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A PROSPECTIVE STUDY ON DONOR SITE HEALING FOLLOWING HARVESTING OF SPLIT THICKNESS SKIN GRAFT

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ABSTRACT

OBJECTIVE

1. Comparison between collagen and normal saline dressing for donor site following harvesting of split thickness skin graft.
2. To analyse various factors and complications encountered during the process of donor site healing following harvesting of split thickness skin graft like:

- Pain
- Ambulation
- Re-epithelization
- Complications like – Infection, delayed wound healing, displacement of collagen sheet.

STUDY DESIGN

- Prospective study.

SETTING

- Krishna Hospital and Research Center, Karad.

SUBJECTS AND METHODS

- This is a prospective study. All patients fulfilling inclusion criteria for skin grafting in Krishna Hospital & Medical Research Centre, Karad, were included in the study which was conducted between December 2020 and June 2022.
- The selected sample for this study was divided into two groups; control group and treatment group. The control group will consisted of 50 patients who underwent conventional dressing with Normal Saline. While the treatment group included 50 patients with haemocoagulase with collagen sheet dressing.
- Finally, the outcomes of the clinical trials were carefully studied.

RESULT

- The initial sample size included 100 patients who underwent STSG.
- Two groups were included in the study, Normal Saline dressing group and collagen dressing group for the study duration consisting of 50 patients each.
- The mean and standard deviation of the age in both the groups was found to be 49.52 ±13.52 and 50.60 ±14.21 respectively.
- In the present study it was found that there is male predominance among the study population. Total 58% of the study population was male population.
- Pain – Minimum and maximum pain score in normal saline dressing was 3 and 7 respectively while in collagen dressing the minimum and maximum pain score was 2 and 6.
- Ambulation – Maximum patients i.e. 21 (42%) patients started to ambulate on POD 3 in Normal Saline dressing. In collagen dressing maximum patients i.e. 28 (56%) patients started to ambulate on POD 1.

- Re-epithelization - Donor site re-epithelisation in the Normal Saline dressing by 21 -24 days. Due to complications of donor site infection the donor site healing extended to 30 - 32 days in about 4 patients. Donor site re-epithelisation was noted between 15-18 days in the collagen dressing group. In 3 patients donor site healing was delayed to 21-23 days due to donor site infection.
- Infection – 4 (8%) patients with Normal Saline dressing showed infection while 3 (6%) patients with Collagen dressing showed infection.
- Soakage – Normal Saline dressing showed soakage while no soakage was seen in collagen dressing.
- Cost – Collagen dressing was expensive compared to Normal Saline dressing

CONCLUSION

- It can be concluded in the study that collagen dressing can provide better post-surgical outcome compared to Normal Saline dressing in following ways:
- Less pain over the donor site in the collagen dressing group.
- Early ambulation was observed in the collagen dressing group.
- Re-epithelisation was complete early in most of the patients in the collagen dressing group.
- Inspection of the donor site wound can be done easily and complications can be recognised early.
- There were less complications in the collagen dressing.

INTRODUCTION

One of the most important and largest organ in the human body is skin which contributes almost 16% of the total body weight. Functions of the skin which are well recognized are protection against the external environment and thermoregulation. Skin also plays a major role in formation of Vitamin D and it also plays a role in protein metabolism. Human body produces maximum amount of vitamin D in the epidermal layer of the skin. (1)

Not only skin acts as a physical barrier to the pathogenic organisms, it also functions as an active immune organ and has prominent antigenic property which plays an important role in the composite tissue allo-transplantation. (2)

Skin is an organ which is prone to trauma. Because of above mentioned functions of the skin, it becomes very important that the skin barrier remains intact and this could be achieved in many ways which includes grafting as well.

There are many indications for the skin grafting which are-

- Promotion of accelerated healing of burns and other wounds,
- Reduction of insensible fluid loss and protection from the bacterial infection,
- Reduction of scar contracture,
- Enhancement of cosmesis.

Aside from these indications, skin grafting can also be used to cover extensive wound area or wounds which show possibility of scarring.

