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Octyl-2-cyanoacrylate Adhesive for Skin Closure: Eight Years Experience

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Abstract. *Cyanoacrylate skin adhesive is increasingly used to ensure and stabilize wound closures. One of the documented favorable effects of these glues is to limit the risk of a surgical site infection by physically isolating the wound. Patients and Methods: From January 2005 to January 2013, 900 patients requiring surgical treatment in the Structure of Plastic Surgery of the University of Sienna were enrolled for the study and divided in two groups; 450 patients treated with glue versus 450 controls. Results: The cohort of patients treated with glue had lower incidence of wound infection and wound dehiscence. Approximately 375 work-hours were economized. Conclusion: Octyl-2-cyanoacrylate is a valuable aid for ensuring the success of surgery by reducing surgical site infections. The use of octyl-2-cyanoacrylate is easy, guarantying a major superficial protection without relevant contraindications and with evident saving of time and resources.*

Cyanoacrylate skin adhesive is increasingly used for wound closure. One of the documented favorable effects of these glues is to limit the risk of a surgical site infection by physically isolating the wound (1). A previous Italian multi-center study evidenced that the use of octyl-2-cyanoacrylate provides a statistically significant decrease in the incidence of wound infection (2) and wound dehiscence, thus improving a satisfactory scarring. After the results obtained, since 2005 the authors have undertaken the present study. From 2005 to 2013, 900 surgical wounds were treated with octyl-2-cyanoacrylate, recording the complications and comparing the rates of infection.

Glues are frequently employed for skin closure, either in cases of surgical wounds and, when possible, in traumatic injuries. The main advantage of the use of octyl-2-cyanoacrylate is to obtain an effective physical isolation of the surgical site, thus lowering the risk of infection and to provide a better initial closure of wound with improved stability (3, 4). These benefits have been demonstrated in many different situations, from trauma to urological and plastic surgery. At present, cyanoacrylates are widely used in many specialties as ophthalmology, cardiac surgery, plastic surgery (5-8), *etc*. The significant reduction of infections enables a good post-operative management and a satisfactory scarring, together with a better wound care by the patient himself. A previous study about infections in surgery showed that the use of tissue adhesives is useful in limiting the infection of the surgical site and also reported a series of parameters, such as the satisfaction of the patients, wound dehiscences and pathological scarring (8).

In the present study the incidence of infection and complications were evaluated in a significantly greater cohort.

Patients and Methods

From January 2005 to January 2013, 900 patients (270 men, 630 women) requiring surgical treatment in the Structure of Plastic Surgery of the University of Sienna were enrolled for the study and divided into two groups; 450 patients treated with glue *versus* 450 controls (Table I).

Patients with pathological conditions impairing normal wound healing, such as diabetes mellitus, corticosteroids chronic administration, vascular problems, morbid obesity and familiar history of pathological scars, were excluded. At the start of this study, the first enrolled patient was randomly assigned to one of the two group created. Subsequently, all the patients were assigned to second group and then to the other again, in series, until reaching 450 patients in both groups. Among the 900 patients, 630 were women (70%).

The age was in a range of 20 and 60 years. All patients provided an informed consent.

The 900 interventions were divided as follows: In the control-group (450 patients):

- Abdominoplasties: 181 patients; 117 women and 64 men. Mean age: 45 for men and 44 for women. The average transverse incisions were 66 cm for the men and 52 cm for the women.

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– Mammary plastic surgery: 108 women; 35 reductions, 23 mastopexies, 50 reconstructions; mean length of the scars, 26.5 cm per side in breast reduction (including periareolar suture and vertical and horizontal incision of the inframammary fold), 16 cm per side in mastopexy (including periareolar suture and the vertical incision) and 10 cm in reconstruction.
– Dermolipectomy of the limb roots: 47 patients; 13 men and 34 women. Mean scar length in men: 32.5 cm (range, 25-40 cm) for the lower limb (suture of the incision at inguinal level, internal subgluteal section and medial of thigh) and 25 cm (range, 15-35 cm) for the upper limb (suture at the level of medial of arm). Mean scar length in women: 28 cm (range, 20-36 cm) for the lower limb and 18.5 cm (range, 10-27 cm) for the upper limb.
– Correction of unsatisfactory scarring results: 114 patients (67 women and 47 men). Mean scar length in men: 15 cm (range, 12-38 cm). Mean scar length in women: 18 cm (range, 12-25 cm) (Table II).

