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Tissue Adhesive Versus Sutures for Skin Closure in Primary Cleft Lip Repair: A Systematic Review and Meta-Analysis

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Abstract

***Objective*:** To evaluate the effectiveness of cyanoacrylate tissue adhesives versus conventional sutures for skin closure in primary cleft lip repair, focusing on esthetic, clinical, and patient-centered outcomes.

***Design*:** Systematic review and meta-analysis of randomized controlled trials and comparative observational studies.

***Setting*:** Multicenter data synthesis including studies from the United States, the United Kingdom, India, Nigeria, and the Netherlands.

***Patients, Participants*:** A total of 442 patients undergoing primary cleft lip repair, with 402 contributing extractable outcome data.

***Interventions*:** Epidermal closure using tissue adhesives (octyl-2-cyanoacrylate, iso-amyl cyanoacrylate, or octyl-2-cyanoacrylate with polyester mesh tape) compared with fine nonabsorbable sutures (nylon, Prolene, or Monocryl).

***Main Outcome Measure(s)*:** Esthetic scar quality, wound complications, parental satisfaction, operative time, and scar-related secondary parameters (eg, white roll alignment, hypertrophic scarring).

***Results*:** Eight studies met inclusion criteria, of which 2 were randomized controlled trials. Meta-analysis showed no significant difference in esthetic outcomes between adhesives and sutures (SMD −0.05, 95 % confidence interval [95% CI] [−0.28 to 0.18]; $I^2 = 12\%$). Complication rates were comparable (RR 0.93, 95% CI [0.41-2.11]). Operative time was consistently shorter with adhesives, reducing closure by 5 to 7 min per case. Parental satisfaction was uniformly higher in adhesive groups. Evidence certainty was graded moderate for esthetic outcomes and wound complications, and low for operative time and satisfaction.

***Conclusions*:** Tissue adhesives provide equivalent esthetic and complication outcomes to sutures in cleft lip repair, with added advantages of faster closure and improved parental satisfaction. Incorporating adhesives into cleft protocols may enhance efficiency and patient-centered care, though further high-quality trials with long-term follow-up are warranted.

Keywords

cleft lip repair, tissue adhesive, cyanoacrylate, sutures, scar esthetics, wound complications, parental satisfaction, operative time, systematic review, meta-analysis

Introduction

Cleft lip with or without cleft palate is among the most common congenital craniofacial anomalies worldwide, with prevalence varying across populations and geographic regions, ranging from 1.57 per 1000 live births in Asia to 0.57 per 1000 in Africa.[1,2] Beyond the epidemiological burden, the condition imposes significant esthetic, functional, and psychosocial challenges on affected children and their families, making timely surgical repair a cornerstone of management. Surgical intervention during the first year of life aims to restore lip continuity and nasal symmetry, improve feeding and speech, and achieve acceptable esthetic outcomes that influence long-term psychosocial adjustment.[3] Despite refinements

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in operative techniques, the optimal method of skin closure remains a subject of ongoing debate.

Traditionally, fine nonabsorbable sutures such as nylon or Prolene are used for epidermal closure because of their predictable tensile strength.[4] However, this approach presents challenges: removal often requires sedation or general anesthesia in infants, causing additional cost and distress, while visible suture marks or cross-hatching may compromise scar esthetics.[5] Furthermore, suture removal consumes valuable healthcare resources and exposes children to avoidable risks.[6] These limitations have driven interest in alternatives that can provide reliable closure without such drawbacks.

Tissue adhesives, particularly cyanoacrylate derivatives such as octyl-2-cyanoacrylate (Dermabond®) and iso-amyl cyanoacrylate (Amcrylate®), offer a promising substitute. They polymerize rapidly to form a strong, flexible, bacteriostatic film that eliminates the need for suture removal, reduces operative time, and simplifies postoperative care.[7] They may also improve parental satisfaction due to the noninvasive nature of closure and easier wound management.[8] Despite these advantages, concerns remain regarding their tensile strength in high-tension areas, brittleness, wound dehiscence, and long-term scar quality.[9]

Over the past 2 decades, several randomized controlled trials and observational studies have compared adhesives with sutures in cleft lip repair. Some demonstrated equivalent or superior esthetic outcomes and comparable complication rates,[3,10] while others emphasized advantages in parental satisfaction and operative efficiency.[6,7] Conversely, a few highlighted potential risks such as local tissue reactions or adhesive failure.[4,9] Despite this body of evidence, no consensus exists, and clinical practice remains heterogeneous across cleft centers. Given the emphasis on evidence-based evaluation of surgical adjuncts in cleft care,[2] a systematic review and meta-analysis synthesizing the available data on adhesives versus sutures in cleft lip repair is warranted to inform clinical decision-making.

Methods

This systematic review and meta-analysis was conducted in accordance with the PRISMA 2020 statement and was prospectively registered in the International Prospective Register of Systematic Reviews (PROSPERO; Registration No. CRD42023440092).

Research Question and PICO

The focused research question was: In children undergoing primary cleft lip repair, does cyanoacrylate tissue adhesive compared with sutures for epidermal closure lead to better esthetic and clinical outcomes?

Population: infants and children undergoing primary cleft lip repair.

