

## Comparative Study Between Collagen Dressing And Conventional Vaseline Gauze Dressing in Healing of Donor Site Wound in Split Skin Graft

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### Abstract:

**Objectives:** To evaluate effectiveness of collagen dressing in comparison to Vaseline gauze dressing in healing of Split Skin Graft donor site wound. Rate of epithelialization, pain, pruritus, type and duration of need of analgesics was compared between both groups

**Methods:** comparative study, purposive sampling technique based on inclusion and exclusion criteria with a sample size of 30 under collagen group and 50 under Vaseline gauze group, study carried out in hospitals under KMC, Mangaluru.

**Patients and outcome assessment:** Epithelialization assessed on 12<sup>th</sup>, 14<sup>th</sup>, 16<sup>th</sup>, 18<sup>th</sup> POD till complete epithelialisation occurs post op where 1=complete epithelialization, 2= scattered or spotty epithelialization, 3=no epithelialisation or infected. Pain assessment with VAS score (0-10) every day for 7 days after which once a week for 35 days, pruritus scoring done once in a week from 14<sup>th</sup> post op day till 35<sup>th</sup> post op day and analgesics requirement (duration and type) was also assessed.

**Results:** rate of epithelialization is faster with collagen when compared to Vaseline gauze as a material for donor site wound, mann whitney test on post op day 12 with a z value of 6.17 and p value < .0001 between 2 groups which is highly significant. Significant reduction in pain and pruritus in patients with collagen dressing was noted on post op day 1 and day 14 respectively. Considerable reduction in use of analgesics especially opioids observed with collagen dressing and also reduction in the duration of use of analgesics was observed with collagen dressing.

**Conclusion:** collagen application to donor site wound (DSW) is better than Vaseline gauze dressing in relation to early wound healing and patient comfort.

**Keywords:** donor site wound (DSW), collagen, Vaseline gauze, epithelialization, pain, pruritus, VAS.

### I. Introduction

Split-skin grafting is commonly employed by surgeons for covering skin defects in case of ulcers, deep burns and following trauma.<sup>(1,2)</sup> Split-skin graft harvesting technique involves harvesting of the epidermis and upper 1/3rd of dermis resulting in a wound called donor site wound (DSW). These wounds pose a kind of burden to patients during the process and after the process of wound healing. These wounds tends to cause enormous pain, are at risk of getting infected, can cause itching (pruritus) and cosmetic inconvenience to the patient.<sup>(1-3)</sup> Local care and management of donor site wound (DSW) should be aimed at creating an environment which promotes early epithelialization with minimal pain and discomfort to the patient with reduction in duration of hospital stay.<sup>(1,4,5)</sup>

Though the procedure of Split skin grafting is more or less standardized, management of donor site wound greatly differs and is a debatable topic. The donor site wound (DSW) usually receives minimal attention and is often associated with delayed wound healing with significant pain and discomfort. Hence, after split skin grafting patient complains of pain which is far more severe in donor site wound area compared to the recipient site. To overcome this problem, a variety of materials and products have been recognized for dressing and care of Donor site wound (DSW).

Skin is a natural protective barrier which prevents the invasion of pathogens and oozing of interstitial fluid. Split skin graft harvesting will cause partial thickness injury with loss of protein rich fluid and blood from the wound. This protein rich exudative fluid and clotted blood together form an eschar, which temporarily covers the wound and the underlying regenerating epithelium. Infection and tissue desiccation at the donor site is not prevented by this eschar resulting in conversion into full thickness loss from partial thickness injury after Split skin graft (SSG) harvesting.<sup>(6)</sup> The left out epithelial cell layer at the periphery of the donor site and

reserve cells in the remaining sweat glands, hair follicles, sebaceous glands proliferate to form a new epidermal layer and this is the first phase in donor site healing. This process of proliferation of cells is followed by migration of the proliferating cells Outwards till the wound is re epithelialized.<sup>(7)</sup> It takes around 10-14 days for complete epithelialization, But the rate of wound healing and new epithelium formation may be influenced by local environment of the wound.<sup>(8)</sup>

Split skin graft donor site wound have been managed with closed or open dressings.<sup>(9)</sup> The closed occlusive dressing results in very good outcomes with considerable reduction in duration of wound healing, good quality of the epithelium which is regenerated along with comfort to the patient. Closed wound dressing also has an advantage of preventing mechanical trauma to donor site, microbial contamination and tissue desiccation, Hence closed wound dressing is always preferential and open method is abandoned and not followed.<sup>(9)</sup>

Most commonly employed dressing at the donor site wound is using a fine meshed gauze which is smeared commonly with petroleum jelly or bismuth. This smeared wet gauze provides an environment which is moist initially and dries up later to become desiccated and results in the formation of eschar which in turn restricts and impairs cellular migration by acting as a mechanical barrier.