In the group of 450 patients treated with glue:
- Abdominal plastic surgery: 150 patients; 103 women and 47 men with an average age of 45 years for the men and 44 years for the women; their average transverse incisions were 66 cm for the men and 52 cm for the women.
- Breast surgery: 138 women; 43 reductions, 38 bilateral mastopexies, 57 reconstructions; reduction average age of 44 years (range, 30-58 years), mastopexy average age of 40 years (range, 35-40 years), reconstruction average age of 49 years (range 33-64 years) resulting in scars averaging 26.5 cm long per breast for reduction mammaplasty (including periareolar suture and vertical and horizontal incision of the inframammary fold), 16 cm long for mastopexy (including periareolar suture and the vertical incision) and 10 cm long for reconstruction.
- Dermolipectomy of the limb roots: 34 patients; 11 men and 23 women with an average age of 50 years for the men and 47 years for the women. Men had an average length of t scars of32.5 cm (range, 25-40 cm) for the lower limb (suture of the incision at inguinal level, internal subgluteal section and medial of thigh) and 25 cm (range, 15-35 cm) for the upper limb (suture at the level of medial of arm). For the women, the average lengths of the scars were 28 cm (range, 20-36 cm) for the lower limb and 18.5 cm (range, 10-27 cm) for the upper limb.
- Correction of unsatisfactory scarring results: 128 patients (40 women and 88 men) with average age of 37 years for the women and 41 years for the men. Sustained scar length averaged 15 cm (range, 12-38 cm) for the men and 18 cm (range, 12-25 cm) for the women (Table II).

Surgical wounds were sutured as follow:
- 3-0/4-0 Vicryl in single or double-layer, using separate stitches with buried knots for subcutaneous lesions.
- 3-0 Monocryl for intradermic sutures.
After suturing, the skin was disinfected with iodopovidone solution and cleaned with saline solution. 2-octyl-cyanoacrylate cutaneous tissue adhesive was then applied in the patients who were allocated in the treatment group (Dermabond® topical skin adhesive; Ethicon Sutures, address) by means of a linear application along the wound. After complete polymerization of the fluid, sterile gauze was applied. The average time of the surgical interventions was 2.8 h (range, 0.5-5 h).). The quantity of tissue adhesive used for the men was 2 to 4 vials for the revision of scarring results from abdominal plastic surgery.

Table I. *Patients*.

	Women	Men	Total
Controls	326	124	450
Treated	304	146	450

In the control group only gauzes and drapes were used to cover the sutures.

All patients were given instructions for wound care. Postoperative checks were conducted after 1, 7 and 15 days and then after 1, 3, 6 and 12 months. In the early postoperative days, erythema, edema, pain and color of the surgical wound were evaluated in order to reveal the presence of infection or dehiscence of the wound.

Results

The cutaneous adhesive detached itself spontaneously from the skin during the days following the surgical operation (average, 11 days). The reported complications are summarized in Table III.

Cases of complications occur differently into two groups, with a higher frequency observed in the "non-glue treated" group. This is also supported by the Chi-square analysis ($p<0.05$) with an odds ratio of 0.50.

The use of octyl-2-cyanoacrylate reduced the timing and the number of post-operative checks. The average time for checking the patient and changing the dressing was found to be approximately 20 min in the control group and 10 minutes in the treated group. Therefore, the use of octyl-2-cyanoacrylate did save about 13500 min (225 hours) in the 450 patients on an average of three post-operative checks. Moreover, patients treated with glue had one post-operative check less than the untreated group (on average, four checks in the untreated group and three in the group treated with glue). These spared post-operative checks led to further 9,000 min (about 150 h) gained by the staff for other activities. By this reason, octyl-2-cyanoacrylate led to an overall 22,500 min (375 h) spared work-time.

Discussion and Conclusion

Tissue glue may be considered as a useful product to reduce the risk of surgical site infections. In the present study, the use of octyl-2-cyanoacrylate, together with a good approximation of the wound edges with suitable cutaneous and subcutaneous sutures, diminishes surface tension (9) and protects the surgical site from external contamination.

As previously mentioned, it is critical to use cutaneous tissue adhesive always with the cutaneous edges of the surgical wound well-positioned (and, therefore, in association with subcutaneous and intradermic sutures) and never without

Table II. *Patients and operations in the non-glue (control) and the glue-treated group.*

