Tissue Adhesive for Wound Closure in Fast-recovery Total Hip Arthroplasty: A Prospective, Randomized and Controlled Study

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Research article

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Abstract

Background

We aimed to present our experience of adopting tissue adhesive as adjunct to standard wound closure in total hip arthroplasty (THA) and evaluate its role and cost performance.

Methods

From September 2019 to November 2019, we prospectively enrolled consecutive patients who underwent simultaneous bilateral THA in this randomized and controlled study. The allocation of tissue adhesive was randomized to either hip. The patients' age, gender, body mass index (BMI), diagnosis, postoperative length of stay (LOS), dressing changes, wound evaluation scores, wound-related cost and complications were collected and analyzed.

Results

During the hospital stay, the dressing change in hips with tissue adhesive was significantly less than that in the other hips (p=0.000). However, the wound-related cost in hips with tissue adhesive was significantly higher (p=0.000). At one-month follow up, patient-reported wound measurement of hips with tissue adhesive was significantly more superior than the other hips (P=0.004). Seventeen patients preferred tissue adhesive and only five patients preferred the standard wound closure.

Conclusions

Tissue adhesive could significantly reduce wound drainage and increase patient satisfaction, which can be an ideal adjunct to standard wound closure in fast-recovery THA.

Background

At present, fast recovery after surgery (ERAS) has developed rapidly in the field of joint replacement [1-3]. In some institutes, the length of stay (LOS) after total hip arthroplasty (THA) has been shortened to less than 48 hours and even became daytime surgery [4,5]. The advent of ERAS also raised the stringent requirements of surgical techniques and perioperative management [6,7]. Wound closure and care are the one of most important aspects in perioperative management. However, compared with analgesia and surgical techniques, there were relatively fewer studies on wound closure and care.

Prolonged wound drainage, which is a common complication after joint replacement, could result in delayed wound healing, limited postoperative activity and even periprosthetic joint infection (PJI) [8,9]. One ideal wound closure, which permits rapid rehabilitation without wound drainage, should be design simple and easy to use.

In recent years, tissue adhesive has been introduced and adopted in orthopedic surgery [10-15]. According to the previous studies, tissue adhesive may be an ideal supplement to standard wound closure following total knee arthroplasty (TKA) [8]. It exists as liquid and polymerizes rapidly when in contact with skin tissue. The protective film produced by the tissue adhesive could quarantine with the external environment and prevent the foreign substances from invading the wound in the early postoperative period [16-19]. However, to our knowledge, there was no study to use the tissue adhesive as the supplement to subcuticular suture in THA.

Thus in this prospective study, we aimed to present our experience of adopting tissue adhesive as adjunct to standard wound closure in THA and evaluate its role and cost performance in reducing wound drainage.

Methods

Study population and design

From September 2019 to November 2019, we prospectively enrolled the consecutive patients who underwent simultaneous bilateral THA in this randomized self-control study. The study was approved by the local ethics committee.

Inclusion criteria: 1. the bilateral THA used the same prosthesis through the posterolateral approach; 2. the written informed consent was obtained prior to participating in this study. Exclusion criteria: 1. previous open surgery or major trauma or infection in either hip; 2. eloid, psoriasis, eczema or other skin diseases; 3. allergy to the ingredients of the tissue adhesive; 4. underlying malignant tumors; 5. regular anticoagulation therapy; 6. peripheral vascular disease; 7. bilateral surgeries performed in stages.

Sample size calculation: according to the previous study and the preliminary results of our pre-experiment, we set $\alpha=0.05$, $\beta=0.10$, the mean difference of dressing change was 1.0. An estimated 24 patients would be needed to provide 90% power. Finally, we decide to enroll 30 patients, which allowed for 20% loss to follow up.

Surgical procedures of wound closure

All patients underwent the right THA firstly and left secondly. The fixed surgical team performed the surgeries and two residents performed the wound closure. Tranexamic acid (TXA) was given intravenously twice before incision and before wound closure. Complete electrocoagulation hemostasis and repeated washing of TXA were did after implanting prosthesis. The joint capsule and external rotator muscles were reconstructed with 2-0 Ethibond non-absorbable suture W4843 (Ethicon, Somerville, NJ, USA). The deep fascia and superficial fascia were closed with 2-0 absorbable knotless barbed suture (Quill, Surgical Specialties Corporation, IL, USA) and 4-0 coated Vicryl Plus antibacterial suture (Ethicon, Somerville, NJ, USA). The subcuticular tissue was closed with 4-0 absorbable knotless barbed suture

(Ethicon, Somerville, NJ, USA). The allocations were done after the standard wound closure. The surgeon and assistants remained blinded before the allocations. The wound closure of right hip was randomized using the computer-generated method in the opaque envelopes. 1 represented the application of tissue adhesive as the supplement of standard wound closure; 2 represented just the standard wound closure without tissue adhesive. The left hip received the opposite method of wound closure (Figure 1).

