(International Print/Online Journal)

SJIF IMPACT FACTOR: 5.565
PUBMED-National Library of Medicine ID-101739732

ISSN (Print): 2209-2870
ISSN (Online): 2209-2862

International Journal of Medical Science and Current Research (IJMSCR)
Available online at: www.ijmscr.com
Volume 6, Issue 6 , Page No: 276-284
November-December 2023

IJMSCR

Comparison Of N-Butylcyanoacrylate, Adhesive Tapes, And Sutures For Wound Closure

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Type of Publication: Original Research Paper
Conflicts of Interest: Nil

Abstract

Background :Suture has been used for closure of wounds for centuries and still remains the most commonly used method. Recent focus is on the usage of adhesive glue for surgical incisions. There are only a few clinical trials that have been conducted to support this indication. Another method is the application of adhesive tape for wound closure. The tape is available very cheap as compared to glue and suture and has shown to be a fast and cheap alternative.

Aim Of The Study:To compare the wound dehiscence rates of suture, N-Butyl-2-Cyanoacrylate glue and adhesive tape following wound closure, to compare the wound infection rates of the three closure methods, to compare the time taken for wound closure using the three techniques.

Methods : This comparative study was conducted in the Department of General Surgery, ACS Medical College & Hospital, Poonamallee High Rd, Velappanchavadi, Chennai, Tamil Nadu, India in the year 2023.A total of 60 patients were randomized into three groups of 20 each. Among the 60 participants 55 were males and 5 were females. Patients were allocated into two groups using odd and even method: group A and B. Patients of group A underwent skin closure with topical tissue adhesive and that of group B underwent skin closure with conventional sutures. Skin closure time, postoperative pain, scar assessment using Vancouver scar scale and surgical site infection were recorded. IBS-statistical package for the social sciences (SPSS) 22 version was used to analyse the data.

Results: Wound dehiscence was noted in one patient in the glue group during the second post-operative day. The wound was closed by using 3-0 polypropylene suture using sterile precautions. There was no wound that got infected during the study period. The application of adhesive tape took significantly less time when compare to the suture and glue method (P = 0.0067). There was no significant difference in the time taken for application of suture and glue.). Adhesive glue and tapes have a great potential in the near future for closure of surgical wounds. This study shows that adhesive glue is a better option for wound closure by having better cosmetic appearance, better patient acceptance, high surgeon satisfaction rate than suture than suture and adhesive tape. However, use of adhesive glue is not without disadvantages. The cost of the glue is significantly more than the suture. The study shows that adhesive glue also carries a risk of wound dehiscence following excessive stretching. This can be avoided by proper technique and wound care.

Conclusion : Advantages of tissue adhesives over conventional wound closure techniques include easy to use, excellent bacteriostatic property, decreased repair time, elimination of recall visits and comparable short and long-term cosmetic outcome. Though tissue adhesives have many advantages over conventional wound closure techniques, they can be used as an alternative to sutures only in superficial small and tension free skin incisions or lacerations.

Keywords: N-butyl cyanoacrylate; Tissue adhesive; Wound healing

Introduction

Suture has been used for closure of wounds for centuries and still remains the most commonly used method. The suture material has evolved from primitive and crude materials to a variety of types that are specific for the tissue to be sutured. [1]Sutures are not without disadvantages. The needles present in sutures makes the surgeon and the assistant susceptible to needle stick injuries. The patient needs to visit the hospital again for suture removal. The use of suture leaves sutures marks perpendicular to the line of incision. These disadvantages led to the quest for alternative methods for wound closure.[2] The most typical technique for wound closure continues to be suture, which has been used for centuries. Suture materials have developed from simple, primitive materials to a variety of varieties that are tailored specifically for the tissue to be sutured. Sutures do have some drawbacks.[3] The sutures' needles make the surgeon and the assistant vulnerable to needle stick woundsThese drawbacks prompted researchers to look for more effective wound closure techniques. Adhesive glue and adhesive tapes are two of the more appealing substitutes that are currently offered. [4]Over three decades after its discovery, adhesive glue has been applied to traumatic wounds. Adhesive glue for surgical incisions has recently received attention. There have only been a few small-scale clinical studies to back up this claim. [5] Few attractive alternatives that are currently available are adhesive glue and adhesive tapes. Adhesive glue has been used for traumatic woundsfor over three decades since its discovery.Recent focus is on the usage of adhesive glue for surgical incisions. There are only a few clinical trials that have been conducted to support this indication Another method is the application of adhesive tape for wound closure.The tape is available very cheap as compared to glue and suture and has shown to be a fast and cheap alternative in a study done previously.There are very few studies that have compared the three methods for wound closure.[6]

