Comparative study of collagen and paraffin gauze dressing on skin graft donor site

Narayanathu Chellappantilla Sreekumar, Panambur Laxminarayan Bhandari, Naduthodikayil Praveen

Department of Plastic Surgery, Government Medical College, Calicut, Kerala, India

Abstract

Background: The major morbidity of split skin graft is donor site pain, soaking and delayed healing. Numerous donor site dressing modalities are available, but the ideal material remains elusive. Method: We compared the effect of bovine type 1 collagen dressing to conventional paraffin impregnated gauze dressing in 20 patients. After harvesting graft by standard technique, one-half was covered by collagen sheet and other half by paraffin gauze. Pain was assessed daily by Visual Analog Scale. Any soaking of dressing was noted. The dressing was removed on 10th day and both areas were inspected for the amount of epithelization. Results: The pain was less in the collagen area when compared to the paraffin gauze area. The difference was highest for the first 3 days (2.16 vs. 5.86, \( P < 0.01 \)) reduced for the next 4 days (0.4 vs. 3.4, \( P < 0.01 \)) and was minimal for the last 3 days (0 vs. 1, \( P > 0.02 \)). Seven patients had soaking limited to paraffin gauze area whereas two patients had soaked in both areas. On removal of dressing on 10th day, average epithelization was slightly higher in collagen area (98%) compared with the paraffin gauze area (95%). Conclusion: Bovine type 1 collagen reduces pain and soaking at skin graft donor site with minimal effect on the rate of epithelization.

Key words: Collagen, donor site dressing, skin graft

INTRODUCTION

Split skin grafting (SSG) is a commonly performed plastic surgical procedure. It is done to cover granulating wounds, defects arising after excision of cutaneous lesions, the release of contractures and donor sites of fascio-cutaneous flaps. Common sites for harvesting SSG are thighs, legs, buttocks and back. Once SSG is harvested, the donor site is covered with paraffin gauze and multiple layers of pads. It usually takes 10-14 days for the wound to epithelize. Patients complain of considerable pain during the early post-operative period.\(^1\) Often the pads get soaked, necessitating frequent dressings and prolonging hospital stay. Any procedure to reduce these complications of pain and soaking would be very beneficial. Numerous dressing modalities are available for the donor site, but the ideal material remains elusive [Table 1].\(^2\) We compared the effect of collagen dressing (bovine type 1 collagen) and paraffin gauze dressing on skin graft donor site in a group of 20 patients.

Correspondence to:
Dr. P. Laxminarayan Bhandari,
“Mangala,” Chilimbi Hilldale Road, P.O. Ashoknagar, Ladyhill, Mangalore - 575 006, Karnataka, India.
E-mail: lax321@gmail.com
MATERIALS AND METHODS

The aim of our study was to compare the outcome of collagen and conventional paraffin impregnated gauze dressing on skin graft donor site. Permission to conduct the study was obtained from Institutional Scientific Committee. Twenty adult patients requiring a minimum of 40 cm² of skin graft were included in the study. Children, critically ill patients and those with infected wounds were excluded. After obtaining informed consent, skin graft was harvested from the anterior thigh by a standard manual technique using Humby’s knife. The donor site was divided vertically into a medial and a lateral half. One-half was covered with collagen sheet (bovine type 1 collagen with triple helical structure), which became the test area. Other half was covered with regular paraffin gauze dressing [Figure 1], which became the control area. Thus, each patient served as his or her own control. An equal amount of pads were applied on both areas and were secured by a bandage. The boundaries of the two sites were marked externally over the dressing by a marker pen, without naming them.

The pain was assessed daily by Visual Analog Score (VAS), on a score of 0-10. Patients were asked to score the pain separately on medial and lateral side. All patients were able to appreciate the difference in pain between the adjacent sides. Any soaking of the dressing was noted. In case of soaking, over padding was done. Dressing was opened after 10 days. Both test and control areas were inspected for a percentage of epithelization. The results were statistically analyzed by paired t-test to obtain P value.

RESULTS

There were 20 patients included in the study. The age group 23-72 years, male:female = 14:6. The average area was 66.7 cm². The indications for grafting included, posttraumatic raw area-6, excision of cutaneous lesions-3, donor site of fascio-cutaneous flaps-6, the release of post burn contractures - 5. Two patients were excluded as their donor site got infected necessitating early dressing removal. There were no allergic side-effects.

Pain, as assessed by VAS, was less in the test area when compared to the control area. The difference was highest for the first 3 days (2.16 vs. 5.86, P < 0.01) reduced for the next 4 days (0.4 vs. 3.4, P < 0.01) and was minimal for the last 3 days (0 vs. 1, P > 0.02). This is probably due to the anti-inflammatory properties of collagen.[3] As the wound epithelized, the difference in pain between test and control sites reduced from 3.7 on first day to 0.6 by day 10 [Figure 2].