Usually, donor site wounds are more painful compared to skin graft wound. For which it is advisable that the skin graft wounds and donor site wounds should be taken care of by an experienced person who is trained in the care and management of skin graft wounds and donor site wounds. It is highly important that patient should be aware that, to heal the primary or original wound another wound needs to be created which can end up making a scar. Another important aspect is that, the patient should be aware that the donor site wound can become more uncomfortable than the graft site wound because of exposure of sensory nerve endings. (Weber et al, 1995)

Even after development of newer advances the split thickness skin graft (STSG) plays an important role in many areas of plastic surgery. Although the method of skin grafting is now more or less standardized, the treatment of donor site differ greatly and it remains a debatable topic. STSG of the donor site is paid little attention which lead to delayed healing along with increased pain and discomfort to the patients. Therefore, it is very common that patient complains more about the donor site compared to the site of surgery.

Harvesting of a split thickness skin graft leads to partial thickness injury and blood outflow and also releases protein rich exudate from the wound. This exudate released from the wound combines with coagulated blood to form eschar that provides temporary cover on the wound and protects the underlying regenerating epithelium. But the formation of eschar doesn't protect from tissue desiccation and infection at the donor site which may convert partial thickness to full thickness loss. Therefore, after harvesting of split thickness skin graft, formation of new epidermis comes from the proliferation of remaining epithelial layer at the periphery of the donor site and reserve cells which are present in the hair follicles, sebaceous glands and sweat glands. The first phase of healing is marked by this process. Cell proliferation is followed by the transport of cell outward until the reepithelization of wound occurs. It takes 10-14 days for complete re-epithelization, but it is possible that the rate of healing may be affected by the thickness of the graft. (3)

Donor site healing also occurs through reepithelization. Epithelial cells migrate from the remnants of hair follicles, sebaceous and sweat glands which are present in the reticular dermis of the skin and which spreads across the wound bed until the skin is fully restored. Usually this occurs within 7-10 days but depending upon the patient's health status such as age and nutrition it can take maximum 21 days as well. It is possible to enhance the wound healing in elderly patients if the surgeon uses small amount of skin graft and which is widely applied over the donor site as fenestrated dressing. (Fatah and Ward, 1984). In such cases, where skin graft spreading is done, it along with reepithelization from the remnants of hair follicles, sweat and sebaceous glands can lead to faster recovery. In first 3-4 days after the surgery, usually donor site leads to production of exudates which depends on the size of the wound. As the reepithelization progresses the exudate secretion also goes down. But during this period, as the donor site is more sensitive because of the exposed nerve ending, it is necessary to apply proper dressing to reduce the discomfort caused to the patient.

The main purpose of treating donor site is to increase the healing with minimum risk of complications and pain to the already injured patient. Moist wound healing is a relatively common idea and search is still going on to find optimal treatment which can provide ideal, moist environment. For this purpose, collagen dressings are used which are composed of type 1 and type 3 bovine collagen which is similar to human collagen and it is accepted by the human body without any possibility of rejection. This collagen is readily available in the market and it is easy to use as well. It has been shown that the time taken for re-epithelization when collagen is used as a dressing for donor site can be compared to other dressing materials. (4)

It is not possible to monitor the actual wound healing as it is not possible to keep the wound under continuous observation and the mean time to the first dressing may be longer. Therefore, most of the donor sites may have healed long before they are inspected.

But it is observed that the patients undergoing collagen dressings have minimal to moderate pain in the post operative period and during the first dressing. In such patients, analgesic requirement is decreased and for them early mobilisation is possible. Important advantage of using collagen for dressing is that it reduces the pain. Also, collagen sheet causes less friction with the wound surface and the dressing which makes it suitable for awkwardly sited donor sites. Also, after the application it doesn't require any bulky dressing which may hamper the mobilisation of the patient and requires no change in the dressing. Collagen mainly provides a scaffolding for epithelial regrowth and it also prevents exudation from the raw area. (5, 6)

