

Relevance of Silk Sutures in Contemporary Dental Practice: A Narrative Review

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Abstract

Silk sutures have long served as a standard non-absorbable material in dental surgical practice and are valued for their handling characteristics, cost-effectiveness, and predictable clinical performance. This narrative review synthesizes the current evidence on the applications, advantages, limitations, and emerging trends associated with silk sutures in contemporary dentistry. Silk continues to be widely applied in third molar extraction, periodontal flap surgery, and dentoalveolar wound closure, often serving as the comparator material against which newer techniques and products are benchmarked. Its principal advantages include favorable pliability, ease of knot placement and removal, low material cost, and clinically acceptable outcomes when properly executed, making it especially suitable for trainee education and high-volume practice settings. However, the braided multifilament structure of silk is consistently associated with greater bacterial colonization than monofilament and coated alternatives, along with reduced tensile strength after exposure to certain beverages. These limitations have driven growing interest in knotless barbed sutures, cyanoacrylate tissue adhesives, antimicrobial nanoparticle coatings, and silk fibroin-based biomaterials as complementary or alternative closure strategies. Overall, silk remains a clinically relevant and accessible suture material for routine dental procedures, whereas emerging technologies offer targeted solutions for cases in which infection risk, prolonged suture retention, or patient sensitivity warrants an alternative selection.

Categories: Other, Oral Medicine, Dentistry

Keywords: dental practice, oral surgery, silk suture, suture material, tissue adhesive, wound closure, wound healing

Introduction And Background

Suturing is a fundamental step in oral surgery that directly influences wound stability, healing quality, and postoperative comfort [1]. Among the many suture materials available to dentists, silk has held a longstanding and dominant position, owing largely to its ease of handling, low cost, and widespread familiarity among clinicians and trainees [1,2]. As a braided, multifilament, non-absorbable material derived from natural protein fibers, silk offers pliability and knot-tying convenience, which continue to make it a default choice in many oral surgical procedures, from third molar extraction to periodontal flap closure [3,4].

Despite its entrenched popularity, the multifilament structure of silk predisposes it to bacterial colonization, a property that has been repeatedly documented in microbiological studies comparing silk with monofilament and antibacterial-coated alternatives [5-7]. Concerns regarding reduced tensile strength under intraoral dietary exposure and comparatively lower knot security relative to synthetic multifilament materials have been raised in recent studies [8,9]. These findings coincide with the emergence of alternative closure technologies, including knotless barbed sutures, cyanoacrylate tissue adhesives, and antimicrobial-coated or nanoparticle-functionalized sutures, each proposed as a means of preserving the clinical benefits of silk while mitigating its recognized shortcomings [10-12].

Although numerous comparative and microbiological studies on silk sutures exist, a synthesized account of their contemporary applications, advantages, limitations, and emerging alternatives specific to dental practice remains limited, particularly as newer knotless and adhesive-based systems continue to be evaluated against this long-established benchmark material [13,14]. This narrative review aims to consolidate the current evidence on the applications, advantages, limitations, and emerging trends relevant to the use of silk sutures in contemporary dentistry, providing clinicians with a practical reference for informed suture material selection in the future.

Review

Applications in contemporary dental practice

Silk remains one of the most frequently selected non-absorbable suture materials for routine oral surgical

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wound closure, particularly following third molar extraction and other dentoalveolar procedures [2]. Survey data from a postdoctoral periodontology program indicate that although absorbable sutures, such as chromic gut, dominate overall clinician preference across most periodontal procedures, non-absorbable materials, including silk, continue to be favored in situations requiring longer flap stability, such as ridge augmentation and implant-related surgeries [2]. In mandibular third molar surgery, silk has historically served as a reference material against which newer suture types and techniques are benchmarked [3].

A split-mouth randomized trial comparing interrupted and vertical mattress sutures after impacted mandibular third molar extraction found that the interrupted technique, most commonly executed with silk, produced significantly lower early postoperative pain and swelling scores during the first four days, although the vertical mattress technique offered better long-term preservation of periodontal probing depth at the adjacent second molar [15]. This finding illustrates that the clinical relevance of silk in contemporary practice depends heavily on the suturing technique applied, in addition to the material itself. Similarly, a prospective observational study comparing simple interrupted, figure-of-eight, and horizontal mattress suturing after non-impacted tooth extraction reported that simple interrupted and horizontal mattress techniques yielded superior early wound healing scores, lower pain, and less edema than figure-of-eight closure, reinforcing that technique selection substantially influences outcomes, independent of suture chemistry [16].

