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Review

Cyanoacrylate adhesive versus fast-absorbing gut suture for cutaneous closure in upper blepharoplasty: A systematic review

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Abstract. *Background:* the choice of suture material for upper blepharoplasty remains highly variable and is often influenced by individual surgeon preferences. Absorbable sutures and cyanoacrylate adhesives offer distinct advantages due to their biodegrading ability, namely increased patient comfort and convenience. However, the current literature lacks direct comparative studies on these materials, and questions persist regarding their strength, durability, and wound-healing characteristics. *Aim:* this review assesses the functional and cosmetic effectiveness of absorbable sutures and cyanoacrylate for cutaneous closure in upper blepharoplasty. *Methods:* the review focuses on studies published since 2000 that compare absorbable sutures and cyanoacrylate use in upper blepharoplasty. A systematic search was conducted using several databases. Inclusion criteria encompassed clinical trials or case series assessing cutaneous closure in upper blepharoplasties. *Results:* five studies met the inclusion criteria and presented various outcomes. In some cases, cyanoacrylate closure demonstrated the potential for superior cosmetic results and reduced closure time. However, a closure with gut sutures alone tended to show a higher dehiscence risk than non-absorbable sutures, though cosmetic results may have been equivalent. No papers were found evaluating synthetic absorbable sutures. *Conclusion:* the included studies were limited by their design, small sample sizes, and limited follow-up durations. The lack of objective measures in the assessment of cosmetic outcomes made it challenging to form direct cross-comparisons. In summary, while absorbable gut suture and cyanoacrylate present satisfactory results in upper blepharoplasty closure, cyanoacrylate primary closure may provide enhanced cosmesis in addition to inherent practical advantages. Surgeons may consider these alternatives over non-absorbable sutures, considering their resource-saving potential and patients' comfort.

Key words: blepharoplasty, surgical adhesive, surgical closure technique, cyanoacrylate, catgut

Introduction

Upper blepharoplasty is a popular oculofacial plastic surgery with functional and cosmetic benefits. To date, the choice of suture material for this procedure varies widely and is ultimately determined by the preferences of individual surgeons. The most common suture material choices for cutaneous closure in upper blepharoplasty include non-absorbable materials, including nylon or polypropylene (prolene), or absorbable materials, including catgut sutures or cyanoacrylate adhesive glue (ethyl-cyanoacrylate, octyl-cyanoacrylate, etc.)[1]. In any case, the optimal suture material for upper blepharoplasty should be associated with a low rate of wound dehiscence, minimal patient discomfort, and permit wound healing with limited scarring to achieve cosmetically pleasing results.

While upper blepharoplasty has a low complication rate and a high patient satisfaction rate, closure material selection is a potential factor that could affect

treatment outcomes[1]. Though several different closure materials continue to be successfully employed, there is a paucity of literature directly comparing primary closure materials in upper blepharoplasty. Absorbable sutures and cyanoacrylate glue offer a distinct advantage over traditional sutures by eliminating the need for follow-up suture removal appointments, thereby saving time for staff and avoiding additional discomfort for patients. Consequently, these materials are popular choices among oculofacial surgeons. However, some surgeons prefer the perceived strength and reliability of non-absorbable sutures based on the belief that non-absorbable sutures lower the risk of wound dehiscence compared to biodegradable options. However, it is unclear whether this assumption has been adequately substantiated with empirical evidence. Additionally, questions remain about whether these absorbable materials can achieve equally aesthetic results from a non-absorbable suture closure in upper blepharoplasty.

Cyanoacrylate-based adhesives facilitate wound closure through self-polymerization, aligning the wound edges to enhance re-epithelization[1]. Cyanoacrylate was discovered in 1919, but it wasn't until the development of cyanoacrylate derivates, the first being butyl-2-cyanoacrylate, in the 1970s, that it became utilized in wound closure[5]. Octyl-2-cyanoacrylate (Dermabond, Johnson & Johnson) was approved by the FDA in 1998[5]. It has further been reported that cyanoacrylate derivatives may possess a bactericidal effect[6]. Blepharoplasty is considered an ideal procedure to employ cyanoacrylate as glue-bound surgical incisions are under relatively low amounts of tension due to the inherent anatomy of the eyelid tissue[1].