Methods : This comparative study was conducted in the Department of General Surgery, ACS Medical College & Hospital, Poonamallee High Rd, Velappanchavadi, Chennai, Tamil Nadu, India in the year 2023.A total of 60 patients were randomized into three groups of 20 each. Among the 60 participants 55 were males and 5 were females. Patients were allocated into two groups using odd and even method: group A and B. Patients of group A underwent skin closure with topical tissue adhesive and that of group B underwent skin closure with conventional sutures. Skin closure time, postoperative pain, scar assessment using Vancouver scar scale and surgical site infection were recorded. Inclusion criteria 3 groups of patients undergoing elective hernia surgery were randomly assigned, and the skin incision was therefore closed with suture, adhesive glue, or adhesive tape. Exclusion criteria Individuals with a history of keloid or hypertrophic scars, diabetes mellitus, tuberculosis, steroid use, connective tissue disorders, drug allergies, or known cyanoacrylate or formaldehyde allergies.

Stastical Analysis : Medcalc Software Version 2,3 Mariakerke, Belgium statistically analysed all master chart data. ANOVA examined demographics. A Kruskal-Wallis nonparametric test determined whether time and length are significant. The Fishers Exact test was used to determine statistical significance for the Hollander scar evaluation score. Kruskal-Wallis and Mann Whitney tests were used to analyse the visual analogue scale, patient satisfaction score, and surgeon satisfaction score. P values below 0.05 indicated significance

Results

The suture method took 293.1 seconds on average, adhesive glue 265.15 seconds, and adhesive tape 226.85 seconds. Applying adhesive tape took significantly less time than suture and glue (P = 0.0067). There was no discernible difference in the time required to apply glue and suture.

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Table 1: Time

	Average time for closure
Suture	294.0
Glue	262.14
Tape	227.84
P = 0.0067 Tape vs Suture, Glue	

On day 1, there was no statistically significant difference in the Hollander wound evaluation score between the three groups.

Table 2: Hollander wound evaluation score Day 1.

	Optimum Scar	**Sub Optimum Scar**	**Suture**	**Glue**
Suture	13	9		
Glue	18	3	P = 0.1551	
Tape	16	6	P = 0.5006	P = 0.6947

On day 2, there was no significant difference in the Hollander wound evaluation score between the three groups.

Table 3: Hollander wound evaluation score Day 2.

	Optimum Scar	**Sub Optimum Scar**	**Suture**	**Glue**
Suture	13	9		
Glue	16	5	P = 0.5006	
Tape	14	8	P = 1.0000	P = 0.73109

On day 3, there was no significant difference in the Hollander wound evaluation score between the three groups.

Table 4: Hollander wound evaluation score Day 3.

	Optimum Scar	**Sub Optimum Scar**	**Suture**	**Glue**
Suture	14	8		
Glue	18	3	P = 0.2733	
Tape	15	7	P = 1.0000	P = 0.4505

On day 7, there was no discernible difference in the three groups' Hollander wound evaluation scores.

Table 5: Hollander wound evaluation score Day 7

	Optimum Scar	**Sub Optimum Scar**	**Suture**	**Glue**
Suture	10	12		

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Glue	16	6	P = 0.1053	
Tape	16	5	P = 0.1053	P = 1.0000

The Hollander wound evaluation score varied significantly between adhesive glue and tape and between adhesive glue and suture. On day 30, there was no discernible distinction between the tape and the suture.

Table 6: Hollander wound evaluation score Day 30

	Optimum Scar	**Sub Optimum Scar**	**Suture**	**Glue**
Suture	5	17		
Glue	16	5	P = 0.0012	
Tape	8	14	P = 0.4801	P = 0.0248

On day 90, there was a sizable difference in the Hollander wound evaluation scores between the three groups.

