Original Article - Comparative Study

Comparative Evaluation of the Aesthetic Outcomes of Octyl-2-Cyanoacrylate Skin Adhesive and Ethilon Suture in Maxillofacial Surgery - A Randomised Clinical Study

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Abstract

Introduction: Wound closure methods have evolved, attributed to the armamentarium including the synthetic sutures, staples, surgical adhesive tapes and, most recently, the cyanoacrylate tissue adhesives. Cyanoacrylates have shown promising results in terms of aesthetic outcomes in other fields of surgery. The aim of this study is to compare the aesthetic value of Dermabond over Ethilon suture when used in case of facial surgical incisions. The purpose of this study was to demonstrate the efficacy of Dermabond for wound closure in the head-and-neck region. **Materials and Methods:** This study involved 20 subjects undergoing maxillofacial surgery. In 10 subjects, skin closure was done with conventional suturing (Ethilon) and other 10 subjects with tissue glue (2-octyl cyanoacrylate). Observations regarding skin closure time and scar assessment were made, and their results were compared. **Results:** The mean time for closure in the Dermabond group was 217.2 ± 42.0 s and for Ethilon suture group was 383.3 ± 140.2 s. Dermabond was significantly better than Ethilon sutures at both 1 month and 3 months with $P = 0.001$ and $P < 0.001$, respectively. For Dermabond, the average score improved from 8.2 ± 2.5 at 1 month to 6.1 ± 1.6 at the 3rd month. The improvement was statistically significant ($P = 0.001$) for Ethilon sutures; the average score improved from 12.0 ± 1.2 at 1 month to 10.2 ± 2.0 at 3rd month. The improvement was statistically significant ($P = 0.038$). **Discussion:** Adhesive glue appears to be superior to conventional suturing in clean elective surgeries. It is a safe and effective method of skin closure with less operative time and better cosmesis of the scar.

Keywords: Cyanoacrylates, octyl-2-cyanoacrylate, surgical incisions, suture, tissue adhesives

Introduction

Face is an aesthetically important part of the body because an individual's self-image comes from his or her own facial appearance.[1] In case of facial incisions, the method of closure should be simple, safe, quick, cost-effective, painless and bactericidal and results in optimal aesthetic appearance of the scar.[2] The use of tissue glues for repair of traumatic lacerations and surgical wounds was first reported in 1959. Tissue glues belong to the family of cyanoacrylates and their adhesive properties are a product of polymerisation that occurs on contact with moisture on the skin. Commercially available tissue glues include octyl cyanoacrylate (Dermabond; Ethicon, Somerville, NJ), butyl cyanoacrylate (LiquiBand; Advanced Medical Solutions, Devon, United Kingdom) and N-butyl-2-cyanoacrylate (GluSeal; GluStitch, Delta, Canada).[2] Octyl-2-cyanoacrylate, the newest cyanoacrylate formulation, has been used in a wide variety of clinical settings.[3,4] The aim of this study was to demonstrate the efficacy of Dermabond for wound closure in the head-and-neck region.

Materials and Methods

This study was conducted on subjects admitted to the hospital in the Department of Oral and Maxillofacial Surgery indicated

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for elective surgery that required either retromandibular or submandibular approach. The subjects were informed about the study and necessary consents were taken. Ethical approval was obtained from the Institutional Ethical Review Committee (MGM/DCH/IERC/04/2017). The study was registered with the Clinical Trials Registry – India: CTRI/2019/11/022020. This was a prospective, randomised, parallel-group, comparative and active-controlled trial enrolling 20 subjects. The sample size was calculated using G*Power (Designed by Franz Faul, Edgar Erdfelder, Axel Buchner in 1996). The subjects were randomly assigned to the groups using research randomiser software. Group A (Dermabond) and Group B (Ethilon suture) consisted of 10 subjects each. Subjects included in the study were between the age group of 15–50 years of either gender. Those with systemic conditions and impairing wound healing (uncontrolled diabetes mellitus, vascular problems, coagulation disorders and peripheral vascular disorders), on immunomodulators (steroids and cyclosporine), with known tendency of hypertrophic scar or keloid formation were excluded from the study. Subjects with active skin infection and known history of hypersensitivity to formaldehyde or cyanoacrylates were also excluded.

