

## Collagen and Dermal Extract Scaffold: A Novel Cover for Burn Wounds Following Tangential Excision

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### Abstract

Tangential excision and immediate cover of the wound with split skin graft forms the gold standard for treatment of deep burns. However split skin grafting has its own disadvantages.

Donor area may not be available in patients with extensive burns. Split skin grafts contract, provide poor cosmetic appearance and functional outcome. Due to advances in biological and cellular engineering many substitutes have been developed. However most of these substitutes are expensive and may not be applicable for routine use in our population. In this article we have described a novel method for cover of wounds after tangential excision in the form of collagen and dermal extract scaffold. This scaffold is safe, easy to prepare, inexpensive and effective in the management of post tangential excision raw areas.

**Keywords:** Tangential excision; Dermal Extract Scaffold.

### Introduction

The ultimate goal in any thermally injured patient is the early closure or coverage of the burns wound. It reduces the morbidity and improves the functional outcome of the patient [1]. The concept of early excision of the burn wound was pioneered by Cope et al. Excision and grafting has become the standard of care all over the world for deep burns [2]. The purpose of early excision and grafting is to remove all dead devitalised tissue from the body and to render the wound bed amenable to cover with skin graft [3-5].

One of the main disadvantages of tangential excision is substantial intraoperative blood loss both from the excision site and from the skin graft donor site [6-9]. When the patient is still unstable, harvesting split thickness grafts can lead to more blood loss and cause deterioration of the general condition of the patient. In such cases, heterografting of the excised bed can be done. Collagen sheets can be applied after tangential excision. Collagen creates the most physiological interface between the wound and the environment [10]. It forms an impermeable layer and acts as a barrier to bacterial invasion. In addition it

is natural, non-immunogenic, nonpyrogenic, hypoallergenic, and pain-free [11-12]. Though collagen acts as a temporary cover till a more permanent cover in the form of split thickness grafting can be done, it takes a long time to cause epithelisation of the wound.

In this article we would like to highlight the use of a novel scaffold of collagen with dermal extract for cover of the wound bed after tangential excision in a patient with 35% accidental thermal burns.

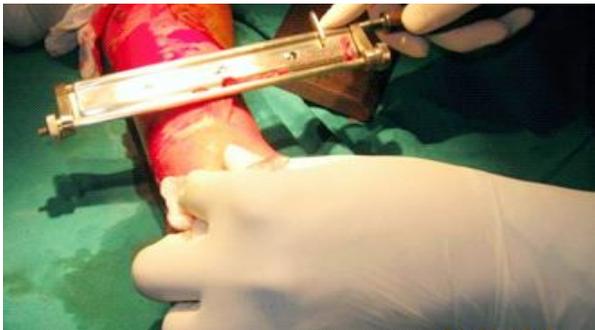
### Case Report

A 35 year old male patient presented to the JIPMER Tertiary Care Burns Centre with history of accidental thermal burns over both forearms, hands, legs and feet. On admission, the patient was stabilised according to the ATLS protocol and IV fluid resuscitation was started according to the Parkland formula. Once, the patient was stabilised, the wounds were assessed. It was noted that the patient had second degree deep thermal burns over forearms, hands and legs (Figure 1). On post burn day 2, the patient was taken up for early tangential excision. Tangential excision was done over the right forearm

(Figure 2). After excision of the necrotic tissue adrenaline saline soaked gauze was placed on the wound to control the bleeding. Once the bleeding from the wound bed was arrested, a scaffold made of collagen and dermal extract was placed on the wound.



**Fig. 1:** Deep burns over the right forearm



**Fig. 2:** Tangential excision being carried out

Preparation of collagen and dermal extract scaffold (Figures 3-5).

Step 1: Informed consent is taken.

Step 2: The site for dermal graft harvest was chosen. One of the following sites was chosen for harvest of dermis – groin, popliteal crease or inferior abdominal skin.

Step 3: Sterile preparation of the surgical site was done and 1% solution of lignocaine mixed with adrenaline was infiltrated in the line of incision.

Step 4: Using a motorized diamond burr, the epidermis over the site of dermis harvest was removed by dermabrasion.

Step 5: Using a surgical scalpel, an incision over the dermis was made and the dermis elevated from the underlying subcutaneous tissue. Any excess subcutaneous tissue stuck to the under surface of the harvested dermis was removed.