But if dressings of this kind get soaked through their entire thickness due to wound discharge, it will become a media for bacterial invasion. Along with that, donor site dressing displacement produces shearing forces which impair epithelial cellular migration and cause patient discomfort in terms of pain. Dressing will be firmly adherent and more prone to cause injury to the regrown epithelium at the time of its removal.<sup>(6)</sup>

Study done in the past has proved that partial thickness skin loss healing is heightened and Promoted by a moist environment. Experiments which have been done in the recent past have shown that use of biological dressings will create a natural and physiological interface between environment and the surface of the wound thereby permitting the body's immunological and repair system to function most effectively. These kind of dressings are more natural, least allergenic and non pyrogenic. Collagen can be used as a natural material for wound dressing and it has certain specific actions that artificial materials for wound dressings do not have. Collagen dressings can provide anti- inflammatory, analgesic, anti-fibrotic and anti-infective properties, and collagen will also speed up the process of neo angiogenesis.<sup>(10)</sup>

The use of collagen sheets for dressing of donor site wound is very close to being called an ideal donor site wound dressing.

## **II. Materials and methods**

Study design: comparative study

Sample size:  $n = \frac{2(Z\alpha + Z\beta)^2 \times \sigma^2}{d^2}$

80 (with 95% confidence level and 90% power)

30 under collagen dressing

50 under conventional Vaseline gauze dressing

**Study period:** October 2014 – September 2016

Sampling methods: purposive sampling technique based on inclusion and exclusion criteria.

Statistical analysis: fishers exact test, chi square test, mann whitney test

Study centre: Kasturba Medical College Hospital, Attavar, Mangaluru

Government Wenlock Hospital, Mangaluru

Kasturba medical college hospital, Ambedkar circle, Mangaluru

## **III. Inclusion criteria**

1. DSW (donor site wound) after SSG harvest for any indication
2. Minimum size of DSW should be 10 x 10 cm

### **Exclusion criteria:**

1. Age <18 and >65years
2. Morbid illness interfering with healing like:
  - A. Immunocompromised state
  - B. Malignancy, local irradiation
  - C. Uncontrolled Diabetes
  - D. Collagen Vascular Disease
  - E. Severe anaemia and hypoproteinemia
3. Patient refusal
4. Hypersensitivity to collagen

**Application methodology**

After harvesting split skin graft (SSG) using humby’s knife, DSW is mopped with a sterile mop. A wet collagen sheet (bovine) of required dimension is taken and prior to application it is washed with normal saline until it is free of isopropyl alcohol preservative, then applied over the donor site ensuring that the trapped air is removed. A light dressing is done with non-adherent padding. In conventional dressing Vaseline gauze is put instead of collagen sheet while rest of the procedure remains the same, as above.

**Parameters to assess outcome:**

**A.** Primary endpoint with respect to the effectiveness of wound dressings in the treatment of DSW is time taken for complete wound healing. Wound healing here is defined as re epithelialization of the total wound surface. We decided re epithelialization of donor site wound to be assessed by an independent investigator who is unaware of the treatment given.

1= complete epithelialization, 2= scattered or spotty epithelialization, 3= no epithelialization or infected. Wound inspected on 12th, 14th, 16th, 18<sup>th</sup> POD and assessment continued till 22<sup>nd</sup> postoperative day.

**B.** Assessment of pain using VAS (visual analogue scale) is measured as (0 – 10). It is documented by the patient on a Visual Analogue Scale, varying from 0 (absent pain) to 10 (intolerable pain). This is scored daily for one week post operatively and once in a week during next three to four postoperative weeks in a diary held by the patient.

**C.** Pruritus over donor area can also be assessed using simple numeric scale from (0-10). Assessed in a patient held diary similar way as pain assessment (0-10) at the end of 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> postoperative week.