Comparative equivalence data support the continued clinical use of silk sutures for mucosal closures. A multicenter, single-blind randomized trial comparing two silk suture brands after mesioangular impacted third molar removal found clinically equivalent outcomes for pain, swelling, and trismus between the two products, with no suture-related adverse events recorded, confirming that silk performs predictably and safely when manufactured to standard specifications [3]. In the context of third molar surgery, a randomized trial assessing suture-less versus multiple silk suture closures found comparable pain, swelling, and lingual nerve outcomes between groups, although suture-less closure resulted in significantly less trismus and fewer instances of delayed healing, suggesting that silk sutures remain a valid but not unequivocally superior closure option [4].

Beyond individual tooth extraction, silk-based suturing techniques extend to broader alveolar procedures. A split-mouth clinical trial comparing interrupted and locked continuous suturing techniques in edentulous ridges undergoing full-arch alveoloplasty found that the locked continuous technique required less suturing time and produced better wound healing scores on postoperative day seven, indicating that the suturing technique applied to silk and comparable materials can influence outcomes in larger surgical fields [17]. A split-mouth randomized controlled trial evaluating the V-Loc knotless closure system against conventional silk sutures after impacted mandibular third molar surgery found that although V-Loc offered a modest reduction in closure time, silk sutures showed significantly better wound healing scores on postoperative day 14, indicating that silk's handling characteristics can translate into superior late-stage healing outcomes in some clinical contexts [18].

A systematic review situated silk within the broader landscape of wound closure options in periodontal flap surgery [13]. The meta-analysis comparing tissue adhesives with sutures found no statistically significant difference in overall wound healing between the two approaches, despite considerable heterogeneity among the included studies, suggesting that silk sutures continue to offer a reliable, evidence-supported closure method, even as adhesive alternatives gain popularity [13]. Table 1 summarizes the comparative handling, microbiological, and mechanical properties of silk and commonly used alternative suture materials in dentistry.

Suture material	Filament type	Knot security	Bacterial colonization	Tensile strength retention	Ease of use
Silk	Multifilament, braided	Lowest among tested non-absorbable materials after repeated throws	Highest among common suture types; multifilament structure favors biofilm retention	Comparable to polypropylene at day 7 but reduced by tea exposure at day 3	Easiest to manipulate and remove; favored by novice operators
PTFE	Monofilament	High knot slippage at baseline but stable thereafter	Significantly lower than silk in aerobic and anaerobic sampling	Resistant to reduction from acidic/tannic beverages	Less pliable; harder to knot than silk
Nylon (polyamide)	Monofilament	Comparable to silk	Lowest bacterial accumulation among tested materials	Not directly reported	Comparable manageability to silk
Polyglactin 910 (Vicryl)	Multifilament, absorbable	Greatest knot security among tested materials	Elevated relative to monofilament sutures	Not directly reported	Requires no removal visit

TABLE 1: Comparative handling, microbiological, and mechanical properties of silk and alternative suture materials in dentistry.

Original table created by the authors based on data synthesized from references [1,5-9,19].

PTFE = polytetrafluoroethylene

These comparative properties frame the specific advantages and limitations of silk, which are examined in the following sections of this review.

Advantages of silk sutures

The principal advantage of silk sutures in dental practice is their superior handling relative to that of many synthetic alternatives, particularly for less experienced operators. A randomized controlled trial evaluating four suture materials among suturing-naïve dental students found that although silk did not statistically outperform polyamide, polyglycolic acid, or polytetrafluoroethylene (PTFE) in an objective structured clinical examination-based assessment, it remained the most commonly used material for novice training because of its low cost and perceived ease of use [1]. This perception of manageability is corroborated by findings comparing knotless barbed sutures with silk, in which silk was judged to be more manageable than PTFE and comparable in handling to nylon despite exhibiting greater postoperative slack [19].

The pliability and low material stiffness of silk provide practical benefits during knot placement and flap approximation. In a retrospective evaluation of six suture materials following impacted third molar extraction, silk was found to be significantly easier to remove than the other tested materials, a property attributable to its smooth handling characteristics and lack of tissue adherence during withdrawal [20]. This ease of removal reduces chairside time and patient discomfort during suture-removal visits, which is a meaningful consideration in high-volume oral surgery practices.

Cost-effectiveness further reinforces the clinical relevance of silk sutures. Because silk is inexpensive relative to monofilament synthetic and barbed suture systems, it remains an accessible option in settings with constrained budgets or high patient throughput without compromising the fundamental goal of flap stabilization during early wound healing [1]. A comparative study of knotless barbed sutures against 3/0 silk in third molar surgery found that although barbed sutures reduced suturing time and postoperative plaque accumulation, silk sutures showed no significant difference from barbed sutures in trismus or edema outcomes at three and seven days, indicating that silk continues to deliver comparable core clinical performance despite its material simplicity [10].