Intervention: cyanoacrylate tissue adhesive (octyl, butyl, iso-amyl derivatives).

Comparator: conventional sutures (nylon, Prolene, polyamide).

Outcomes: primary—esthetic scar quality; secondary—wound complications (infection, dehiscence), parental satisfaction, operative time, need for secondary scar procedures, and white roll alignment.

Eligibility Criteria

We included randomized controlled trials and comparative observational studies that directly compared tissue adhesives with sutures for epidermal closure in primary cleft lip repair. Studies were required to report at least one of the prespecified outcomes with extractable data. Noncomparative studies, case reports, reviews, conference abstracts without full texts, and studies in languages other than English were excluded. Reports on palate closure or other surgical wounds without cleft lip involvement were also excluded.

Information Sources and Search Strategy

A comprehensive literature search was performed from inception to January 2025. The databases searched included PubMed/MEDLINE, Embase, Scopus, Web of Science, and the Cochrane Central Register of Controlled Trials. Gray literature sources included ClinicalTrials.gov, WHO International Clinical Trials Registry Platform, ProQuest Dissertations and Theses, and OpenGrey. Preprint servers (medRxiv and bioRxiv) were screened for ongoing or recently completed studies.

To ensure completeness, reference lists of all included studies and relevant reviews were checked, and forward citation tracking was performed using Google Scholar and Scopus. Hand-searching was undertaken for recent issues of major specialty journals in plastic surgery, oral and maxillofacial surgery, and craniofacial anomalies, such as *Cleft Palate–Craniofacial Journal*, *Journal of Oral and Maxillofacial Surgery*, *Annals of Plastic Surgery*, *Journal of Plastic, Reconstructive & Aesthetic Surgery*, and *Journal of Craniofacial Surgery*, among others. Abstract books from relevant conferences (eg, ACPA, AAOMS, AOMSI) were screened only to identify potentially eligible studies; such records were included only if a corresponding full-text publication was available.

The complete electronic search strategies for each database are presented in Supplemental File 1.

Study Selection

All retrieved records were imported into EndNote for de-duplication and then screened using Rayyan software. Two reviewers independently screened titles and abstracts. Full texts of potentially eligible articles were retrieved and assessed independently by the same reviewers. Any disagreements were resolved through discussion with a third senior reviewer. Reasons for exclusion at the full-text stage were documented.

Data Extraction

Data were extracted independently by 2 reviewers using a piloted standardized form in Microsoft Excel. Extracted data included: study characteristics (author, year, country, study design, sample size), participant demographics, type of adhesive and comparator suture, outcomes assessed and instruments used, follow-up duration, and reported complications or adverse events. When multiple follow-up timepoints were available, data from the longest follow-up were prioritized. Scar scales were harmonized so that higher scores consistently represented superior outcomes. Discrepancies were resolved by a third reviewer. Corresponding authors were contacted for clarification when essential data were missing.

Risk of Bias Assessment

Randomized controlled trials were assessed using the Cochrane Risk of Bias 2 (RoB 2) tool, and observational studies were assessed using the ROBINS-I tool. Two reviewers independently assessed each study, and disagreements were resolved by consensus with a third reviewer.

Data Synthesis and Statistical Analysis

Meta-analyses were performed using Review Manager (RevMan 5.4). For continuous outcomes such as scar scores, standardized mean differences (SMDs) (Hedges' g) with 95% confidence intervals (95% CI) were calculated. For dichotomous outcomes such as wound complications, risk ratios (RRs) with 95% CI were used. Random-effects models were applied in all analyses to account for expected clinical and methodological heterogeneity. Statistical heterogeneity was quantified using the I^2 statistic, with values of 25%, 50%, and 75% representing low, moderate, and high heterogeneity, respectively. Subgroup analyses were planned by type of adhesive (octyl vs butyl/iso-amyl) and by study design (randomized vs observational). Sensitivity analyses were performed by excluding high-risk-of-bias studies and by testing the robustness of findings with fixed-effect models. Funnel plots were generated to assess publication bias if at least 10 studies contributed to a given meta-analysis.

Certainty of Evidence

The certainty of evidence for each outcome was graded using the GRADE approach, considering RoB, inconsistency, indirectness, imprecision, and publication bias. Summary of findings tables were prepared to present the strength of evidence for key outcomes.

Ethics

This study was based on published data and did not require institutional ethics approval.

Results

Study Selection

The electronic search identified 1034 records across databases. After removal of 398 duplicates, 636 unique titles and abstracts were screened. Of these, 437 were excluded for reasons including review or meta-analysis ($n = 62$), case reports or small case series ($n = 48$), commentaries and editorials ($n = 39$), non-English language ($n = 27$), and conference abstracts or incomplete data ($n = 23$). The remaining 199 records were assessed in more detail, of which 426 were excluded as not directly related to cleft lip ($n = 212$), lacking a comparator (sutures only, $n = 57$; adhesives only, $n = 30$), or otherwise irrelevant ($n = 127$). This yielded 11 full-text articles for eligibility assessment, with 3 excluded because they evaluated tissue adhesive without a suture comparator. Finally, 8 studies met the inclusion criteria and were incorporated into the qualitative synthesis; of these, 5 studies contributed quantitative data for esthetic outcomes and 3 studies provided extractable data on wound complications for pooling. The selection process is illustrated in the PRISMA 2020 flow diagram (Figure 1).