Gut, also known as "catgut" or "fast-absorbing gut," is a type of suture material made from purified collagenous fibers derived from the intestinal submucosal layer of ruminants, usually goats, cattle, or sheep. Once applied, gut sutures are naturally degraded by human cutaneous proteolytic enzymes. Though it has been extensively used in plastic surgery since the 1970s, including otoplasty, blepharoplasty, ptosis surgery, and rhytidectomy, catgut has been banned in several European countries since 2002 due to the possibility of transmitting bovine spongiform encephalopathy (BSE)[2]. Additionally, reports indicate that gut sutures may be more prone to inducing clinically significant inflammation and redness during their degradation and absorption in some patients compared to non-absorbing sutures[3,4], which could negatively affect aestheticism. Though still prevalent in the United States, the use of catgut is reduced worldwide and, in several cases, has been replaced by synthetic absorbable sutures. These include polyglycolic acid (Dexon), polyglactin 910 (Vicry), pliglecaprone (Monocryl), polydioxanone (PDS), and polyglytone 6211 (Caprosyn). However, these synthetic materials are not commonly employed for upper blepharoplasty due to their long dissolution time, typically two months or longer. This extended presence can be cosmetically unappealing, especially compared to plain gut sutures, which dissolve in 7-10 days. For blepharoplasty, the prolonged visibility of synthetic absorbable sutures is considered unnecessary and undesirable.

This paper seeks to comprehensively review the literature examining the use of absorbable sutures and cyanoacrylate as materials for cutaneous closure in upper blepharoplasty procedures. This will offer valuable insights on the functional and cosmetic effectiveness of these two into these two popular options, recognized for their convenience and comfort by physicians and patients. The papers incorporated in this review will assess and compare absorbable sutures (gut and synthetics) and cyanoacrylate against each, other and non-absorbable suture materials. For surgeons who wish to save time, conserve resources, and minimize patient discomfort, this review will consolidate evidence and attempt to discern potential superiority among these closure materials. The scope of this review will include papers published since the year 2000 and will look at both human trials and case series.

Methods

The databases Pubmed, Cochrane, Embase, and Google Scholar were queried using an advanced search for manuscripts, including the terms "absorbable suture" or "cyanoacrylate" and "blepharoplasty" in their title or abstract. Analogous terms, such as "catgut," "vicryl," "monocryl," "octyl-cyanoacrylate," and others, were also employed in searches to ensure complete

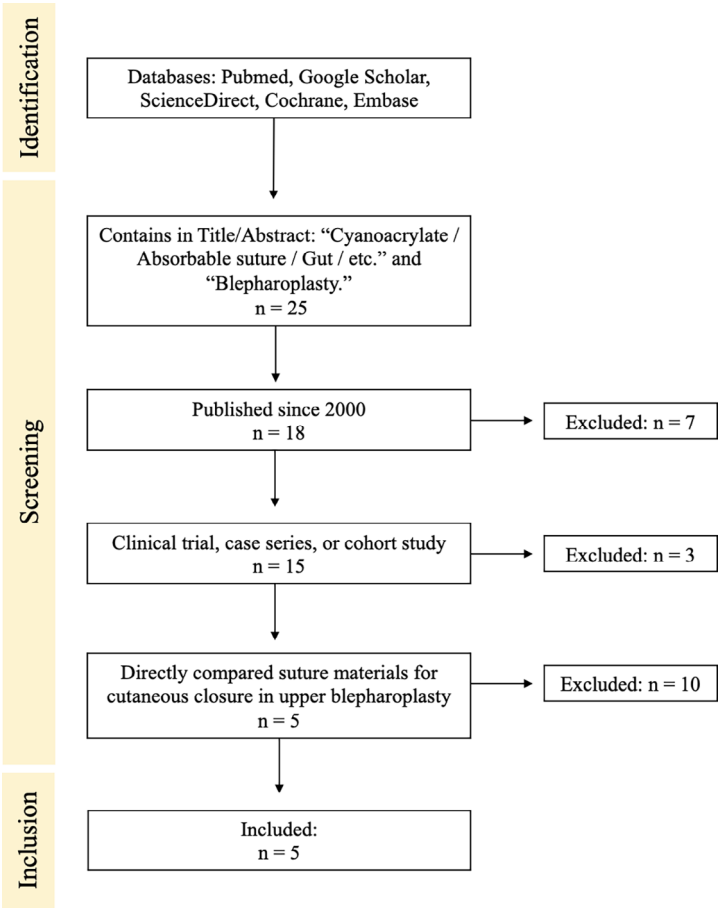

Figure 1. Literature review schematic.

