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2-Octyl-Cyanoacrylate Mesh Dressings for Total Joint Arthroplasty: Dressing Design Influences Risks of Wound Complications

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ABSTRACT

Background: Recent liquid adhesive skin closure systems with a mesh patch and a 2-octyl cyanoacrylate liquid formula have shown promising results in total joint arthroplasty. Chemical accelerators are typically included to promote the rapid polymerization of 2-octyl cyanoacrylate. The goal of the study is to distinguish designs and wound complication differences between 2 similar systems.

Methods: An 18-week retrospective study was conducted from July to December 2023, including 207 total hip arthroplasty and 212 total knee arthroplasty cases from 4 attending surgeons at 1 institution that used 1 of 2 dressing designs. Both dressings had a 2-octyl cyanoacrylate liquid adhesive formula that applied topically to a polyester-based mesh overlaying the wound. Mesh A (used in 274 cases) included an accelerator, a quaternary ammonium salt, on the mesh patch, whereas Mesh B (used in 145 cases) included a similar accelerator within the adhesive applicator.

Results: Wound complications (3.2 versus 7.6%; $X^2 = 3.86$; df = 1; $P = .049$), early periprosthetic joint infections (0 versus 2.8%; $X^2 = 7.63$; df = 1; $P = .006$), and 90-day reoperations for wound complications (0.4 versus 3.4%; $X^2 = 6.39$; df = 1; $P = .011$) were significantly lower in patients who received Mesh A versus B, respectively. There was no difference in superficial surgical site infections (0.7 versus 0%; $X^2 = 1.06$; df = 1; $P = .302$) or allergy rates (3.3 versus 4.1%; $X^2 = 0.12$; df = 1; $P = .655$) between Mesh A and B.

Conclusions: We observed significantly different performance in wound complications, early postoperative periprosthetic joint infections, and 90-day reoperation between the 2 designs. Having the accelerator in the applicator rather than on the mesh patch may lead to premature polymerization before bonding appropriately with the mesh to create the desired wound closure and seal.

Level of Evidence: Level III.

Advancements in the development of long-chained cyanoacrylate topical skin adhesives have allowed for their increased popularity in surgical wound closure practice [1,2]. Liquid cyanoacrylate monomers polymerize in an exothermic reaction when contacting anions from skin moisture or wound exudate, leaving a strong, waterproof bond formation for tissue closure [1–3]. The benefits of cyanoacrylate adhesives include lower rates of infection and dehiscence, as well as improved surgical wound closure times and cosmetic scar appearance [4–9].

The first cyanoacrylate used in surgical practice was N-butyl-2-cyanoacrylate, which is known for its rapid polymerization. One of the first publications revealed that epithelization and the formation of new connective tissue occurred earlier with N-butyl-2-cyanoacrylate when compared to 5-0 monofilament sutures [10]. The N-butyl-2 cyanoacrylate formula showed great benefit when it

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Ethical Review Committee Statement: This study was approved by our Institutional Review Board (IRB-AAAV1003) and conducted in accordance with the ethical standards in the 1964 Declaration of Helsinki.

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was first used in emergent procedures for lacerations; however, initial bonding strength was relatively weaker when applied to areas of skin that saw more tension or were longer in length [3].

A newer-generation cyanoacrylate tissue adhesive, 2-Octyl cyanoacrylate, was approved by the Food and Drug Administration in 1998 after showing comparable results to sutures and greater bond strength compared to N-butyl-2-cyanoacrylate [11,12]. 2-Octyl cyanoacrylate was quickly found to be more durable and flexible to use on higher tension and larger wounds, due to its longer carbon chain than N-butyl-2 cyanoacrylate, with no difference in cosmetic appearance [9,13–17]. In addition to the hydrophobic nature of the cyanoacrylate polymer, 2-octyl cyanoacrylate has been also specifically shown to be antimicrobial against both gram-negative and gram-positive bacteria that cause surgical site infections (SSIs) [11,18–20]. In vitro studies of 2-Octyl cyanoacrylate using agar media showed patency retention against both gram-negative and gram-positive bacteria [20] and inhibition of gram-positive bacterial growth [19]. 2-octyl cyanoacrylate provides a strong, physical moisture-resistant barrier that effectively inhibits bacteria from contacting the wound and prevents bacterial proliferation. It is also theorized that the cell capsule of gram-positive bacteria is destabilized through electromagnetic reactions with the 2-octyl cyanoacrylate, preventing proliferation [11]. However, the trade-off with the longer carbon chain presents a prolonged polymerization time. As a result, 2-octyl cyanoacrylate takes longer to set when contacting the skin compared to N-butyl-2 cyanoacrylate [21]. Chemical activators and accelerants are commonly used to speed up the polymerization of 2-octyl cyanoacrylate to help counteract this longer setting time [3].