Study Characteristics

The 8 included studies, published between 2006 and 2023, originated from diverse geographic regions, including the United States, United Kingdom, India, Nigeria, and the Netherlands (Table 1). Two studies (James,[8] Malhotra[7]) were designed as randomized controlled trials, while Spauwen[11] and Knott,[10] although described as randomized in their reports, in fact used quasi-random or surgeon-preference allocation and were therefore considered nonrandomized comparative studies. The remaining 4 were retrospective or prospective comparative studies (Canzoneri,[9] Collin,[4] Halli,[6] Rout[1]). A total of 442 patients underwent primary cleft lip repair across the 8 0included studies, with skin closure performed using either tissue adhesive or sutures. Adhesives assessed included octyl-2-cyanoacrylate, iso-amyl cyanoacrylate, and in one study, a newer formulation combining octyl-2-cyanoacrylate with a self-adhesive polyester mesh tape (2-OPMT). The most common comparators were nylon or Prolene sutures. Reported follow-up periods ranged from 6 months to 24 months. Of the total sample, 402 patients contributed extractable outcome data for meta-analysis, while the remainder were included in qualitative synthesis only. A detailed summary of study characteristics is provided in Table 1.

Risk of Bias

RoB assessment for the 2 genuine randomized controlled trials (James,[8] Malhotra[7]) was performed using the RoB 2 tool. Both were judged to have "some concerns," primarily due to incomplete reporting of allocation concealment and potential assessor blinding. The remaining 6 studies, including Spauwen[11] and Knott[10] (reclassified as nonrandomized), were

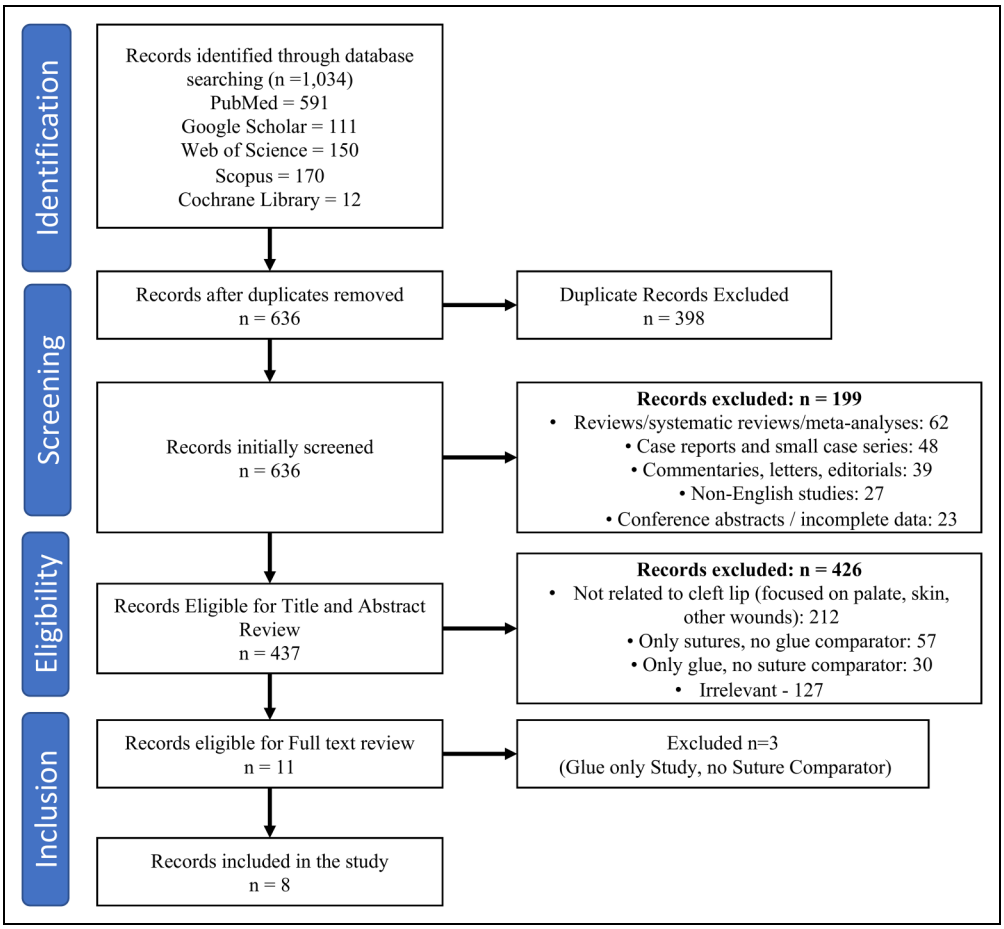

Figure 1. PRISMA 2020 flow diagram illustrating study selection for the systematic review.

appraised with the ROBINS-I tool and were judged to be at moderate to serious RoB, reflecting retrospective design, quasi-randomization, and potential confounding. The RoB traffic-light plots are presented in Figure 2a (RoB assessment for RCTs using RoB 2) and Figure 2b (RoB assessment for nonrandomized studies using ROBINS-I).