**D.** Duration of need of analgesics and type of analgesics (NSAIDs/ opioids)

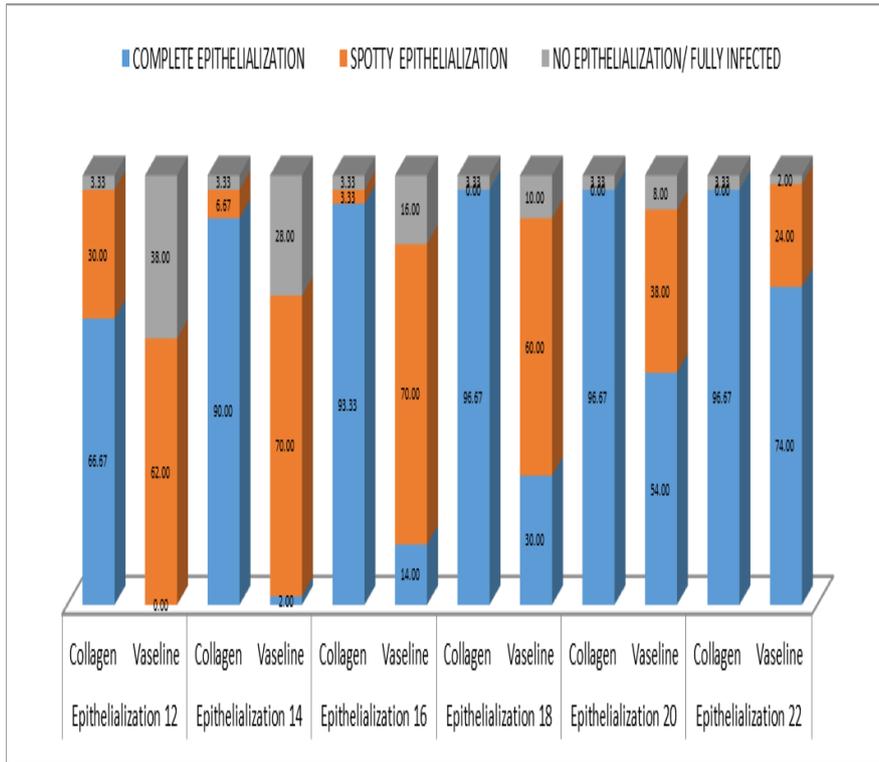
- 0 = no need,
- 1 =1-3days,
- 2 =4-10days,
- 3 =11-14days,
- 4 =>14days.

**IV. Results**

Chart comparing rate of epithelialization between Vaseline gauze and collagen dressing

Group	1		2		3		Mannwhitney test		
	freq	%	freq	%	freq	%	Z value	p	
Epithelialization 12	Collagen	20	66.7%	9	30.0%	1	3.3%	6.17	p<0.001, HS
	Vaseline	0	.0%	31	62.0%	19	38.0%		
Epithelialization 14	Collagen	27	90.0%	2	6.7%	1	3.3%	7.07	p<0.001, HS
	Vaseline	1	2.0%	35	70.0%	14	28.0%		
Epithelialization 16	Collagen	28	93.3%	1	3.3%	1	3.3%	6.37	p<0.001, HS
	Vaseline	7	14.0%	35	70.0%	8	16.0%		
Epithelialization 18	Collagen	29	96.7%	0	.0%	1	3.3%	5.46	p<0.001, HS
	Vaseline	15	30.0%	30	60.0%	5	10.0%		
Epithelialization 20	Collagen	29	96.7%	0	.0%	1	3.3%	3.85	p<0.001, HS
	Vaseline	27	54.0%	19	38.0%	4	8.0%		
Epithelialization 22	Collagen	29	96.7%	0	.0%	1	3.3%	2.47	.013
	Vaseline	37	74.0%	12	24.0%	1	2.0%		

