2-octyl cyanoacrylate with interrupted sutures vs continuous suturing in adult male circumcision: A randomized controlled pilot trial

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ABSTRACT

Introduction: This randomized controlled pilot study evaluated the use of 2-octyl cyanoacrylate (2-OCA) combined with four interrupted sutures vs. continuous suturing for wound closure in adult male circumcision. While continuous sutures are the current standard at the Men's Health Clinic Manitoba, 2-OCA has demonstrated superior results in the context of cosmesis, postoperative pain, and operative time, as shown in pediatric populations. The primary objective was to assess cosmetic satisfaction. Secondary outcomes included operative time, postoperative pain, and complications.

KEY MESSAGES

- Limited evidence exists evaluating tissue adhesives for wound closure in adult male circumcision.
- Use of 2-octyl cyanoacrylate (2-OCA) with interrupted sutures resulted in comparable cosmetic satisfaction and shorter operative times when compared with continuous suturing.
- Higher rates of wound dehiscence occurred in the tissue adhesive group, leading to early study termination and highlighting safety concerns that limit its routine clinical use.
- Further studies are required to clarify the safety profile of tissue adhesives in adult circumcision and to identify patient or technical factors that may mitigate complication risk.

Methods: A non-blinded, randomized controlled pilot study was conducted at a single ambulatory urology surgical center. Twenty patients undergoing circumcision were randomly assigned to receive either 2-OCA with four interrupted sutures or continuous suturing for wound closure. Data collected included demographic information, intraoperative time, postoperative pain, adverse events, and cosmetic satisfaction at six and 12 weeks.
Results: Cosmetic satisfaction at six and 12 weeks was similar between groups, both with a median of 5 (highly satisfied). Mean procedure time was shorter in the 2-OCA group compared to the continuous suture group (28.7 vs. 34.3 min, p=0.037). Postoperative pain was low in both groups and did not differ significantly; however, wound dehiscence occurred in 50% of 2-OCA cases, prompting early study termination.
Conclusions: Although 2-OCA with interrupted sutures may offer faster procedures and comparable cosmetic results, the observed complications do not support its routine use in adult circumcision. Larger, blinded trials are needed to further evaluate the safety of tissue adhesives and address current study limitations, including small sample size, non-blinded design, and reliance on patient-reported outcomes.

INTRODUCTION

Male circumcisions are among the oldest and most common urological procedures, with a global prevalence of ~38% in 2016.[1,2] Although most of these procedures are generally conducted within the neonatal period, many are now being performed further into adulthood.[3–5] Despite the substantial number of circumcisions being performed worldwide, complications are relatively low, at approximately 1-4%.[6,7] Nonetheless, when complications do occur, they can have significant implications for patient satisfaction and clinical outcomes. Common postoperative issues that arise from this procedure revolve around pain and increased sensitivity, wound infection and dehiscence, bleeding and hematoma formation, and poor cosmesis.[6,7] Wound closure technique plays a critical role in negating many of these outcomes, and as such, optimizing closure methods remains a key area of interest in surgical innovation.

Traditionally, the most common method of wound closure in adult circumcision has been the interrupted suture technique, which allows precise skin edge approximation. However, other techniques utilized include the subcuticular closure and, more recently, the continuous suture, which reduces wound breakdown due to its hemostatic qualities.[8,9] Currently, the standard of care for wound closure following adult male circumcision at the Men's Health Clinic Manitoba (MHCM), the single ambulatory surgical center where this study took place, is the continuous suture. Despite the positive attributes of these suturing techniques, they are not without challenges.[10] As such, exploring alternative wound closure methods that may optimize wound

healing, minimize complications, and improve patient satisfaction remains an important area of investigation.