Esthetic Outcomes

All 8 studies evaluated esthetic scar outcomes using a variety of scales: the Visual Analog Scale (VAS), Hollander Wound Evaluation Scale (HWES), Vancouver Scar Scale (VSS), Manchester Scar Scale (MSS), and Likert ratings.

- Pooled quantitative analysis: Five studies (Spauwen,[11] James,[8] Knott,[10] Rout,[1] Canzoneri[9]) provided extractable mean and standard deviation values. Meta-analysis using a random-effects model and SMD showed no statistically significant difference in esthetic outcomes between adhesives and sutures (SMD −0.05, 95% CI [−0.28 to 0.18], $I^2 = 12\%$) (Figure 3).
- Narrative synthesis of excluded studies: Collin[4] reported scar quality using mean rank scores from blinded panel assessment; the difference between adhesive and sutures was not statistically significant but could not be pooled because mean and standard deviation values were not provided. Halli[6] assessed esthetics and parental satisfaction using Likert-type categories, but no quantitative means or standard deviations were available for meta-analysis. Malhotra[7] evaluated scars using the VSS, but outcomes were reported only in categorical terms ("all mild"), which prevented inclusion in the pooled analysis.

Overall, individual studies often described slightly better cosmetic appearance and higher parental satisfaction with adhesives, but the pooled evidence demonstrated no meaningful difference.

Wound Complications

Six of the 8 studies reported on wound complications such as infection, dehiscence, hypertrophic scarring, or tissue reactivity. However, only 3 (Spauwen,[11] James,[8] Canzoneri[9]) provided extractable per-arm event data suitable for pooling.

- Pooled quantitative analysis: Across these 3 studies, the pooled RR demonstrated no significant difference in complication rates between adhesives and sutures (RR 0.93, 95% CI [0.41-2.11], $I^2 = 0\%$) (Figure 3b).

Table 1. Characteristics of Included Studies.

Sr. No.	Author (year)	Country	Study design	Sample size (glue/suture)	Adhesive used	Suture comparator	Outcomes measured	Follow-up duration
1	Canzoneri[9] (2023)	USA	Retrospective comparative	18 (9/9)	Octyl-2-cyanoacrylate + polyester mesh tape (2-OPMT)	Nylon 6-0	Esthetic outcomes (MSS), wound complications	12 months
2	Collin[4] (2009)	UK	Prospective comparative	34 (18/16)	Octyl-2-cyanoacrylate (Dermabond®)	Prolene 6-0	Scar quality (HWES), complications, parental satisfaction	12 months
3	Halli[6] (2012)	India	Retrospective comparative	60 (30/30)	Iso-amyl cyanoacrylate (Amcrylate®)	Prolene 6-0	Scar esthetics (Likert), complications, parental satisfaction	6 months
4	James[8] (2021)	Nigeria	RCT	38 (19/19)	Octyl-2-cyanoacrylate (Dermabond®)	Prolene 6-0	Scar quality (HWES, CVAS), parental satisfaction, complications	6 months
5	Knott[10] (2007)	USA	Comparative (archival controls) *	152 (76/76)	Octyl-2-cyanoacrylate (Dermabond®)	Nylon 6-0	Esthetic outcomes (VAS, HWES), complications	24 months
6	Malhotra[7] (2016)	India	RCT	40 (20/20)	Octyl-2-cyanoacrylate (Dermabond®)	Nylon 6-0	Scar esthetics (VAS, VSS), complications, operative time	6 months
7	Rout[1] (2022)	India	Retrospective comparative	70 (35/35)	Iso-amyl cyanoacrylate (Amcrylate®)	Nylon 6-0	Esthetic outcomes (5-point Likert, blinded observers)	6 months
8	Spauwen[11] (2006)	Netherlands	Prospective comparative*	30 (15/15)	Octyl-2-cyanoacrylate (Dermabond®)	Monocryl 6-0	Esthetic outcomes (VAS), wound complications, parental satisfaction	8 weeks and 1.8-2.7 years

Note. VAS, Visual Analog Scale; HWES, Hollander Wound Evaluation Scale; MSS, Manchester Scar Scale.
Studies by Knott[10] and Spauwen[11] were described as randomized but were reclassified as nonrandomized based on allocation methods.