The surgical procedure was performed under general anaesthesia under aseptic precautions. After the surgical procedure, suturing of deeper tissues was done using Vicryl 3-0 for subjects in both the groups before closure of the skin. The same surgeon carried out all the operative procedures. The same single observer, with the help of a stopwatch, measured the time required for closure intraoperatively. In the post-operative period, Ethilon sutures were removed on the 7th day, while Dermabond was found to start peeling off, on an average, from day 5. In addition, in the Dermabond group, the presence of signs of allergic contact dermatitis (ACD) was checked postoperatively.

The incision wounds were observed on 7th day, 15th day and 1 month for evaluation using the Wound Evaluation Scale and tissue response and complications using ASEPSIS scale by three blinded observers. Qualitative assessment of scar and aesthetic appearance was evaluated after 1 month and 3 months by the same three blinded observers who were trained in using Manchester Scar Scale. Interrater and intrarater reliability was done for the three observers. Patient acceptance of the scar was noted at the end of the 3rd month using modified Patient and Observer Scar Assessment Scale (POSAS). A data collection sheet was designed for entering data of all the subjects. Statistical Product and Service Solutions (SPSS), Version 22.0.0, (Armonk, New York). An alpha level of 0.05 was used as a cutoff for statistical significance along with 95% confidence intervals. Agreement between the three blinded raters was calculated using Fleiss' kappa. It showed substantial agreement between the raters (K = 0.783, $P < 0.001$).

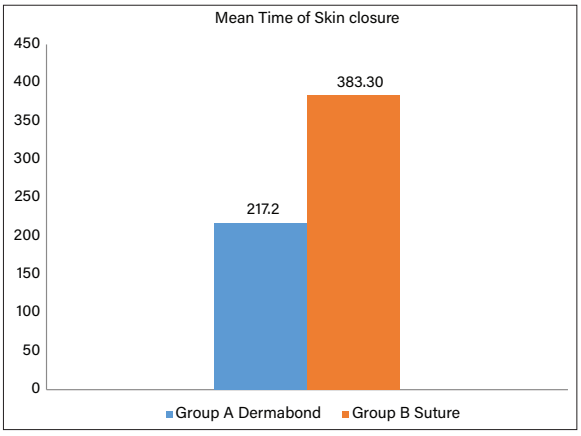
Results

This study comprised 20 subjects, which met the selection criteria. There were 13 (65%) males and 7 females (35%). The average age of the subjects was 29.6 ± 9.42 years. The mean age in the Dermabond group was 30.7 years and Ethilon suture group was 28.6 years ($P = 0.631$, not significant). There were seven retromandibular incisions, three submandibular incisions in Group A and eight retromandibular and two submandibular incisions in Group B. There was no significant difference regarding site between the two groups ($P = 0.807$). The average incision length in the Dermabond group was 3.2 ± 0.58 cm and for Ethilon suture group was 3.3 ± 1.03 cm. There was no significant difference between the groups [t (18) = 0.266, $P = 0.793$].

The time required for closure of the incision was evaluated for both the groups as shown in Graph 1. The mean time for closure in the Dermabond group was 217.2 ± 42.0 s and for Ethilon suture group was 383.3 ± 140.2 s. The test showed that this time difference was statistically significant [t (10.6) = 3.586, $P = 0.005$]. The time taken for closure in the Dermabond group was significantly lesser.

The wounds were evaluated on 7th, 15th days and 1 month postoperatively. It was evaluated using five different parameters. There was no significant difference between Dermabond and Ethilon suture in stepped-off borders and edge inversion at any point of time. There was no significant difference in contour irregularity between the two groups at 7th and 15th post-operative day; however, at the 1st post-operative month, there was only 1 (10%) case of irregularity in the Dermabond group compared to 6 (60%) in the Ethilon suture group. This difference was statistically significant ($P = 0.050$). Inflammation was significantly more in the Ethilon suture group (80%) compared to the Dermabond group (30%) on the 7th day only ($P = 0.035$). There was no difference on the 15th day and at 1 month. Dermabond was significantly better than the Ethilon suture when compared by scar width at all points of time ($P = 0.035$ at 7th day, $P = 0.001$ at 15th day and $P = 0.020$ at 1 month).

Additional treatment, Serous discharge, Erythema, Purulent exudate, Separation of deep tissues, Isolation of bacteria and Stay as inpatient (ASEPSIS) score was also evaluated on 7th, 15th days and 1 month postoperatively using four different parameters: (1) serous exudate, (2) erythaema, (3) purulent



Graph 1: Bar graph depicting the mean time required for skin closure in Dermabond group and Ethilon Suture group

exudate and (4) separation of deeper tissues. Dermabond was equivalent to Ethilon suture in terms of asepsis and infection scores.