In total joint arthroplasty (TJA) cases, wound complications are relatively common and are risk factors for periprosthetic joint infections (PJIs). Many previous published studies have focused on various wound closure systems for TJA to decrease the risk of these wound complications [22–25]. 2-Octyl cyanoacrylate dressings have shown promising results in this patient population, especially as total knee arthroplasty (TKA) and total hip arthroplasty (THA) incisions are longer and experience more tension than most incisions elsewhere on the body. Liquid skin adhesives have shown improved surgical time, tissue healing, and cosmetic results in THA and TKA cases when compared to sutures [25–27]. Recent designs of the skin closure system include a mesh patch overlaying the incision and a 2-octyl cyanoacrylate liquid adhesive applied topically over the mesh. The mesh patch shares the tension of the wound, potentially decreasing ischemia and delaying wound healing. The reduced tension across the wound promotes an earlier new tissue connection and improves the cosmetic appearance of TJA incisions compared to other liquid adhesives alone or sutures [26,28–32]. Allergic reactions to the polyester mesh occur at low rates but routinely resolve on their own or respond well to a short course of topical or oral corticosteroids and are not typically associated with superficial SSI or deep PJI [33–35].

Our institution has used a liquid adhesive and mesh patch skin closure system from 1 manufacturer for the past 6 years, observing excellent results in both primary THA [30] and TKA [31] patients. In October 2023, based on a new contract signed by our institution, our arthroplasty division began using a different liquid adhesive and mesh patch skin closure system from a competitive manufacturer for all TJA cases. Although these surgical dressings are quite similar in appearance, there are small design differences with respect to the activator and applicator, and the effectiveness of this new system has not been studied. The goal of the present study was to distinguish the formula and/or design differences of both products and identify if there is a difference in wound complications between the 2 skin closure systems.

Methodology

Study Population

After approval from our international review board (IRB-AAAV1003), a retrospective cohort study was conducted that included an 18-week period of primary THA and TKA cases from 4 attending arthroplasty surgeons performed between July 31, 2023 and December 6, 2023.

The type of dressing adhesive was recorded, and patients who did not receive the mesh or liquid adhesive dressing from either of the 2 manufacturers were excluded. For example, a small number of high-risk patients who received closed-incision negative pressure therapy due to an increased risk of wound complications or infection were excluded. Additionally, patients who were lost to follow-up before 90 days were excluded as well.

Regarding surgical technique, skin preparation remained the same throughout the 18-week study period, with 2% chlorhexidine gluconate in 70% isopropyl alcohol and an antimicrobial skin adhesive drape prior to incision. Surgical exposure remained entirely consistent, with TKA using a medial parapatellar or mid-vastus approach and with THA using a supine, anterior-based approach. The closure technique also remained unchanged, with the deep fascia, subcutaneous layer, and subcuticular layer all closed with absorbable barbed sutures.

Skin Closure Systems

The new skin closure system (Mesh B) was applied for a 6-week period from October 23, 2023 through December 6, 2023. To compare over a contemporaneous time period, we chose a comparative cohort who received the original skin closure system (Mesh A) over the immediately preceding 12 weeks from July 31, 2023 through October 22, 2023. Prior to the change from Mesh A to Mesh B, all surgical team members underwent training on application techniques for Mesh B, and representatives from the manufacturer were available in the operating room during the initial weeks and were responsive to any questions. All final mesh dressings were applied consistent with their respective instructions [36,37], and no additional bandages or wraps were applied over the mesh. All patients were given the same postoperative care instructions regarding wound care, rehabilitation, antibiotic prophylaxis, and anticoagulation. Mesh removal and wound check normally occur at the 2-week postoperative visit; however, some patients present early due to concern for wound complications.