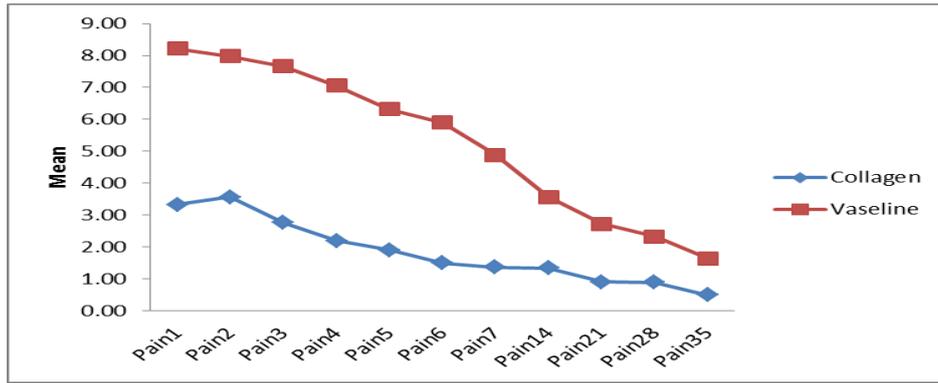
1- complete epithelialization, 2- spotty epithelialization, 3- infected/no epithelialization



Epithelialization with collagen as a donor site dressing material on post op day 12 was complete in 66.7% of cases, in around 30% of cases spotty epithelialization was noted and 3.3 % of cases showed no epithelialization. On comparing epithelialization with Vaseline gauze dressing on postoperative day 12, none of the cases showed complete epithelialization. About 62% of cases showed spotty epithelialization and in around 38% of cases donor site wound (DSW) was infected or no epithelialization was seen. On postoperative day 12, Z- value is 6.17 with a P value <.001 which is highly significant. On postoperative day 20, in 96.7% of cases with collagen as dressing material for donor site, wound epithelialization was complete and 3.3% of cases i.e, 1 out of 30 cases showed infection. In case of Vaseline gauze dressing only 54% of cases showed complete epithelialization, 19 out of 50 cases i.e, 38% of cases showed spotty epithelialization and 8% of cases were either infected or no epithelialization. On postoperative day 20, Z-value is 3.85 with a P value <.001 which is highly significant.

Chart on comparison of pain perception between Vaseline gauze and collagen dressing

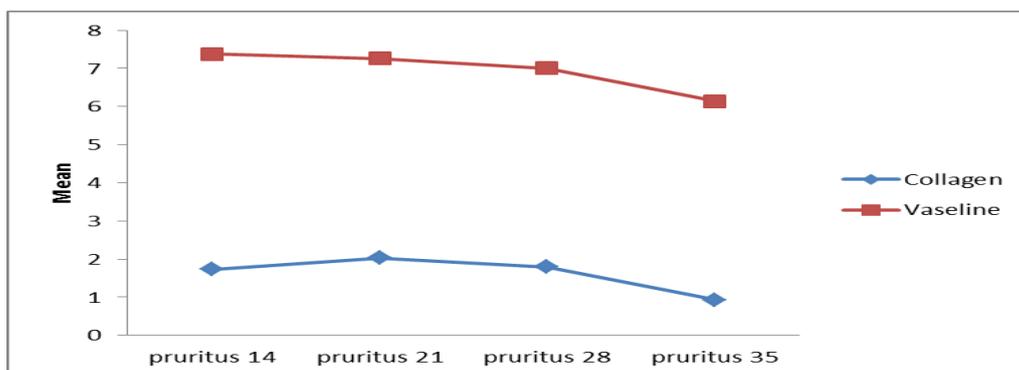
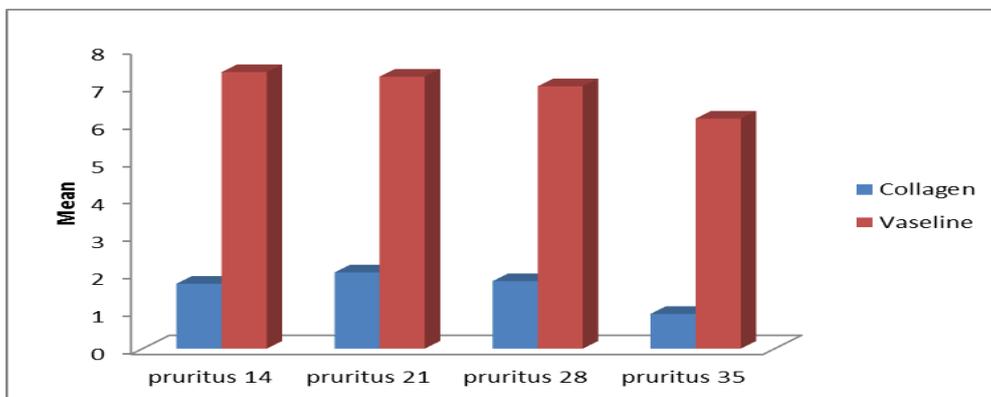
Group	N	Mean	Std. Deviation	Median	Mannwhitney test Z value	p	
Pain1	Collagen	30	3.33	1.953	3.00	7.06	p<0.0001 HS
	Vaseline	50	8.22	1.093	8.00		
Pain2	Collagen	30	3.57	1.870	3.00	6.91	p<0.0001 HS
	Vaseline	50	7.98	1.134	8.00		
Pain3	Collagen	30	2.77	1.813	2.50	7.16	p<0.0001 HS
	Vaseline	50	7.66	1.303	8.00		
Pain4	Collagen	30	2.20	1.750	2.00	6.95	p<0.0001 HS
	Vaseline	50	7.06	1.490	7.00		
Pain5	Collagen	30	1.90	.923	2.00	7.34	p<0.0001 HS
	Vaseline	50	6.32	1.477	7.00		
Pain6	Collagen	30	1.50	1.075	1.00	7.04	p<0.0001 HS
	Vaseline	50	5.90	1.693	6.00		
Pain7	Collagen	30	1.37	.890	1.00	7.10	p<0.0001 HS
	Vaseline	50	4.88	1.586	5.00		
Pain14	Collagen	30	1.33	.994	1.00	4.99	p<0.0001 HS
	Vaseline	50	3.56	2.042	3.00		
Pain21	Collagen	30	.90	.885	1.00	4.22	p<0.0001 HS
	Vaseline	48	2.73	2.210	2.00		
Pain28	Collagen	29	.90	1.081	1.00	3.57	p<0.0001 HS
	Vaseline	39	2.33	1.675	2.00		
Pain35	Collagen	30	.50	1.042	.00	2.70	.007
	Vaseline	11	1.64	1.804	1.00		



