

Original Research Article

A COMPARATIVE PROSPECTIVE STUDY OF SURGICAL WOUND CLOSURE BY STAPLES AND SUTURES

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Received : 03/01/2026
Received in revised form : 07/02/2026
Accepted : 24/02/2026

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DOI: 10.70034/ijmedph.2026.1.605

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2026; 16 (1); 3532-3535

ABSTRACT

Background: Optimal skin closure in orthopaedic surgery is essential to promote rapid healing, reduce postoperative complications, and achieve acceptable cosmetic outcomes. Although conventional sutures remain widely used, surgical skin staplers have emerged as a faster alternative. Evidence comparing their clinical effectiveness remains inconsistent, particularly in the Indian orthopaedic setting. **Aim:** To compare the clinical outcomes of skin closure using metallic staples versus monocryl sutures in elective orthopaedic surgeries.

Materials and Methods: A hospital-based prospective randomized comparative study was conducted at BGS Global Hospital, Bangalore, from July 2020 to May 2021. A total of 110 patients undergoing elective open orthopaedic procedures were randomly allocated into two groups: stapler group (n=55) and suture group (n=55). Deep layers were closed uniformly, and only skin closure differed. Outcomes assessed included wound closure time, postoperative pain using the Visual Analogue Scale (VAS), wound healing using the Hollander Wound Evaluation Score (HWES), scar visibility, and wound infection. Statistical analysis was performed using repeated measures ANOVA with significance set at $p < 0.05$.

Results: Mean wound closure time was significantly shorter with staples (198.33 ± 31.97 seconds) compared with sutures (616.69 ± 113.04 seconds) ($p < 0.001$). VAS scores showed significantly less postoperative pain in the staple group over follow-up. HWES indicated better wound healing with staples. Visible scar was significantly lower with staples (40%) than sutures (63.6%) ($p = 0.022$). Wound infection rates were lower with staples (5.5%) than sutures (12.7%), though not statistically significant ($p = 0.320$).

Conclusion: Skin staplers provide faster wound closure with improved pain profile and cosmetic outcomes compared with monocryl sutures in orthopaedic surgeries, making them an effective alternative for skin closure.

Keywords: Stapler, skin, wound closure, surgical wound, monocryl, healing, scar, orthopaedic.

INTRODUCTION

Surgery, derived from the term “chirurgery” meaning handwork, represents the science of performing manual operations to restore health. Any surgical intervention inevitably produces a wound, and optimal wound management aims to achieve rapid healing with minimal tissue damage and acceptable

cosmetic outcomes. Accurate approximation of dermal edges is therefore essential. Sutures have historically been the standard method of wound closure, with documentation dating back to ancient Egyptian and Greek practices and detailed descriptions in the Sushruta Samhita. Over time, advances in asepsis and biomaterials led to the development of synthetic sutures with improved

tensile strength, reduced tissue reaction, and predictable absorption.

The invention of surgical staples by Hümér Hütl in 1908 marked a major evolution in wound closure techniques. Modern staplers provide rapid skin approximation and are widely used in various surgical specialties. However, despite technological advances, surgical site infections (SSIs) remain a significant cause of postoperative morbidity, particularly in resource-limited settings. Multiple factors influence wound healing and infection risk, including patient comorbidities, operative technique, and the type of skin closure material used.

While staples are considered faster and easier to apply, conventional sutures are often regarded as more economical and cosmetically acceptable. Existing literature shows conflicting evidence regarding postoperative pain, infection rates, and cosmetic outcomes between these two methods, particularly in orthopaedic surgeries in the Indian context. Therefore, this prospective randomized comparative study was undertaken to evaluate whether skin staples offer superior clinical outcomes compared with monocryl sutures in elective open orthopaedic procedures.

Review of Literature

Skin Structure and Wound Healing: The skin functions as a protective barrier and plays a vital role in thermoregulation, sensation, and aesthetics. It consists of two main layers—the epidermis and dermis—each contributing to wound repair. Wound healing occurs through inflammatory, proliferative, and remodeling phases and may proceed by primary or secondary intention depending on tissue loss and contamination.

Evolution of Sutures: Sutures have evolved from natural materials such as catgut, silk, and linen to modern synthetic absorbable and non-absorbable materials. Ideal sutures should possess adequate tensile strength, minimal tissue reactivity, good handling characteristics, and cost effectiveness. Synthetic absorbable sutures like polyglactin and monocryl provide predictable absorption and reduced tissue reaction compared with catgut. Non-absorbable materials such as nylon and polypropylene are preferred where prolonged tensile strength is required.

Development of Surgical Staples: Surgical stapling began with Hütl's prototype in 1908 and later improvements made the devices lighter and more user-friendly. Modern skin staplers allow rapid wound closure, consistent edge eversion, and reduced needlestick injuries. However, improper technique may lead to cross-hatching scars or tissue strangulation.



Comparative Clinical Evidence: Several studies have compared sutures and staples. Gohiya et al. reported higher infection rates with staples, whereas Vala et al. demonstrated significantly reduced closure time with staples but increased pain during removal. Chavan et al. observed superior scar outcomes and patient satisfaction with staples. Conversely, some randomized trials found no significant difference in cosmetic results or infection rates between the two methods. Cochrane reviews have concluded that evidence remains insufficient to recommend a universally superior technique. Given these conflicting findings and limited data from South India, further comparative evaluation in orthopaedic surgeries is warranted.

Aims and Objectives

Aim: To determine whether skin staples are superior to conventional suture material for surgical wound approximation in orthopaedic surgeries.