Mesh A (Dermabond Prineo, Johnson & Johnson, New Brunswick, NJ; Figure 1A) used a 22-cm polyester-based rectangular adherent mesh woven in a square pattern, and, after covering the closed skin incision with the mesh, a liquid adhesive with a highly purified 2-octyl cyanoacrylate monomer formula was applied topically [36]. The mesh design included a chemical accelerant (benzalkonium chloride, a quaternary ammonium salt) within the mesh itself, which accelerated the polymerization of the 2-octyl cyanoacrylate monomers [38].

Mesh B (Liquiband XL, Medtronic, Minneapolis, Minneapolis; Figure 1B) also used a 22-cm polyester-based rectangular adherent mesh woven in a hexagonal pattern, and, after covering the closed skin incision with the mesh, a liquid adhesive containing a similar 2-Octyl cyanoacrylate formula was applied topically [37]. While the second closure system also used quaternary ammonium salt as an accelerant, this accelerant was located inside the liquid applicator rather than on the mesh dressing as in Mesh A [39]. The glass capsule containing the monomer formula was broken upon squeezing the applicator, as per application instructions, thus

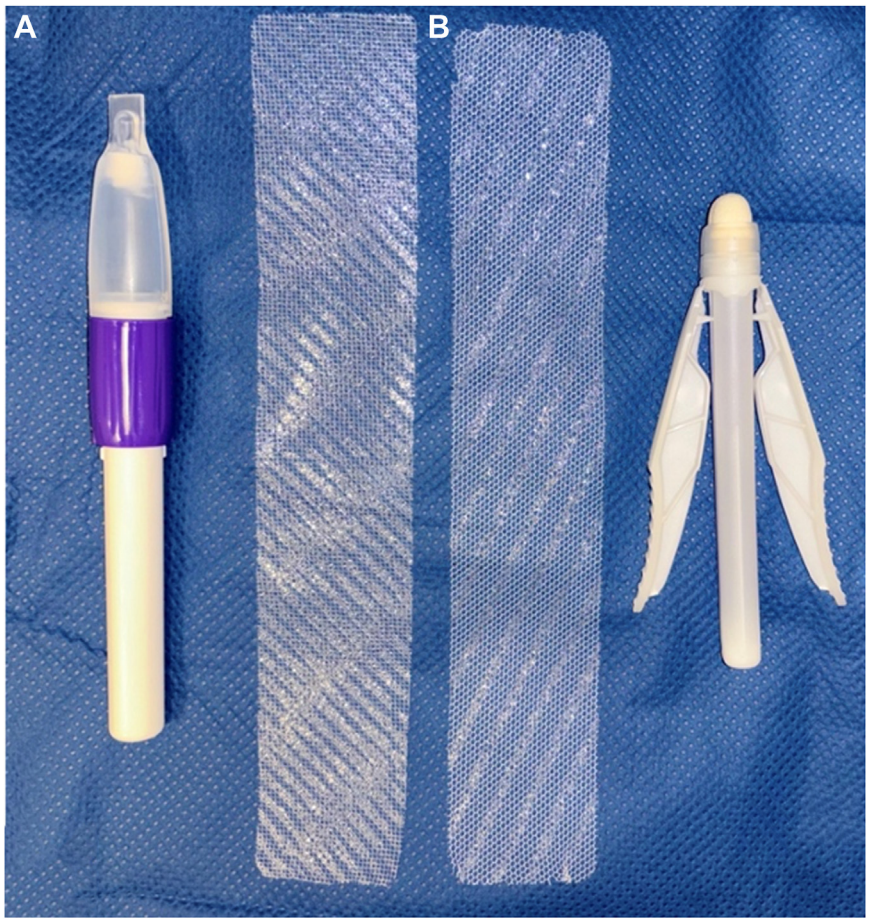

Fig. 1. Comparison of (A) Mesh A, where the accelerant is in the polyester mesh, versus (B) Mesh B, where the accelerant is in the applicator (B).

mixing the formula into the porous block of the applicator containing the accelerant before applying it to the mesh patch [37,39]. Therefore, the main publicly available difference between the 2 skin closure systems is that Mesh A had the accelerant located on the mesh patch, while Mesh B had the accelerant within the liquid adhesive applicator.