Tissue adhesives such as 2-octyl cyanoacrylate (2-OCA) have emerged as a promising alternative to traditional suturing techniques in various surgical fields. 2-OCA is FDA-approved for superficial wound closure and is commonly used by emergency physicians, otolaryngologists, dermatologists, and plastic surgeons as an external tissue adhesive for closing lacerations and surgical incisions in place of sutures or staples.[11] In pediatric circumcision, 2-OCA for wound closure has been associated with shorter operative time, reduced post-operative pain, and improved cosmetic appearance.[4,12–16] Few studies have explored the outcomes of 2-OCA use in adult male circumcision.[17,18] As a result, its clinical applications remain limited.

Safety, efficiency, and cosmetic outcomes are key considerations when evaluating wound closure techniques for adult circumcision. Cyanoacrylate adhesives have been associated with strong wound bonding, rapid healing, and a reduced risk of infection, as well as hemostatic and bacteriostatic properties that support improved wound healing.[16,19,20] Studies in neonatal circumcision have reported fewer wound healing complications and decreased postoperative pain, suggesting that 2-OCA may provide a safe and comfortable alternative to traditional suturing in adults.[12–14,16] In addition, the ease of application of 2-OCA can reduce operating room time compared with traditional suturing, improving workflow efficiency, lowering healthcare costs, and offering particular advantages in high-throughput outpatient settings such as the MHCM.[4,12,14–16] Finally, cosmetic outcomes play an important role in patient satisfaction. Continuous sutures can result in visible scarring, stitch marks, and uneven healing, whereas cyanoacrylate adhesives provide smoother wound edge approximation and may reduce scar formation. Pediatric studies have demonstrated superior aesthetic results with 2-OCA, suggesting these benefits may extend to adults, where postoperative appearance is closely linked to overall satisfaction.[4,13–16]

With these potential advantages in mind, our group aimed to evaluate whether 2-OCA with four interrupted sutures is superior to continuous sutures as a wound closure technique following adult circumcision. Our primary objective was to assess patient satisfaction with the cosmetic outcome of the wound closure. Secondary objectives included intraoperative time, adverse events, and post-operative pain. We hypothesize that patients undergoing circumcision with 2-OCA and four interrupted sutures for wound closure will experience superior cosmetic outcomes, intraoperative times, rates of adverse events, and post-operative pain levels compared to those associated with continuous suturing. This may demonstrate a favourable alternative to the current wound closure technique practiced in the MHCM office and around the world for adult circumcision.

METHODS

A non-blinded randomized controlled pilot study was conducted on patients undergoing circumcision at a single ambulatory surgical center, MHCM, to evaluate the cosmesis of 2-OCA with four interrupted sutures versus continuous suturing alone for wound closure. Efficacy was

assessed through an assessment of baseline patient demographics, an immediate post-operative questionnaire, and a repeat questionnaire administered at approximately 6 and 12 weeks post-operatively to assess variables such as post-procedure pain as well as their satisfaction with the recovery process and cosmesis post-circumcision. This study was approved by the University of Manitoba's Health and Research Ethics Board (HS26545). The trial was registered at ClinicalTrials.gov (NCT06487494).

Study population and data collection

All circumcisions were performed at a single urological outpatient ambulatory surgical center, MHCM, from August 2024 to May 2025 by three surgeons. The inclusion criteria included all eligible patients aged 16 years or older undergoing circumcision. Given the fact that this was a pilot study, there was no prior information to base the sample size on; however, based on previous research, a sample size of 12 per group was appropriate.[21,22] Once enrolled, patients were randomized 1:1 using a computer-generated random list. Patients were randomized to either 2-OCA with four interrupted sutures or continuous suturing alone for wound closure. Patient demographic information, including age and the Charlson Comorbidity Index, was collected before the procedure. During the procedure, total procedure time and suture time were recorded, as well as any adverse events. Total procedure time was defined as the interval from the administration of local anesthetic to the completion of suturing. Immediately following the procedure, patients were asked to complete a VAS questionnaire rating the pain (1 - no pain, 10 - excruciating pain) associated with their procedure. Patients were brought in for a routine visit 6 weeks post-op. During the visit, closure of the wound as well as any potential complications were assessed. At that time, a questionnaire was administered to assess variables such as post-procedure pain as well as satisfaction with the cosmesis post-circumcision (1 - extremely dissatisfied, 5 - very satisfied). Lastly, a repeat questionnaire was administered over the phone at approximately 12 weeks post-operation, assessing cosmetic satisfaction post-circumcision. Study data was stored using Research Electronic Data Capture (REDCap), a secure, web-based platform hosted at the University of Manitoba, specifically designed to support data collection and management for research studies.[23,24]

