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ORIGINAL STUDY

Dermabond wound closure in primary hip arthroplasty

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Cyanoacrylate glues have been used in various surgical specialties for primary wound closure or as a supplement to other methods. We assessed the overall results and safety of this technique following primary hip arthroplasty.

Ninety-three patients undergoing primary total hip replacement were studied. The surgical wound had been closed with subcuticular vicryl followed by the application of topical dermabond adhesive, without any additional dressings.

The mean follow-up was 7.2 months. One patient suffered wound dehiscence on the third post operative day. Two patients had serous oozing from the wound for the initial 3-4 days.

This technique provides an immediate water tight seal in a sterile operative environment and provides a barrier to micro organisms. It has good tensile strength, aesthetic value and patient satisfaction.

Keywords : dermabond ; cyanoacrylate glues ; hip arthroplasty.

INTRODUCTION

Hip arthroplasty has come a long way since its inception. Wound closure techniques are also evolving and have reached a new 'generation' with the advent of tissue adhesives. There are a few studies of the application of adhesives for large wound closure in orthopaedic literature.

We present the results of this method of wound closure following primary hip arthroplasty. Our technique involves subcuticular wound closure followed by the application of dermabond adhesive (fig 1 & 2). No occlusive dressings are applied. The effectiveness of dermabond as a sole dressing in total hip arthroplasty wounds is assessed.

MATERIALS AND METHODS

Ninety-three patients operated by the senior author (PMA) were included in this outcome study. Sixteen patients were assessed prospectively while, for the remaining 77 patients, assessment was based upon their medical records. All the patients were operated for primary total hip arthroplasty between February 2005 and June 2006. The surgery was performed at the Royal Gwent NHS Hospital or St. Joseph's Hospital, Newport, United Kingdom. Patients operated for revision arthroplasty were excluded from the study.

All patients received peri-operative antibiotic cover and mechanical thromboprophylaxis. They were mobilised within 24 hours of surgery. Patients were discharged from the hospital only when the wounds were

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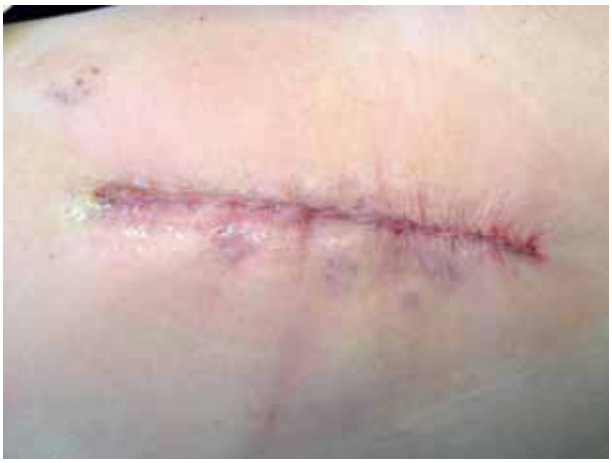

Fig. 1. — Immediate post operative appearance of the wound

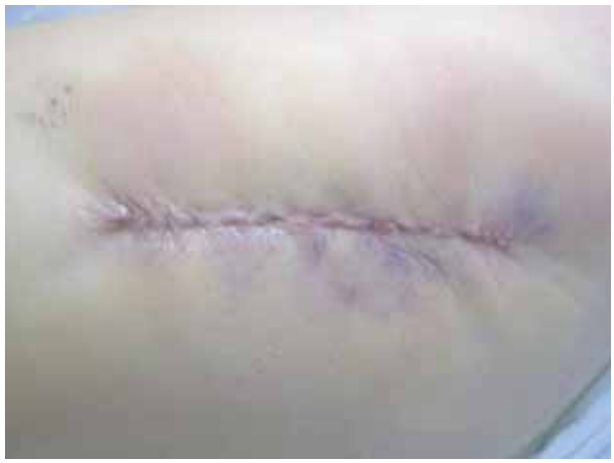

Fig. 2. — Wound appearance 6 weeks after the surgery

dry and they were medically well and safe to mobilise independently.