Outcomes

All early wound complications, superficial SSIs, deep SSIs, PJIs, reoperations, and allergic reactions to the dressing within 90 days of the index surgery were recorded. Wound complications were identified using guidelines and criteria outlined in previous literature [40,41]. The complications recorded in the present study included wound dehiscence, wound breakdown, delayed healing, prolonged drainage, and superficial and deep SSI. Superficial SSI was defined according to the Centers for Disease Control and Prevention [42], and deep SSI was defined according to the 2018 Musculoskeletal Infection Society criteria [43]. Some patients experienced more than 1 wound complication (eg, wound breakdown and prolonged drainage); however, the overall wound complication rate was calculated by patient count. In cases of deep SSI, the infecting organism was identified by culture.

Allergies to the mesh were defined similarly to previously published studies [33–35], which reported a contact dermatitis presenting with pruritus and erythematous papules, with or without vesicles, blisters, or bullae. The prior studies identified this contact dermatitis in patients receiving Mesh A and attributed the allergy to the 2-octyl cyanoacrylate liquid adhesive formula. As Mesh B uses the same 2-octyl cyanoacrylate formula, allergy was defined as the same for both products.

Data Analyses

The study population was split into 2 cohorts: Mesh A and Mesh B. Case type and sex were tested as confounding variables between the cohorts using *Chi*-square tests. Age and body mass index (BMI) were tested similarly using independent sample *t*-tests. Overall wound complications, wound complications with superficial SSIs, wound complications with deep SSIs, reoperation due to wound complications, and allergy rates were evaluated in *Chi*-square tests to determine differences between the cohorts. *Chi*-square tests were performed using Microsoft Excel version 16.76 (Microsoft, Redmond, Washington) and independent sample *t*-tests were performed using the Statistical Package for Social Sciences (SPSS) version 28.0.0.1.0 (International Business Machines Corporation, Armonk, NY).

Results

Study Population and Demographics

Over the 18-week study period, 449 primary THA and TKA cases were performed. A total of 419 (93%) cases (207 THA and 212 TKA) were included in the analysis, as 24 patients used dressings other

than the 2 studied and 6 patients were lost to follow-up before the study period ended.

Of the 419 cases, 274 (65%) received Mesh A, while 145 (35%) received Mesh B. Case type was not found to be a confounder between the cohorts, as there was no significant difference of THA (48% versus 52%) and TKA cases (52% versus 48%) between the Mesh A and Mesh B cohorts, respectively ($X^2 = 0.80$; df = 1; $P = .370$). The sample included 171 men and 248 women. Sex was not found to be a confounding factor between the cohorts, as both were 41% men and 59% women ($X^2 = 0.03$; df = 1; $P = .863$) (Table 1). Age and BMI were also not found to be confounding factors between the cohorts. The mean age of the sample was 69 years, and the mean ages of the Mesh A and Mesh B cohorts were 69 years (range, 23 to 88) and 68.9 years (range, 21 to 94), respectively; t (417) = 0.780, $P = .441$. Furthermore, the mean BMI of the sample was 30.9, and the mean BMIs of the Mesh A and Mesh B cohorts were 31.2 (range, 18.5 to 47.3) and 30.5 kg/m^2 (range, 19.2 to 45.8), respectively; t (417) = 1.39, $P = .165$ (Table 1).

