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Evaluation of Effectiveness of Collagen Dressing in Healing of Split Skin graft Donor Site Wound

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ABSTRACT

Background: Split-skin grafting is commonly employed by surgeons for covering skin defects in case of Skin ulcers, deep burns and following trauma. **Objectives:** To evaluate effectiveness of collagen dressing in healing of Split Skin Graft Donor site wound (DSW).

Material and Methods: This comparative study was conducted in the Department of General surgery, Kasturba Medical College affiliated Hospitals, Mangaluru between October 2014 to September 2019 and continued in few private hospitals in Mysore from September 2021 to August 2022. Purposive Sampling technique based on inclusion and exclusion criteria was used.

Results: Epithelialization with collagen as a donor site dressing material on postoperative 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. Pain and burning sensation are the two most distressing symptoms patient will suffer from at the donor site wound in postoperative period. Minimal use of analgesics is observed with collagen as dressing material for donor site wound.

Conclusion: Epithelialisation rate was faster with the use of collagen as a material for donor site wound in comparison with conventional Vaseline gauze dressing.

Keywords: Epithelialization, Pain, Pruritus, NSAIDs, Opioids, Split Skin graft, Vaseline gauze, wet collagen.

INTRODUCTION

Skin is the largest single organ in the body which covers the external surface of the human body. It Protects from external environmental insults such as trauma, radiation, microbial invasion, it facilitates thermoregulation (through vasoconstriction, vasodilation, sweating) and prevention of fluid loss. This protective intact skin barrier is very important especially following injury to prevent fluid loss from the body, prevent infection and to reduce incidence of wound contracture and cosmetic disfigurement. Therefore to overcome this problem, skin grafting is performed.

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)

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usually receives minimal attention and is often associated with delayed wound healing with significant pain and discomfort to the patient.

Hence, patients having undergone split skin graft complain of pain which is far more severe in donor site wound 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).

Wound healing is a complex process which involves the expression of various growth Factors sequentially which promote cellular proliferation with migration and synthesis of new connective tissue matrix with the deposition of collagen.[1,2]

Wounds which are held in the phase of inflammation show cessation in the growth of epidermis and its migration over the wound surface.[3,4] The most common feature of all types of wounds is an increase in the levels of some lytic enzymes known as matrix metalloproteinases, which leads to increase in proteolytic activity thereby inactivating the growth factors involved in the process of wound healing.

Activity of these matrix metalloproteinases can be hindered by use of collagen without interfering in the activity of growth factors on wound healing. Thus, compared to conventional Vaseline gauze dressing collagen serves to be a better alternative.

Skin is a natural protective barrier which prevents the invasion of microorganisms and oozing of interstitial fluid. The split skin graft harvesting leads to partial skin thickness injury with loss of protein rich fluid and blood from the wound.

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.[5] The left out epithelial cell layer at the periphery of the donor site wound 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 wound healing.

Split skin graft donor site wound have been managed with closed or open dressing techniques.[6] 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 maximal comfort to the patient. Closed wound dressing also has an advantage of preventing mechanical trauma to donor site wound, microbial contamination and tissue desiccation, hence closed wound dressing is always preferential and open method is abandoned and not followed.[6]

Experiments which have been done in the recent past have shown that use of biological dressing will create a natural and physiological interface between environment and the surface of the wound thereby permitting body’s immunological system and reparative system to function effectively. These kind of dressings are more natural, least allergenic, non-pyrogenic.

Use of amniotic membranes and porcine xenografts as dressing materials in various experiments have been carried out in the recent past, but results were poor with both.

There was a delayed healing with the amniotic membrane dressing and subepithelial incorporation and rejection leading to abnormal healing in most cases employing the use of porcine xenografts.[7,8] The use of wet collagen for dressing of donor site wound is very close to being called an ideal donor site wound dressing.

MATERIAL &METHODS

This comparative study was conducted in the Department of General surgery, Kasturba Medical College affiliated Hospitals, Mangaluru between October 2014 to September 2019 and continued in few private hospitals in Mysore from September 2021 to August 2022. Purposive Sampling technique based on inclusion and exclusion criteria was used. Ethical approval was obtained from the institution's ethics committee.