The Manchester Scar Scale was used to measure the aesthetic appearance of the scars at 1 month and 3 months postoperatively. Mann–Whitney *U*-test was performed to compare the difference in Manchester Scar Scale scores between the two groups. It showed that Dermabond was significantly better than Ethilon sutures at both 1 month and 3 months with $P = 0.001$ and $P < 0.001$, respectively. For Dermabond, the average score improved from 8.2 ± 2.5 at 1 month to 6.1 ± 1.6 at the 3rd month. The improvement was statistically significant ($P = 0.001$). For Ethilon sutures, the average score improved from 12.0 ± 1.2 at 1 month to 10.2 ± 2.0 at the 3rd month. The improvement was statistically significant ($P = 0.038$) [Graph 2].

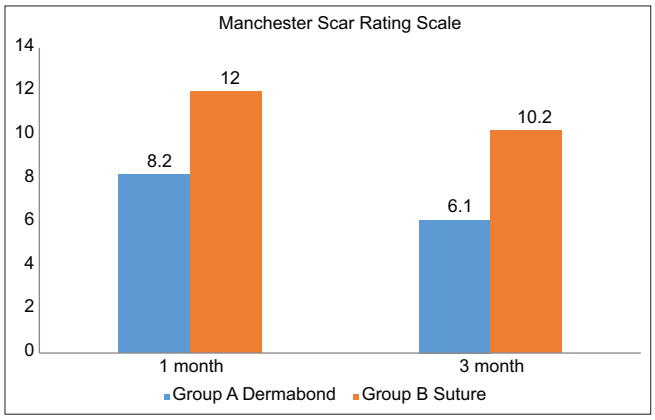
The Patient and Observer Scar Assessment Scale (POSAS) score was recorded at the end of the 3rd month postoperatively. In the Dermabond group, 3 (30%) subjects rated the scar as average and 7 (70%) subjects rated the scar as good. In the Ethilon suture group, 2 (20%) subjects rated the scar as bad, 6 (60%) as average and 2 (20%) as good. Chi-square test showed $P = 0.074$. Subjects in the Dermabond group consistently rated their scars better than Ethilon sutures group. However, this was not statistically significant [Graph 3]. No subjects in the Dermabond group showed any signs of allergic contact dermatitis (ACD).

Discussion

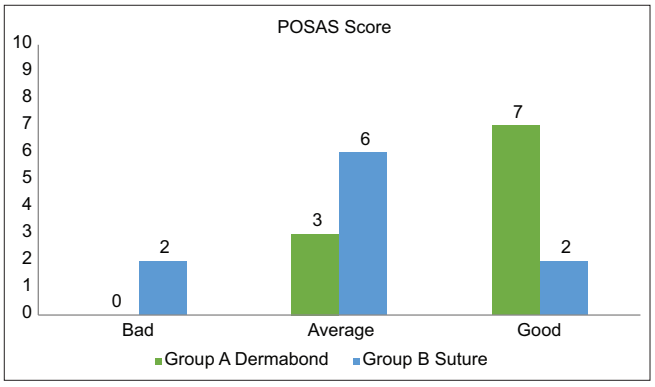
This study found no statistically significant association between age, gender and site in terms of the materials used. Octyl-2-cyanoacrylate (Dermabond) was found to be equivalent to suture in terms of asepsis and infection scores. Dermabond performed equally well with low infection rate. Wachter *et al*., in 2010 noted an overall infection rate of 0.43%, when octyl-2-cyanoacrylate (Dermabond) was used for wound closure post-spinal surgery.[4] McMullen *et al*., in 2017 documented no accounts of foreign body reaction or infection with the use of octyl-2-cyanoacrylate.[5] Toriumi and Bagal in 2002 reported no instances of wound dehiscence, haematoma or infection.[6] Blondeel *et al*., in 2004 found decreased incidence of post-operative wound infection.[7] Sniezek *et al*., in 2007 and Ando *et al*., in 2014 had similar findings of lower post-operative infection and complication rate.[8,9] Subramanya *et al*., in 2019 found that octyl-2-cyanoacrylate tissue adhesive has a low rate of dehiscence and low infection rate and provides excellent cosmetic results for closure of surgical incisions.[10] James *et al*., in 2021 observed that topical skin adhesive appears to be safe for use in cleft lip repair skin closure as it elicited minimal tissue reaction and no hypertrophic scar formation.[11]