All the patients were reviewed for the information as per table I. The same information was obtained for the patients examined prospectively for the study. The primary outcome measure of our study was the development of any wound complication. Patients having any transient drainage or erythema were noted. Any objective evidence of infection, viz. discharge from the wound, pyrexia, wound culture report or necessity of a secondary procedure was also recorded. Any patient discharged later than 4 days postoperatively was considered a 'delayed discharge' and the record was examined in detail to determine the reason for the delay.

Statistical analysis

Descriptive statistics was used for most of the data. Chi square test was used to assess the association between two variables, where possible. SPSS software version 12.0 (SPSS Inc, Chicago, Illinois) was used for analysis. A p value of less than or equal to 0.5 was considered significant.

Technique

Total hip arthroplasty wounds were closed in layers with absorbable sutures following meticulous haemostasis. Subcuticular skin closure was performed with 3-0 undyed Vicryl® (Ethicon) to oppose the wound edges. Dermabond® (Ethicon) tissue adhesive was then applied in accordance with the technique advised in the product information booklet by the manufacturers. Dermabond® (Ethicon) was applied in multiple thin layers on to a dry wound. A gentle brushing motion was used for the application. The width of application was approximately 5 mm on the either side of the incision. Adhesives are always applied topically, never between wound edges. No further wound dressing was applied following polymerisation of the tissue adhesive. Wound Drains were not used in any patients in our series.

RESULTS

The records of all 93 patients were available for analysis. All of them had undergone a primary total hip replacement. The mean post-operative follow-up was 7.2 months (range : 1.3 to 17.5). The mean age of the patients was 68.9 years (range : 51.4 to 89.6). Fifty-eight patients suffered from no significant co-morbidity. Six patients suffered from diabetes and 5 patients had a primary diagnosis of rheumatoid arthritis. The remaining 25 patients had a past medical history of suffering from one or more medical co-morbidities. The mean Body Mass Index (BMI) of the patients was 27.8 (range : 17.4 to 39.3).

Of the 93 patients, one patient suffered post operative wound dehiscence on the third post-op day. This required re-suturing in the operating theatre. Two patients had oozing from the wound for the initial 3-4 days and required a protective dressing. None had clinical evidence of infection. The wound culture from all these three patients was negative.

Table I. — (Proforma)

Age	
BMI	
Co-Morbidities	
Intra-operative significant events	
Diagnosis	
Use of drain	
Wound on	Day 1
	Day 2
	Day 3
	Day 4
Wound complications if any	
Culture Report if applicable	
Length of stay :	Pre-operative
	Post-operative
Reason for delayed discharge	
Wound on 1st Follow-up (6/52)	
Wound on 2nd Follow-up (6/12)	
Wound on final follow-up	

The wounds with drainage resolved spontaneously without any further intervention. Empirical intravenous antibiotics were given to the patient with dehiscence. The data did not reveal any statistical significance for association between wound complications and co-morbidities, age or BMI.

The average duration from surgery to discharge was 4.6 days (range : 2 to 14). Twenty-four patients were discharged after four days. Seventeen of these patients were delayed as they were rehabilitating and undergoing intensive physiotherapy for better mobilisation. Seven patients required more medical input for various conditions, viz. chest infection, MI. The length of stay of patients with pre-operative medical co-morbidities was found to be significantly higher than with those without any co-morbidities (Chi-square : 4.27 ; df : 1 ; $p < 0.5$). No patient required re-admission following discharge.

DISCUSSION

Dermabond (Ethicon Inc. Somerville, New Jersey, USA) is a high-viscosity flexible cyanoacrylate glue. Cyanoacrylate was first synthesised in 1949 as a tissue adhesive. Its clinical use in surgical practice was first described by Coover *et al* (*6*), ten years later. 2-butyl cyanoacrylate was used for numerous years. It has, more recently, been refined to 2-octyl cyanoacrylate, with improvement in strength and flexibility (*12,28*). Dermabond is a sterile, liquid, topical skin adhesive containing a monomeric formulation, 2-octyl cyanoacrylate. It has a remarkable property to polymerise immediately on exposure to weak bases such as water and blood (*1*). Cyanoacrylate glues are biodegradable, bacteriostatic and haemostatic adhesives.