On post op day 1 mean and median pain perception scores with collagen group is 3.33 and 3.00 out of 10 when compared to Vaseline gauze dressing group which is 8.22 and 8.00 respectively which shows pain perception in collagen dressing group is far lesser in immediate postoperative phase when compared to the Vaseline gauze dressing group with a Z- value of 7.06 and P value <.0001 which is highly significant. Similarly on postoperative day 2,3,4,7,14, 28 the Z values are 6.91, 7.16, 6.95, 7.10, 4.99, 3.57 respectively with a P value <.0001 which is highly significant.

Chart on comparison of pruritus between Vaseline gauze and collagen dressing

	Group	N	Mean	Std. Deviation	Median	Mannwhitney test Z value	p
Pruritus14	Collagen	30	1.73	1.143	2.00	6.92	p<0.0001 HS
	Vaseline	50	7.38	2.137	8.00		
Pruritus21	Collagen	30	2.03	2.157	2.00	6.62	p<0.0001 HS
	Vaseline	50	7.26	1.893	8.00		
Pruritus28	Collagen	30	1.80	1.648	2.00	6.91	p<0.0001 HS
	Vaseline	50	7.00	1.917	7.50		
Pruritus35	Collagen	28	.93	1.538	.00	6.50	p<0.0001 HS
	Vaseline	50	6.14	2.365	7.00		