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Sample size: Sample size was calculating by using forma
$n = [2(Z\alpha + Z\beta)2 \times \sigma 2]\ d2$
80 (with 95% confidence level and 90% power)
30 under collagen dressing
50 under conventional Vaseline gauze dressing

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 anemia and Hypoproteinemia
   3. Patient refusal
   4. Hypersensitivity to collagen

Methodology
After harvesting split skin graft (SSG) using Humby knife, DSW is mopped with a sterile mop. A wet collagen sheet 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, 18th POD and assessment continued till 22nd 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 2nd, 3rd, 4th and 5th 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.

Statistical Analysis
Finding the relevance of research parameters on a categorical scale between groups has been accomplished through the use of either the Chi-square test or Fisher's exact test and mann whitney test. Significance level of P less than 0.05 would serve as the cut off value.

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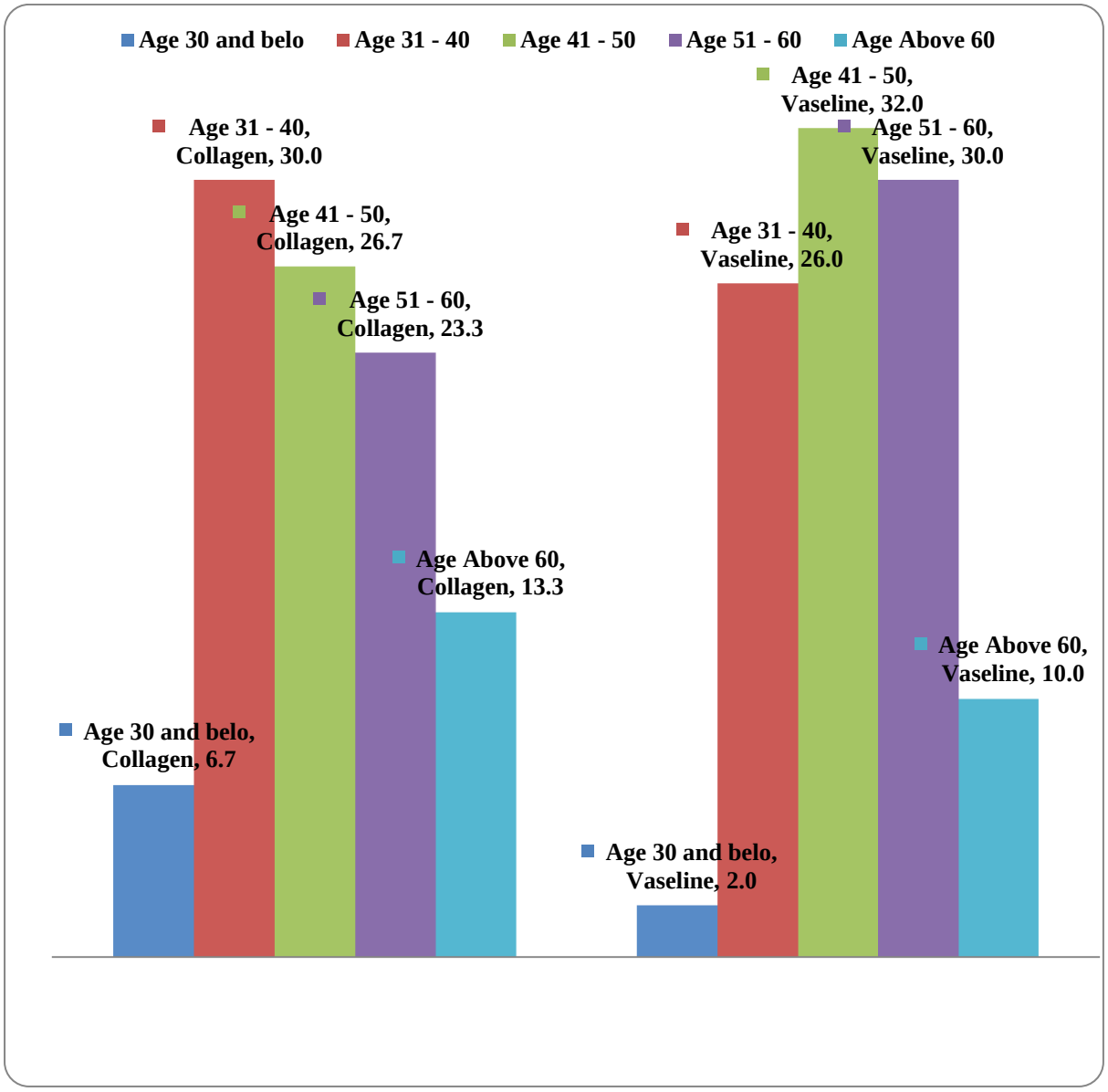
RESULTS