Review of the literature reveals satisfaction with the use of Dermabond in a variety of surgical specialities (*7,10,11,16,25,26,29*). Its efficacy in the emergency setting for small lacerations, especially for children is widely accepted (*22*). There are a few studies evaluating the use of skin adhesives in arthroplasty wound closures.

Satisfactory cosmetic results obtained with dermabond and subcuticular closure have been recognised previously (*5,7-9,11,20,22,24,26*). The aim of our study was not to assess the cosmetic outcome of wound closure with Dermabond but to evaluate the overall outcome and safety of hip arthroplasty wounds closed and dressed with this method. The advent of more rapid rehabilitation and quicker discharge of patients from hospitals following arthroplasty increases the need for a safe technique of wound closure which permits rapid healing without complication (*12*). Patients regard the appearance of their wounds as an indicator of the success of their operation (*24*).

Toriumi *et al* (*28*) performed a randomised controlled trial of plastic surgical patients, using a modified Hollander scale, to ascertain the cosmetic results with Dermabond. They concluded that the patient satisfaction was significantly better with the Dermabond group. Similarly, Gennari *et al* (*7*) concluded from their randomised controlled trial that the patient satisfaction is significantly higher with the wounds closed using adhesives. They also found that the overall costs of tissue adhesive use are significantly lower when compared to the standard techniques. This is due to fewer post operative physician and assistant services being required (*2,7, 8*). For arthroplasty patients, by facilitating early mobilisation and regain of confidence in the absence of dressings, discharge from the hospital may be accelerated. This potentially increases the cost benefits.

The use of Dermabond for larger incisions has been performed by various authors as an adjunct to subcuticular closure with absorbable sutures (*5,25*). It provides a means of simple coverage and replaces the occlusive dressing. Patients can be allowed to shower and return to normal activity sooner. This experience in urological procedures did not reveal any wound healing problems or infections (*25*). It provides a flexible water-resistant protective coating and eliminates the need for suture removal (*5,8,25*). The application of Dermabond is quick and prolongs the theatre time only slightly (*5,7,9,22*). Patients are advised not to disturb the polymerised film of Dermabond adhesive. The adhesive sloughs naturally with time, often still present at 6 weeks post-operatively. Patients may shower or bathe the site gently, though are advised not to restart swimming. They are advised to pat the area dry rather than rub the wound.

Besides enhancing healing, an ideal dressing should prevent invasion of pathogens and control the number of bacteria already present in the wounds (*15*). Bhende *et al* (*4*) concluded from their *in vitro* experiments that octyl cyanoacrylate tissue adhesive is an effective barrier to microbial penetration by Gram-positive and Gram-negative, motile and nonmotile species. Other studies have proven effectiveness of 2-octyl cyanoacrylate films as barriers to various pathogens, including bacteria, fungi, and yeast (*15,17,23*). Dermabond provides an effective barrier in clinical use as well, and reduces the incidence of infection (*8,9,20,22,28*). It is particularly effective against common skin pathogens (*23*).

Koukoubis *et al* (*13*) performed experiments to assess the tensile strengths of adhesive glues and sutures alone and the combination of suture and glue. They concluded that the combination of cyanoacrylate glue plus suture provided the maximum tensile strength before tissue separation. The tensile strength of glue and sutures alone has not been found to be significantly different but the patterns of failure differ in the two groups (*27*). Dermabond has been shown to retain its strength and durability, even when athletes were allowed to re-enter competition immediately following the wound repair (*22*). The reinforcing combination provides a closure that is mechanically significantly stronger (*13*). One of our study patients suffered a wound dehiscence on the third post-operative day. The closure had been performed by a trainee, and the dehiscence was due to failure of the knot of the subcuticular suture. Our data did not reveal any significant association between the wound complications and co-morbidities, age or BMI. Because of the small number of complications involved, no definitive conclusions can be drawn on the association based on this data.