Overall Wound Complications

We found that 4.8% of the patients had at least 1 wound complication over the 18-week study period (Table 2), and some patients experienced more than 1 wound complication. The occurrence of wound complications was not statistically significant between THA (4.8%) and TKA (5.0%) cases; $X^2 = 0.003$, $P = .956$. When all cases were categorized by primary surgeon, there were no statistically significant differences in wound complications among the 4 surgeons (6.6 versus 5.9 versus 5.2 versus 3.1%; $X^2 = 1.093$; $P = .779$). The overall occurrence of individual wound complications included wound dehiscence in 11 patients, wound breakdown in 5 patients, delayed healing in 4 patients, and prolonged drainage in 9 patients. Superficial SSI accompanied wound complications in 2 patients, and deep SSI accompanied wound complications in 4 patients. Of the entire sample, 6 (1.4%) patients underwent reoperation due to wound complications with or without SSI (Table 2).

Noninfectious wound complications resolved with local wound care in the majority of patients. The 2 patients who had superficial SSIs responded well to a short course of oral antibiotics and did not require surgical management. The 6 patients requiring reoperation are described in detail in the section below.

Overall, 15 patients (3.6%) reported an allergic reaction to the dressing. All allergies resolved within 10 days with supportive care aimed at reducing allergic symptoms including topical corticosteroid or antibiotic ointments, oral diphenhydramine, or oral corticosteroids. No patients who had an allergic reaction suffered an SSI or needed reoperation.

Table 1
Patient Demographics by Accelerant Location Design.

Demographic	*N*	Mesh A	Mesh B	*P* Value
N (%)	419	274 (65)	145 (35)	-
Sex, n (%)				
Men	171 (41)	111 (41)	60T (41)	.863
Women	248 (59)	163 (59)	85 (59)	
Age, mean (y)	69	69	68	.441
BMI, mean	30.9	31.2	30.5	.165
Case Type, n (%)				
THA	207 (49)	131 (48)	76 (52)	.370
TKA	212 (51)	143 (52)	69 (48)	

The design of Mesh A included the accelerator on the mesh patch, and the design of Mesh B included the accelerator in the liquid adhesive applicator.
BMI, body mass index; THA, total hip arthroplasty; TKA, total knee arthroplasty.

Table 2
Wound Complications, Surgical Site Infection (SSI), and Allergy Rates Between 2 Liquid Adhesive Skin Closure Systems With Different Accelerant Location Designs.

Postoperative Complication	*N*	Mesh A[a]	Mesh B[b]	*P* Value
N (%)	419	274 (65)	145 (35)	-
Complications, n (%)				
Overall wound complication	20 (4.8)	9 (3.2)	11 (7.6)	.049
Wound complication[c] with Superficial SSI	2 (0.5)	2 (0.7)	0 (0)	.302
Wound complication[c] with Deep SSI	4 (1.0)	0 (0)	4 (2.8)	.006
Revision TJA due to wound complication with or without SSI	6 (1.4)	1 (0.4)	5 (3.4)	.011
Allergy, n (%)	15 (3.6)	9 (3.3)	6 (4.1)	.655

SSI, surgical site infection; TJA, total joint arthroplasty.
[a] The design of Mesh A included the accelerator on the mesh patch.
[b] The design of Mesh B included the accelerator in the liquid adhesive applicator.
[c] Wound complications included the following diagnoses: wound dehiscence, breakdown, and delayed healing.

Mesh A versus Mesh B

The rate of wound complications was found to be significantly higher in patients receiving Mesh B (7.6%) compared to those receiving Mesh A (3.2%) ($X^2 = 3.86$; df = 1; $P = .049$). The rate of superficial SSI was not significant between the Mesh A (0.7%) and Mesh B (0%) groups ($X^2 = 1.06$; df = 1; $P = .302$).

Deep SSI (PJI) within 90 days of index surgery was found to be significantly higher in patients receiving Mesh B (2.8%) compared to those receiving Mesh A (0.0%) ($X^2 = 7.63$; df = 1; $P = .006$). The positive cultures for these 4 cases in the Mesh B cohort included *Serratia marcescens*, methicillin-susceptible *Staphylococcus aureus*, *Staphylococcus epidermidis,* and *Escherichia coli*. All 4 of these patients required reoperation, as described below.