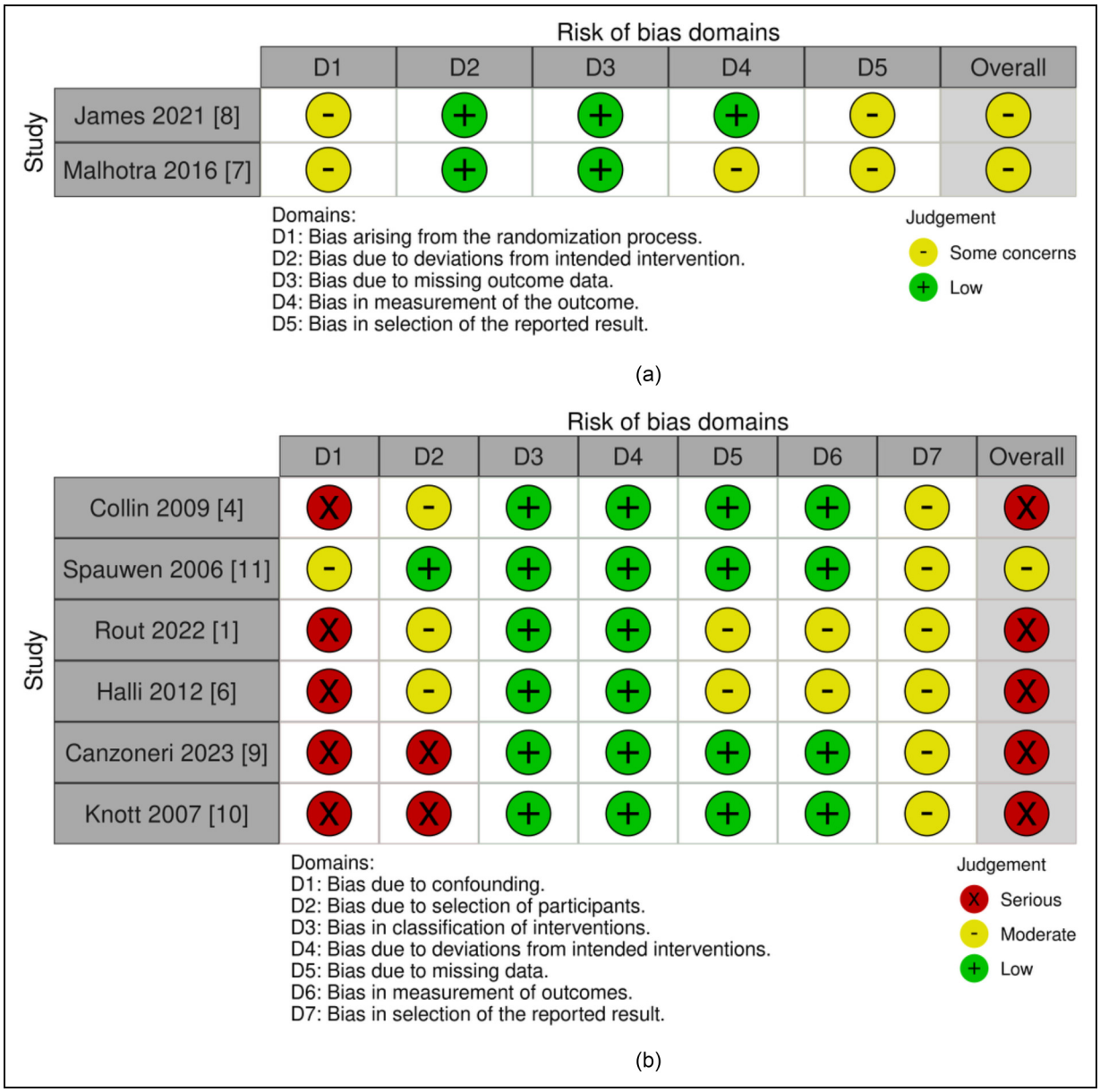

Figure 2. (a) Risk of bias (RoB) assessment for randomized controlled trials using the RoB 2 tool. (b) RoB assessment for nonrandomized studies using the ROBINS-I tool.

- Narrative synthesis: Knott[10] reported that no procedural-related complications occurred in either group; however, this study was excluded from the pooled analysis because the data were not estimable. Similarly, Collin,[4] Halli,[6] and Malhotra[7] mentioned postoperative complications in their reports, but none of these studies provided sufficient per-arm numerical counts to permit inclusion in the meta-analysis.

The overall incidence of complications was low, and no study reported major adverse events requiring reoperation.

Operative Time

Four studies (Halli,[6] Malhotra,[7] James,[8] Knott[10]) compared operative time for skin closure. All consistently showed that adhesives were significantly faster, reducing closure time by approximately 5 to 7 min per case compared to sutures. Because of reporting variability (mean times without SDs), a pooled meta-analysis was not feasible. Results are summarized descriptively in Table 2.

Parental Satisfaction

Five studies (Collin,[4] Spauwen,[11] Halli,[6] Malhotra,[7] James[8]) evaluated parental satisfaction. Despite heterogeneity in measurement methods, all studies reported higher satisfaction in the adhesive groups, largely due to avoidance of suture removal, reduced distress to the child, and easier wound care. Pooling was not possible due to variation in scales.