Surgical protocol

Surgical procedures were performed by one of three primary surgeons within a procedure room at the ambulatory surgical center. Before surgery, the area to be excised was marked out, and the patient gave consent. The patient was taken to a procedure room and placed in a supine position. A dorsal nerve (modified pudendal nerve block) and peripheral ring block were performed with 1% lidocaine and 0.25% bupivacaine. A small dorsal slit was made to help reduce the foreskin. The foreskin was retracted. The incision line was then marked circumferentially on the outer skin, 3mm below the corona. The incision was then carried through the skin and subcutaneous tissues down to within a layer of buck's fascia. Next, the foreskin was retracted back over. Another circumferential incision was made 3mm proximal to the corona. The

intervening foreskin was excised. Meticulous hemostasis was obtained with electrocautery.[25] Patients randomized to the control group received continuous suturing to re-approximate all skin edges, while the experimental group received 4 interrupted sutures, and the skin edges were re-approximated with Dermabond Advanced Topical Skin Adhesive 2-OCA. 3.0 Vicryl (polyglactin 910) sutures were used for both groups. The wound was dressed with topical antibiotic ointment and a strip of ribbon gauze around the penis for pressure to be maintained over the wound for about 24-48 hours.

Statistical analysis

Data was analyzed using the statistical software R. Continuous variables, including demographic data, were summarized using means and standard deviations. Descriptive statistics were utilized for categorical variables. Normally distributed outcomes were analyzed using independent t-tests, while non-normally distributed data, including VAS pain scores and cosmetic satisfaction, were assessed using Mann-Whitney U-tests. Statistical analysis was completed with an alpha of 0.05, and a p-value <0.05 was considered statistically significant. Patients who were unable to receive the wound closure method to which they were initially assigned were analyzed as treated. This approach was chosen to better reflect the practical application and feasibility of each technique in a real-world clinical setting.

RESULTS

This study enrolled and completed procedures for 20 patients. Recruitment was initially planned for 24 participants. However, the study was concluded early due to the high rates of dehiscence observed in the experimental arm and the participating surgeons' decision to discontinue using the tissue adhesive. Adult circumcision in our study population was performed primarily for medical indications, including phimosis, balanitis, posthitis, recurrent frenulum tears, or paraphimosis, with only one patient undergoing elective circumcision for religious reasons. Within the control arm (n = 10) and experimental arm (n = 10), no significant intra-operative complications were reported. Baseline demographic characteristics were comparable between groups, with no significant differences observed in age or CCI (Table 1).

A total of 17 participants completed the questionnaire at 6 weeks, and 18 participants completed the questionnaire at 12 weeks. Cosmetic satisfaction scores (median, range) at the 6-week follow-up did not differ significantly between the continuous suture (5, 4-5) and 2-OCA groups (5, 4-5) ($W = 37.5$, $p = 0.91$) (Figure 1). At the 12-week post-operative time point, cosmetic satisfaction scores (median, range) also did not differ significantly between the continuous suture arm (5, 2-5) and the 2-OCA arm (5, 4-5) ($W = 40$, $p = 1$) (Figure 2). Cosmetic satisfaction scores remained high among patients who experienced dehiscence, with most reporting scores of 4 or 5; only one patient in the continuous suture group reported a score of 2 at the 12-week time point.