The early reoperation rate for wound complications was also found to be significantly higher in patients receiving Mesh B (3.4%) compared to those receiving Mesh A (0.4%) ($X^2 = 6.39$; df = 1; $P = .011$). These reoperations included the 4 patients in the Mesh B cohort with PJI, along with 2 additional patients (1 in each cohort) who underwent reoperation for wound dehiscence without SSI or PJI. All patients who underwent early reoperation for wound complications who did and did not have an SSI had initial surgical treatment under a debridement, antibiotics, and implant retention protocol. There were 5 successfully treated with a single reoperation, while 1 required multiple reoperations. This patient, who had a *Serratia marcescens* PJI following primary TKA that used a Mesh B dressing, required multiple debridements, the removal of components and the extensor mechanism, and the insertion of an antibiotic spacer with orthoplastics coverage using a local rotational medial gastrocnemius flap (Figure 2). Mesh dressings were not used for any reoperations; all patients undergoing revision surgery were treated with closed-incision negative pressure therapy.

Allergic reactions to the mesh dressing were not found to be significant between the Mesh A (3.3%) and Mesh B (4.1%) cohorts ($X^2 = 0.12$; df = 1; $P = .655$).

Discussion

The overall wound complication rate in the present study was 4.8%, which is highly comparable to similar published papers on liquid adhesive dressings with mesh patches in TJA [30,31]. Wound complications put patients at substantially higher risk of PJI, which is one of the most difficult and costliest complications to treat, and thus recent publications focus on methods to improve wound closure with the aim of reducing this risk [22–32]. This study found

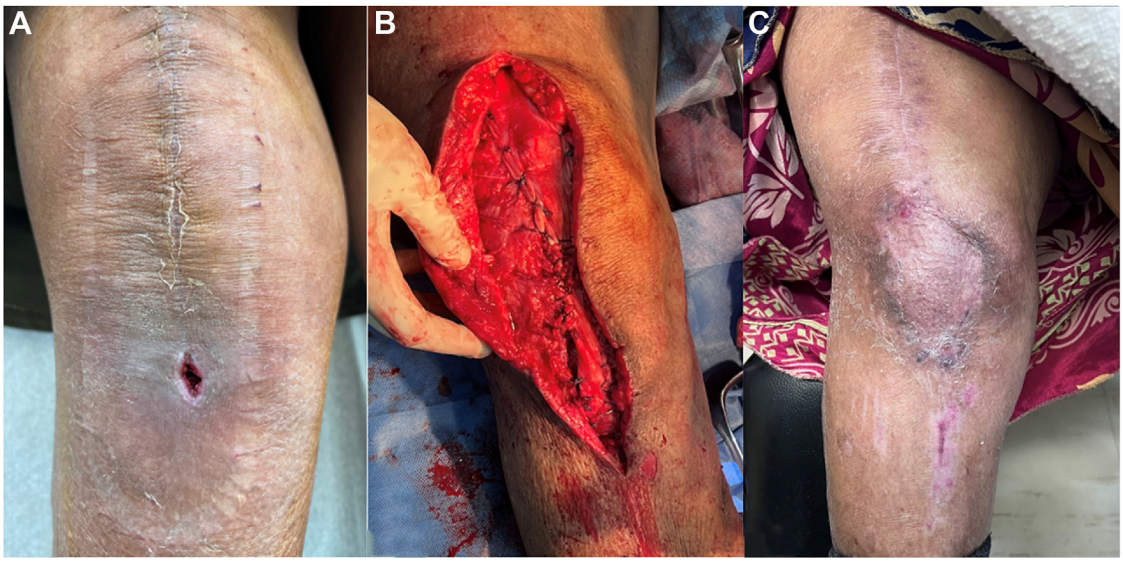

Fig. 2. An 80-year-old healthy woman who received Mesh B following an uncomplicated primary total knee arthroplasty (TKA). (A) She presented with delayed wound healing and a small distal dehiscence 24 days after primary TKA that did not resolve with nonoperative treatment. She was treated operatively with a debridement, antibiotics, and implant retention (DAIR) procedure 28 days following her initial surgery. Cultures from that surgery demonstrated *Serratia marcescens* periprostatic joint infection (PJI), which subsequently required (B) multiple debridements, resection of components and the necrotic extensor mechanism, and the insertion of an antibiotic spacer with extensor mechanism reconstruction. (C) Most recent follow-up: 64 days following the final revision (123 days after primary TKA) with a healing incision and a medial gastrocnemius flap.

that wound complications, deep PJI within 90 days, and early reoperation due to wound complications all had significantly lower rates in the cohort that had a dressing design that included the 2-Octyl cyanoacrylate accelerator directly on the mesh (Mesh A) compared to the design that included the accelerator within the applicator (Mesh B).