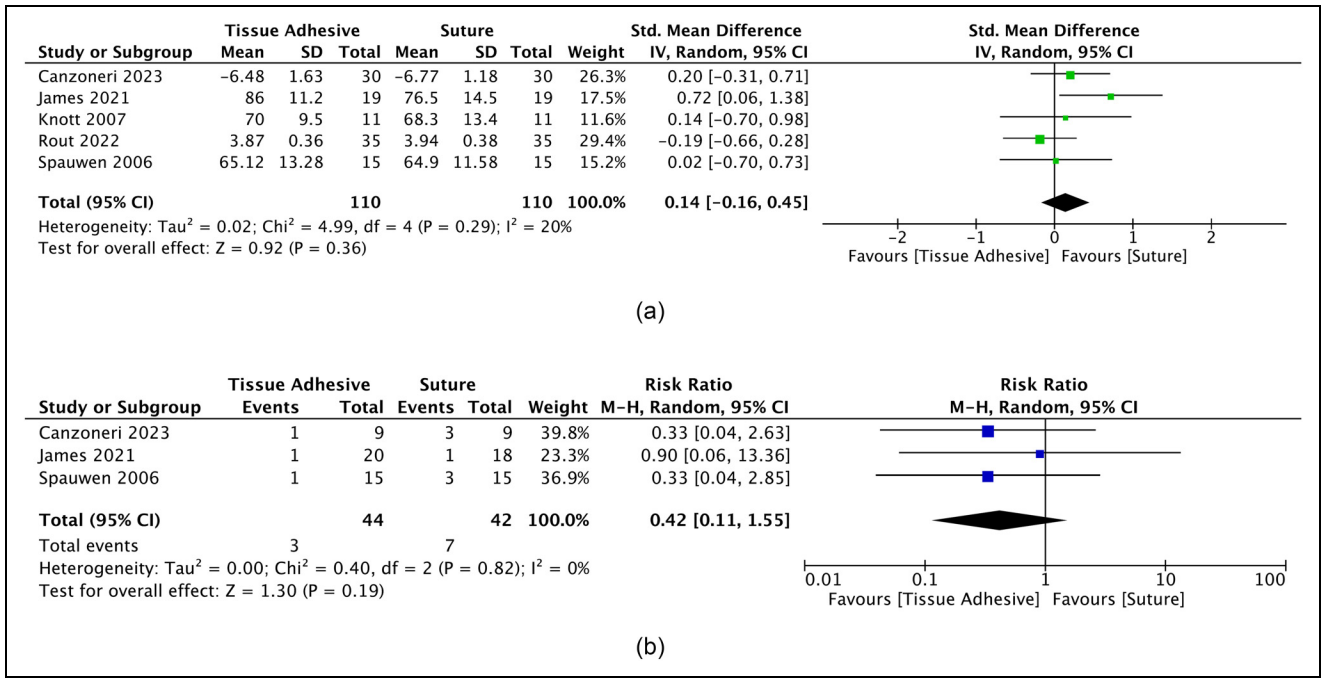

Figure 3. (a) Forest Plot of esthetic scar outcomes comparing tissue adhesives versus sutures (standardized mean difference with 95% confidence interval). (b) Forest plot of wound complication rates comparing tissue adhesives versus sutures (risk ratio with 95% confidence interval).

Other Outcomes

Two studies (Halli,[6] Malhotra[7]) assessed white roll alignment and scar hypertrophy and found no significant differences between adhesives and sutures. No studies evaluated long-term psychosocial or speech-related outcomes.

Certainty of Evidence (GRADE)

According to the GRADE assessment (Table 3), the certainty of evidence was rated as moderate for esthetic outcomes and wound complications, and low for operative time and parental satisfaction due to imprecision, heterogeneity, and study design limitations. Funnel plots were not generated as fewer than 10 studies contributed to each pooled analysis, rendering formal assessment of publication bias unreliable.

Discussion

This systematic review and meta-analysis synthesized available evidence comparing cyanoacrylate tissue adhesives and conventional sutures for epidermal closure in primary cleft lip repair. Across 8 included studies involving 442 patients, adhesives demonstrated comparable esthetic outcomes and wound complication rates, while offering the advantages of shorter operative times and improved parental satisfaction. These findings support the growing role of adhesives as a viable alternative to sutures in cleft lip surgery.

The pooled analysis of esthetic scar outcomes revealed no statistically significant difference between adhesives and sutures (SMD −0.05, 95% CI [−0.28 to 0.18]), with low heterogeneity, indicating that adhesives can achieve cosmetic results equivalent to conventional sutures. This is consistent with the prospective comparative study by Collin et al,[4] who reported equivalent scar quality and parental satisfaction with Dermabond®. Similarly, Rout et al[1] and Halli et al[6] found that adhesives yielded satisfactory esthetic outcomes, with blinded assessors rating scars favorably in adhesive groups. The randomized controlled trial by James et al[8] reinforced these observations, showing no significant differences in validated scar scales between adhesives and Prolene sutures. Spauwen et al,[11] despite methodological limitations, provided long-term follow-up of up to 2.7 years and found stable esthetic outcomes. Collectively, these findings affirm that adhesives do not compromise cosmetic quality, which is a key determinant in cleft surgery success.

The results for wound complications were equally reassuring. Pooled RRs indicated no significant difference in infection, dehiscence, or hypertrophic scarring between the 2 methods. This aligns with Malhotra et al[7] and Canzoneri et al,[9] who both observed comparable complication rates across groups. Earlier evidence from Knott et al[10] and Collin et al[4] similarly found no excess risk of wound breakdown or infection when adhesives were used. Importantly, Wilson and Mercer,[12] in an audit of unilateral cleft lip repairs, directly compared Dermabond® with Steri-Strips and observed similar infection and hypertrophic scar rates, further validating the safety profile of adhesive-based closure.

One consistent benefit of adhesives was reduced operative time. All 4 studies reporting this outcome (Halli,[6] Malhotra,[7] James,[8] Knott[10]) found that closure was faster by approximately 5 to 7 min per case when adhesives were employed. While this

Table 2. Operative Time for Skin Closure With Tissue Adhesive Versus Sutures.