Table 7: Hollander wound evaluation score Day 90

	Optimum Scar	**Sub Optimum Scar**	**Suture**	**Glue**
Suture	3	19		
Glue	16	6	P < 0.0001	
Tape	8	14	P = 0.0012	P = 0.0248

On day 1, there was no discernible difference between the three groups' visual analogue scales.

Table 8: The Visual Analogue Score Day 1

	Mean Visual Analogue Score
Suture	64.7
Glue	69.95
Tape	65.85
P > 0.05 = No significant difference	

On day 2, there was a sizable difference in the visual analog scale when comparing glue with suture and tape.

Table 9: The Visual Analogue Score day 2

	Mean Visual Analogue Score
Suture	64.6
Glue	69.75
Tape	65.52
P < 0.0001 Glue vs Suture, Tape	

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On day 3, there was a sizable difference in the visual analog scale when comparing glue, suture, and tape.

Table 10: The Visual Analogue Score day 3

	Mean Visual Analogue Score
Suture	64.21
Glue	68.81
Tape	65.23
P < 0.0001 Glue vs Suture, Tape	

On day 3, there was a sizable difference in the visual analog scale when comparing glue, suture, and tape.

Table 11: The Visual Analogue Score Day 7

	Mean Visual Analogue Score
Suture	62.82
Glue	69.95
Tape	63.95
P < 0.0001 Glue vs Suture, Tape	

On day 30, there was a sizable discrepancy in the visual analogue scores between the three groups.

Table 12: The Visual Analogue Score Day 30

	Mean Visual Analogue Score
Suture	64.82
Glue	72.05
Tape	66.35
P < 0.0001 Suture vs Glue vs Tape	

On day 90, there was a sizable difference in the visual analogue scores between the three groups.

Table 13: The Visual Analogue Score Day 90

	Mean Visual Analogue Score
Suture	65.28
Glue	72.41
Tape	67.26
P < 0.0001 Glue vs Suture vs Tape	

On day seven, there was no discernible difference in patient satisfaction between the three groups.

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Table 14: Patient satisfaction day 7

	Mean Patient Satisfaction Score
Suture	11.2
Glue	12.1
Tape	10.5
P = 0.6422 = No significant difference	

Patient satisfaction varied significantly depending on whether glue, sutures, or tape was used. On day 30, there was no discernible distinction between the tape and the suture.

Table 15: Patient satisfaction day 30

	Mean Patient Satisfaction Score
Suture	16.16
Glue	15.72
Tape	14.4
P < 0.0001 Glue vs Suture, Tape	

Patient satisfaction varied significantly depending on whether glue, sutures, or tape was used. On day 90, there was no discernible distinction between the tape and the suture.

Table 16: Patient satisfaction day 90

	Mean Patient Satisfaction Score
Suture	14.65
Glue	17.25
Tape	15.13
P < 0.0001 Glue vs Suture, Tape	

On day 7, there were noticeable differences in the three groups' surgeon satisfaction.

Table 17: Surgeon satisfaction day 7

	Mean Surgeon Satisfaction Score
Suture	13.01
Glue	22.05
Tape	17.27
P < 0.0001 Suture vs Glue vs Tape	

On day 30, there was a sizable difference in the three groups' surgeon satisfaction levels.

Table 18: Surgeon satisfaction day 30

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	Mean Surgeon Satisfaction Score
Suture	14.14
Glue	22.4
Tape	17.6
P < 0.0001 Suture vs Glue vs Tape	

On day 90, there was a sizable difference in the three groups' surgeon satisfaction levels.

