Clinical Benefits of the Dermabond Prineo Skin Closure System for Total Hip and Knee Arthroplasty Compared to Skin Staples

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Background

Elective total joint replacement surgery is one of the most commonly performed procedures in the U.S. In 2014 alone, 370,770 total hip arthroplasty (THA) and 680,150 total knee arthroplasty (TKA) procedures were performed. Given this high volume, it is important to have successful wound closure and healing. However, current literature is unclear about the optimal wound closure method for arthroplasty.

Skin stapling is the current gold standard for wound closure of THA and TKA. The FDA-approved Dermabond Prineo Skin Closure System by Ethicon (Prineo) can be used as an alternative to skin staples to help provide strength, flexibility, and antimicrobial protection.

Little evidence exists evaluating the clinical outcomes among orthopedic patients who receive the Prineo compared to those who receive staples for skin closure. This study aims to retrospectively evaluate whether the use of Prineo influences clinical outcomes for patients undergoing elective total joint arthroplasty compared to skin staples.

Problem Statement

Compared to skin staples, the Prineo would be associated with fewer complications of wound healing and well-managed wound pain after elective THA or TKA.

Methods

A retrospective chart review was conducted for patients who underwent THA and/or TKA by a single surgeon between September 2016 and December 2017 at Lehigh Valley Health Network. A total of 522 patients was identified and included in this study.

Clinical characteristics collected from chart review included the following: age, sex, surgical procedure, laterality, skin closure device, discharge disposition, as well as smoking status, BMI, and diagnosis of diabetes at time of surgery. Outcome measures included post-operative length of stay (LOS), pre- and post-operative pain scores, wound complication rate including surgical site infection (SSI), intra-operative wound closure time, and 30-, 60-, and 90-day readmission rates.

In both clinical cohort, subcutaneous layers were closed with 2-0 absorbable sutures to approximate skin edges, while the wound was dressed with a surgical dressing. Ethicon disposable skin stapler and the Prineo device were used for skin closure. Staples were removed 2 weeks post-operatively.

Statistical analysis was performed using SPSS 25.

Results

Patient characteristics are outlined in Table 1.

Table 1: Patient Characteristics

	Staples	Prineo
Total patients	256	266
Age (median, range)	66 (19-89)	67 (36-90)
Males (n, %)	96 (38)	99 (37)
Females (n, %)	160 (62)	167 (63)
Primary TKA (n, %)	161 (63)	165 (62)
Primary THA (n, %)	77 (30)	89 (33)
Revision TKA/THA	18 (7)	12 (5)
Right extremity surgery	122 (48)	131 (49)
Left extremity surgery	122 (48)	117 (44)
Bilateral extremity surgery	12 (4)	18 (7)
Home Health discharge disposition	188 (73)	192 (72)
SNF discharge disposition	46 (18)	54 (20)
Rehab Facility discharge disposition	19 (7)	12 (5)
Home discharge disposition	4 (2)	8 (3)

While LOS appears to be equivocal between the two groups, the use of Prineo was associated with significant decrease in length of hospitalization (1.9 versus 2.1, p=0.01). The use of the Prineo was also associated with reduced 30-day readmission rate when compared to the staples cohort (1.5% versus 5.1%, p=0.02). 60-day and 90-day readmission rates were comparable between the two groups as seen in Table 2. Patients receiving the Prineo showed greater rates of reduced post-operative pain scores when compared to the staples cohort (25% versus 18%, p=0.05).

Table 2: Outcome Measures

	Staples	Prineo	p-value
Average LOS (days)	2.1	1.9	**0.01**
30-day readmission rates (%)	5.1	1.5	**0.02**
60-day readmission rates (%)	0.8	1.1	0.72
90-day readmission rates (%)	1.2	0.8	0.65
Reduced postoperative pain (%)	25	18	**0.05**
Average intraoperative closure time (minutes)	28	30	0.07
SSI rate (%)	0.4	0.0	0.30
Wound complication rate (%)	1.2	0.4	0.30

Although not statistically significant, patients in the Prineo cohort had lower SSI rates compared to the staples cohort (0.4% versus 1.2%). One patient in the Prineo cohort suffered a superficial wound complication, while 3 patients in the staples group suffered wound complications (2 superficial and 1 acquired SSI requiring operative irrigation and debridement with poly-exchange). All superficial wound complications required treatment with cephalexin and were resolved by week 6. No wound dehiscence was reported. Patient characteristics for wound complications are outlined in Table 3.

Table 3: Patient Characteristics with Wound Complications

	Staples (n=3)	Prineo (n=1)
Gender (n, %)		
Male	2 (67)	0 (0)
Female	1 (33)	1 (100)
Age (median, range)	75 (67-82)	77
Surgical procedure (n, %)		
TKA	3 (100)	1 (100)
THA	0 (0)	0 (0)
Revision (n, %)	2 (67)	0 (0)
Diabetes mellitus (n, %)	0 (0)	0 (0)
Smoking (n, %)	0 (0)	0 (0)
Obesity (n, %)	3 (100)	0 (0)

Discussion

Use of the Prineo for wound closure was associated with clinical benefits of shorter LOS, reduced 30-day readmission rates, and greater rates of reduced post-operative pain score. Literature research also showed higher patient satisfaction with the Prineo likely due to the following reasons: ease of self-care, less pain on removal, ability to shower immediately following surgery, and greater cosmetic satisfaction with scar appearance.