After application, collagen becomes a stiff sheet within 48 hours which is able to withstand the pressure and shearing of the clothes. Therefore, it helps in protection of donor site from any

mechanical trauma and infection and also leads to decrease in loss of protein in exudate. Once the reepithelization is complete, the overlying film and coagulated blood separates spontaneously. Because of this removal of dressing from the site becomes easy and without pain.
But there are certain disadvantages related to use of collagen dressing which is, formation of hematoma where proper haemostasis has not been achieved. Also, infection at the donor site leads to complete degradation of film and that is associated with significant donor site pain. (7, 8)
Wound infection is commonly limited to the donor site with no associated systemic infection, also it does not cause any full thickness loss and after the wound is redressed this does not affect the reepithelization. Therefore, collagen dressing shows that it can have good advantage over the other dressing materials for donor sites. Mainly in factors such as pain free site and also there is likelihood of early mobilisation of the patients and this may lead to reduced morbidity as well.
With this, the dissertation has been prepared with objective of comparing the collagen and normal saline dressing for donor site after the harvesting of split thickness graft and also to analyse the factor associated with the donor site healing.

METHODS AND MATERIALS

Method of Selection:

The sample was selected randomly from all the patients who satisfy the inclusion and exclusion criteria. This was done to avoid any selection bias. The inclusion and exclusion criteria to select the patients for the study are as mentioned below:

Inclusion Criteria:

- All the donor sites of the split thickness skin grafts.
- All patients above the age of 18 years.

Exclusion Criteria:

- Patients suffering from various comorbidities like psoriasis, albinism, Marjolin's ulcers, areas with exposed nerves, bones and tendons
- Patients having large donor site area.

Sample size:

This study consisted of a sample of 100 patients at Krishna Institute of Medical Sciences, Karad.

$n=(SD_1^2 + SD_2^2)(Z_{1-\alpha/2}+Z_{1-\beta})^2/(M_1-M_2)^2$

$n=(4^2+4^2)(13)/(20-17)^2$

$n=(16+16)(13)/(3)^2$

$n=47$

n= sample size.

SD_1=standard deviation of no. of days required for healing using conventional dressing. = 4

SD_2=standard deviation of no. of days required for healing using collangen dressing. =4

M_1=mean of no. of days required for healing using conventional dressing. =20

M_2 = mean of no. of days required for healing using conventional dressing. =17

$Z_{1-\alpha/2}$ =normal deviate for conventional dressing.

$Z_{1-\beta}$ = normal deviate for collagen dressing.

$(Z_{1-\alpha/2}+Z_{1-\beta})^2$ =13.

Period of study:

The study was conducted from December 2020 to June 2022.

Study Design:

The study was conducted in the Department of Surgery, and also the patients referred from other Departments of Krishna Institute of Medical Sciences, Karad from December 2020 to

July 2022.
The selected sample for this study was divided into two groups; control group and treatment group. The control group will consisted of 50 patients who underwent conventional dressing. While the treatment group included 50 patients with haemocoagulase with collagen sheet dressing.
Control group: The conventional normal saline dressing consisted of application of gauze soaked in normal saline over the donor site which is be further covered by sterile gamjee pad and gauze.
Treatment group: In this group, we applied approximately 5-10 drops of haemocoagulase topical solution to the donor site which is smeared over the donor site. After checking for hemostasis, sterile moist collagen sheet is sieved and applied over the donor site which is then allowed to dry. The collagen sheet is sieved to help in the drainage of the exudate and air bubbles.
To maximize the effectiveness of the dressing, the patients were shifted to the post-operative ward only after the collagen sheet has dried adequately. It is imperative to take extra care to prevent displacement of the collagen sheet.

RESULTS

Total 100 patients were included in the study who were randomly allocated in the normal saline dressing group and collagen dressing group.

AGE WISE DISTRIBUTION:
In the present study it was found that there is male predominance among the study population. In the normal saline dressing group 56% of the patients were males and 22% of female. Whereas in collagen dressing 60% of the patients were males and 40% of the patients were female. Total 58% of the study population was male population.

Table 01: Age distribution of the patients.

AGE GROUP	NORMAL SALINE DRESSING	COLLAGEN DRESSING
20-30	6 (12%)	9 (18%)
31-40	7 (14%)	4 (8%)
41-50	12 (24%)	15 (30%)
51-60	18 (36%)	17 (34%)
>60	7 (14%)	5 (10%)
TOTAL	50	50

GENDER WISE DISTRIBUTION:
Table 02: Gender distribution of the patients.