Khan *et al* (*12*) performed a randomised controlled trial for comparison of the closure techniques of the arthroplasty wounds. This is the only available literature in English language, describing the use of OCA in arthroplasty or orthopaedic wounds. They have concluded that with the use of OCA, there were significantly more cases without strike through, indicating that the wounds were sealed completely with OCA. In our method of wound closure the perfect seal of Dermabond is applied over the wound closed in subcuticular manner. The seal is performed in the most sterile environment possible. The wounds are not disturbed or exposed to the ward environment subsequently for dressing changes.

2-octyl cyanoacrylate has not revealed any local toxic reaction in human use (*20,29*). It is biologically inert and does not have any histotoxicity or disadvantages with regard to tissue regeneration (*19*).

Various randomised controlled trials and meta-analyses have refuted the use of drains following primary hip arthroplasty. They do not reduce the incidence of haematoma development, infection or transfusion requirement (*3,14,18,21*). We do not recommend the routine use of wound drains as they may not decrease the wound complications and oozing but rather act as a portal for the entry of micro-organisms.

CONCLUSION

These results suggest that the substitution of Dermabond for occlusive wound dressing in hip arthroplasty is a safe, reliable, aesthetic and attractive alternative to the traditional wound repair and dressing methods. A transparent polymer film sealant substitutes the occlusive dressings in an

effective manner preventing any contact with the external environment. Wounds are not disturbed outside the sterile operative environment and there is no discomfort from suture removal.