coverage of the literature. The inclusion criteria encompassed clinical trials or case series that compared suture materials, assessed cutaneous closure specifically in upper blepharoplasty procedures, and were published after the year 2000. Exclusion criteria comprised studies involving non-human subjects, pre-clinical investigations, case reports, evaluations of subdermal closure, examinations of closures unrelated to blepharoplasty procedures, and those published before 2000. Papers that met inclusion criteria were systematically reviewed and evaluated by two authors sequentially (Figure 1).

Results

Twenty-five publications met the search criteria and were reviewed. Seven papers were excluded because they were published before the year 2000. Three were excluded because they did not present primary evidence. Ten were excluded because they did not directly compare suture materials, did not evaluate cutaneous closure, or looked at procedures other than upper blepharoplasty. Five papers met the inclusion criteria. Of these papers, two evaluated cyanoacrylate closure, two evaluated gut suture closure, and one compared both cyanoacrylate and gut suture closure. None evaluated synthetic absorbable suture closure.

Perin (2009) presented a prospective case series following eight female patients who underwent upper blepharoplasty followed by a cyanoacrylate cutaneous closure[5]. Aesthetic photographic evaluations were performed by three blinded oculofacial surgeons at ten days and six months post-operative using the standardized six-point Hollander scale. The authors reported successful aesthetic outcomes, with a mean Hollander

score of 5.5 at ten days and 5.9 at six months with a cyanoacrylate closure. The authors also reported minor wound dehiscence in two of the 16 eyelids (12.5%). In this paper, the authors describe a closure technique employing temporary traction sutures to approximate wound edges before applying cyanoacrylate, which they believe is superior to forcep's approximation. They attribute the two instances of wound separation to a "learning curve" in mastering the cyanoacrylate closure technique. Hence, they suggest that this separation rate is unlikely to represent the actual effectiveness of cyanoacrylate when applied correctly. The authors did not observe a significant time gap between cyanoacrylate and the traditional running suture for upper blepharoplasty skin closure. The authors conclude that cyanoacrylate closure is a safe, easy-to-learn technique that can provide aesthetic results equivalent to conventional suturing techniques. The applicability of this study's results is limited by their small sample size and noted procedural errors in blepharoplasty closure. Overall, the quality of evidence is low, and the risk of bias is high.

Jaggi (2009) conducted a prospective study assessing satisfaction among 28 patients who underwent upper blepharoplasty at one surgical center[3]. Patients either received nylon sutures bilaterally, gut sutures bilaterally, or nylon in one eyelid with gut in the other. An analysis of the patient responses to a validated Blepharoplasty Outcome Evaluation (BOE) administered one year post-operatively revealed that neither nylon nor gut was determined to be superior as perceived by patients. However, there was a strong non-significant positive trend towards preferring the appearance of one's eyelids when a fast-absorbing gut was used in closure (p=0.06). The authors concluded that gut sutures were an excellent alternative to non-absorbable sutures for upper blepharoplasty closure. While there was a sufficient follow-up duration, the external validity of these results is limited by the study's small sample size and the lack of statistical significance in their findings. This study's evidence quality is moderate, and the risk of bias is also moderate.