GENDER	NORMAL SALINE DRESSING	COLLAGEN DRESSING
MALE	28 (56%)	30 (60%)
FEMALE	22 (44%)	20 (40%)
TOTAL	50	50

PAIN:
It was observed during the study that, there was significant difference between the two types of dressing groups used in the study.
NORMAL SALINE DRESSING - Minimum pain score of 3 which was present only in 2 (4%) patients whereas maximum pain score experienced was 7 which was experienced by total 9

(18%) patients out of 50. Majority of patients had 6 pain score in normal saline dressing in 19(38%) patients. Pain score of 4 is seen in 9 (18%) patients.
COLLAGEN DRESSING - Compared to the normal saline dressed there was significant reduction in pain in the collagen dressing patients. Minimum score experienced in this group was 2 noted in almost 13 (26%) patients. Whereas maximum pain score was 6 experienced by 2 (4%) patients. Pain score of 4 was noted in 16 (32%) patients and pain score of 5 was noted in 9 (18%) patients.

Table 03: Comparison of Pain score between Collagen dressing and Normal Saline dressing.

PAIN SCORE	COLLAGEN DRESSING	NORMAL SALINE DRESSING	P VALUE
2	13 (26%)	-	
3	10 (20%)	2 (4%)	<0.05
4	16 (32%)	9 (18%)	
5	9 (18%)	11 (22%)	
6	2 (4%)	19 (38%)	
7	-	9 (18%)	
TOTAL	(n=50)	(n=50)	

AMBULATION:
NORMAL SALINE DRESSING - Because of high pain experienced among the normal saline dressing population it was observed that there was a limitation in their mobility. It was noted that out of total 50 patients only 21 patients (42%) were ambulant on the 3rd post operative day. 15 patients (30%) were ambulant on the 2nd post operative day whereas 14 patients (28%) of the patients were ambulant on the 4th post operatively.
COLLAGEN DRESSING - Compared with the normal saline dressing, collagen dressing patients had better outcome post operatively. 28 (56%) patients were ambulant on the 1st day after the surgery whereas 20 patients (40%) of the study population was ambulant on the 2nd post operatively. The remaining 2 (4%) patients ambulated on the 3rd postoperative day. Early ambulation was noted in the patients with the collagen dressing.

Table 04: Comparison of ambulation day in the normal saline dressing and collagen dressing study group.

AMBULATION DAY	NO OF PATIENTS IN NORMAL SALINE DRESSING (%)	NO OF PATIENTS IN COLLAGEN DRESSING (%)
POD 1	0 (0%)	28 (56%)
POD 2	15 (30%)	20 (40%)
POD 3	21 (42%)	2 (4%)
POD 4	14 (28%)	0 (0%)

RE EPITHELISATION:
NORMAL SALINE DRESSING - Donor site re-epithelisation was assessed in the normal saline dressing by the loosening of the dressings. Average time taken for the donor sites to re-epithelise was 21 -24 days. Due to complications of donor site infection the donor site healing extended to 30 -32 days in about 4
patients.
COLLAGEN DRESSING - Donor site re-epithelisation was noted between 15-18 days in the collagen dressing group. In 3 patients donor site healing was delayed to 21-23 days due to donor site infection which was treated by conservative methods due to the ease of inspection of donor site and had the advantage of early identification of donor site complications.

Table 05: Comparison of Re-epithelization in the normal saline dressing and collagen dressing study group.

	NORMAL SALINE DRESSING	COLLAGEN DRESSING
DONOR SITE RE EPITHELISATION (IN DAYS)	21-23 DAYS	15-18 DAYS
EXTENSION OF DAYS DUE TO COMPLICATIONS	30-32 DAYS IN 4 PATIENTS	21-24 DAYS IN 3 PATIENTS

DONOR SITE COMPLICATIONS:

Infection

Donor site infection was noted in 4(8%) patients of the normal saline dressing group. It was managed with conservative dressings with framycetin.
Donor site dressings on periodic review showing excessive soakage with foul smell were opened end wound swabs taken.
Donor site infection noted in 3 (6%) patients in the collagen dressing group, conservative e dressings done to treat the infection in these patients.

Table 06: Comparison of infection in the normal saline dressing and collagen dressing study group.