REFERENCES

1. **Anderson JM, Gibbons DF.** The new generation of biomedical polymers. *Biomater Med Devices Artif Organs* 1974 ; 2 : 235-248.
2. **Applebaum JS, Zalut T, Applebaum D.** The use of tissue adhesion for traumatic laceration repair in the emergency department. *Ann Emerg Med* 1993 ; 22 : 1190-1192.
3. **Ashraf T, Darmanis S, Krikler SJ.** Effectiveness of suction drainage after primary or revision total hip and total knee arthroplasty. *Orthopedics* 2001 ; 24 : 1158-1160.
4. **Bhende S, Rothenburger S, Spangler DJ, Dito M.** In vitro assessment of microbial barrier properties of Dermabond topical skin adhesive. *Surg Infect* (*Larchmt*) 2002, 3 : 251-257.
5. **Bruns TB, Worthington JM.** Using tissue adhesive for wound repair : a practical guide to dermabond. *Am Fam Physician* 2000 ; 61 : 1383-1388.
6. **Coover HN, Joyner FB, Sheerer NH, Wicker TH.** Chemistry and performance of cyanoacrylate adhesive. *Special Tec Papers* 1959 ; 5 : 413-417.
7. **Gennari R, Rotmensz N, Ballardini B *et al.*** A prospective, randomized, controlled clinical trial of tissue adhesive (2-octyl cyanoacrylate) versus standard wound closure in breast surgery. *Surgery* 2004 ; 136 : 593-599.
8. **Gordon CA.** Reducing needle-stick injuries with the use of 2-octyl cyanoacrylates for laceration repair. *J Am Acad Nurse Pract* 2001 ; 13 : 10-12.
9. **Jallali N, Haji A, Watson CJ.** A prospective randomized trial comparing 2-octyl cyanoacrylate to conventional suturing in closure of laparoscopic cholecystectomy incisions. *J Laparoendosc Adv Surg Tech A* 2004 ; 14 : 209-211.
10. **Kamer FM, Joseph JH.** Histoacryl – its use in aesthetic facial plastic surgery. *Arch Otolaryngeal Head Neck Surg* 1989 ; 115 : 193-197.
11. **Keng TM, Bucknall TE.** A clinical trial of tissue adhesive (histoacryl) in skin closure of groin wounds. *Med J Malaysia* 1989 ; 44 : 122-128.
12. **Khan RJ, Fick D, Yao F *et al.*** A comparison of three methods of wound closure following arthroplasty : A prospective randomised controlled trial. *J Bone Joint Surg* 2006 ; 88-B : 238-242.
13. **Koukoubis, TD, Glisson RR, Feagin JA Jr *et al.*** Augmentation of meniscal repairs with cyanoacrylate glue. *J Biomed Mater Res* 1995 ; 29 : 715-720.
14. **Mengal B, Aebi J, Rodriguez A, Lemaire R.** [A prospective randomized study of wound drainage versus non-drainage in primary total hip or knee arthroplasty] (in French). *Rev Chir Orthop R* 2001 ; 87 : 29-39.
15. **Mertz PM, Davis SC, Cazzaniga AL *et al.*** Barrier and antibacterial properties of 2-octyl cyanoacrylate-derived wound treatment films. *J Cutan Med Surg* 2003 7 : 1-6.
16. **Meskin SW, Ritterband DC, Shapiro DE *et al.*** Liquid bandage (2-octyl cyanoacrylate) as a temporary wound barrier in clear corneal cataract surgery. *Ophthalmology* 2005 ; 112 : 2015-2021.
17. **Narang U, Mainwaring L, Spath G, Barefoot J.** In-vitro analysis for microbial barrier properties of 2-octyl cyanoacrylate-derived wound treatment films. *J Cutan Med Surg* 2003 ; 7 : 13-19.
18. **Niskanen RO, Korkala OL, Haapala J *et al.*** Drainage is of no use in primary uncomplicated cemented hip and knee arthroplasty for osteoarthritis : a prospective randomized study. *J Arthroplasty* 2000 ; 15 : 567-569.
19. **Nitsch A, Pabyk A, Honig JF *et al.*** Cellular, histomorphologic, and clinical characteristics of a new octyl-2-cyanoacrylate skin adhesive. *Aesthetic Plast Surg* 2005 ; 29 : 53-58.
20. **Ong CC, Jacobsen AS, Joseph VT.** Comparing wound closure using tissue glue versus subcuticular suture for pediatric surgical incisions : a prospective, randomised trial. *Pediatr Surg Int* 2002 ; 18 : 553-555.
21. **Parker MJ, Roberts CP, Hay D.** Closed suction drainage for hip and knee arthroplasty. A meta-analysis. *J Bone Joint Surg* 2004 ; 86-A : 1146-1152.
22. **Perron AD, Garcia JA, Parker Hays E, Schafermeyer R.** The efficacy of cyanoacrylate-derived surgical adhesive for use in the repair of lacerations during competitive athletics. *Am J Emerg Med* 2000 ; 18 : 261-263.
23. **Quinn JV, Osmond MH, Yurack JA, Moir PJ.** N-2-butyl cyanoacrylate : Risk of bacterial contamination with an appraisal of its antimicrobial effects. *J Emerg Med* 1995 ; 13 : 581-585.
24. **Quinn J, Wells G, Sutcliffe T *et al.*** Tissue adhesive versus suture wound repair at 1 year : Randomized clinical trial correlating early, 3-month, and 1-year cosmetic outcome. *Ann Emerg Med* 1998 ; 32 : 645-649.
25. **Rajimwale A, Golden BK, Oottomasathien S *et al.*** Octyl-2-Cyanoacrylate as a routine dressing after open pediatric urological procedures. *J Urol* 2004 ; 171 : 2407-2408.
26. **Santibanez-Gallerani A, Armstrong MB, Thaller SR.** Improved esthetic results with fine-tip Dermabond application technique. *J Craniofac Surg* 2005 ; 16 : 890-892.
27. **Shapiro AJ, Dinsmore RC, North JH Jr.** Tensile strength of wound closure with cyanoacrylate glue. *Am Surg* 2001 ; 67 : 1113-1115.
28. **Toriumi DM, O'Grady K, Desai D, Bagal A.** Use of octyl-2-cyanoacrylate for skin closure in facial plastic surgery. *Plast Reconstr Surg* 1998 ; 102 : 2209-2219.
29. **Tse DT, Panje WR, Anderson RL.** Cyanoacrylate adhesive used to stop CSF leaks during orbital surgery. *Arch Ophthalmol* 1984 ; 102 : 1337-1339.