Objectives: To compare the clinical outcomes of skin closure using monocryl sutures and metallic staples in orthopaedic surgeries. To evaluate wound healing outcomes using the Visual Analogue Scale (VAS) and Hollander Wound Evaluation Score (HWES).

MATERIALS AND METHODS

Study Design and Setting: This hospital-based prospective randomized comparative study was conducted in the Department of Orthopaedics at BGS Global Hospital, Bangalore, from July 2020 to May 2021 (11 months including follow-up). Study

Population: Patients aged 18–80 years undergoing elective open orthopaedic procedures were considered. A total sample size of 110 patients (55 per group) was calculated based on expected wound complication rates.

Inclusion Criteria: Age 18–80 years, Elective open orthopaedic surgery, Hemoglobin >10 g%, Incision length >5 cm, Willing to provide consent.

Exclusion Criteria: Open fractures, Active infections, Hand/foot surgeries, Minimally invasive procedures, Immunocompromised patients.

Randomization and Grouping: Patients were randomly allocated using computer-generated numbers: Group 1: Skin staplers (n=55) Group 2: Monocryl sutures (n=55)

Operative Procedure Standard preoperative protocols were followed. Deep layers were closed with

absorbable sutures in all cases; only skin closure differed by group allocation. Time required for skin closure was recorded intraoperatively. All patients received uniform antibiotic prophylaxis until postoperative day five. Patients were blinded to closure method using adhesive dressings. Postoperative Assessment Wound evaluation was performed on postoperative day 2, day 7, 2 weeks, and 6 weeks. Outcome measures included: Pain assessment using Visual Analogue Scale (VAS), Wound healing using Hollander Wound Evaluation Score (HWES), Presence of discharge, infection, or dehiscence Scar visibility. Staple or suture removal was performed on day 10 depending on wound status. Statistical Analysis Data were analyzed using SPSS version 22. Continuous variables were expressed as mean \pm standard deviation; categorical variables as frequencies and percentages. Repeated measures ANOVA compared VAS and HWES over time. A p-value <0.05 was considered statistically significant.

RESULTS

A total of 110 patients were equally distributed between the stapler and suture groups (55 each). Males predominated in both groups. The mean age of participants was 52.06 ± 14.33 years. Wound Closure Time The mean closure time with staples (198.33 ± 31.97 seconds) was significantly lower than with sutures (616.69 ± 113.04 seconds) ($p < 0.001$), demonstrating the substantial time-saving advantage of stapling. Postoperative Pain (VAS) VAS scores declined in both groups over time. However, patients in the staple group experienced significantly lower pain scores overall. At postoperative day 2, mean VAS was 6.04 (staples) versus 6.16 (sutures). By week 2, scores reduced to 0.91 and 1.91 respectively. At 6 weeks, both groups showed minimal pain. Hollander Wound Evaluation Score HWES progressively improved in both groups but showed better outcomes with staples. Mean scores at 6 weeks were 0.04 in the staple group versus 0.09 in the suture group, indicating superior wound appearance. Scar Visibility Visible scar was present in 40% of staple patients compared with 63.6% in the suture group ($p = 0.022$), demonstrating statistically significant cosmetic superiority of staples. Wound Infection Infection rates were low overall: Staples: 5.5% Sutures: 12.7%. Although staples showed fewer infections, the difference was not statistically significant ($p = 0.320$).



Overall, staplers demonstrated faster closure, reduced pain scores, improved wound evaluation scores, and better cosmetic outcomes.

DISCUSSION

This prospective randomized study compared skin staplers and monocryl sutures in elective orthopaedic surgeries. The findings indicate that staples provide significant operative time savings, improved patient comfort, and better cosmetic outcomes without increasing infection risk. The dramatic reduction in closure time with staples aligns with previous studies by Kanagaye, Meiring, and Harvey, all of which reported substantial time efficiency with stapling devices. Time saving in the operating room has important implications for surgical workflow, anesthesia duration, and overall healthcare costs. Pain assessment using VAS demonstrated statistically significant improvement in the staple group across follow-up intervals. This contrasts with some studies (e.g., Vala et al., Shantz et al.) that reported higher removal pain with staples. Differences may be attributable to surgical technique, patient population, or postoperative care protocols. HWES analysis showed superior wound healing trends with staples. Additionally, scar visibility was significantly lower in the staple group, supporting findings by Chavan et al. regarding improved cosmetic outcomes. Proper staple placement likely contributes to consistent wound edge eversion and

reduced tissue trauma. Although infection rates were lower with staples, the difference was not statistically significant. This aligns with several randomized trials and Cochrane reviews suggesting comparable infection risks between methods when aseptic technique is maintained. From a practical standpoint, staples offer advantages such as: Rapid application Reduced needlestick injury risk Consistent wound edge approximation. However, sutures remain more economical and do not require specialized removal instruments. Therefore, the choice of closure method may depend on clinical context, resource availability, and surgeon preference. Overall, this study supports the growing body of evidence favoring skin staplers for orthopaedic wound closure while acknowledging that both methods remain clinically acceptable.

CONCLUSION

This prospective randomized study demonstrates that skin staplers are superior to monocryl sutures for skin closure in elective orthopaedic surgeries. Staples significantly reduce wound closure time, improve postoperative pain scores, enhance wound healing outcomes, and produce less visible scarring. Although infection rates were lower with staples, the difference was not statistically significant. Given their efficiency and favorable clinical outcomes, skin staplers represent an effective alternative to conventional sutures for orthopaedic wound closure. However, cost considerations and surgeon expertise should guide the final choice of closure technique.

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