The reason for the observed differences between the 2 cohorts in this study is not definitively known, but we hypothesize it may be due to the quality of the seal achieved between the dressing designs. 2-octyl cyanoacrylate polymerizes rapidly when contacting anions. The strong electronegativity of the nitrile and ester groups attached to the α-carbon of the cyanoacrylate allows for nucleophilic substitution of the anion at the β-carbon, generating a resonance-stabilized carbanion at the α-carbon. The carbanion becomes reactive with the nucleophilic β-carbon of a second 2-octyl cyanoacrylate monomer, propagating a chain reaction of polymerization [44]. In surgical practice, polymerization occurs when 2-octyl cyanoacrylate contacts the anions found within the skin and wound exudate. However, the larger carbon chain in 2-octyl cyanoacrylate makes the monomer slightly less reactive, and thus it has a slower polymerization rate compared to N-butyl-2-cyanoacrylate. Thus, to improve efficiency in an operative room environment, chemical accelerators are commonly used in most skin closure system designs that use a 2-octyl cyanoacrylate liquid adhesive formula [3,44]. Additionally, with the new dressing designs, including mesh patches, the adhesive is applied over the mesh without coming directly into contact with most of the skin or wound exudate, limiting the amount of exposure to anions that promote polymerization. Accelerators, like the quaternary ammonium salts used by the manufacturers in the present study, increase the presence of available anions in the monomers, which allows for a rapid carbanion production rate and an overall ideal kinetic polymerization rate [44]. The polymerization of 2-octyl cyanoacrylate over the mesh patch allows for a strong but flexible bond that reduces wound tension and promotes new tissue connection, with in vitro studies showing antimicrobial properties of the moisture-resistant seal preventing bacterial penetration and proliferation [11,18,19,26,28–32].

The authors of the present study hypothesize that the increased wound complication rates seen when the accelerator was in the applicator may potentially be attributable to the polymerization beginning to occur within the applicator before contacting the mesh. The directions from the manufacturer of Mesh B state that the applicator must be squeezed to break the glass capsule containing the 2-octyl cyanoacrylate, which mixes into the porous block within the applicator containing the accelerator [37–39]. The skin closure benefit of these types of dressings is a result of the 2-octyl cyanoacrylate bonding directly to the polyester mesh overlaying the skin. Thus, applying adhesive that has already started to polymerize before even being applied to the mesh may cause it to lose some or most of its viability to achieve the desired seal. Anecdotally, the surgical teams at our institution routinely noted difficulty getting the adhesive out of the applicator and would frequently need to open multiple applicators, which support our hypothesis that the polymerization had begun prematurely.

Further supporting this hypothesis is the observation made by the authors of a space between the mesh and the wound. There was consistently a nonadhered area between the incision and mesh, which led to the collection of exudate and perspiration, and subsequent skin maceration. This was particularly noted at the time of early removal of Mesh B by the authors, during a postoperative visit earlier than the usual 2-week scheduled visit due to concern for wound complications. Mesh B was often found to adhere peripherally but not centrally to the incision, which the authors suggest may be due to early polymerization resulting in uneven application. During the time between the initiation of the liquid formula of Mesh B in the applicator and the complete coverage of the mesh, some of the formula polymerized before application, while others polymerized on the mesh. Although there was some degree of polymerization sufficient for partial adhesion, it failed to create a robust, moisture-resistant seal over the wound that was unable to fully capitalize on its closure and antimicrobial benefits.

