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Original article:

Comparison of the Cosmetic Appearance of Tissue Adhesive (Glue) Isoamyl-2-cyanoacrylate v/s Conventional Skin Suturing

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ABSTRACT

Introduction: Most skin grafts are successful, but in some cases they do not heal well and require repeat grafting. The scars resulting from application of acrylates were compared with the scars resulting from subcuticular skin closure and it was noted that post-operative pain, discomfort and erythema of the wound margins was significantly less when the tissue adhesive was used. This study, employs Isoamyl-2-cynoacrylate which is one of the series of homologues called alkylcyanoacrylates and compares the cosmetic appearance of split skin graft (SSG) after application of Isoamyl 2-cyanoacrylate and conventional suturing technique.

Material and Methods: 50 patients admitted for skin grafting because of skin loss in the Surgery department were included in the present study and divided into two groups. Group A consisted of cases where Split Skin Graft fixation was done using Isoamyl-2-cyanoacrylate, marketed in India by the trade name of NOVOCRYL. Group B consisted of cases where conventional percutaneous interrupted sutures were applied with silk 3-0 cutting body needle (CBN) suture for graft fixation. Cosmetic appearance was subjectively evaluated as satisfactory or unsatisfactory according to patient's satisfaction. Graft contracture was categorized as present or absent.

Results: Cosmetic appearance was excellent in 14 cases in group A and 15 cases in group B. Good in 6 cases in group A and 6 cases in group B, and fair in 5cases in group A and4 cases in group B. The difference between group A and group B was statistically not significant. On follow up cosmetic appearance was assessed according to patient satisfaction. Cosmetic appearance was not statistically significant and was comparable between group A and B.

Conclusion: Isoamyl-2-cyanoacrylate is effective material for SSG fixation Post-operative scar hypertrophy are comparable as compared to percutaneous sutures. It can thus be concluded that Isoamyl-2-cyanoacrylate (Novocryl) is a good material for SSG fixation in elective, clean and uncontaminated cases after ensuring proper hemostasis with good post operative cosmetic appearance of scar.

Keywords: Alkylcyanoacrylates; Tissue Adhesive; Surgical Grafting.

INTRODUCTION

Most skin grafts are successful, but in some cases they do not heal well and require repeat grafting. Survival of Skin Graft depends upon rapid revascularisation of Graft.[1] The most common causes of graft failure are hematoma, infection, and movement.[2]

The recovery from surgery is usually rapid after split thickness skin grafting. The skin graft must be protected from trauma or shearing movement for 2-3 weeks. Depending on the location of the graft, a dressing may be necessary for 1-2 weeks. Exercise that might stretch or injure the graft should be avoided for 3-4 weeks.[3]

Split skin graft is a common procedure for providing skin cover. Proper fixation of the graft is very important for its successful take. Normally the graft is fixed by applying sutures at the margins with the margins of the recipient area.

Cyanoacrylates are glue type materials which are present in market for about more than 30 years. Particularly cyanoacrylates (butylcyanoacrylates and Isoamyl-2-cynoacrylate) are in use for various purposes for quite a considerable time. In 1959, Coover et al chemically analyzed and examined the performance of cyanoacrylate adhesives and proposed their application in surgical procedures.[4] In 1974, Binnie and Forrest histologically compared cyanoacrylates and silk sutures which were used in the immobilization of periodontal flaps.[5] The results indicated minimal edema and swelling and better gingival contour by using cyanoacrylates.

The final appearance of the scar was claimed to be excellent after the use of these tissue adhesives by Watson.[6]

The scars resulting from application of acrylates were compared with the scars resulting from subcuticular skin closure and it was noted that post-operative pain, discomfort and erythema of the wound margins was significantly less when the tissue adhesive was used.[7] Today medical grade products using butyl, isobutyl,octyl esters and Isoamyl-2-cyanoacrylate are available across the world.

This study, employs Isoamyl-2-cynoacrylate which is one of the series of homologues called alkylcyanoacrylates and compares the cosmetic appearance of split skin graft (SSG) after application of Isoamyl 2-cyanoacrylate and conventional suturing technique.

MATERIALS AND METHODS

50 patients admitted for skin grafting because of skin loss in the Surgery department of Sri Guru Ramdas Hospital attached to Sri Guru Ramdas Institute of Medical Science and Research, Vallah, Sri Amritsar, Punjab (India) were enrolled for the present study. They were divided into two groups. Group A consisted of cases where Split Skin Graft fixation was done using Isoamyl-2-cyanoacrylate, marketed in India by the trade name of NOVOCRYL. Group B consisted of cases where conventional percutaneous interrupted sutures were applied with silk 3-0 cutting body needle (CBN) suture for graft fixation. Inpatients with ulcer area equal to or >20cm^2 were included in the present study. Patient having diabetes, immunocompromised or patients suffering from any disease influencing wound healing viz. skin diseases and with infected wounds were excluded from the study. All the patients underwent routine tests before surgery.