The HISTOACRYL® tissue adhesive (B.Braun, Melsungen, German) was applied evenly on both sides of the wound and waited for air-drying for 30 seconds. When the tissue adhesive got dry, a standard wound dressing was applied to the surface of the wound. During the hospital stay, patients and caregivers were told to notify the surgeon or nurse for dressing change if blood or exudate soaked the dressing. If the dressing could keep dry and clean before discharge, the patient wound received one dressing change. The dressing change caused by discharge was not recorded. All patients received antibiotics within 24 hours and aspirin in 35 days postoperatively.

Follow-up and wound evaluation

The preoperative, intraoperative and postoperative information of each patient including age, gender, body mass index (BMI), diagnosis, postoperative LOS, the times of dressing changes and the wound-related cost, were collected prospectively.

Wound-related cost was the sum of cost of the suture, tissue adhesive, wound dressing, and other additional materials during the hospital day.

At one-month follow-up after surgery, the wound-related complications and wound-related evaluation scores were recorded. The wound-related complications were defined as redness, dehiscence, subcutaneous hematoma, prolong wound drainage (>5days), surgical site infection (SSI) and re-suture caused by any reasons. Wound-related evaluation scores included patient scar assessment score (PSAS), Hollander wound evaluation score (HWES) and Vancouver scar score (VSS). PSAS was evaluated by the patients themselves. HWES and VSS were evaluated by two independent orthopedic residents who were unknown to which hip adopted the tissue adhesive. Both two residents received professional training and maintain satisfying consistency of wound evaluation in the pre-experiment. The mean scores evaluated by the two resident were used as the final scores. In addition, all patients wound be asked which side of wound closure they prefer.

PSAS [20]: the scoring system mainly refers to the patient's own feeling and the evaluation of wound. 6 represents normal skin and 60 represents worst imaginable scar in the patient’s scale (Table 1).

Table 1. Patient scar assessment score (PSAS).										
*	1	2	3	4	5	6	7	8	9	10
Is the scar painful?										
Is the scar itching?										
#	1	2	3	4	5	6	7	8	9	10
Is the color of the scar different?										
Is the scar more stiff?										
Is the thickness of the scar different?										
Is the scar irregular?										
Total score Patient Scar Score										
* 0 means “no, no complains”,10 means “yes, more imaginable”										
# 0 means “no, as normal skin”,10 means “yes, very different”										

HWES [21]: the scoring system includes 6 items, which are step-off of borders, contour irregularities, margin separation, edge inversion, excessive distortion and overall appearance. 1 point is for each item. The lower the score, the better the wound healing (Table 2).

Table 2. Hollander wound evaluation score (HWES).		
Incision attribute	Score if absent	Score if present
Step – off borders	0	1
Contour Irregularities	0	1
Margin Separation	0	1
Edge inversion	0	1
Excessive Distortion	0	1
Overall appearance	0 (satisfactory)	1 (unsatisfactory)
Total Hollander score	0 (best)	6 (worse)

VSS [22]: the scoring system includes 4 items, which include vascularity, pliability, height and pigmentation. On this scale, lower scores represent a more normal appearance (Table 3).

Table 3
Vancouver scar score (VSS).

Score	Vascularity	Pliability	Height	Pigmentation
0	Normal	Normal	Flat	Normal
1	Pink	Supple	< 2mm	Hypopigmentation
2	Red	Yielding	2 – 4 mm	Mixed
3	Purple	Firm	> 4mm	Hyperpigmentation
4	–	Banding	–	–

Statistical Analysis

All statistical analyses were performed by SPSS version 22 (Inc., Chicago, IL, USA). Data was showed as median, mode and interquartile range (IQR) (skewed distribution) or mean±standard deviation (SD) (normal distribution). Measurement data was analyzed by student's tests or rank-sum test. Count data was analyzed by rank-sum test or Fisher exact test. A value of α=0.05 suits all tests. The intraclass correlation coefficient (ICC) was used to assess the observers' agreement: 0.81 to 1.00, nearly perfect reliability; 0.61 to 0.80, strong reliability; 0.41 to 0.60, moderate reliability; 0.21 to 0.40, fair reliability; and 0 to 0.20, poor reliability.

Results

Thirty-three patients were enrolled in this study. Two patients failed to complete the scheduled follow-up and one patient had re-operation because of recurrent dislocation. Finally, 30 patients were analyzed, which included 23 patients with osteonecrosis of femoral head (ONFH), 5 patients with developmental dysplasia of hip (DDH) and 2 patients with ankylosing spondylitis (AS). The basic information was shown in Table 4. There was no PJI or re-operation during the one-month follow-up in this cohort.

Table 4
The demographics of thirty patients.