In the present study, the time taken for closure using octyl-2-cyanoacrylate (Dermabond) was significantly lesser. Castañón García-Alix *et al*., in 2003 reported that Octyl-2-cyanoacrylate was easier to use than conventional sutures in all its applications, requiring less time than conventional sutures.[3,12] Wang *et al*., in 2020 indicated that the use of octyl-2-cyanoacrylate was a more efficient way that can reduce the time of closure and cost in wound closure after total hip arthroplasty.[13] Aitchison *et al*., in their meta-analysis in 2022 noted that tissue adhesives offer safe, cost-effective and time-saving alternatives to suture closure of laparoscopic port sites.[14] Niedermeier and Samora in 2018 recommended that if Dermabond was utilised for wounds and surgical closure, applying only a thin layer, utilising the small applicator would lead to more expeditious setting times and cost-effectiveness.[15] Pattanshetti *et al*., in 2021 found that wound closure using octyl-2-cyanoacrylate required significantly less time for skin closure compared to conventional suturing in patients undergoing laparoscopic appendicectomy.[16]

The primary motive of conducting this study was to find a better wound closure material in terms of its aesthetic outcome since patients are more concerned about facial scars. We found that the scar formed with the use of octyl-2-cyanoacrylate (Dermabond) was more aesthetic and significantly better than Nylon (Ethilon) sutures at both 1st and 3rd month postoperatively as seen in Figures 1 and 2. In support of the same, a study done by Wachter *et al*., in 2010 found satisfactory cosmetic results in all



Graph 2: Bar graph giving a pictorial comparison of scar formed across the two groups



Graph 3: Bar graph giving comparative distribution of patient satisfaction score. POSAS: Patient and Observer Scar Assessment Scale

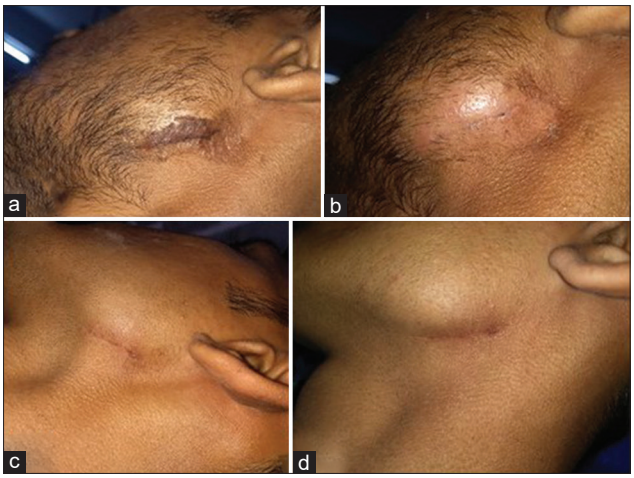


Figure 1: Post-operative photograph showing the wound formed in the Dermabond group on (a) 7th day (b) 15th day (c) end of 1st month (d) end of 3rd month

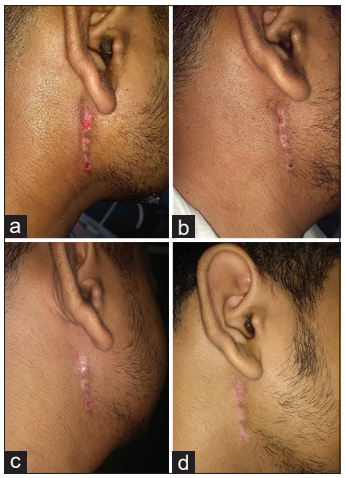


Figure 2: Post-operative photograph showing the wound formed in the Ethilon group on (a) 7th day (b) 15th day (c) end of 1st month (d) end of 3rd month