Kouba (2011) conducted a randomized controlled trial with 36 participants over one year at a single surgical center, comparing cyanoacrylate, prolene, and gut for cutaneous closure in bilateral upper blepharoplasty[1]. Participants were divided into three groups based on different closure materials used in either eyelid. Group one received cyanoacrylate in one eyelid and gut in the other; group two received cyanoacrylate in one eyelid and polypropylene in the other; and group three received gut in one eye and polypropylene in the other. Blinded physician evaluators determined the evaluation of cosmetic outcomes at one and three months post-operatively. Group one (cyanoacrylate vs. gut) revealed a superior aesthetic appearance for the cyanoacrylate eyelid at the one-month and three-month marks. Similarly, patient ratings indicated that the cyanoacrylate-closed eyelid was perceived to have a decreased scar thickness and width, with improved texture and color at one and three months, compared to the gut eyelid. Additionally, at the end of month one (but not month three), the cyanoacrylate eyelid was determined to have less erythema than the gut eyelid. Groups two (cyanoacrylate vs. prolene) and three (prolene vs. gut) did not show significant differences across any criteria at either month one or three. Although insignificant, patient and physician preferences for overall cosmetic outcomes indicated a slight preference for cyanoacrylate over fast-absorbing gut and polypropylene sutures. It must be noted that surgical closure involved a subcutaneous deep vicryl suture in the lateral one-third of the incision, which may have influenced the post-operative complication rate by reducing instances of wound dehiscence. One strength of this study is its three-group, randomized, controlled prospective design, enabling the direct comparison of suture materials. Despite this, the significance of the findings is still limited by a sample size of only 36 participants and a limited follow-up period of only three months. Overall, the quality of evidence is moderate, and there is a moderate risk of bias.

Suriano (2011) performed a retrospective study of 20 patients (40 eyelids) evaluating surgical closure times in upper blepharoplasty between nylon and ethyl-2-cyanoacrylate[7]. Seven patients received 6-0 nylon monofilament, and 13 received ethyl-2-cyanoacrylate. The authors report a mean time to close of 6.069 minutes in the cyanoacrylate group, compared to 11.914 minutes in the nylon group. No cases of wound dehiscence or infection were noted. The authors also found that the financial cost of either closure material

Table 1. Summary of results

Study	N	Design	Key Finding(s)
Perin (2009)	8	Prospective	*Cyanoacrylate* provides cosmetic results equivalent to non-absorbable sutures
Jaggi (2009)	28	Prospective	*Fast-absorbing gut* provides equivalent cosmetic results to non-absorbable sutures
Kouba (2012)	36	Prospective	*Cyanoacrylate* adhesive may result in improved cosmetic results with decreased scarring compared to *fast-absorbing gut* and non-absorbable suture
Suriano (2011)	20	Prospective	*Cyanoacrylate* adhesive may permit faster closure time compared to traditional sutures
Homer (2021)	2376	Retrospective	Plain, *fast-absorbing gut* suture has a significantly greater dehiscence rate than non-absorbable polypropylene

was roughly comparable. Although these researchers observed a decrease in closure time with cyanoacrylate, its universal applicability is limited due to the varied techniques employed by different surgeons to approximate wound edges, leading to anticipated variations in closure times. The quality of evidence presented in this study is relatively low, and the risk of bias is rather high.

Homer (2021) undertook a retrospective study of 2376 cases of upper blepharoplasty at a single surgical center, comparing wound dehiscence rates between upper blepharoplasty closures with fast-absorbing gut versus polypropylene[8]. All cases were performed at a single surgical center. The study's results revealed a 3.9% dehiscence rate for plain gut, compared to a 0.6% dehiscence rate for polypropylene. This finding was statistically significant ($p = 0.0025$). Their analysis also revealed that the male gender, of no specific age range, was a significant predictor of dehiscence. This is the first large-scale retrospective study to compare dehiscence in upper blepharoplasty based on suture material. The study's robust sample size and statistically significant results indicate a broader applicability to all blepharoplasty patients, and, therefore, represent some of the more substantial evidence covered in this review, with a relatively low risk of bias (Table 1).

Discussion

Some studies that did not meet the review's criteria still offered valuable evidence for comparison, including increased occurrence of stitch marks with non-absorbable sutures and increased erythema with absorbable sutures in various facial surgeries[9], increased patient and physician cosmetic rating for absorbable over non-absorbable sutures one-month following upper blepharoplasty[10], and a superior physician cosmetic rating of scars closed with cyanoacrylate one year following various facial surgeries compared to non-absorbable sutures[11]. In 1999, Greene et al. conducted a prospective controlled study with 20 participants comparing an upper blepharoplasty closure with cyanoacrylate versus either polypropylene or fast-absorbing gut. His results revealed no significant difference between wound complications, dehiscence, duration of healing, inflammation, or final incision appearance when evaluated at one, two, and four weeks after surgery by blinded physicians[12]. While this has the strength of being a direct comparative study, follow-up time was limited to an insufficient four weeks post-operative. In one comparative study of interrupted versus continuous suture techniques using vicryl, a synthetic absorbable suture, researchers manually removed the sutures at seven weeks post-operative, precluding any assessment of its absorbable quality, and found that the interrupted technique resulted in less ecchymosis and inflammation[13].