Basic information	Data
Age (Median, mode, IQR) (years)	30.5, 32, 11
Male:Female	17:13
BMI (Mean ± SD) (kg/m^2)	23.07 ± 2.97
Postoperative LOS (Mean, mode, IQR) (day)	4, 4, 1

During the hospital stay, the dressing change in hips with tissue adhesive was significantly less than that in the other hips (p = 0.000) (Table 5, Fig. 2). However, wound-related cost in hips with tissue adhesive was significantly higher than that in the other hips (p = 0.000). Prolonged wound drainage was found in

three patients (four hips) and three of four hips were performed the standard suture. BMI of these three patient were larger than 27 kg/m^2 and the patient with bilateral prolonged wound drainage was larger than 30 kg/m^2.

From the view of the patients, the PSAS in hips with tissue adhesive was more superior than the other hips significantly (p = 0.004). And, seventeen patients preferred the wound closure of tissue adhesive, eight patients had no preference and only five patients preferred the standard wound closure (Fig. 3). From the view of the observers, there were no significant differences in the HWES and VSS between two methods. (Table 5) These scores assessed by two observers had NEARLY PERFECT RELIABILITY WITH EACH OTHER (ICC > 0.81) (Table 6). THE POSTOPERATIVE ONE-MONTH APPEARANCES OF BILATERAL WOUND IN ONE PATIENT WERE SHOWN IN Fig. 4.

Table 5
Dressing change, wound-related cost, complications and evaluation scores between two methods of wound closure in thirty patients.

Data	Tissue adhesive	Standard wound closure	P
Dressing change (Median, mode, IQR)	0, 0, 1	2, 2, 1	0.000
Wound – related cost (mean ± SD) (US dollar)	272.39 ± 10.12	221.83 ± 13.55	0.000
Wound-related complications	1/29	3/27	0.306
PSAS (Mean ± SD)	22.83 ± 9.48	30.57 ± 9.54	0.004
HWES (Median, mode, IQR)	0, 0 ,0	0, 0, 0	0.414
VSS (Mean ± SD)	5.13 ± 1.16	5.77 ± 1.16	0.057

Table 6
The inter-observers' agreements between two observers.

Evaluation system	PSAS, 95% CI	HWES, 95% CI	VSS, 95% CI
Inter-observer agreement	0.96 (0.93 to 0.97)	0.93 (0.89 to 0.96)	0.85 (0.76 to 0.91)

Discussion

This prospective, randomized and self-control study found that the supplementary tissue adhesive to standard wound closure in hip replacement could reduce the wound drainage and increase the patient satisfaction, despite increasing the medical expense. So the tissue adhesive combining with standard wound closure can be one reliable and effective choice for THA.

Implement the concept of ERAS in joint replacement should firstly ensure the safety and effectiveness, further improve the perioperative management and rehabilitation, reduce hospitalization days and costs

to increase patient satisfaction. Prolonged wound drainage following THA might delay wound healing and functional exercise, prolong hospital stay and even increase risk of PJI, which could be detrimental to clinical outcomes [11, 23]. Wound management without drainage is an important partway to ERAS, which urgently need new techniques and materials to be adopted in wound closure.

In our institute, the patients who underwent THA were relatively young and had the higher requirement of wound appearance and fast recovery. Previous studies has shown the safety of subcutaneous suture in joint surgery, even in total knee arthropalsty [24–26]. So we usually adopted the subcuticular suture, neither skin interrupted suture nor staple, for cosmetic appearance. However, this standard wound closure failed to solve the fundamental problem of wound drainage.

How to avoid postoperative wound drainage remained to be in the limelight. Maybe tissue adhesive is a good choice. The tissue adhesive in this study is composed by N-butyl-2-cyanoacrylate and early application in humans can be traced back to 1980s [27]. It would form a protective film on the surface of wound in 30 seconds and have certain bacteriostatic action, which could reduce the incidence of wound drainage and surgical site infection. Furthermore, it would provide the high-strength adhesive property for about 10 days. Therefore, these characteristics and advantages contribute to its extensive clinical application in surgery.

In this study, the dressing change in thirty hips with tissue adhesive decreased by 50% when comparing to the other thirty hips. The patient-reported evaluation scores of wounds with tissue adhesive were more superior than those without tissue adhesive. In the group of standard wound closure, the patients who had the bilateral posterolateral incisions needed to lie on their side for 3–5 minutes to finish the disinfection and dressing change, which would aggravate the pain of the other incision. But in the group of tissue adhesive, less dressing change could reduce the surgeons' workload and the inconvenience to the patients caused by dressing change. This might explain why more than three times as many patients preferred tissue adhesive as standard wound closure despite the additional wound-related cost.