Ulcer preparation was done by following standard surgical practice before application of split skin graft i.e. irrigate, debride and obtain haemostasis. SSG was dried with dry and sterile gauge to assure direct tissue contact. In group A, 25 patient's undergoing elective procedures were included and split skin graft fixation was done using Isoamyl-2-cyanoacrylate (Novocryl). One ampoule containing 0.25 ml of Novocryl was used for ulcer area upto 50cm^2. Area

greater than 50 cm^2 was closed with ampoules containing 0.5ml Novocryl. Prior to applying the tissue adhesives, the area was dried as far as possible

For application of Isoamyl-2-cynoacrylate (NOVOCRYL), applicator was removed from the blister pouch. Solution was immediately drawn after cutting glass ampoule into syringe or dropper. SSG was placed over the prepared ulcer bed and the cyanoacrylate was applied to the ulcer edge and graft edge in stages, maximum being 10 cm in single stage to the SSG edge as well as to the edge of wound so as to avoid drying of the glue. Manual approximation of SSG and ulcer edge for approximately 2 minutes after the application of cyanoacrylate was maintained. Protective dressings such as gauge was applied only after the adhesive film had completely solidified or polymerized. As soon as the film of tissue adhesive material dried over whole graft area, wound was considered closed and dressing was applied over wound area with the help of adhesive tape. The glue was not funded by any company, but was procured by the patient.

In group B, 25 patients undergoing elective procedures were included and split skin graft fixation was done using conventional interrupted silk 3-0 CBN suture.

For both groups proper care was given to obliterate dead spaces and achieve haemostasis, so as to have a dry ulcer when the adhesive was applied. Patients were given routine antibiotics post operatively along with analgesics and anti-inflammatory drugs.

The operated site was examined for evaluation of fixation of graft after 2 days, 7 days, 2 weeks and after 8 weeks. Follow up was done at 8 weeks and graft contracture and cosmetic appearance of graft were evaluated. Various observations noted in the patients after placement of graft with isoamyl 2-cyanoacrylate and with silk 3-0 on needle were recorded in the performa and a comparative study was done. Cosmetic appearance was subjectively evaluated as satisfactory or unsatisfactory according to patient's satisfaction. Graft contracture was categorized as present or absent.

RESULTS

Cosmetic appearance was subjective evaluation based on patient satisfaction. Varying factors like loss of graft, stitches in group B, presence of serous discharge played the role in cosmetic outcome. As shown in table 1, cosmetic appearance was excellent in 14 cases in group A and 15 cases in group B. Good in 6 cases in group A and 6 cases in group B, and fair in 5cases in group A and4 cases in group B. Stitches were removed at 6 days in group B patients. All the patients included in the study attended the follow up. On the criteria laid down in the material and methods, the cosmetic appearance of the site was assessed. As shown from table 2, difference between group A and group B was statistically not significant. On follow up cosmetic appearance was assessed according to patient satisfaction. Cosmetic appearance was not statistically significant and was comparable between group A and B (table 3). Graft contracture was assessed as present or absent on 8^{th} week on follow up. Contracture occurs in healing process but was mild and seen in5 cases in group A and B. Presence of graft contracture was statistically not significant with equivalent results seen in group A and B (table 4).

Table 1: Showing Cosmetic Appearance At 1 Week

Cosmetic appearance at 1 week	Group A	Group B	Total
Excellent	14(56%)	15(60%)	29
Good	6(24%)	6(24%)	12
Fair	5(20%)	4(16%)	9
Bad	0(0%)	0(0%)	0
Total	25	25	50

df=1;p>0.05;not significant

Table 2: Showing Cosmetic Appearance At 2 Week

Cosmetic appearance at 2 week	Group A	Group B	Total
Excellent	14(56%)	15(60%)	29
Good	7(28%)	6(24%)	13
Fair	4(16%)	4(16%)	8
Bad	0(0%)	0(0%)	0
Total	25	25	50

df=1;p>0.05;not significant

Table 3: Showing Cosmetic Appearance At 8 Week

Cosmetic appearance at 8 week	Group A	Group B	Total
Excellent	19(76%)	19(76%)	38
Good	5(20%)	5(20%)	10
Fair	1(4%)	1(4%)	2
Bad	0(0%)	0(0%)	0
Total	25	25	50

df=1;p>0.05;not significant

Table 4: Showing graft contracture at 8 week

Graft contracture at 8 week	Group A	Group B	Total
Present	5(20%)	5(20%)	10
Absent	20(80%)	20(80%)	40
Total	25	25	50

df=1;p>0.05;not significant

DISCUSSION

The basic requirement of any SSG fixation method is that it should hold the graft edges in apposition for a sufficient length of time to allow proper fixation to occur. There must be no movement between skin graft edges whilst the healing proceeds. These are a number of well proven techniques of SSG fixation employing a variety of materials, for example suturing materials, tapes, clips and adhesives.