There was a statistically significant difference in procedure time between the two groups ($p = 0.037$) (Figure 1). The mean procedure time (± SD) was longer in the continuous suture

group (34.4 minutes ± 6.47) compared to the 2-OCA group (28.7 minutes ± 4.62), with a 95% confidence interval for the difference ranging from 0.38 to 11.02 minutes. Suture time was recorded for 14 participants (7 per arm). Mean suture time (± SD) was 9.36 ± 2.28 minutes in the continuous suture group and 6.36 ± 2.84 minutes in the 2-OCA group. The difference approached statistical significance ($p = 0.051$; 95% CI: -0.01 to 6.02 minutes) (Figure 3).

Immediate post-procedure pain was low in both groups, with median (range) scores of 0.0 (0–0) in the 2-OCA group and 0.0 (0–1) in the continuous suture group. This difference was not statistically significant ($W = 55$, $p = 0.37$).

During the healing period, complication rates were 20% in the continuous suture group and 50% in the 2-OCA group. Five of the six wound dehiscence cases occurred in the 2-OCA group, and one occurred in the continuous suture group. Of the six cases, two occurred under the care of one surgeon and four under another. All cases were minor or partial dehiscence, and only one patient, in the 2-OCA group, required surgical intervention. Three patients who experienced wound dehiscence presented within the first two weeks postoperatively (days 7–15), while the remaining three were identified at the routine 6-week follow-up visit. A detailed breakdown of complications observed during follow-up is presented in Table 2.

Pain level at 6 weeks (median, range) was lower in the 2-OCA group (0, 0–2) compared to the continuous suture group (0, 0–3), although this difference was not statistically significant ($W = 44.5$, $p = 0.30$).

DISCUSSION

This study aimed to evaluate whether 2-OCA combined with four interrupted sutures was a superior alternative to continuous suturing for adult circumcision wound closure, with patient cosmetic satisfaction as the primary outcome. Our findings demonstrate that cosmetic satisfaction scores were similarly high in both groups, indicating that 2-OCA with interrupted sutures did not demonstrate superiority over continuous sutures in terms of patient-reported aesthetic results. However, despite shorter procedure and suture times and comparable low postoperative pain, the 2-OCA group experienced a higher incidence of wound dehiscence, which ultimately prompted early termination of the study. This study offers a novel contribution by being one of the few randomized controlled trials in the adult population to directly compare wound closure methods for circumcision.

While previous studies in pediatric populations have consistently demonstrated favourable outcomes with 2-OCA, such as reduced operative time, minimal postoperative pain, decreased complication rates, and superior cosmetic appearance, our findings in the adult context reveal a more nuanced picture.[4,12–16] Although we observed high patient-reported cosmetic satisfaction and low pain scores with significantly reduced procedure time in the 2-OCA group, these benefits were offset by a higher incidence of wound dehiscence and the need for additional follow-up. Five patients in the 2-OCA group experienced dehiscence, including one requiring reoperation. These complications, not commonly reported in pediatric cases, suggest that tissue

characteristics, wound tension, and patient activity levels may present unique challenges when using 2-OCA for this surgical context in adults.

Dehiscence is a recognized concern in surgical wound closure and has been previously reported in association with tissue adhesives, which may offer less tensile strength than traditional suturing techniques.[27–30] Possible contributing factors include high skin moisture content, the adhesive's rigid structure, and limited elasticity following application.[31] Another important factor may have been the use of topical antibiotic ointment, which can cause premature peeling of the adhesive and compromise wound integrity. In our trial, the wound was dressed with topical antibiotic ointment and a strip of ribbon gauze, and participants were permitted to begin topical antibiotic ointment application after 3–5 days. This may have contributed to the higher incidence of dehiscence and ultimately the early closure of the study. For future trials, avoiding topical antibiotic ointment use postoperatively may facilitate more reliable wound closure and better reflect the adhesive's true performance. The mechanical limitations of cyanoacrylate underscore the need for careful technique and appropriate patient selection to ensure reliable wound closure. Further research is needed to optimize 2-OCA use and identify patient or procedural factors that increase dehiscence risk in adult circumcision.