These dressing designs are proprietary to each manufacturer, and thus the authors are unable to comment on the design rationale between putting the accelerator on the mesh versus in the applicator. The difference may be due to an intellectual property

design restriction. Nevertheless, not having the chemical accelerator on the mesh could be suggestive of an effort to try to decrease the risk of an allergic reaction to the mesh by limiting the chemical ingredients on the mesh. However, our results did not find a significant difference in the rate of allergic reaction in the accelerator on the mesh (3.3%) versus accelerator in the applicator (4.1%) cohorts. The allergic reaction rate across the entire sample (3.6%) was also highly comparable to that found in previous studies [33–35]. Regardless of the design rationales, the design of Mesh A, where the accelerator is on the mesh itself, appears to be a more effective skin closure system in hip and knee arthroplasty patients, as evidenced by the significantly decreased wound problems observed in the present study. Allowing for the polymerization of the 2-octyl cyanoacrylate to occur after the adhesive is applied to the mesh appears desirable for optimal bonding and adequate skin closure and seal.

The comparison of these 2 similar mesh and liquid adhesive skin closure systems has, to the best of our knowledge, not been done before in a clinical environment within orthopaedic surgery or any other surgical specialty, which is a strength of the present study. The results reveal how a small change in design, even with largely similar products, can have a major impact on the outcome of wound healing due to the chemical properties of the reaction. Another design strength of the present study is the generalizability of the results due to the sample, which includes patients from multiple surgeons. Nevertheless, all surgeons used similar exposure and closure techniques, in addition to identical postoperative care instructions, removing the likelihood of bias.

One major potential limitation of the present study is that the properties of both skin closure systems are not fully known to the authors. Both mesh patches are described as polyester-based. However, the design of the mesh in the second system, where the accelerant was in the applicator, was a woven-hexagonal pattern [37], whereas the mesh with the accelerator on it in the first system may have been woven, knitted, nonknitted, or a mixture [45]. Likewise, more information was found in the patent of Mesh A, which stated that additional accelerators, other than the benzalkonium chloride, may have been added to create a blend, which could yield more precise polymerization ratios and rates [45]. It is unclear whether the same was true for Mesh B, which includes the accelerator in the applicator; all that is known is that quaternary ammonium salt was used [39]. Therefore, it is unclear if the 2 products were exactly the same, and additional accelerators that are not reported in the product literature cannot be ruled out entirely when explaining the difference in wound complication rates between the 2 systems. Additionally, this study has a relatively short study period and relatively small sample size. While we intend to follow these patients for a longer period going forward, we believe these important findings of a new product are concerning enough to report to our surgical colleagues. Furthermore, due to the small sample size, wound complications between the 2 dressings were not analyzed independently of case type, although there was no difference in THA and TKA cases between the cohorts and no difference in overall wound complication occurrence between THA and TKA cases. Additionally, the institutional dataset used for the present study did not include comorbidities and, thus, were not assessed. The present study serves as a preliminary investigation for future research regarding the chemical accelerant design of liquid adhesive and mesh skin closure systems and deserves further study.

In conclusion, 2-octyl cyanoacrylate mesh skin closure systems used to treat surgical incisions in primary TJA patients appear to function differently depending on their design. We observed significantly greater wound complications, early PJI, and early reoperation within 90 days when the chemical accelerator is located within the applicator compared to when it is located on the mesh. Having the accelerator in the applicator may lead to premature polymerization before being applied to the mesh and consequently not bonding appropriately with and through the mesh to promote wound closure. With the knowledge of this chemical reaction and how one design may optimize high-tension TJA wound healing results over the other, advancements can be made in reducing the risk of PJI, which has been a highly studied topic in TJA [22–25].

CRediT authorship contribution statement

Catelyn A. Woelfle: Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Roshan P. Shah:** Writing – review & editing, Methodology, Investigation, Conceptualization. **Alexander L. Neuwirth:** Writing – review & editing, Methodology, Investigation, Conceptualization. **Carl L. Herndon:** Writing – review & editing, Methodology, Investigation, Conceptualization. **William N. Levine:** Writing – review & editing, Methodology, Investigation, Conceptualization. **H. John Cooper:** Writing – review & editing, Project administration, Methodology, Investigation, Conceptualization.

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