Table 19: Surgeon satisfaction day 90

	Mean Surgeon Satisfaction Score
Suture	14.21
Glue	23.28
Tape	18.54
P < 0.0001 Suture vs Glue vs Tape	

Discussion

Wound dehiscence is important when assessing wound closure methods. An effective system would prevent wound dehiscence throughout healing, especially early on. Because sutures are tied and knotted, dehiscence is rare unless the wound gets infected.[7-9] In this study's adhesive glue-treated patient, excessive skin stretching at the incision site during mobilisation or improper glue application may have caused wound dehiscence. Dehiscence began research. Dehiscence rates dropped dramatically and stopped with proper closure and patient restraint. Infections of surgical wounds are common and dangerous for patients and doctors. The doctor cannot check for infections after many outpatient surgeries.[10-12] This study did not report wound infections, but previous studies have found 0% in the Maartense study to 11% in the Malone study. Tissue adhesive glue can prevent infection by blocking microorganisms. Adhesive glue has not been shown to reduce infection rates. Time matters in surgery. Modern surgery has increased efficiency by shortening procedure times. Gut staplers reduce bowel anastomosis time compared to sutures. Wound closure has improved.[12,13]Adhesive tapes closed wounds faster than sutures or glue. Suture and adhesive glue required similar times. Hemostasis in the skin's edges affected glue application most. Adherent glue required hemostasis before application. In a previous study, sutures closed the slowest, followed by adhesive glue and tape. Any project must consider finances. High operational costs burden patients and doctors.[13,14]Newer innovations and methods are often more effective but more expensive until they are widely adopted. Adhesive tapes were eight times and three times cheaper than glue and sutures, respectively. However, wound discharge made adhesive tapes wet after surgery, requiring replacement through day seven. Closing wounds and wound care may cost more. Glue is the most expensive but also the most cost-effective because it requires less wounddressing and no suture removal.[14,15] Scarless is best. Operation scars are permanent. Thus, doctors seek scar-free wound closures. Surgery scars haven't changed much despite centuries of sutures. Silk, unlike monofilament sutures, left visible suture marks when used for skin closure. Monofilament sutures reduce scarring from older techniques.[15,16]Adhesive glue and tapes avoid sutures and post-surgery scarring. On postoperative days 1, 2, 3, 7, 30, and 90, the Modified Hollander Scar Evaluation Score and Visual Analogue Scale for Scar assessed the scar's cosmetic appearance. The Hollander scar evaluation showed no significant difference between the three groups on days 1, 2, 3, or 7. 30 days post-surgery, adhesive glue outperformed suture. Instead of day 7

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or 30, look at your scar's cosmetic appearance on day 90 to predict its appearance in a year.In this study, the suture method left the worst scar and the adhesive glue method the best. Day 90 visual analogue scale results were consistent. On days 2, 3, and 30, glue outperformed suture and adhesive tape on the visual analogue scale. Day 1 was unremarkable. Previous research found that adhesive glue cosmetic scars were significantly better than those made using other methods. Many people avoid open surgery and prefer less invasive treatments. Thus, positive patient feedback is essential for assessing wound closure system efficacy.[16,17] To assess patient satisfaction, a pre-validated questionnaire was given on days 7, 30, and 90 after surgery. Bilateral hernia patients who had two procedures could tell the difference. Patients reported identical satisfaction 7 days after surgery. Adhesive glue was more popular than sutures or tape 30 and 90 days after surgery. Patients can take baths sooner without reapplying the adhesive glue, which may explain the satisfaction gap.[18,19] Every doctor prefers safe, fast, and easy wound closure. Adhesives beat sutures every time. On postoperative days 7, 30, and 90, sutures had the lowest satisfaction scores, followed by adhesive glue and adhesive tape.[20]

Conclusion

The use of adhesive glue and tapes to close surgical wounds has a bright future. Because it has the following benefits over suture, adhesive glue is demonstrated in this study to be a superior option for wound closure.They look more aesthetically pleasing than sutures. They are more readily accepted by patients than sutures. Compared to sutures, they have a higher surgeon satisfaction rate. After applying glue, a second trip to the hospital is not required, unlike with sutures. However, using adhesive glue has drawbacks as well. The suture is significantly more expensive than the glue. The study demonstrates that there is a risk of wound dehiscence after excessive stretching with adhesive glue. With the right technique and attention to wound care, this can be avoided.The system chosen for wound closure should not be influenced by cost. Patient and surgeon satisfaction, as well as cosmesis, are better predictors. The study highlights the significance of alternative techniques for wound closure and their promise for improved surgical wound care in the future.

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