The application of 2-OCA presents a distinct learning curve compared to traditional suturing, requiring precise wound edge alignment, controlled adhesive application, adequate curing time, and a moisture-controlled environment. In our study, all surgeons were experienced in suturing but had varying prior experience with 2-OCA, which may have contributed to inconsistent outcomes such as wound dehiscence. Procedures were performed by three different surgeons, and subtle differences in technique or comfort with the adhesive may have introduced additional variability. The surgeons reported that using the glue was more technically challenging, citing difficulties in achieving proper wound approximation, the need for additional glue tubes, and excess adhesive on the surrounding skin. Consistent with our findings, circumcision studies from India also observed slightly higher dehiscence rates in the tissue glue group, largely attributed to early glue application errors that resolved without intervention.[17,18]

This study derives its strength from being one of the few randomized controlled trials to evaluate the efficacy of 2-OCA for wound closure in adult male circumcision, providing comparative data against the traditional continuous suturing technique. The randomized design minimizes selection bias and enhances the validity of the findings. Additionally, the systematic collection of postoperative data at multiple time points, including immediately post-operatively and at 6- and 12-week follow-ups, enabled a thorough assessment of both short-term and long-term outcomes, including pain, adverse events, and cosmetic satisfaction. This extended follow-up period allowed patients to provide more accurate and reflective evaluations, capturing the evolving nature of wound healing and satisfaction over time.

This study has several limitations that should be considered when interpreting the results. As a pilot study with a small sample size (n = 20) conducted at a single center, the statistical power and generalizability of the findings are limited. Early study termination due to increased

wound dehiscence in the 2-OCA group further reduced sample size and study robustness. The non-blinded design introduces potential performance and detection bias, as both patients and providers were aware of the intervention, which may have influenced subjective outcomes such as pain and cosmetic satisfaction. Although standardized tools, including the VAS pain scale, were used to minimize variability, patient-reported measures such as cosmetic satisfaction remain inherently subjective. In some cases, patients reported high satisfaction with the cosmetic outcome, while the surgeon's assessment suggested otherwise, highlighting the potential disconnect between patient perception and clinical evaluation. In addition, because this study evaluated 2-OCA in combination with four interrupted sutures rather than as a standalone closure method, the individual contribution of the tissue adhesive cannot be fully isolated. Finally, this trial captured wound complications, but postoperative erections were not systematically measured or recorded, limiting our ability to evaluate their potential contribution to wound dehiscence in adult patients, which may represent an important difference from the pediatric population.

Future studies should prioritize evaluating the safety limitations of 2-OCA in adult circumcision, particularly the association with wound dehiscence. Larger, multicenter, double-blind trials with objective outcome measures, such as surgeon-rated cosmesis and standardized wound assessments, are needed. Controlling for surgeon experience through standardized training may also help clarify the role of technique in post-operative outcomes. These efforts will help determine whether 2-OCA has a safe and appropriate role in adult circumcision wound closure. Additionally, a future randomized controlled trial evaluating eight interrupted sutures with 2-OCA versus standard circumferential suturing may help determine whether an increased number of sutures improves the mechanical support of this hybrid approach while preserving operative efficiency.

CONCLUSIONS

This study provides preliminary evidence that 2-OCA combined with interrupted sutures did not demonstrate superiority over continuous suturing in terms of patient-reported cosmetic satisfaction, the primary outcome of interest in this trial. However, despite comparable aesthetic results and reduced operative and suture times, the higher rate of wound dehiscence observed in the 2-OCA group raises safety concerns and ultimately does not support its broader use as a standard wound closure technique in adult circumcision. These findings are particularly relevant given the limited randomized controlled trial literature on tissue adhesives in this context. While the study is limited by its small sample size, non-blinded design, and reliance on patient-reported outcomes, it offers valuable insight into the practical challenges and early risks associated with adopting 2-OCA in adult circumcision.