Obesity was an important risk factor of fat liquefaction and wound drainage after THA. Tissue adhesives might have the potential to reduce partial fat liquefaction resulting from secondary suture of the wound. In the group of standard wound closure, three hips occurred prolong wound drainage, which was treated with additional suture postoperatively. In the group of tissue adhesive, only one hip had prolonged wound drainage. BMI of all three patient were larger than 27 kg/m^2 and that of the only patient with bilateral prolonged wound drainage was larger than 30 kg/m^2.

Some surgeons have also reported their experience in arthroplasty and controversy exists surrounding the application of tissue adhesive. Gromov and El-Gazzar proved its role in reducing wound drainage when tissue adhesive worked as the supplement to staples [8, 11]. However, another two randomized controlled trials showed no significant differences in the cosmetic appearance of scars, the incidence of complications, or patient satisfaction between tissue adhesive and standard wound closure [10–12]. These authors just analyzed the clinical outcomes, without taking the dressing change and medical

expenses into consideration. According to the above studies and our experience, tissue adhesive should be the adjunct, not substitution, to standard wound closure in THA.

There is no denying that some patients were allergic to tissue adhesive, though no allergy was found in this study [28, 29]. Dunnett performed 912 knee replacement and discovered allergy in 1.7% patients [30]. It usually manifested as the erythematous pruritic papular rash surrounding the incision site within postoperative 1 to 3 weeks and cleared with topical steroids within 2 weeks.

This study is not without limitations. Firstly, small sample size and short follow-up decreased the possibility of positive outcomes. Secondly, because medical consumptive material pricing systems in other institutes were different and wound-related costs after discharge were not analyzed, the cost-performance of tissue adhesive in other institutes may be different from this study. Thirdly, the blinding has been invalid when the dressings were changed postoperatively and the inherent limitation might eventually affect the patient's preferences.

Conclusions

Tissue adhesive could significantly reduce wound drainage and increase patient satisfaction, which can be an ideal adjunct to standard wound closure in fast-recovery THA.

Abbreviations

THA: total hip arthroplasty; BMI: body mass index; LOS: length of stay; ERAS: fast recovery after surgery; PJI: periprosthetic joint infection; TKA: total knee arthroplasty; TXA: tranexamic acid; SSI: surgical site infection; PSAS: patient scar assessment score; HWES: Hollander wound evaluation score; VSS: Vancouver scar score (VSS); IQR: interquartile range; SD: standard deviation; ICC: intraclass correlation coefficient; ONFH: osteonecrosis of femoral head; DDH: developmental dysplasia of hip; AS: ankylosing spondylitis.

Declarations

Ethics approval and consent to participate: The study was approved by the medical ethics committee of Chinese PLA General Hospital (S2019-166-01) and registered at Chinese Clinical Trial Registry (the clinical trial registration number: ChiCTR1900025730). All procedures were conducted in compliance with the guidelines of the Declaration of Helsinki. The patients were informed consent prior to their participation in the study.

Consent for publication: We have obtained consent for publication.

Availability of data and material: All data generated or analyzed during this study are included in this published article.

Competing interests: The authors declare that they have no competing interests.

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Author Contributions: All authors have made substantial contributions to: (1) the conception and design of the study, acquisition of data, or analysis and interpretation of data; (2) drafting the article or revising it critically for important intellectual content; (3) final approval of the version to be submitted. WC: primarily responsible for oversight of the research project, including all data acquisition and analysis, and manuscript preparation and approval. XK and MY: primarily responsible for all computational analyses in the article and the drafting of the manuscript. XK and MY were the co-first authors. ZC, JC and YW: revised the manuscript and helped perform the analysis with constructive discussions. All authors have read and approved the final submitted manuscript.

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References

1. Kehlet Henrik,Fast-track hip and knee arthroplasty.[J] .Lancet, 2013, 381: 1600-2.
2. Stambough Jeffrey B,Nunley Ryan M,Curry Madelyn C et al. Rapid recovery protocols for primary total hip arthroplasty can safely reduce length of stay without increasing readmissions.[J] .J Arthroplasty, 2015, 30: 521-6.
3. Husted Henrik,Holm Gitte,Jacobsen Steffen,Predictors of length of stay and patient satisfaction after hip and knee replacement surgery: fast-track experience in 712 patients.[J] .Acta Orthop, 2008, 79: 168-73.
4. Raphael Michael,Jaeger Melanie,van Vlymen Janet,Easily adoptable total joint arthroplasty program allows discharge home in two days.[J] .Can J Anaesth, 2011, 58: 902-10.
5. Petersen Pelle B,Kehlet Henrik,Jørgensen Christoffer C et al. Incidence and Risk Factors for Stroke in Fast-Track Hip and Knee Arthroplasty-A Clinical Registry Study of 24,862 Procedures.[J] .J Arthroplasty, 2019, 34: 743-749.e2.
6. Khan Sameer K,Malviya Ajay,Muller Scott D et al. Reduced short-term complications and mortality following Enhanced Recovery primary hip and knee arthroplasty: results from 6,000 consecutive procedures.[J] .Acta Orthop, 2014, 85: 26-31.
7. Malek I A,Royce G,Bhatti S U et al. A comparison between the direct anterior and posterior approaches for total hip arthroplasty: the role of an 'Enhanced Recovery' pathway.[J] .Bone Joint J, 2016, null: 754-60.
8. Gromov Kirill,Troelsen Anders,Raaschou Sofie et al. Tissue Adhesive for Wound Closure Reduces Immediate Postoperative Wound Dressing Changes After Primary TKA: A Randomized Controlled Study in Simultaneous Bilateral TKA.[J] .Clin. Orthop. Relat. Res., 2019, undefined: undefined.
9. Scuderi Giles R,Avoiding Postoperative Wound Complications in Total Joint Arthroplasty.[J] .J Arthroplasty, 2018, 33: 3109-3112.