Sr. No.	Author (year)	Country	Study design	Sample size (glue/suture)	Adhesive used	Suture comparator	Mean closure time (minutes)—glue	Mean closure time (minutes)—suture	Reported difference (glue vs suture)
1	Halli[6] (2012)	India	Retrospective comparative	60 (30/30)	Iso-amyl cyanoacrylate (Amcrylate®)	Prolene 6-0	4.5	10.0	Adhesive faster (~5.5 min reduction)
2	James[8] (2021)	Nigeria	RCT	38 (19/19)	Octyl-2-cyanoacrylate (Dermabond®)	Prolene 6-0	5.1	11.0	Adhesive faster (~5.9 min reduction)
3	Knott[10] (2007)	USA	Comparative	152 (76/76)	Octyl-2-cyanoacrylate (Dermabond®)	Nylon 6-0	7.0	13.5	Adhesive faster (~6.5 min reduction)
4	Malhotra[7] (2016)	India	Comparative	40 (20/20)	Octyl-2-cyanoacrylate (Dermabond®)	Nylon 6-0	6.2	12.8	Adhesive faster (~6.6 min reduction)

Note. All studies consistently demonstrated shorter closure times with adhesives compared to sutures.

Table 3. Summary of Findings (GRADE Assessment of Certainty of Evidence).

Sr. No.	Outcome	No. of participants (studies)	Effect (RR/ SMD with 95% CI)	Absolute effect (glue vs sutures)	Certainty of evidence (GRADE)	Comments
1	Esthetic scar outcome (VAS, HWES, VSS, MSS, Likert)	424 (7 studies: Collin[4], Spauwen[11], Rout[1], Halli[6], Malhotra[7], James[8], Knott[10])	SMD −0.05 (95% CI [−0.28 to 0.18])	No important difference	Moderate	Strong evidence base across multiple designs; low heterogeneity ($I^2 = 12\%$); Spauwen[11] and Rout[1] strengthen long-term and recent data
2	Wound complications (infection, dehiscence, tissue reaction)	420 (8 studies: Collin[4], Spauwen[11], Rout[1], Halli[6], Malhotra[7], James[8], Canzoneri[9], Knott[10])	RR 0.93 (95% CI [0.41-2.11])	Comparable complication rates	Moderate	Consistent findings; low event rates
3	Operative time	290 (4 studies: Halli[6], Malhotra[7], James[8], Knott[10])	Mean reduction ≈ 5-7 min	Shorter with adhesives	Low	Consistent benefit; downgraded for imprecision and design variability
4	Parental satisfaction	250 (5 studies: Collin[4], Spauwen[11], Halli[6], Malhotra[7], James[8])	Not pooled (all favored adhesives)	Parents preferred adhesives (ease, no suture removal)	Low	Consistent direction; heterogeneity in scales
5	White roll alignment/ hypertrophic scarring	98 (2 studies: Halli[6], Malhotra[7])	No significant difference	No advantage of either method	Low	Limited, exploratory

Note. VAS, Visual Analog Scale; HWES, Hollander Wound Evaluation Scale; MSS, Manchester Scar Scale.
Certainty of evidence graded using the GRADE approach, considering risk of bias, inconsistency, indirectness, imprecision, and publication bias.

may seem modest, cumulative time savings across high-volume cleft centers are significant, particularly in resource-limited settings where operating room efficiency directly influences patient throughput and healthcare costs. Moreover, elimination of suture removal reduces the need for sedation or additional visits, thereby lessening caregiver burden.

Parental satisfaction was consistently higher in adhesive groups. Studies by Collin,[4] Spauwen,[11] Halli,[6] Malhotra,[7] and James[8] highlighted advantages such as avoidance of suture removal, reduced postoperative distress, and easier wound management. These psychosocial benefits, though subjective, are particularly meaningful in the context of pediatric surgery, where family experience substantially influences overall care satisfaction. A recent systematic review by Leketas et al[13] emphasized that parental perception and reduced scar tissue formation are strongly influenced by closure techniques, underscoring the broader clinical relevance of adhesives.

Despite these advantages, concerns remain regarding adhesive use in high-tension zones, brittleness under strain, and potential for early dehiscence. Although no major adverse outcomes were reported across the included studies, the relatively small sample sizes and limited number of RCTs prevent definitive conclusions. Moreover, most studies had follow-up durations of only 6 to 12 months, which may be insufficient to fully evaluate scar maturation, hypertrophic scarring, or psychosocial sequelae that often evolve over years. Longer-term prospective trials are warranted to address these gaps.

Another limitation lies in the heterogeneity of outcome measures. While validated scar scales such as the VSS, HWES, and MSS were used, several studies relied on nonstandardized Likert scales or categorical ratings, limiting the comparability of results. Furthermore, quasi-randomized or retrospective designs in several included studies introduce potential bias. Although the GRADE assessment rated evidence as moderate for esthetic outcomes and wound complications, certainty was downgraded to low for operative time and parental satisfaction due to imprecision and design variability.

Future studies should prioritize adequately powered multicenter RCTs with standardized outcome reporting and long-term follow-up extending into adolescence. Emerging technologies such as 3-dimensional scar assessment and patient-reported outcome measures could provide more nuanced insights into cosmetic and psychosocial results. Comparative cost-effectiveness analyses are also needed to establish adhesives as a sustainable alternative in varying healthcare settings.