	NO. OF PATIENTS IN NORMAL SALINE (%)	NO. OF PATIENTS IN COLLAGEN DRESSING (%)
DONOR SITE INFECTION	4 (8%)	3 (6%)
NO INFECTION	46 (92%)	47 (94%)

Collagen Displacement

2 (4%) patients in the study group had shearing of collagen sheet when applied to donor site in the postoperative period. Wound was cleaned and normal saline dressing applied and patient was excluded from the study.

Table 07: Collagen displacement in collagen dressing.

	NO. OF PATIENTS (%)
COLLAGEN DISPACEMENT PRESENT	2 (4%)
NO COLLAGEN DISPLACEMENT	48 (96%)

Dressing Soakage

More patients with normal saline dressings and excessive padding experienced donor site dressing soakage. The dressing's extra weight was a drawback of this. To rule out an infection at the donor site, the malodor that was caused by dressing soakage was swiftly controlled. Patients with normal saline dressings found it extremely uncomfortable to wear the garments due to the increased bulk of the dressing brought on by excessive padding and seepage of exudates from the dressing to the garments. The hemocoagulase and collagen combination dressing did not have the drawbacks of soakage or bulky dressing.
The patients felt more comfortable while wearing the clothes, which improved their spirits and promoted early ambulation. Although the exposed raw region at the donor site initially caused the patients to be uneasy, they were counselled and, in the post-operative period, direct observation

of the healing donor sites helped to reduce their uneasiness. Patients who underwent numerous grafting surgeries and were treated with both techniques of dressing opted for the combination dressing in subsequent procedures due to the decreased discomfort, comfort of dressing, and benefit of wearing the garments early.

Table 08: Overall comparison between normal saline dressing and collagen dressing study group.

	COLLAGEN DRESSING	NORMAL SALINE DRESSING
PAIN SCORE	4	6
AMBULATION	POD 1	POD 3
REEPITHELISATION	15-18 DAYS	21-24 DAYS
COST FACTOR	EXPENSIVE	LESS EXPENSIVE

In the group receiving both collagen sheet and hemcoagulase treatment, pain intensity was significantly reduced. This made it easier to start walking early the following day.
In every case, full epithelization was discovered. Even though the surgery was more expensive, it will end up saving money because it encourages a higher patient turnover rate and better acceptability. The posterior thigh donor sites frequently experience shearing of the collagen sheet, which can cause serious donor site morbidity.

DISCUSSION

In the present study total 100 patients were included. All the patients were allocated in two groups of closed dressing and collagen dressing. 50 patients each distributed in the two groups. Split-thickness skin grafting (STSG) is a frequently used reconstructive technique but is associated with variations in practice.
Numerous controlled studies in the last 50 years have established that moist wound healing is the best evidence based practice. Dried wound tissue is more prone to complications such as infection, scarring, pain and prolonged healing. The goal of treating skin graft donor sites is to promote healing while minimizing the risk of introducing new complications and pain to an already traumatized patient.
Essentially, the wound was left open to scab, which is contradictory to the best evidence-based practice of today, that of moist wound healing. In recent years, much has been published highlighting the benefits of moisture-retentive dressings in treating donor sites. Moisture-retentive dressings that have been used include hydrocolloids, foams, and transparent thin film dressings, alone or in combination with absorbent materials such as alginates, hydrofibers or gauze.

Age distribution:
It was observed that majority of the patients in the study population were present in 41-50 years age group and 51-60 years age group. In the closed dressing 36% of patients were in 51-60 years whereas it was 34% of the collagen dressing were in 51-60 years. 24% of closed dressing patients were present in 41-50 years age group whereas 30% of the collagen dressing population was present in 41-50 years age group. Total 30% of the study population was present in 20-30 years, 22% of the study population was present in 31-40 years and 24% of the total study population was present in >60 years age group.
In study by **Tushar J. Dave**, [13] mean age of subjects in collagen group was 49.8±11.6 years and in conventional group was 49.67±15.2 years. There was no significant difference in mean age between 2 groups.