10. Khan R J K,Fick D,Yao F et al. A comparison of three methods of wound closure following arthroplasty: a prospective, randomised, controlled trial.[J] .J Bone Joint Surg Br, 2006, 88: 238-42.
11. El-Gazzar Yaser,Smith Daniel C,Kim Sun Jin et al. The use of dermabond® as an adjunct to wound closure after total knee arthroplasty: examining immediate post-operative wound drainage.[J] .J Arthroplasty, 2013, 28: 553-6.
12. Livesey C,Wylde V,Descamps S et al. Skin closure after total hip replacement: a randomised controlled trial of skin adhesive versus surgical staples.[J] .J Bone Joint Surg Br, 2009, 91: 725-9.
13. Miller Adam G,Swank Michael L,Dermabond efficacy in total joint arthroplasty wounds.[J] .Am J. Orthop., 2010, 39: 476-8.
14. Garbuz Donald,2-octylcyanoacrylate, staples, and sutures had similar wound closure outcomes after total hip or knee replacement.[J] .J Bone Joint Surg Am, 2006, 88: 1895.
15. Lieberman Jay,Skin adhesive or staples were not different for skin closure after total hip replacement.[J] .J Bone Joint Surg Am, 2010, 92: 476.
16. Pelissier P,Casoli V,Le Bail B et al. Internal use of n-butyl 2-cyanoacrylate (Indermil) for wound closure: an experimental study.[J] .Plast. Reconstr. Surg., 2001, 108: 1661-6.
17. Anderson J M,Gibbons D F,The new generation of biomedical polymers.[J] .Biomater Med Devices Artif Organs, 1974, 2: 235-48.
18. Braginsky Lena,Javellana Melissa,Cleveland Emily et al. Tissue Adhesive Compared With Sterile Strips After Cesarean Delivery: A Randomized Controlled Trial.[J] .Obstet Gynecol, 2019, 134: 295-301.
19. Dumville Jo C,Coulthard Paul,Worthington Helen V et al. Tissue adhesives for closure of surgical incisions.[J] .Cochrane Database Syst Rev, 2014, undefined: CD004287.
20. Raklyar Eduard,Zloty David M,Use of a patient and observer scar assessment scale to evaluate the V-Y advancement flap for reconstruction of medial cheek defects.[J] .Dermatol Surg, 2012, 38: 1968-74.
21. Hollander J E,Singer A J,Valentine S et al. Wound registry: development and validation.[J] .Ann Emerg Med, 1995, 25: 675-85.
22. Baryza M J,Baryza G A,The Vancouver Scar Scale: an administration tool and its interrater reliability. [J] .J Burn Care Rehabil, 1995, 16: 535-8.
23. Parvizi J, Ghanem E, Sharkey P et al. Does Excessive Anticoagulation Predispose the Patient to Periprosthetic Infection?[J]. Journal of Arthroplasty, 2007, 22(2):0-305.
24. Agarwala Sanjay,Vijayvargiya Mayank,Concealed cosmetic closure in total knee replacement surgery - A prospective audit assessing appearance and patient satisfaction.[J] .J Clin Orthop Trauma, 2019, 10: 111-116.
25. Rui Min,Zheng Xin,Sun Shao-Song et al. A prospective randomised comparison of 2 skin closure techniques in primary total hip arthroplasty surgery.[J] .Hip Int, 2018, 28: 101-105.

26. Shetty A A,Kumar V S,Morgan-Hough C et al. Comparing wound complication rates following closure of hip wounds with metallic skin staples or subcuticular vicryl suture: a prospective randomised trial. [J] .J Orthop Surg (Hong Kong), 2004, 12: 191-3.
27. Messi G,Canciani G,Marchi A G,Costs and benefits of the use of tissue adhesives in wounds in children.[J] .Pediatr Med Chir, 1990, 12: 185-8.
28. El-Dars L D,Chaudhury W,Hughes T M et al. Allergic contact dermatitis to Dermabond after orthopaedic joint replacement.[J] .Contact Derm., 2010, 62: 315-7.
29. Gonzalo-Garijo,MAngeles,Pérez-Calderón,Remedios,Pérez-Rangel. Inmaculada et al. Contact dermatitis after orthopaedic surgery.[J] .Contact Derm., 2009, 61: 299-300.
30. Durando Dunnett,Porubsky Caitlin,Winter Suzanne et al. Allergic contact dermatitis to dermabond (2-octyl cyanoacrylate) after total knee arthroplasty.[J] .Dermatitis, 2014, 25: 99-100.