In the present study adhesive material isoamyl-2- cyanoacrylatewas used. The aim was to evaluate this material regarding its effectiveness in skin graft fixation and comparison was done regarding nature and appearance of scars in wounds, closed with conventional percutaneous interrupted sutures using 3-0 silk CBN suture. Many workers evaluated this material only in a particular type of wound, like Ashley FL et al[8] and Watson DP et al[6] used adhesives for the closure of facial lacerations only. Adoni and Antebyin used tissue adhesive for the closure of episiotomy wounds.[9] Barreiro D in 1995 used these material for the closure of abdominal lower midline incisions only.[10]

Maw JL et al evaluated this material in skin wounds resulting from head and neck surgery.[7]

In another study conducted by Simon HK et al, cyanoacrylate was shown to be a preferred method of cutaneous closure of lacerations oriented against the langer's lines.[11] So, in none of the studies, adhesive material was tried for fixation of SSG.

Patients belonging to all age groups of both the sexes were included in the study. It has been shown that this new adhesive material can be used in any age group and sex without any ill effects.

In a study conducted by Osmond MH et al[12] in the Emergency Department at the University of Ottawa the tissue adhesive was shown to be more cost-effective method of skin closure as compared to non-absorbable sutures as it resulted in more efficient use of resources and was also preferred by the parents. While closing paediatric fascial lacerations in the Emergency Department it was shown that the tissue adhesive was the more efficient method, largely because of lower costs of physician and assistant services in ED, consumption of less material during the procedure, and the absence of routine follow-up costs. In addition, this study had revealed that the majority of the parents, given a choice, would prefer a tissue adhesive for the treatment of their child's laceration.

Saxena et al[13] and Gorozpe CJ et al[14] also confirmed the cost effectiveness of tissue adhesives as compared to sutures. In this study, as most cases were done under regional or general anaesthesia, time saved during surgery did not convert into significant cost saving. Also as the cost of glue is more than silk sutures, it did not translate into savings.

Novocryl (group A) produced graft contracture in 5 cases as compared to same no. of cases in percutaneous sutures with silk 3-0, at 8 weeks. Thus in both groups good cosmetic result was obtained. James and Mefall[15] in a study on FGG, with an average graft thickness of 0.9mm, reported a 24% and 39% rate of shrinkage 3-months after the surgery by using the Full Thickness Flap (FTF) and Partial Thickness Flap (PTF) techniques respectively.

In this study, the rate of graft, shrinkage with a thickness of 1-1.5mm, 3 months after the surgery, was 38% in the test group, and 41% in the control group, employing the PTF technique.

Cosmetic appearance was subjectively evaluated based on patient satisfaction at 1 week, 2 weeks, and 8 weeks on a scale of excellent, good, fair and bad.

Patient cosmetic appearance was excellent in 14 cases in group A and 15 cases in group B. Good in 6 cases in group

A and 6 cases in group B, and fair in 5 cases in group A and4 cases in group B. At 2nd week, excellent results in 14 cases in group A and 15 cases in group B, good in 7 cases in group A and 6 cases in group B and fair in 4 cases in group A and B was seen. At 8th week cosmetic appearance was excellent in 19 cases in group A and B. Good in 5 cases in group A and group B, and fair in 1 cases in group A and B.

Cosmetic appearance outcome was not statistically significant at 1 and 2 weeks, and at 8 weeks. The main difference in the two groups was the absence of cross hatching in adhesive material group. Cosmetic appearance was also dependent on loss of graft, presence of graft contracture, another factor being patient satisfaction In the study conducted by Tamez OA, meshed split-thickness skin grafts (STSGs) secured with 2-octylcyanoacrylate (2-OCA) were compared with meshed STSGs secured by suture and bolster (S&B). The 2 techniques were compared for graft survival, foreign-body giant cell response, inflammatory response, appearance, texture, and application time. Evaluations were performed on postoperative days 14, 24, 48, and 56. Biopsy specimens were obtained on postoperative days 14 and 56. There were no significant differences in percent survival, foreign-body giant cell response, inflammatory response, and appearance between control and study grafts.[16] Fegler and Fegler study showed better healing process by using tissue adhesives, Moreover, scar formation was reduced by 38% in the tissue adhesive group.[17]

This concludes that the cosmetic appearance of the graft when fixed with tissue adhesive was comparable to scar resulting from interrupted suture closure.

CONCLUSION

Isoamyl-2-cyanoacrylate is effective material for SSG fixation. Post-operative scar hypertrophy is comparable as compared to percutaneous sutures. Tissue adhesive material is least reactive and does not produce any allergic reactions. There is no incidence of tearing of thin SSG as compared to suturing while fixation of graft. It can thus be concluded that Isoamyl-2-cyanoacrylate (Novocryl) is a good material for SSG fixation in elective, clean and uncontaminated cases after ensuring proper hemostasis with good post operative cosmetic appearance of scar and therefore be made to encourage this promising new technique of skin graft fixation, but more work needs to be done on cost of glue, easy availability, patient acceptability.

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