Gender distribution:
In the present study it was found that there is male predominance among the study population. In the closed dressing group 56% of the patients were males and 22% of female. Whereas in collagen dressing 60% of the patients were males and 40% of the patients were female. Total 58% of the study population was male population.
In study by **Tushar J. Dave**, [13] In collagen group, 53.3% were males and 46.7% were females and in conventional group, 80% were males and 20% were females. There was no significant difference in mean age between 2 groups.

Pain:
After the split thickness graft was harvested, dressing was applied on the skin graft site. Pain score was measured on the numerical ratings scale on the scale of 0 to 10. 0 was no pain and 10 worst pain. It was observed that there was difference between the pain experienced among the study population of both the groups.
In the closed dressing group maximum pain felt was on the score of 7 in total 9 patients (18%). Maximum number of patients experienced the pain on numerical rating scale of 6 were total 19 in number (38%) followed by 22% on pain score of 5. Relatively less number of patients experienced less pain with only 2 patients (4%) were experienced pain score 3.
There was significant improvement in the pain outcome of collagen dressing patients with almost 26% patients experiencing pain score of 2. 38% of the study population experiencing pain score 3. 32% of the population experienced pain of 4 in the collagen dressing. Compared to closed dressing only 4% patients were observed to experience pain of 6. There were no patients among the study population who experienced the pain of 7.
The difference among the study population was statistically significant with the p value < 0.05 suggestive of that collagen dressing can lead to significant pain reduction after application compared to closed dressing.
In a study done by **Raymond Horch et al** [9] observed that when collagen dressing was compared with the polyurethane dressing. Pain in both the group was compared using visual analogue scale where it was found that the discomfort at the doner site on day 1, 3, 5, 7, 10, more discomfort and pain was felt after dressing with the polyurethane film compared to collagen dressing application. This finding was statistically significant with the p value <0.005.
In another study where collagen dressing was matched with normal saline dressing done by **Sandhya Nagaraj et al** [10] observed that when the mean visual analogue scores were compared between collagen dressing and normal saline dressing on 5, 10, 14 and 20th day, collagen dressing patients had significantly less pain compared to normal saline dressing on all days except at 21 day when it was observed that the wound may have healed.
Pontén and Nordgaard[11] used collagen film as dressing for skin graft donor site in 55 patients. They reported that the donor sites were not painful and the nursing staff could reduce or eliminate time-consuming work with frequent dressings.
In the study by **Ayaz et al**, [12] significant reduction in pain and pruritus in patients with collagen dressing was noted on POD 1 and POD 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.

Ambulation:
Due to moist nature of the collagen dressing on the donor site such as hydrocolloids, foams, transparent thin film dressing alone or in combination with absorbent materials such as alginates, hydrofibers or gauze can provide excellent pain reduction and other moisture retentive benefits. Whereas wound left open to scab or the closed dressing applied on the donor site there is seem to much pain among the study population.

Another advantage of the collagen sheet is that once adherent to the wound has low friction between the wound surface and dressing and this has made it suitable for awkwardly sited donor sites.
Also once applied it does not require a bulky dressing which would
hamper mobilisation, or require a change of dressing as there is no
soakage of the dressing due to wound exudate.
It was observed in the present study that due to increased pain in the closed dressing patients there was limitation in the mobility. Comparatively collagen dressing because of relatively less pain experienced during the dressing were able to increase their mobility earlier.
Out of total 50 patients in the closed dressing group, only 21 patients were able to move on the 3rd day after the surgery. Whereas 30% of the study population was able to move on the 2nd post operative day and 28% of the patients were ambulant on the 4th post operative day.
Compared to the closed dressing there was excellent improvement in the study population under the collagen dressing. Due to moist nature of the dressing and less friction between the dressing and graft site, there was very less pain compared to closed dressing because of which this study population had better outcome post operatively. 28 (56%) patients were ambulant on the 1st day after the surgery whereas 20 patients (40%) of the study population was ambulant on the 2nd post operatively.
The remaining 2 patients ambulated on the 3rd postoperative day. Early ambulation was noted in the in patients with the collagen dressing. These findings were showing the superiority of the collagen dressing compared to closed type of dressing.