Figures

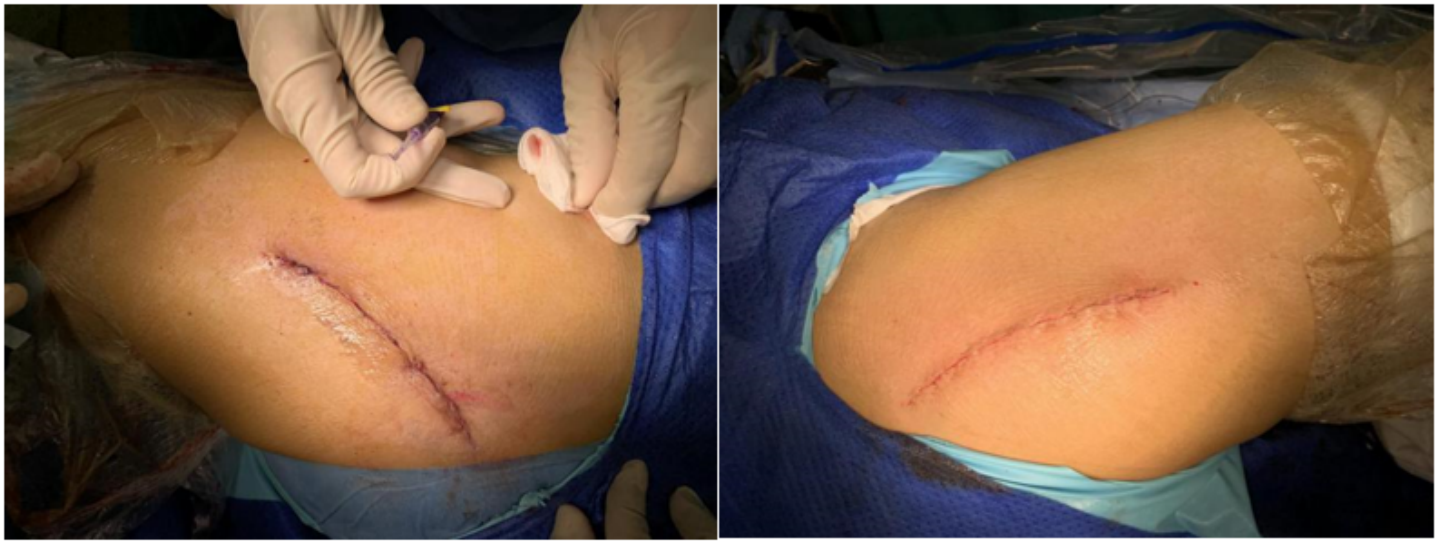

Figure 1

The experiences of bilateral wound in the operating room (left: tissue adhesive; right: standard wound closure).