Graph1 showing age wise distribution of collagen and Vaseline dressing

Table 1: Sex distribution

		Group		
		Collagen	Vaseline	Total
Sex	F	9	10	19
		30.0%	20.0%	23.8%
	M	21	40	61
		70.0%	80.0%	76.3%
Total		30	50	80
		100.0%	100.0%	100.0%

X2=1.03 p=.309, NS

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Table 2: comparing rate of epithelialization between Vaseline gauze and collagen dressing

	Group	N	50th (Median)	25th percentile	Mannwhitney test	
					Z value	p
Epithelialization 12	Collagen	30	1.00	2.00	6.17	p<0.001, HS
	Vaseline	50	2.00	3.00		
Epithelialization 14	Collagen	30	1.00	1.00	7.07	p<0.001, HS
	Vaseline	50	2.00	3.00		
Epithelialization 16	Collagen	30	1.00	1.00	6.37	p<0.001, HS
	Vaseline	50	2.00	2.00		
Epithelialization 18	Collagen	30	1.00	1.00	5.46	p<0.001, HS
	Vaseline	50	1.00	2.00		
Epithelialization 20	Collagen	30	1.00	1.00	3.85	p<0.001, HS
	Vaseline	50	1.00	2.00		
Epithelialization 22	Collagen	30	1.00	1.00	2.47	.013
	Vaseline	50	1.00	2.00		sih

Epithelialization with collagen as a donor site dressing material on postoperative 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 where 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 14, 90% of cases with collagen as a dressing material for donor site wound showed complete epithelialization, 6.7% of cases i.e, only 2 cases showed spotty epithelialization and 1 case continued to remain infected or showed no signs of epithelialization. With Vaseline gauze as donor site dressing material 2% of cases that is only one case out of 50 showed complete epithelialization, 70% of cases showed spotty epithelialization and 28% showed no epithelialization or was infected. On postoperative day 14 Z-value is 7.07 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, one 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.

Rate of epithelialization is faster with use 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 occurs in donor site wound but it occurs very slow and late when compared to collagen where it is faster.

