Original Article

International Journal of Neurology and Neurosurgery
Volume 15 Number 2, April – June 2023
DOI: http://dx.doi.org/10.21088/ijnns.0975.0223.15223.1

Role of Fibrin Glue in Adherence of the Flap and Skin Graft

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How to cite this article:
Barath Kumar Singh P, Ravi Kumar Chittoria/Role of Fibrin Glue in Adherence of the Flap and Skin Graft/Int J Neurol Neurosurg.2023;15(2): 41-44.

Abstract

Flaps and skin grafts are common part of plastic surgery. Complications noted with the flaps, skin grafts are seroma, hematoma underneath which causes failure of flaps and skin grafts. Fibrin glue promotes adhesion of the flaps, skin grafts in minutes. Evicel is a commercially available fibrin glue, which is used as a sealant materials and adherent material underneath the flaps. Fibrin glue was proposed to decrease the hematoma, seroma. In this article we highlight the role of fibrin glue in key stone flap in scalp electrical burn.

Keywords: Fibrin Glue; Adherence; Flap; Skin Graft; Scalp; Electrical; Burn.

INTRODUCTION

In 1940, the first studies on the application of fibrinogen as a tissue adhesive were conducted.[1] With the development of methods for the isolation and concentration of coagulation components in the 1970s, the idea of fibrin glue started to take shape. Fibrin glue was successful in healing a peripheral nerve, according to a 1972 report. Since then, the usage of fibrin glue has been expanded into a number of medical specialties and there have been numerous reports of achievements.[2] As the best sealant substance, fibrin glue has been recommended by many surgeons, and as it comes from people, it is not hazardous to tissue. In seconds or minutes, fibrin glue induces strong adhesion; it is reabsorbed a few days later, confines tissue more quickly, and lowers the danger of hematomas and graft losses.[3] In this case report, we highlight the role of fibrin glue in the adherence of flap.

MATERIALS AND METHODS

This study was done at tertiary care hospital after obtaining approval of departmental scientific and ethical committee. Informed consent was obtained from the patient. This is a prospective descriptive non randomised case study about a 45 year old male sustained electrical burn injuries while working at construction building. He sustained electrocution by contact with electric wire as it fell on patient head. Patient initially went to local hospital, then arrived to our emergency department with an electrical burn in the vertex region of the scalp (entry zone) and the left leg (exit zone). The Scalp had a contact with a 220 V of alternating current. It was presumed that the current entered his skull and exited through his left foot. The other external skin

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Received on: 07.11.2022

Accepted on: 25.03.2023

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injury to scalp, chest wall, abdomen and both thighs and left foot. Multiple second degree superficial burns involving face, neck, chest and abdomen (anterior aspect), bilateral arms (anterior aspect), bilateral thighs, multiple blisters over thigh, legs and second degree burns involving frontoparietal region of scalp at the vertex (fig. 1).



Fig. 1: Scalp electrical burn wound at presentation

The mid-frontoparietal scalp was charred. He was resuscitated with the standard WHO burn protocol. The electrical burn will undergo progressive skin necrosis, so the debridement was done after demarcation of necrotic patch. The dermabrasion is done using the high speed rotating head dermabrader with 4200rpm. The non-viable necrotic tissue was debrided without damaging the normal tissues in both horizontal and vertical planes with dermabrader in scalp burn wound (fig. 2).



Fig. 2: Dermabrasion assisted debridement

After wound debridement with derma-abrasion was done till the removal of unhealthy tissues. The end point of dermabrasion assisted debridement of scalp bone till the removal of necrosed top layer of bone and the bleeding point appears over the skull bone (fig. 3). After debridement biological Human amniotic membrane, collagen scaffold, cyclic NPWT (negative pressure wound therapy) was applied for improving granulation and for preventing infection (fig. 4). Once the wound bed showed healthy granulation, perforator based type



Fig. 3: Post dermabrasion assisted debridement till the appearance of bleeding points



Fig. 4: Well granulated electrical burn scalp wound

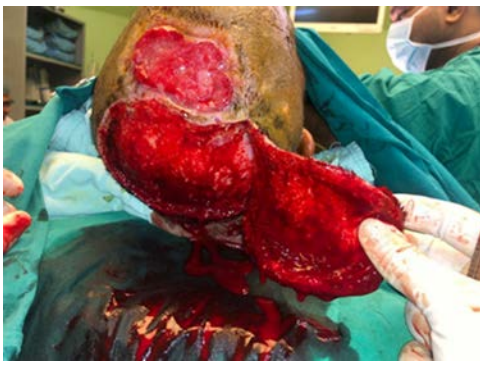


Fig. 5: Type 4 keystone perforator flap

4 keystone flap was done (fig. 5). The secondary defect of the scalp was covered with split skin



Fig. 6: Fibrin glue applied over the scalp primary wound bed

graft taken from thigh. Before the flap inset and skin graft application, we used fibrin glue over the wound bed (fig. 6 & 7).