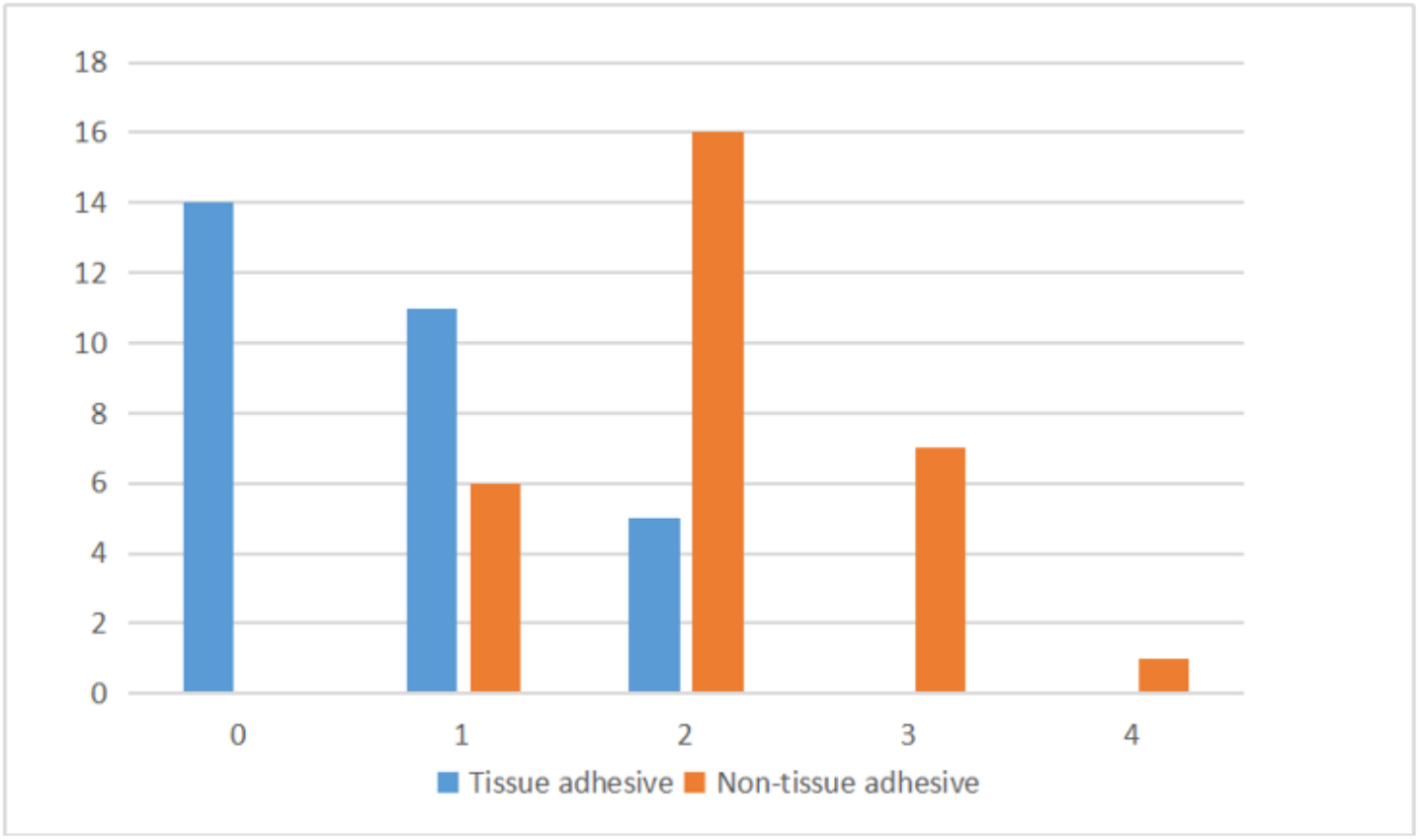

Figure 2

The times of dressing change between two methods in thirty patients.