patients (90.6%) that were available for 6-week follow-up.[4] The results of the study by Toriumi *et al*., in 1998 revealed superior cosmetic outcome at the end 1 year with octyl-2-cyanoacrylate as compared to sutures.[17] Saxena *et al*., in 2023 showed that octyl-2-cyanoacrylate offered the benefit of decreased procedure time with less pain, no need for its removal and better cosmetic outcome compared to sutures.[18] Chang *et al*., in 2019 established that Dermabond could be a safe and effective tool for wound closure after haemangioma excision on the lip.[19] Swaminathan *et al*., in 2018 found octyl-2-cyanoacrylate to be a safe and an effective method of skin closure with less post-operative pain and better cosmesis of the scar.[20] Toriumi and Bagal also noted high patient satisfaction in the group treated with octyl-2-cyanoacrylate.[6] Hall and Bailes in 2005 reviewed records of 200 consecutive patients with Dermabond closure after discectomy or laminectomy. Their patient responses were overwhelmingly positive.[21] Laccourreye *et al*., in 2005 carried out a prospective non-randomised evaluation of the octyl-2-cyanoacrylate (Dermabond) for skin closure in head-and-neck surgery. The degree of satisfaction was very high amongst the Dermabond study group.[22] Man *et al*., too had higher overall patient satisfaction score.[12] On similar lines, patients from our Dermabond group consistently rated their scars and overall experience to be better in comparison to Ethilon suture group. Park *et al*., in 2018 showed that the use of 2-octyl cyanoacrylate topical skin adhesive for wound closure following ankle fracture surgery was effective and safe and showed higher patient satisfaction compared to simple interrupted nylon sutures.[23] Ananda *et al*., in 2019 concluded that skin glue gives the best results in terms of less post-operative pain, wound asepsis, better cosmesis and cost-effectiveness.[24]

Clinical signs of ACD were not observed in any of the subjects in the Dermabond group, thereby making it a preferable choice along with its other advantages over conventional sutures. There is ambiguity in current available scientific literature regarding ACD caused by octyl-2-cyanoacrylate. In patients with a known history of ACD, the use of octyl-2-cyanoacrylate should be avoided. With early recognition and suitable treatment, patients' symptoms resolve without a substantial impact on healing.[25] There are significant risk factors in patients with ACD following the use of octyl-2-cyanoacrylate; clinicians and patients should be aware of these facts before using topical skin adhesives.[26]

To summarise, 2-octyl cyanoacrylate (Dermabond) provides an excellent, strong and flexible method of approximating wound edges. Advantages of octyl-2-cyanoacrylate include ease of application, absence of needles and suture removal and higher rate of patient satisfaction. Octyl-2-cyanoacrylate should not be applied to tissues within wounds; it should be applied to intact skin at wound edge to hold the injured surfaces together. In addition, it should not be used for wounds involving mucous membrane, contaminated wounds, deep wounds or wounds that approximate under tension. Octyl-2-cyanoacrylate is particularly useful in superficial wounds or wounds in which the deep dermis has been closed with sutures. Octyl-2-cyanoacrylate (Dermabond) used over sutures at the time of surgery provides extra support, creates an impermeable suture line and decreases the need for post-operative dressing. Ben Safta *et al*., concluded with their study that octyl cyanoacrylate tissue adhesives are valid alternatives to sutures.[27]

Conclusion

Cyanoacrylate derivatives like octyl-2-Cyanoacrylate appear to be safe and effective when used for surgical incisions. Based on this study, the authors found that octyl-2-cyanoacrylate (Dermabond) and Ethilon suture were equally effective in terms of maintaining lower post-operative infection rates. The wound healing was comparable with the use of both Dermabond and Ethilon sutures. There is a remarkable reduction in time taken for closure using Dermabond. Octyl-2-cyanoacrylate gave excellent aesthetic results with a better patient acceptance and experience. Thus, octyl-2-cyanoacrylate has promising results as an innovative,

easy-to-apply and effective alternative to conventional Ethilon sutures. It is safe and can be recommended for closure of facial skin incisions. Despite being introduced long ago, Dermabond has still not gained much popularity. Through this study, the authors suggest the need to encourage its use, especially in head-and-neck surgical incisions, owing to the results obtained.

Limitations

While this study provides valuable insights into skin adhesives, there are certain limitations, which may impact the interpretation and generalisation of the findings. One of the primary limitations is the small sample size restricting the generalisability of the results. Further research with larger sample sizes is warranted to validate the current findings. Due to specific characteristics of our sample and study setting, cultural, demographic or contextual differences may limit the applicability of the results beyond the scope of this study. Despite these limitations, the authors believe that the present study makes a valuable contribution to the existing literature on skin adhesives. By transparently acknowledging these limitations, we hope to encourage future research endeavours to address these gaps and advance our understanding of the topic.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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