Fewer wound complications seen in the Prineo can be attributed to antimicrobial properties of 2-octylcyanoacrylate. Reducing risk of infection can lead to substantial economic benefits. A 90-day economic model based on 500 annual hip and knee arthroplasty procedures estimated $56.70 to $79.62 cost savings per patient with 60% uptake of the Prineo. This estimate is roughly translated to an annual hospital savings of $28,349 to $39,809.

A single-surgeon, a single-center study design may have affected the findings seen in this research. Patients were also evaluated by multiple healthcare providers after discharge from hospital, leading to potential inconsistencies in clinical assessment of wound healing and complications. Although the baseline patient characteristics for both groups were similar and optimized prior to procedures, patient factors following their discharge such as wound care could have significantly altered the clinical outcome measures. Considering these limitations, further studies involving multiple surgeons are required to guide clinical practice in total hip and knee arthroplasty.

Conclusion

Current literature does not provide clear guidelines for skin closure in THA and TKA. In this study, use of the Prineo was associated with clinical benefits such as decreased LOS, 30-day hospital readmission, and wound pain compared to skin staples. However, there was no significant difference in readmission rate beyond 30 days post-discharge, as well as in skin closure time, SSI, and wound complication between the Prineo and staples. Further studies involving multiple orthopedic surgeons across regions may help validate our findings and recommend optimal wound closure method in arthroplasty procedures.

REFERENCES

1. Maradit Kremers H, Larson DR, Crowson CS, Kremers WK, Washington RE, Steiner CA, et al. Prevalence of Total Hip and Knee Replacement in the United States. The Journal of bone and joint surgery American volume. 2015;97(17):1386-97.
2. Sloan M, Premkumar A, Sheth NP. Projected Volume of Primary Total Joint Arthroplasty in the U.S., 2014 to 2030. J Bone Joint Surg Am. 2018;100(17):1455-60.
3. Singh B, Mowbray MAS, Nunn G, Mearns S. Closure of hip wound, clips or subcuticular sutures: does it make a difference? European Journal of Orthopedic Surgery & Traumatology; June 2006;16:124-9.
4. Singhal AK, Hussain A. Skin closure with automatic stapling in total hip and knee arthroplasty. *JK Practitioner*. 2006;13:142-3.
5. Newman JT, Morgan SJ, Resende GV, Williams AE, Hammerberg EM, Dayton MR. Modality of wound closure after total knee replacement: are staples as safe as sutures? A retrospective study of 181 patients. *Patient Saf Surg*. 2011;5(1):26. Published 2011 Oct 19. doi:10.1186/1754-9493-5-26
6. Smith TO, Sexton D, Mann C, Donell S. Sutures versus staples for skin closure in orthopaedic surgery: meta-analysis. *BMJ*. 2010;340:c1199. Published 2010 Mar 16. doi:10.1136/bmj.c1199
7. Graham DA, Jeffery JA, Bain D, Davis P, Bentley G. Staple vs subcuticular vicryl skin closure in knee replacement surgery: a spectrophotographic assessment of wound characteristics. Knee 2000;7:239-43.
8. Ethicon US LLC. [webpage on the Internet] DERMABOND™ PRI-NEO™ Skin Closure System (22 cm) instructions for use [updated April 2016] [Accessed March 24, 2019]. Available: http://hostedvl106.quosavl.com/cgi-isapi/server.dll?8080?IFUs?.cmt1bWFyMTJAaXRzLmpuai5jb20=?GetOneDocPureFullTxt?p2frdflcj7n4t01muj4u25m7nc?8.
9. Park YH, Song JH, Choi GW, Kim HJ. Comparison of 2-Octyl Cyanoacrylate Topical Skin Adhesive and Simple Interrupted Nylon Sutures for Wound Closure in Ankle Fracture Surgery. Foot Ankle Int. 2018;39(11):1283-9.
10. Huemer GM, Schmidt M, Helml GH, Shafighi M, Dunst-Huemer KM. Effective wound closure with a new two-component wound closure device (Prineo) in excisional body-contouring surgery: experience in over 200 procedures. Aesthetic Plast Surg. 2012;36(2):382-6.
11. Lee JC, Ishtihar S, Means JJ, Wu J, Rohde CH. In Search of an Ideal Closure Method: A Randomized, Controlled Trial of Octyl-2-Cyanoacrylate and Adhesive Mesh versus Subcuticular Suture in Reduction Mammaplasty. Plast Reconstr Surg. 2018;142(4):850-6.
12. Ando M, Tamaki T, Yoshida M, Sasaki S, Toge Y, Matsumoto T, et al. Surgical site infection in spinal surgery: a comparative study between 2-octyl-cyanoacrylate and staples for wound closure. Eur Spine J. 2014;23(4):854-62.
13. Patel H, Khoury H, Girgenti D, Welner S, Yu H. Burden of Surgical Site Infections Associated with Arthroplasty and the Contribution of Staphylococcus aureus. Surg Infect (Larchmt). 2016;17(1):78-88.
14. Whitehouse JD, Friedman ND, Kirkland KB, Richardson WJ, Sexton DJ. The impact of surgical-site infections following orthopedic surgery at a community hospital and a university hospital: adverse quality of life, excess length of stay, and extra cost. Infect Control Hosp Epidemiol. 2002;23(4):183-9.
15. Sadik K, Flener J, Gargiulo J, Post Z, Wurzelbacher S, Hogan A, et al. A US hospital budget impact analysis of a skin closure system compared with standard of care in hip and knee arthroplasty. ClinicoEconomics and outcomes research : CEOR. 2018;11:1-11.