Two patients had soaking with a foul smell in both test and control areas noted by 4th day. These patients had an infection in the donor site necessitating the early removal of dressing and wound care. There were excluded from further study. Seven patients had soaking limited to control site occurring within the first 2 days. The absence of soaking in the test area is probably due to the hemostatic effect of collagen. Over padding was done without removal of the dressing.

Table 1: Various dressing materials for skin graft donor sites

| Category                          | Brand name                                      |
|-----------------------------------|-------------------------------------------------|
| Polymer-based dressing            | Transforming methacrylate or Suprathel          |
| Crystalline cellulose             | Carboxymethylcellulose, Veloderm, Rayon         |
| Alginate                          | Kaltostat, Algisite, Melgisorb                  |
| Polyurethane                      | Opsite, Biatain-Ibu                             |
| Gauze dressing                    | Adaptic, Jelonet, Xeroform, Vaseline            |
| Hydrocolloid                      | DuoDerm E, Tegaderm                             |
| Hydrofiber                        | Aquacel                                         |
| Silicone                          | Mepitel, AWBAT-D                                |
| Keratin dressing                  | Keramatrix - Replicine                          |
| Self-adhesive fabric              | Mefix                                           |
| Nylon dressing                    | Bridal veil                                     |
| Carbohydrate wound dressing       | Glucan II                                       |
| Multilayer combination            | Oxyband                                         |
| Collagen                          | Skin Temp, CutyCol, Neuskin                     |

Figure 1: Combination pictures showing donor site in various stages: Immediately after graft harvest (a), After application of collagen sheet (b), Dressing removal after 10 days (c)

Figure 2: Area chart showing average Visual Analog Score in test (blue) and control (red) sites
On opening of the dressing on 10th day, average epithelization was slightly higher in the test area (98%) compared with the control area (95%) among noninfected cases. As we could not assess epithelization on a day-to-day basis, any significant difference occurring before the 10th day was not measurable. Thus collagen seems to have a minimal advantage over conventional paraffin gauze on the rate of epithelization.

### DISCUSSION

Collagen is the main structural protein of tissues. There are 28 subtypes of collagen identified. Type 1 collagen is the most abundant form and is present in the dermis, bone, tendon, and scars. Collagen has a triple helical structure, which generally consists of two identical chains and an additional chain with a different chemical composition. Commercially available collagen can be from bovine, porcine or avian sources. We used type I bovine collagen with the triple helical structure for our study. It is available in sheets of various dimensions.

Collagen is used as a natural wound dressing and has properties that artificial wound dressings do not have. Collagen dressings can provide anti-inflammatory, anti-fibrotic, and analgesic properties, as well as promote angiogenesis. Throughout the four phases of wound healing, collagen performs the following functions in wound healing:

1. **Guiding function:** Collagen fibers serve to guide fibroblasts. Fibroblasts migrate along a connective tissue matrix.
2. **Chemotactic properties:** The large surface area available on collagen fibers can attract fibrogenic cells which help in healing.
3. **Nucleation:** Collagen, in the presence of certain neutral salt molecules can act as a nucleating agent causing the formation of fibrillar structures. A collagen wound dressing might serve as a guide for orienting new collagen deposition and capillary growth.
4. **Hemostatic properties:** Blood platelets interact with the collagen to make a hemostatic plug.

There have been few studies conducted to determine the effect of collagen on skin graft donor sites. Pontén and Nordgaard 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. Horch and Stark compared collagen to polyurethane dressings in 20 patients. They noticed improved rate of epithelialization, reduced patient discomfort and more convenience with collagen. Fernandes de Carvalho et al. compared three dressing modalities-bovine collagen calcium-alginate dressing + transparent polyurethane film, transparent polyurethane film alone and cellulose soaked in normal saline. They observed greatest epithelialization and less pain in subjects managed with the bovine collagen calcium-alginate dressing covered with a transparent polyurethane film. Halankan et al. compared collagen dressing to paraffin impregnated gauze dressing in 30 patients. They proposed collagen to be the ideal donor site dressing.

Our study has similar findings. Patients with collagen dressings are found to have only minimal to moderate pain in the entire postoperative period. In these patients analgesic requirement is reduced, and early mobilization can be done. This is the major advantage of using collagen as a donor site dressing. The second major advantage is the reduction in soaking of the donor site, which will reduce the need for frequent dressing saving time and resources for the hospital staff and minimizing discomfort for the patient. We found that collagen slightly increases epithelization.

Two of our patients had an infection in donor site (both test and control) leading to persistent wounds after 10 days, which healed with prolonged dressings. One of them was later diagnosed to have Hodgkin’s Lymphoma and received chemotherapy.

### CONCLUSION

Bovine type I collagen reduces pain and soaking at skin graft donor site. The reduction in pain is highest for first 3 days and then gradually diminishes. We found minimal effect of collagen on the rate of epithelization.

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