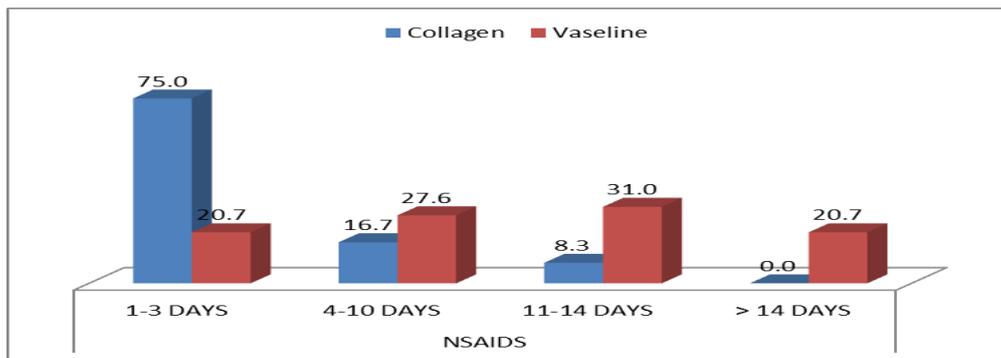


On postoperative day 14, mean and median pruritus score was 1.73 and 2.00 with collagen group in comparison with Vaseline gauze group where it is 7.38 and 8.00 respectively with a Z- value of 6.92 and p value <.0001 which is highly significant. On postoperative day 21 mean and median pruritus score with collagen dressing is 2.03 and 2.0 in comparison with Vaseline gauze dressing where mean and median pruritus score was 7.26 and 8.00 respectively with a Z- value of 6.62 and P value <.0001 which is highly significant. Similarly on post op day 35 mean and median pruritus score with collagen dressing is 0.93, 0.00 in comparison with Vaseline gauze dressing where mean and median pruritus score was 6.14 and 7.00 respectively with a Z-value of 6.50 and P value <.0001 which is highly significant.

Chart on comparison of NSAIDs and opioids as analgesic and its duration of requirement between Vaseline gauze and collagen dressing

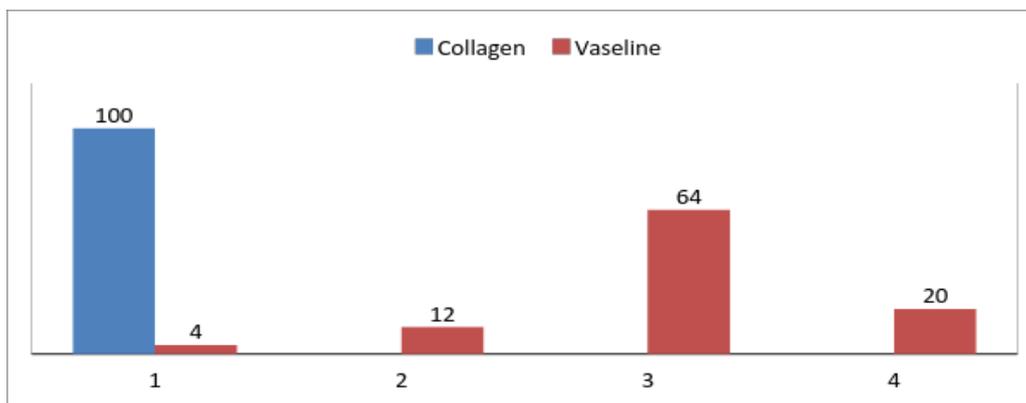
		Group		Total
		Collagen	Vaseline	
NSAIDS	1-3 DAYS	18 75.0%	6 20.7%	24 45.3%
	4-10 DAYS	4 16.7%	8 27.6%	12 22.6%
	11 - 14 DAYS	2 8.3%	9 31.0%	11 20.8%
	> 14 DAYS	0 .0%	6 20.7%	6 11.3%
Total		24 100.0%	29 100.0%	53 100.0%

Fishers exact test p=.001, HS



		Group		Total
		Collagen	Vaseline	
OPIOIDS	1-3 DAYS	2 100.0%	1 4.0%	3 11.1%
	4-10 DAYS	0 .0%	3 12.0%	3 11.1%
	11 - 14 DAYS	0 .0%	16 64.0%	16 59.3%
	> 14 DAYS	0 .0%	5 20.0%	5 18.5%
Total		2 100.0%	25 100.0%	27 100.0%

Fishers exact test p=.016, significant



75% of patients with collagen dressing i.e, 18 out of 24 cases who required NSAIDs as analgesic, required them only for initial 3 post op days. 16.7% of patients with collagen dressing required NSAIDs for 4 to 10 days post op. No patients required NSAIDs with collagen dressing for > 2 Weeks. Whereas in Vaseline gauze dressing group 31% of cases i.e, 9 out of 29 patients who required NSAIDs required it for 11-14 days and around 20.7% i.e, 6 out of 29 cases who required NSAIDs for analgesia required for > 2 weeks with a P value of .001 which is highly significant. Among collagen dressing group only 2 out of 30 cases required opioids for analgesia and only for initial couple of days whereas in Vaseline gauze group 64% i.e, 16 out of 25 pts who required opioids as analgesics required it for 11-14 days and 20% of cases required for > 2 weeks with a P value of 0.16 which is significant.