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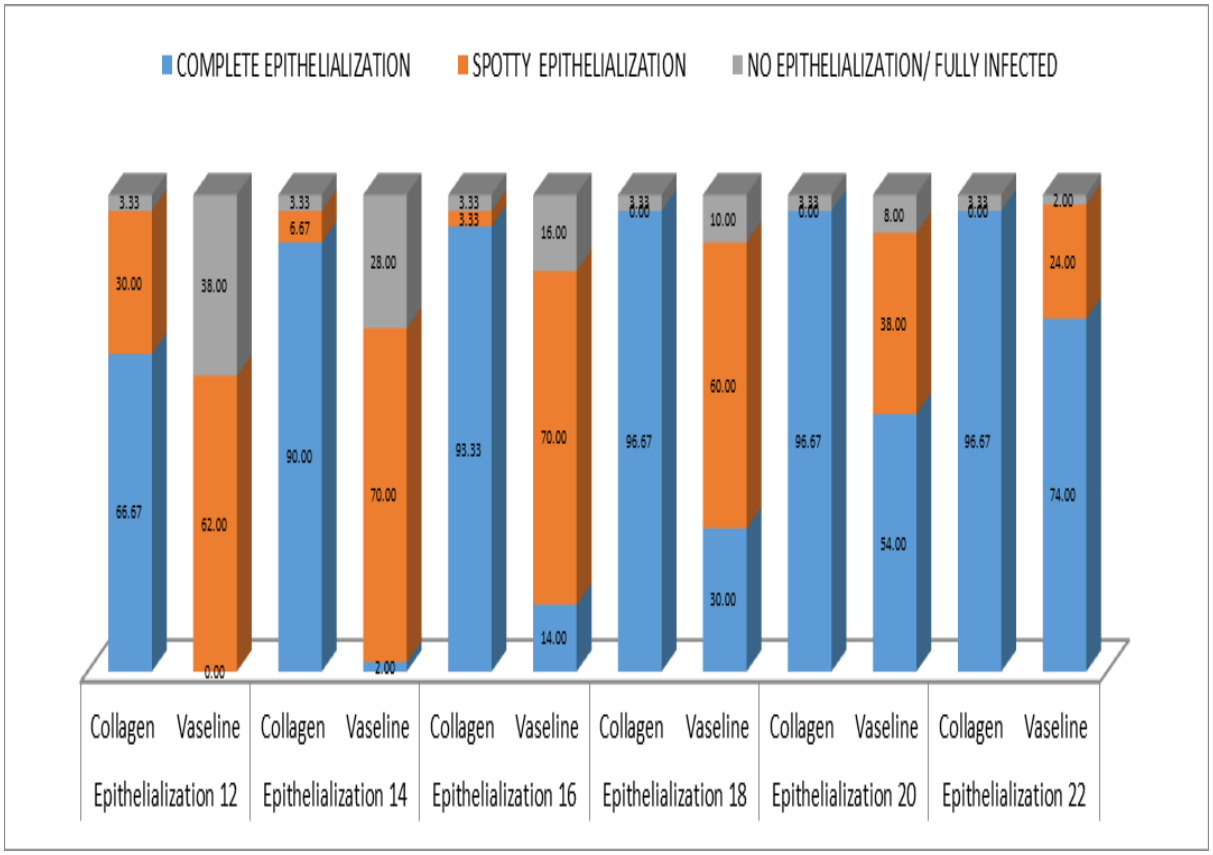
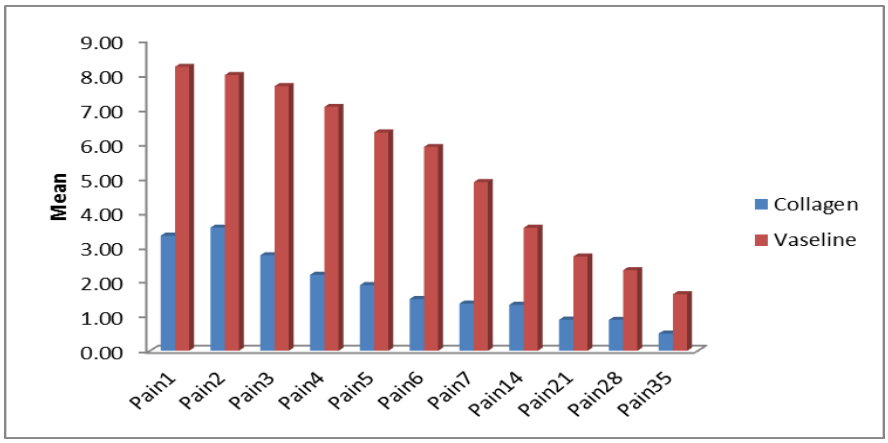


Graph 2 showing epithelialization on day 12,14,16,18,20,22 between vaseline gauze and collagen dressing

Pain and burning sensation are the two most distressing symptoms patient will suffer from at the donor site wound in postoperative period. On postoperative day1 mean and median pain perception scores with collagen group is 3.33 and 3.00 out of 10 with collagen group 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 period 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 postop 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.



Graph 3 on comparison of pain perception between Vaseline gauze and collagen dressing

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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 postoperative 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.

Table 3: 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
	Vaseline	50	7.38	2.137	8.00		HS
Pruritus21	Collagen	30	2.03	2.157	2.00	6.62	p<0.0001
	Vaseline	50	7.26	1.893	8.00		HS
Pruritus28	Collagen	30	1.80	1.648	2.00	6.91	p<0.0001
	Vaseline	50	7.00	1.917	7.50		HS
Pruritus35	Collagen	28	.93	1.538	.00	6.50	p<0.0001
	Vaseline	50	6.14	2.365	7.00		HS

75% of patients with collagen dressing i.e, 18 out of 24 cases who required NSAIDs as analgesics, required them only for initial three postoperative days. 16.7% of patients with collagen dressing required NSAIDs for 4 to 10 days, 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.

Table 4: Chart on comparison of opioids as analgesic and its duration of requirement between Vaseline gauze and collagen dressing

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

Fishers exact test p=.016, significant

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DISCUSSION

This trend suggests that during initial post op day 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 postoperative day pain perception also decreases with Vaseline gauze dressing but not as significantly when compared to collagen dressing.

It shows that pruritus severity is more in case of Vaseline gauze dressing when compared to collagen dressing where it is least. As number of postoperative day increases pruritus decreases but the severity of itching in initial postoperative weeks will be least with collagen dressing in comparison with the conventional Vaseline gauze dressing.