Surgery (control)	No. of patients	Average age (years)	Range of scar length (cm)	Average of scar (cm)
Abdominoplasty	181	45 male (M), 44 female (F)	50-82 M, 40-64 F	66 M, 52 F
Breast reduction	35	44	18-36 per breast	26,5
Mastopexy	23	40	12-20 per breast	16
Breast reconstruction	50	43	7-12 per breast	8 per breast
Dermolipectomy of the upper limbs	29	50 M, 47 F	15-35 M, 10-27 F	25 M, 18,5 F
Dermolipectomy of the lower limbs	18	50 M, 47 F	25-40 M, 20-36 F	32,5 M, 28 F
Scar revision	114	41 M, 37 F	12-38 M, 12-25 F	15 M, 18 F
Surgery (treated with glue)	**No. of patients**	**Average age (years)**	**Range of scar length (cm)**	**Average of scar (cm)**
Abdominoplasty	150	45 M. 44 F	50-82 M, 40-64 F	66 M, 52 F
Breast reduction	43	44 F	18-36 per breast	26,5
Mastopexy	38	40 F	12-20 per breast	16
Breast reconstruction	57	48 F	7-12 per breast	8 per breast
Dermolipectomy of the upper limbs	26	50 M, 47 F	15-35 M, 10-27 F	25 M, 18,5 F
Dermolipectomy of the lower limbs	18	50 M, 47 F	25-40 M, 20-36 F	32,5 M, 28 F
Scar revision	128	41 M, 37 F	12-38 M, 12-25 F	15 M, 18 F

the use of an underlying suture (10), even in superficial linear wounds of small dimensions. The evaluation of the postoperative results revealed patients' satisfaction and good compliance. Another advantage provided by the use of the tissue adhesive is the possibility of leaving the wound without any dressing in the days following surgery. The study confirms that octyl-2-cyanoacrylate is an effective aid for ensuring the success of the surgery in terms of wound closure as it reduces the risk of surgical site infections, the timing and the number of post-operative checks (about 375 work-hours), thus ensuring the patient's satisfaction. The use of octyl-2-cyanoacrylate is easy, guarantying a major superficial protection without major contraindications and with evident saving of time and resources.

Table III. *Complications*.

A. Glue-treated

Suture with octyl-2-cyanoacrylate	Infection	Dehiscence
Breast reduction	1	1
Mastopexy	0	0
Dermolipectomy of the limbs	1	2
Abdominoplasty	2	4
Scar revision	1	3

B. Non-glue treated

Suture without octyl-2-cyanoacrylate	Infection	Dehiscence
Breast reduction	2	2
Mastopexy	1	1
Dermolipectomy of the limbs	4	3
Abdominoplasty	6	5
Scar revision	5	2

Conflicts of Interest

The Authors declare that they have no conflict of interest.

Disclosures

The Authors disclose any commercial interest in this study.

References

1 Mertz PM, Davis SC, Cazzaniga AL, Drosou A and Eaglstein WH: Barrier and antibacterial properties of 2-octyl cyanoacrylate-derived wound treatment films. J Cutan Med Surg *7(1)*: 1-6, 2003.

2 Drapeau C MJ, D'Aniello C, Brafa A, Nicastri E, Silvestri A, G Nisi, Petrosillo N and the Italian Group on Surgical Infections in Plastic Surgery. Surgical Site Infections in Plastic Surgery: An Italian Multicenter Study; Journal of Surgical Res *143*: 393-397, 2007.

3 Singer AJ, Chale S, Giardano P, Hocker M, Cairns C, Hamilton R, Nadkarni M, Mills AM, Hollander JE: Evaluation of a novel wound closure device: a multicenter randomized controlled trial; Acad Emerg Med *18(10)*: 1060-1064, 2011.

4 Eymann R, Kiefer M: Glue instead of stitches: a minor change of the operative technique with a serious impact on the shunt infection rate. Acta Neurochir Suppl *106*: 87-89, 2010.

5 Rubino C, Brongo S, Pagliara D, Cuomo R, Abbinante G, Campitiello N, Santanelli F and Chessa D: Infections in breast implants: a review with a focus on developing countries. J Infect Dev Ctries *8(9)*: 1089-1095, 2014.

6 Perin LF, Helene A Jr. and Fraga MF: Sutureless closure of the upper eyelids in blepharoplasty: use of octyl-2-cyanoacrylate.Aesthet Surg J *29(2)*: 87-92, 2009.

7 Hinyokika Kiyo. Shimizu T, Masumori N, Hirobe M, Hashimoto K, Maeda T, Fukuta F, Tanaka T and Tsukamoto T: Use of 2-octylcyanoacrylate tissue glue for skin closure in radical retropubic prostatectomy. Kyoto University Research Information Repository *56(9)*: 495-498, 2010.

8 Silvestri A, Brandi C, Grimaldi L, Nisi G, Brafa A, Calabrò M and D'Aniello C: Octyl-2-cyanoacrylate adhesive for skin closure and prevention of infection in plastic surgery. Aesthetic Plast Surg *30(6)*: 695-699, 2006.

9 Rojas WE, Di Martino E, Harandi B and Westhofen M: Long-term results of suture-free cutanous wound closure in head and neck incisions with octylcyanoacrylate topival skin adhesive. Laryngorhinootologie *81(9)*: 644-648, 2002.

10 Vargas G and Reger TB: An alternative to sutures. Plast Surg Nurs *21(2)*: 83-85, 2001.

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