## V. Discussion

Collagen improves deposition of fibroblasts in the dermis and promotes angiogenesis, formation of granulation tissue and re epithelialization.<sup>(11)</sup> Synthesis of collagen is mainly by fibroblasts which helps in cementing and also serve as a plastic material in the process of wound healing. Amongst the new types of wound dressings/ materials; Biological dressings such as collagen Provide the most physiological interface between the environment and wound surface and is impermeable to bacteria.<sup>(12)</sup> For application of collagen dressing and post application management no specific skill is required.<sup>(13)</sup> Ideal dressing should be immunologically tolerated and should result in better quality of healed skin with minimal scarring.<sup>(14)</sup>

Rate of epithelialization is faster with usage of collagen as dressing material for donor site wound when compared to Vaseline gauze dressing. On post op day 22 around 74% of cases with Vaseline gauze as dressing material for donor site wound showed complete epithelialization in comparison with collagen which showed complete epithelialization in 96.76% of cases which suggests that even with Vaseline gauze as dressing material for donor site wound epithelialization does occur in donor site wound, but it occurs very slow and later when compared to collagen where it is faster.

As it is well known, pain and burning sensation are the two most distressing symptoms a patient suffers from at the donor site wound in post op period. The trend in the study suggests that during initial postoperative days pain perception at the donor site wound with collagen as a dressing material is far lesser when compared to Vaseline gauze dressing. But with increase in the number of post op days pain perception also decreases with Vaseline gauze dressing but not as significantly when compared to collagen dressing. Study also showed that incidence and severity of pruritus is more in case of Vaseline gauze dressing when compared to collagen dressing.

Use of analgesics is least with collagen dressing and required only for few days whereas with Vaseline gauze group it is required for long duration and opioids are also needed with or without NSAIDs for adequate analgesia.

### **Collagen performs the following functions through the four phases of wound healing.**<sup>(10,15)</sup>

1. Chemotactic function: fibroblasts will be attracted by the large surface area of collagen fibrils which are available thereby promoting early healing.

2. Haemostatic function: haemostatic plug is formed by interaction between platelets in blood and collagen.

3. Guidance function: Collagen fibrils serve to guide fibroblasts. Fibroblasts migrate along the connective tissue matrix, collagen fibrils aid in guidance.

4. Nucleation: collagen acts like a nucleating agent leading to fibrillar structure formation in presence of certain salt like neutral molecules .collagen dressing provides guidance for the orientation of capillary growth and new collagen deposition.

Few studies have been carried out to find the effect and use of collagen on donor site wound of split skin graft.

Nordgaard and Pontén used collagen as donor site wound dressing material in skin grafting in 55 patients.<sup>(16)</sup> They reported that there was reduction in frequency of dressing with the elimination of time consumed while doing dressings among nursing staff and it is totally pain free. Horch and Stark did a study comparing collagen with polyurethane dressings in 20 patients.<sup>(17)</sup> They found that there was improvement in patient comfort and rate of epithelialization with collagen in comparison with polyurethane dressings. Fernandes de Carvalho et al. compared three dressing modalities namely calcium-alginate with bovine collagen dressing + transparent polyurethane film, cellulose soaked in normal saline and transparent polyurethane film alone.<sup>(18)</sup> They found least pain and fastest rate of epithelialization in patients managed with the bovine collagen calcium-alginate dressing covered with a transparent polyurethane film. Halankar et al compared collagen dressing with paraffin gauze dressing in 30 patients. They found collagen to be the ideal donor site dressing in split skin grafting.<sup>(19)</sup>

## **VI. Conclusion**

Rate of epithelialization is faster with use of collagen as a material for donor site wound in comparison with conventional vaseline gauze dressing. Severity of pain is minimal in initial postoperative days and incidence of pruritus during process of wound healing and post wound healing is least with the use of collagen. Also Minimal use of analgesics is observed with collagen as dressing material for donor site wound.

### **Therefore Collagen helps in**

- promoting early healing
- Reducing severity of pain at the donor site wound
- Reducing incidence of pruritus
- Reducing duration of requirement of analgesics

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