Fig. 7: Fibrin glue applied over the skin graft site

Fibrin glue used in this study was *Evicel* (R) Fibrin Sealant Human, *Ethicon*, Inc, Somerville, NJ, USA). It is supplied as one vial each of biological active component 2 (BAC2) (55–85 mg/ml fibrinogen) and thrombin (800–1200 IU/ml human thrombin) frozen solutions. Fibrin glue (*Evicel*) was sprayed in short bursts (0.1–0.2 ml) onto the tissue to produce a thin, even layer, followed by flap inset and skin grafting.

RESULTS

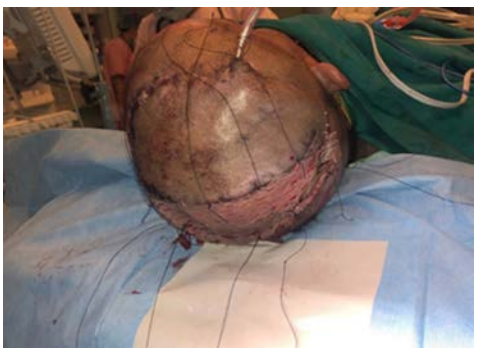


Fig. 8: Keystone perforator flap POD 1

The scalp wound with exposed bone was covered with adequate granulation tissue by the regenerative techniques followed by keystone perforator flap cover (fig. 8) done in our case. Patient was compliance with fibrin glue. No reactions were noted to fibrin glue. No complications were noted post procedure. There was no complication associated with the flap and the skin graft applied. Both flap and skin graft were healthy without any necrosis after 2 weeks (fig. 9). Patient discharged successfully.



Fig. 9: Keystone perforator flap post 2 weeks

DISCUSSION

The application of fibrin glue has been mentioned in a variety of contexts, including the treatment of burn victims and the restoration of peripheral nerves and other viscera, the closure of fistulas, the removal of cerebral tumours, and skin grafting.[2,3,5,7-12] The literature emphasises the ongoing development in fibrin glue preparation and application. Commercially available fibrin glue is made from homologous plasma. However, contamination problems that could be brought on by the HIV and hepatitis C viruses[13] have deterred its manufacture in several nations. Although there is talk about the likelihood of hypersensitivity reactions from heterologous proteins, there are accounts of the synthesis of fibrin glue by extraction of fibrinogen from animal serum.[14] This study's fibrin glue product is called *Evicel* (R).

Evicel is produced from a collection of human plasma. Two packages make up the *Evicel* single use kit. One box contains a vial of BAC2 and another contains a vial of thrombin. An instrument for applying sterile spray is contained in the second container. It is best to combine the two substances (BAC2 and thrombin) before topically applying them. One blood unit can create autologous fibrin glue (500 ml). Through the use of centrifugation and cryoprecipitation, fibrinogen is extracted from blood and transformed into fibrin glue during surgery by the addition of thrombin. Fibrinogen can be utilised for two years after being stored at 20°C in a freezer. Studies have shown that the main benefit of using fibrin glue during surgery on organs with non-sutureable haemorrhage, such as the liver, spleen, and retroperitoneal surfaces, in effective haemostasis.[15] Several investigations involving internal organ surgery have also reported on the solid adhesion that aids the merging of tissues.[15] Three stages are involved in skin graft take. The first stage, called plasmatic imbibition, lasts for 24 to 48 hours. When generalised blood flow has been established by the fifth or sixth post -graft day, an inosculatory phase and a process of capillary in growth begin virtually simultaneously. The graft is initially connected to the bed by a

thin fibrin mesh, but within the first four days, this mesh work becomes coated with endothelial cells and connects with the graft's vasculature. Numerous investigations have demonstrated that the stabilisation of the graft by the fibrin network between the graft and the recipient bed is essential for early skin graft survival. In order to stabilise the graft and allow graft nutrition through serum imbibitions (plasmatic circulation) with the subsequent in growth of vascular buds, fibrin glue creates an instantaneous, strongly cross -linked fibrin network (neovascularisation). Due to the fast haemostasis, it was seen in our study that the intraoperative application of fibrin glue considerably facilitated surgery. It was noticed during clinical development that there was no development of haematomas, and if they occurred, they were minor and did not interfere with flap and graft take because of the quick and effective haemostasis. In comparison to control instances, the surgery took less time because the graft adhesion was strong and no suture was required. The expense of using fibrin glue is a limiting barrier because the commercially available products are highly expensive.

CONCLUSION

The Safety profile of fibrin glue was excellent and there were no adverse effects noted with it being effective in promoting the take of flap and skin graft. Cost of fibrin glue and small sample size are the limiting factors.

Financial support and sponsorship

This study was financially supported by the Department of Plastic Surgery, Jawaharlal Institute of Postgraduate Medical Education and Research, Puducherry, India.

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