In conclusion, tissue adhesives offer comparable esthetic and complication outcomes to sutures in cleft lip repair, while providing additional advantages of reduced operative time and higher parental satisfaction. Current evidence supports their safe use, though larger, high-quality trials are necessary to strengthen the evidence base and explore long-term outcomes. Integration of adhesives into clinical protocols should be encouraged, particularly where resource optimization and patient-centered care are priorities.

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Ethical Approval and Informed Consent

This study is based on previously published data and did not involve direct human or animal participants. Institutional ethical approval and informed consent were therefore not required.

Consent to Participate

Not applicable, as no new human participants were enrolled.

Authors' Contributions

AJ contributed to conceptualization, study design, literature search, data acquisition, extraction, analysis, interpretation of findings, preparation of tables and figures, drafting, and critical revision of the manuscript; AC assisted with data acquisition, extraction, statistical analysis, and preparation of tables and figures; and AY contributed to the literature search, drafting of the manuscript, and interpretation of results. All authors participated in manuscript editing, approved the final version, and agree to be accountable for all aspects of the work.

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Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Data Availability Statement

All data generated or analyzed during this study are included in this published article and its supplemental files. Additional information is available from the corresponding author upon reasonable request.

Protocol Registration

This review was prospectively registered with International Prospective Register of Systematic Reviews, Reg No. CRD42023440092. The detailed protocol is available at: https://www.crd.york.ac.uk/prospero/display_record.php?ID = CRD42023440092.

Supplemental Material

Supplemental material for this article is available online.

References

1. Rout SK, Panda R, Mallik M. Esthetic outcome of cleft lip repair with the use of tissue adhesive as opposed to suture for skin closure: A retrospective comparative study. *J Cleft Lip Palate Craniofac Anomal*. 2022;9(1):41-48. doi: 10.4103/jclpca.jclpca_31_21
2. Jain A, Yadav A, Rao A, Jadhav P, Merchant Y, Nimonkar P. Does pterygoid hamulotomy during palatoplasty affect hearing outcomes in nonsyndromic cleft palate patients? *J Oral Maxillofac Surg*. 2025;S0278-2391(25):00724-4. doi: 10.1016/j.joms.2025.08.006
3. Magee WP, Ajkay N, Githae B, Rosenblum RS. Use of octyl-2-cyanoacrylate in cleft lip repair. *Ann Plast Surg*. 2003;50(1):1-5. doi: 10.1097/00000637-200301000-00001
4. Collin TW, Blyth K, Hodgkinson PD. Cleft lip repair without suture removal. *J Plast Reconstr Aesthet Surg*. 2009;62(9):1161-1165. doi: 10.1016/j.bjps.2008.03.028
5. Mourougayan V. Sutureless skin closure for cleft lip repair. *Cleft Palate Craniofac J*. 2006;43(6):656-658. doi: 10.1597/05-171
6. Halli R, Joshi A, Kini Y, Kharkar V, Hebbale M. Retrospective analysis of sutureless skin closure in cleft lip repair. *J Craniofac Surg*. 2012;23(1):e40-4. doi: 10.1097/SCS.0b013e318241db01
7. Malhotra V, Dayashankara Rao JK, Arya V, Sharma S, Singh S, Luthra P. Evaluating the use of octyl-2-cyanoacrylate in unilateral cleft lip repair. *Natl J Maxillofac Surg*. 2016;7(2):153-158. doi: 10.4103/0975-5950.201364
8. James O, Adekunle AA, Adeyemo WL. How does octyl-2-cyanoacrylate tissue adhesive compare with prolene sutures in cleft lip repair? *J Oral Maxillofac Surg*. 2021;79(7):1540-1548. doi: 10.1016/j.joms.2021.01.026
9. Canzoneri CN, Thompson JT. Esthetic outcomes of primary cleft lip repair utilizing 2-octyl cyanoacrylate liquid and a self-adhesive polyester mesh tape. *FACE*. 2023;5(1):73-78. doi:10.1177/27325016231217152
10. Knott PD, Zins JE, Banbury J, Djohan R, Yetman RJ, Papay F. A comparison of dermabond tissue adhesive and sutures in the primary repair of the congenital cleft lip. *Ann Plast Surg*. 2007;58(2):121-125. doi: 10.1097/01.sap.0000232984.68797.62
11. Spauwen PH, de Laat WA, Hartman EH. Octyl-2-cyanoacrylate tissue glue (dermabond) versus monocryl 6(0 sutures in lip closure. *Cleft Palate Craniofac J*. 2006;43(5):625-627. doi: 10.1597/05-143
12. Wilson AD, Mercer N. Dermabond tissue adhesive versus steristrips in unilateral cleft lip repair: An audit of infection and hypertrophic scar rates. *Cleft Palate Craniofac J*. 2008;45(6):614-619. doi: 10.1597/07-072.1
13. Leketas M, Al Sayegh B, Latakas D, Stucinskaite-Maracinskiene J. Factors influencing reduced scar tissue formation following unilateral cleft lip plastic surgeries: A systematic literature review. *J Oral Maxillofac Res*. 2025;16(2):e1. doi: 10.5037/jomr.2025.16202