Since the year 2000, studies summarized in this review offer several interesting conclusions. Some evidence suggests that cyanoacrylate closure may yield more cosmetically appealing results in upper blepharoplasty than absorbable and non-absorbable sutures[1,5].

Evidence in this review shows that patient satisfaction may be greatest with cyanoacrylate closure[1], and if dehiscence does not occur, it may also be very high with absorbable gut closure[3]. Additionally, it was demonstrated that cyanoacrylate closure has the potential to reduce closure time for surgeons, though this finding is not universal[5,7]. The only large-scale study revealed that closure with a fast-absorbing gut was associated with a significantly greater rate of wound dehiscence in upper blepharoplasty compared to non-absorbable suture closure[8]. Within the available literature, there is only one study since 2000 that directly compared fast-absorbing gut to cyanoacrylate and, though limited by a small sample size and short follow-up duration, noted superiority with cyanoacrylate in both the patient and physician's judgment at one and three-month marks post-operatively[1].

The findings outlined in this review are limited in their external applicability due to the inherent limitations in each included study, most notably those with small sample sizes. Additionally, most of the included studies involved surgical procedures performed by one or more physicians, introducing a potential opportunity for procedural bias in closure technique. Only some studies evaluated in this review have sufficient statistical power to yield generalizable and significant findings. Additionally, the subjectivity of one's aesthetic appearance following blepharoplasty, has led to the need for more objective measures of overall success, making objective cross-comparison challenging. Many studies employ different methods of evaluating cosmetic outcomes, further obscuring the ability to discern clear superiority.

It is important to note that many authors have reported excellent results using hybrid closure methods. A prospective study with 866 participants by Joshi et al. revealed lower rates of milia and standing cone deformity with the use of two interrupted 6-0 prolene sutures at either end of the incision with a running 6-0 fast-absorbing gut along the incision line, compared to running prolene, interrupted prolene, and running fast-absorbing gut[4]. Additionally, a prospective study with 293 participants by Kashkouli et al. found that adding a subcutaneous orbicularis 6-0 polyglactin suture to cutaneous 6-0 nylon significantly reduced rates of lateral wound dehiscence in upper blepharoplasty compared to 6-0 nylon alone[14]. However, some authors argue that employing a layered suture technique in a superficial skin area such as the eyelid might extend the healing duration, increase discomfort, and potentially lead to inferior cosmetic results[8].

Non-absorbable sutures still represent robust options for surgeons willing to allocate extra resources to manually extract them several days after surgery. Many surgeons have typically considered this tradeoff acceptable in exchange for the heightened wound security and decreased risk of dehiscence with non-absorbable sutures compared to absorbable ones or adhesive glues. Homer's retrospective study supported this assumption; however, the same effect has not yet been demonstrated with cyanoacrylate adhesive when applied correctly. Surgeons should consider this evidence when evaluating the tradeoffs of using gut or glue over traditional, non-absorbable sutures in upper blepharoplasty.

Conclusion

The results of this review, though limited by several factors, indicate that upper blepharoplasty closure with catgut and cyanoacrylate yields adequate cosmetic results and high patient satisfaction rates. However, gut sutures may increase the risk of dehiscence. In some cases, there is evidence for enhanced cosmesis with cyanoacrylate compared to other closure materials. The lack of overall strong evidence is a significant finding, as we have identified a fundamental gap in the current literature for oculofacial surgeons looking to use evidence-based practices. Additional studies are required to evaluate the advantages and drawbacks of these closure options compared to non-absorbable sutures. Considering the findings of our review and the benefits of preserving staff resources and minimizing patient discomfort associated with suture removal follow-up appointments, there's a case to be made for choosing these materials, particularly cyanoacrylate, over non-absorbable sutures.

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