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FIGURES AND TABLES

Figure 1. Cosmetic appearance satisfaction at 6 weeks in the continuous suture arm vs. the 2-OCA with four interrupted sutures arm.

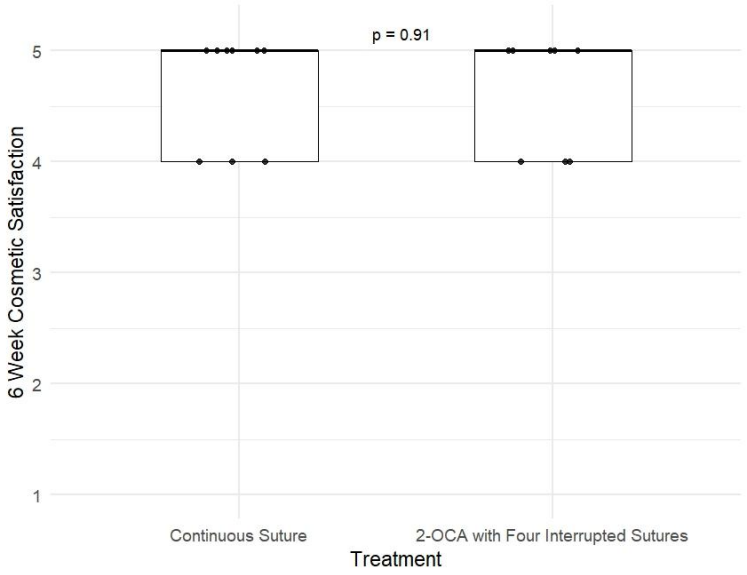

Figure 2. Cosmetic appearance satisfaction at 12 weeks in the continuous suture arm versus the 2-OCA with four interrupted sutures arm.

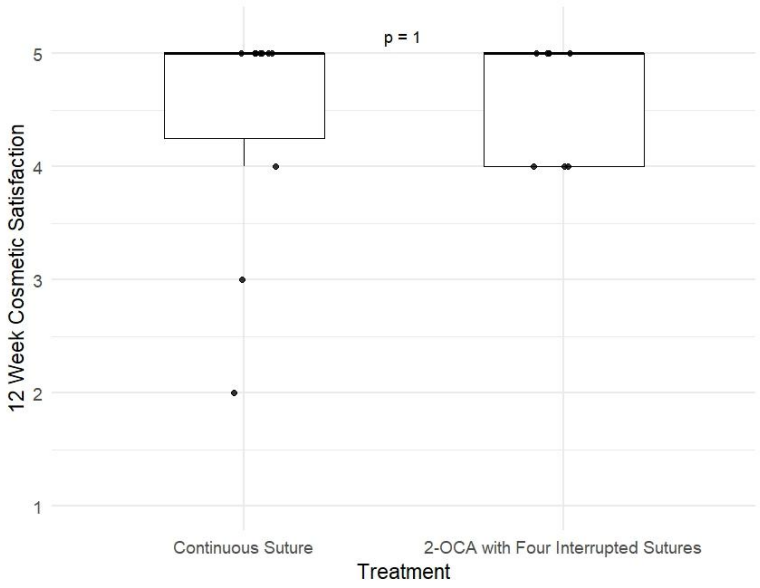

Figure 3. Procedure time differences in the continuous suture arm versus the 2-OCA with four interrupted sutures arm.