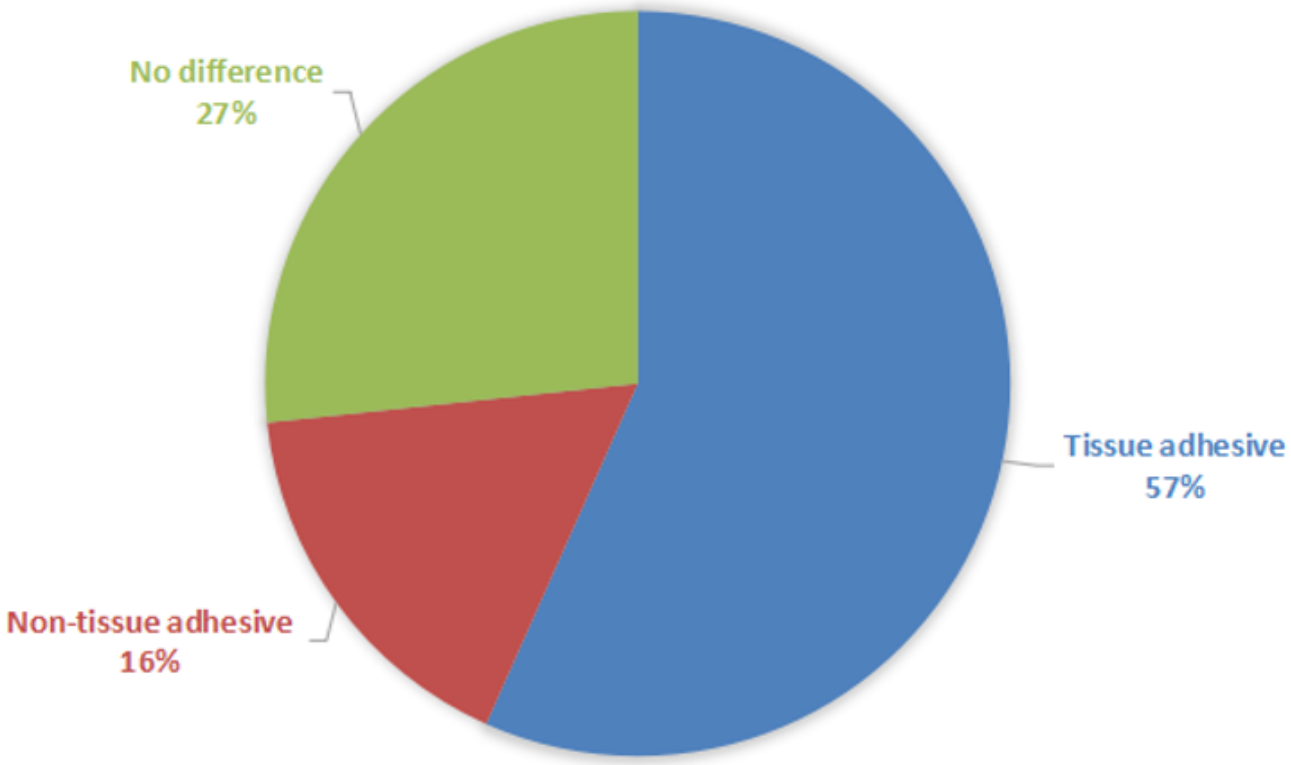

Figure 3

The preference distribution for wound closure in thirty patients.

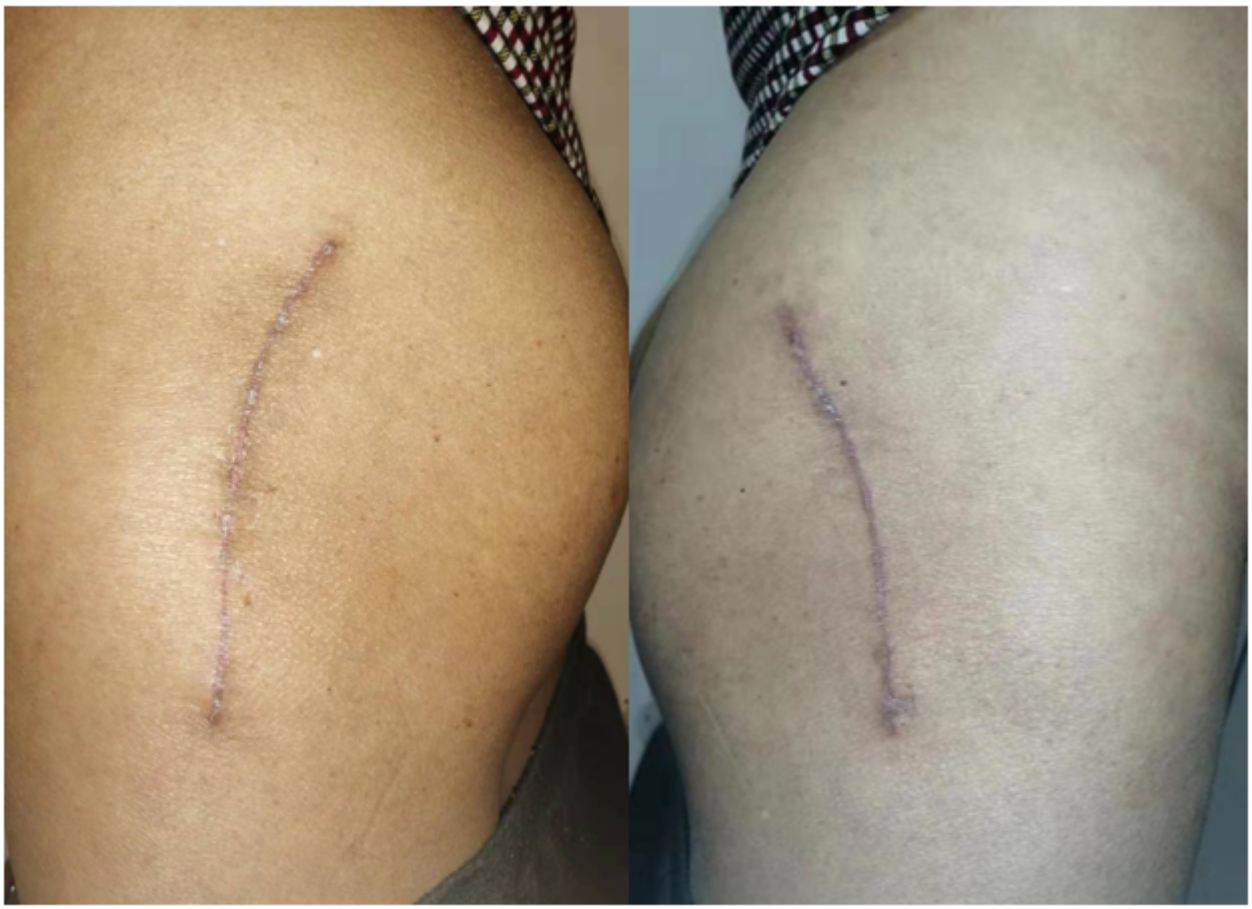

Figure 4

The appearance of bilateral wounds at postoperative one month (left: tissue adhesive; right: standard wound closure).

Supplementary Files

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- CONSORT2010Checklist.pdf