Re-epithelisation:
Donor site re epithelisation was assessed in the closed dressing by
the loosening of the dressings average time taken for the donor sites to re epithelise was 21 -24 days. Due to complications of donor site
infection the donor site healing extended to 30 -32 days in about 4
patients.
Donor site re epithelisation was noted between 15-18 days in the
collagen dressing group. In 3 patients donor site healing was delayed to 21-23 days due to donor site infection which was treated by conservative
methods due to the ease of inspection of donor site and had the advantage of early identification of donor site complications. In 2 patient there was displacement of collagen sheet from the donor site and it was converted to closed dressing and excluded from study. The healing time noted in that patient was 24 days.
It was found that the if haemostasis was achieved properly in the collagen dressing it can lead to improved re epithelisation, lower infection rate and less pain.
Collagen dressing provides excellent post surgical outcomes though application of the dressing on the graft side is a difficult process. It requires only one time application which led to further pain and ambulation improvement. But it was noticed during the dressing that if adequate haemostasis is not achieved then there is higher chances of infection rate and fluid collection at the dressing site. Also, there is evidence that antigenicity of the collagen is minimum which can further reduce the infection rate among the study population.
Also, collagen can act as a mechanical support at the graft site and can also be able to stimulate the migration of fibroblasts. These fibroblasts can further participate in the scar formation where collagen can become an essential product that can provide tensile strength of the healing of soft tissue as well.
It was also noted in the **Raymond Horch** [9] study that wound healing can be accelerated using immediate collagen source and it can provide an early matrix for the re-epithelisation.
In **Sandhya Nagaraj study** [10] it was observed that epithelisation rate on day 10 was much better in the collagen group though it was found to be non significant. Collagen patients had faster

epithelisation and wound healing. And majority of the patients in the collagen group needed only one dressing till the post operative day 14.

Donor site complications:

Infection

Donor site infection was noted in 4 (8%) patients of the closed dressing group. It was managed with conservative dressings with framycetin. Donor site dressings on periodic review showing excessive soakage with foul smell were opened end wound swabs taken. Donor site infection noted in 3 (6%) patients in the collagen dressing group, conservative e dressings done to treat with the infection in these patients.

It was also observed that collagen sheet application was required only once which resulted in better epithelisation and pain control. The infection rate was found to be almost similar in both the groups but it can be controlled further in the collagen group if hemostasis can be achieved adequately at the donor site.

In study by **Tushar J. Dave**,[13] in the collagen group 6.7% had surgical site infection and in conventional group 13.3% had surgical site infection.

However, **Hutchinson and McGuckin**, [12] in a review of 29 donor site studies, showed an infection rate of only 2.7% in occluded wounds versus an infection rate of 6.4% in conventionally dressed wounds.

Collagen Displacement

2 (4%) patients in the study group had shearing of collagen sheet when applied to donor site in the postoperative period. Wound was cleaned and closed dressing applied and patient was excluded from the study.

Following table compared the variables compared among the study group.

PAIN SCORE	COLLAGEN DRESSING	CLOSED DRESSING
Pain score	4	6
Ambulation	POD 1	POD 3
Re-epithelisation	15-18 Days	21-24 Days
Cost factor	Expensive	Less expensive

From the above table it can be observed that the pain score dramatically improved among the collagen dressing study population compared to closed dressing. Collagen dressing patients due to reduction in pain showed early ambulation, that is on 1st day after the surgery itself, whereas closed dressing patients took almost 3 days post surgery for ambulation. Due to moist nature of the collagen dressing and the supportive feature of the collagen such only once application, relatively less infection rate enabled that group for early epithelisation.

Though collagen dressing is considered as expensive compared to closed dressing the benefit provided by this dressing outweighs the cost of the dressing. Such as lower rate of infection, early ambulation and epithelisation. In some cases patients in the collagen dressing group could walk while dressing was present. All these characteristics of the dressing can provide much better cost benefit to the patients compared to the closed dressing.

CONCLUSION

- It can be concluded in the study that collagen dressing can provide better post-surgical outcome compared to Normal Saline dressing in following ways:
- Less pain over the donor site in the collagen dressing group.
- Early ambulation was observed in the collagen dressing group.
- Re-epithelisation was complete early in most of the patients in the collagen dressing group.

- Inspection of the donor site wound can be done easily and complications can be recognised early.
- There were less complications in the collagen dressing.

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