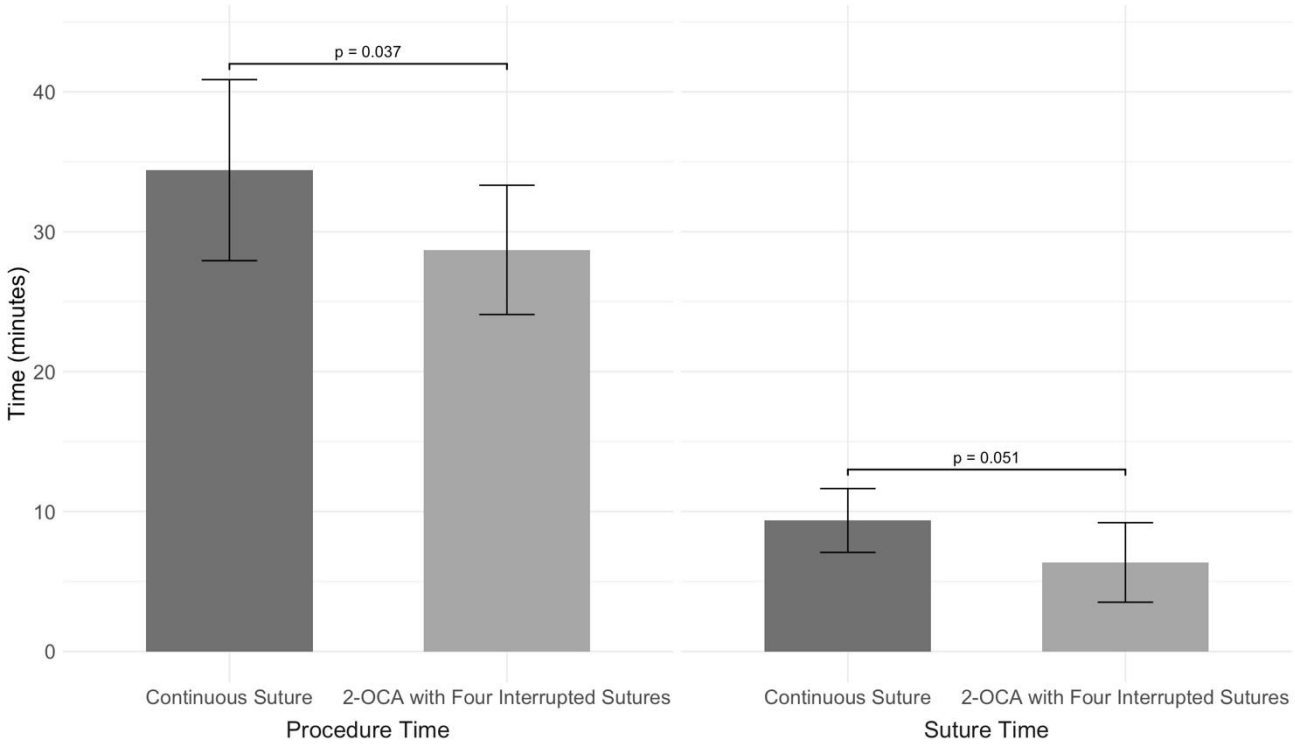

Table 1. Demographic characteristics of patients in the continuous suture arm vs. the 2-OCA with four interrupted sutures arm			
Characteristic	**Continuous suture (n = 10)**	**4 interrupted sutures & 2-OCA (n=10)**	**Significance (95% CI)**
Age, mean (± S.D)	50.2 (15.3)	43.5 (23.2)	p=0.4564
Charlson comorbidity score, median (range)	0 (0-1)	0 (0-9)	p=0.9249

Charlson Comorbidity Score was analyzed using the Mann-Whitney U test due to skewed distribution. CI: confidence interval; SD: standard deviation.

Table 2. Incidence and types of postoperative complications during the healing period in the continuous suture arm vs. the 2-OCA with four interrupted sutures arm		
Complications	**Continuous Suture (n=10)**	**4 interrupted sutures & 2-OCA (n=10)**
Early MHCM visit	2	2
Hospital admission	0	0
ER/Urgent care visit	0	1
Family doctor visit	0	0
Infection	1	1
Reoperation	0	1
Dehiscence	1	5