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

Collagen can be used as a natural material for wound site dressing and its action is different on wound site in comparison to artificial materials for wound dressings. Collagen dressings can provide anti- inflammatory, analgesic, anti-fibrotic and anti-infective properties, andcollagen will also promote the process of neo angiogenesis.[9]

In wound healing collagen performs the following functions through the four phases of wound healing.[9,10]

1. Chemotactic function: Fibrogenic cells will be attracted by the large surface area of
2. collagen fibers which are available thereby promoting early healing.
3. Haemostatic function: haemostatic plug is formed by interaction between platelets in blood and collagen.
4. Guidance function: Collagen fibres guide the fibroblasts. Fibroblasts migrate along the matrix of connective tissue.
5. Nucleation: collagen acts like a nucleating agent leading to fibrillary 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 dressing material in skin grafting in 55 patients.[8] 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.[11] 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- calcium-alginate bovine collagen dressing with transparent polyurethane film, cellulose soaked in normal saline and transparent polyurethane film alone.[12] They found least pain and fastest epithelialization in patients dressed with the calcium-alginate bovine collagen 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.[13]

CONCLUSION

Epithelialisation rate was faster with the use of collagen as a material for donor site wound in comparison with conventional vaseline gauze dressing. Severity of pain was mimimal in initial post op days and incidence of pruritus during process of wound healing and post wound healing is least with the use of collagen. And minimal use of analgesics is observed with collagen as dressing material for donor site wound.

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REFERENCES

1. Singer AJ, Clark RA. Cutaneous wound healing. N Engl J Med.1999; 341: 738-46.
2. Witte MB, Barbul A. General principles of wound healing. SurgClin North Am. 1997; 77: 509-28.
3. Loots MA, Lamme EN, Zeegelaar J, Mekkes JR, Bos JD, Middelkoop E. Differences in cellular infiltrate and extracellular matrix of chronic diabetic and venous ulcers versus acute wounds. J Invest Dermatol.1998; 111: 850-57.
4. Jude EB, Boulton AJ, Ferguson MW, Appleton I. The role of nitric oxide synthase isoforms and arginase in the pathogenesis of diabetic foot ulcers: possible modulatory effects by transforming growth factor beta 1. Diabetologia.1999; 42: 748-57.
5. Weber RS, Hankins P, Limitone E, et al. Split-Thickness Skin Graft Donor Site Management. A Randomised Prospective Trial Comparing a Hydrophilic Polyurethane Absorbent Foam Dressing with a petroleum gauze Dressing. Arch Otolaryngol Head Neck Surg 1995; 121 (10): 1145-9.
6. Kilinc H, Sensoz O, Ozdemir R, Unlu RE, Baran C. Which dressing for split thickness skin graft donor site? Ann PlastSurg 2001; 46 (4): 409-14.
7. salisbury RE, Wilmore DW, Silverstein P, Pruitt BA. Biological Dressing for Skin Graft Donor Sites. Arch Surg 1973; 106 : 705-6.
8. Ponten B, Nordgaard JO. The Use of Collagen Film as a Dressing for Donor Areas in split skin grafting. Scand J PlastReconstrSurg 1976; 10: 237-40.
9. Fleck CA, Simman R. Modern collagen wound dressings: Function and purpose. J Am Col Certif Wound Spec 2011;2:50-4.
10. Albu MG, Ferdes M, Kaya DA, Ghica MV, Titorencu I, Popa L, et al. Collagen wound dressings with anti-inflammatory activity. Mol Cryst Liq Cryst 2012;555:271-9.
11. Horch RE, Stark GB. Comparison of the effect of a collagen dressing and a polyurethane dressing on the healing of split thickness skin graft (STSG) donor sites. Scand J Plast Reconstr Surg Hand Surg 1998;32:407-13.
12. Fernandes de Carvalho V, Paggiaro AO, Isaac C, Gringlas J, Ferreira MC. Clinical trial comparing 3 different wound dressings for the management of partial-thickness skin graft donor sites. J Wound Ostomy Continence Nurs 2011;38:643-7.
13. Halankar P, Gomes DC, Chaudhari C. Collagen Dressing in the Management of Donor Site of Split Thickness Skin Grafts. Bombay Hosp J 1998;47.