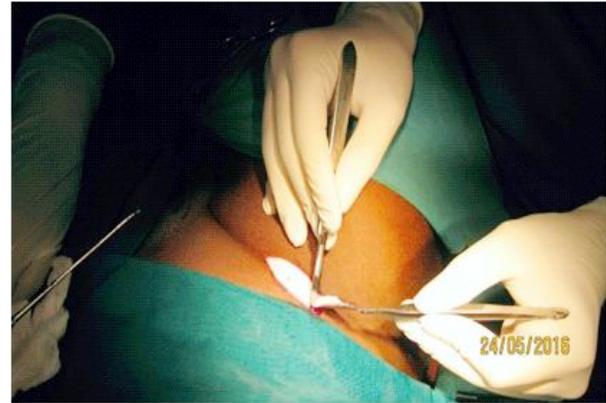
Step 6: the donor site was closed primarily.

Step 6: The harvested dermis was minced into tiny pieces using an 11 number surgical blade.

Step 7: A mallet was used to crush the dermal

pieces and further increase the surface area of the dermal extract.

Step 8: The dermal extract was spread out over a collagen sheet.



**Fig. 3a:** Dermis being harvested from groin region



**Fig. 3b:** Wound closed primarily



**Fig. 4:** Prepared dermal extract



**Fig. 5:** dermal extract placed over collagen sheet to create a scaffold



**Fig. 6:** Collagen and dermal extract scaffold placed on post excision raw area.

The prepared collagen and dermal extract scaffold was placed on the wound and sterile dressing was applied on top (Figure 6). The first postoperative dressing was done on post op day seven. When the wound was opened, it was found that the wound had contracted and epithelial islands had developed on the wound. Regular dressings were done with collagen and the patient was discharged after 25 days of admission without the need for skin graft (Figure 7). Patient was followed up for 1 month. All wounds were healed well without hypertrophic scar formation or wound breakdown.



**Fig. 7:** Picture showing well healed wounds

## Discussion

Autologous split thickness skin grafting is the gold standard for treatment following tangential excision. However donor area may not always be available. In addition, sometimes split thickness skin graft can give a poor functional outcome with poor cosmesis<sup>13</sup>. Therefore, to overcome this issue, in the past decade research has been conducted on the use of artificial epithelial and dermal substitutes.

An ideal substitute should have the following characteristics [14].

1. Inexpensive
2. analgesic,
3. Have a long shelf life
4. can be used off the shelf,
5. nonantigenic
6. Durable
7. Flexible
8. Prevents water loss
9. Antimicrobial
10. Conforms to irregular wounds.
11. Can be applied in a single sitting.

Various skin substitutes have been tried and tested for application in burns like honey, collagen, biobrane, transcyte, epicel etc. each with their own advantages and disadvantages.

The advantages that collagen has over the other biological substitutes is the ease of availability in various sizes, ease of removal, inexpensive, hypoallergenic, pain free, ability to store for around three years and the ability to incorporate drugs and growth factors which can be released in a controlled manner<sup>1</sup>.

Lynch et al [15] used dermal autograft in tissue expander breast reconstruction. The structurally intact matrix of dermal autograft served as a scaffold that maybe necessary for tissue ingrowth and angiogenesis. Many studies have utilized acellular dermal tissue matrix or cultured human dermis for the treatment of diabetic ulcers [16-18]. The advantages of using autologous dermis as a means of wound bed preparation are plenty. Firstly, it can be performed under local anesthesia as a day care procedure. The donor sites can be closed primarily, leaving behind minimal scars. The dermal tissue that is harvested is autologous thus preventing any antigenic reaction and inflammation as occurs with allogenic dermal matrix [14].

Thus by combining the advantages of collagen and dermal extract in the same patient problems such as limited availability of donor area, use of heterogenous material for wound cover, cost etc can be overcome easily.

## Conclusion

Biological skin substitutes like collagen have been used regularly for wound cover after tangential excision. Through this article we would like to advocate the use of collagen along with dermal

extract as a scaffold for wound cover after tangential excision. It is not only easily available and easily prepared but it is a highly effective method to induce early epithelisation in post tangential excision raw areas, avoiding the need for an additional procedure like split skin grafting.

#### *Conflicts of Interest*

None

#### *Source of Funding*

None

#### *Disclosures*

None

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