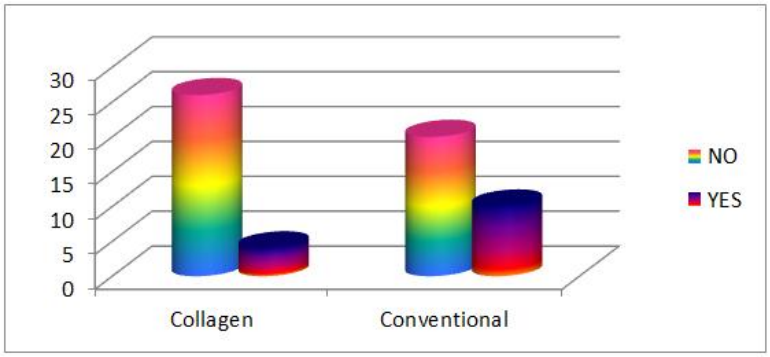
Independent T test between Type of dressing and Complete wound healing time:

Type of Dressing	N	Mean	Std. Deviation	T Value	df	P value
Collagen	30	13.2	3.5467	-4.4221	58	<.0001
SSD	30	19.533	6.9962			

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

Infections	**No**	**Yes**
Collagen	26(87%)	4 (13%)
SSD	20 (67%)	10(33%)

Table 11: Infections

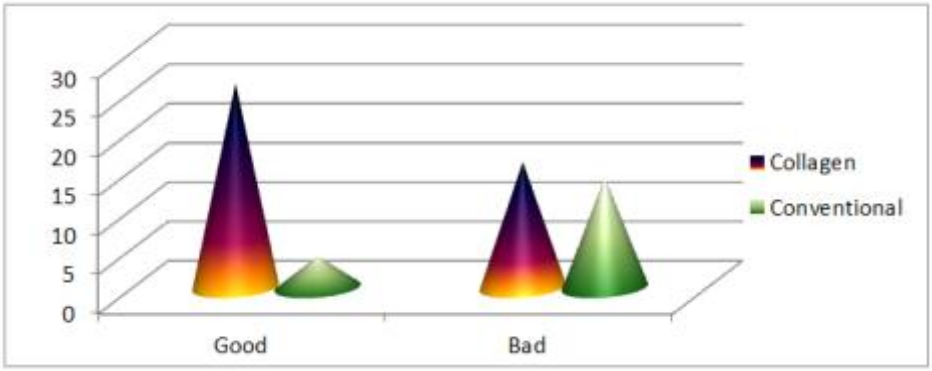


Graph 11

87% of patients with collagen dressing had no infection. Infection rate with collagen dressing is much lower than that with SSD.

Scar	Good	Bad
Group I	26	4
Group II	16	14

Table 12: Resultant scar



Graph 12

Patients in Group 1 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.

Following is the cost analysis in a patient having 30% partial thickness burns:

	Cost in Rs	P value
Collagen	3,770.00	
SSD	4410.00	0.122

Table 13: comparison of cost in both groups in present study

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 are taken into consideration collagen dressing, is more cost effective than SSD dressing.

DISCUSSION: Burn wound management is a real challenging task to the Surgeon. Wound is devoid of its keratin layer which makes it vulnerable to infections. There is continuous loss of body heat, fluid and electrolytes due to absence of the skin barrier. Burn area lacks the scaffold of collagen which makes the wound difficult to epithelialize resulting in scar and contractures. Exposed nerve endings are vulnerable to external stimuli causing pain.

All these features point towards need of a barrier over the burn wound to protect the underlying tissue, and that can act as a scaffold for epithelialization.

Over the years the dressing for burns has evolved from the traditional exposure method to the biological dressings.

Silver sulphadiazine dressing is being used as standard dressing in many burns unit.

In this study collagen dressing was used as an alternative to SSD and a prospective comparative study was conducted.

Pain Score: In this study a 10 point visual analogue scoring system was used with 0 standing for no pain and 10 implying maximum pain. Scores were recorded on day 1, 2, 7 and 14.

The average pain score recorded was 4.5 in collagen group and 5.63 in SSD group on Day 1, 2.033 and 4.566 on Day 2, 1.366 and 3.533 on day 7 and 0.566 and 3.033 on Day 14 in collagen and SSD group respectively.

The P value being less than 0.0001 implies statistically significant reduction of pain in Collagen group as compared to those in SSD group.

Healing time: It is the time taken for more than 90% epithelialization of the wound.

In the present study collagen group had an average healing time of 13. 2days and the SSD group 19.53 days with a significant p value of less than 0.0001.

Cost efficacy: In the present study the average cost borne by a patient with 30%burns treated with collagen with an average healing time of 13.2 days was Rs 3770 and those treated with SSD with average 9 dressings was Rs 4410 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 labor of both the patient and the person accompanying.

Considering these facts, collagen dressing can be graded as more cost effective than Silver sulphadiazine dressing.

CONCLUSION: Collagen provides an ideal dressing for partial thickness burns owing to its properties.

Pain was significantly reduced in patients dressed with collagen since it forms a temporary barrier preventing any external source from stimulating nerve endings to cause pain.

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 properties 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 epithelialization.

The collagen dressing is more cost effective than SSD. A SSD has disadvantage of the large number of dressings, prolonged hospital stay, amount pain, loss of time and labour of the patient and the accompanying person which makes collagen dressing more cost effective as it is most of the time a single dressing.

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ORIGINAL ARTICLE

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