Knot-tying behavior represents a further dimension of silk’s practical utility, even though its knot security is comparatively modest. Laboratory testing of knot security across suture materials commonly used in oral and maxillofacial surgery found that surgeon’s knots using four throws achieved reliable security across materials, and that silk’s flexibility allowed straightforward throw placement, even though its ultimate holding strength was lower than that of polyglactin 910 [9]. This combination of low cost, familiar handling, and acceptable clinical performance in properly executed knots explains why silk remains embedded in standard teaching curricula and everyday oral surgical practice, despite the emergence of materials with superior individual properties.

Limitations of silk sutures

The most consistently reported limitation of silk sutures in the dental literature is their propensity for bacterial colonization, which is a consequence of their braided, multifilament architecture. A comparative study of 10 suture materials used in dentoalveolar surgery found that multifilament sutures, including silk, exhibited significantly higher bacterial colonization than monofilament materials, and that monofilament sutures demonstrated superior wound epithelization according to the Landry index [5]. This pattern was confirmed in a quantitative pilot study that directly compared silk with PTFE after third molar surgery, which found statistically greater bacterial retention on silk in both aerobic and anaerobic sampling, supporting the conclusion that PTFE outperforms silk in reducing bacterial biofilm accumulation [6].

A systematic review synthesizing 11 studies and 649 suture samples from patients undergoing third molar removal similarly found that although silk was the most frequently used suture material, it also most often accumulated the highest bacterial load among the 25 suture types examined, whereas antibacterial-coated and monofilament sutures showed significantly lower colonization [7]. A randomized controlled trial comparing silk, nylon, and PTFE further demonstrated that silk exhibited the poorest microbiological and histological performance among the three materials, showing higher bacterial DNA copy counts and a more pronounced lymphocyte-associated immune response, although it did not display in vitro cytotoxicity [19].

The mechanical durability of these materials under intraoral conditions is a second notable limitation. An in vitro evaluation of tensile strength found that tea exposure caused a significant reduction in the tensile strength of silk sutures at day three, whereas silk and polypropylene retained strength comparably better than other materials by day seven [8]. A related study assessing tensile strength and knot security across beverages found that polypropylene displayed significantly higher baseline tensile strength than silk and that the incidence of knot breakage at baseline was higher for silk than for all other tested sutures except for PTFE, indicating a comparative mechanical disadvantage under standard clinical conditions [21].

Collectively, these limitations, bacterial retention, reduced tensile durability under dietary exposure, and occasional hypersensitivity, have prompted many centers to favor monofilament or coated alternatives in cases where infection risk or prolonged suture retention is a particular concern, even though silk continues to perform acceptably across most routine dentoalveolar indications [7].

Emerging trends and alternatives

Research interest has increasingly shifted toward sutures and closure technologies designed to address the principal shortcomings of silk, while retaining its favorable handling profile. Silk fibroin, which is distinct from braided silk suture threads, has emerged as a biomaterial of interest for guided bone regeneration membrane applications. A study on multilayered silk fibroin membranes reported mechanical performance, including elastic modulus and suture retention strength, comparable to commercial collagen membranes, alongside improved manufacturing reproducibility relative to existing bioabsorbable options, positioning silk-derived biomaterials as a promising direction distinct from conventional suture applications [22].

Antimicrobial surface modification is another active area of development that directly targets silk colonization. A study coating silk sutures with biosynthesized silver nanoparticles via a green synthesis approach demonstrated measurable antimicrobial activity against *Candida albicans*, *Escherichia coli*, and *Staphylococcus aureus*, while maintaining biocompatibility with fibroblast cell cultures, suggesting that nanoparticle coating could preserve silk's handling advantages while mitigating its infection-related drawbacks [12].

Knotless and barbed suture systems are a further trend in reshaping closure practices in oral surgery. Comparative evidence indicates that unidirectional barbed sutures reduce suturing time relative to silk sutures while achieving comparable or superior wound healing scores, reflecting a broader movement toward closure systems that minimize operator-dependent variability in knot security [10]. Tissue adhesives represent a parallel, non-suture alternative that is gaining traction, particularly in periodontal surgeries. A pilot randomized controlled trial combining cyanoacrylate adhesive with low-level laser therapy for sutureless periodontal flap closure found significantly lower postoperative analgesic consumption and higher patient preference scores than conventional silk suturing, along with consistently lower pain scores and higher early wound healing indices across follow-up visits [11].

A systematic review and meta-analysis comparing tissue adhesives with sutures in periodontal flap surgery similarly concluded that wound healing outcomes with adhesives were comparable to or better than those with sutures, positioning adhesives as a viable non-invasive alternative in terms of cosmetic outcome and patient satisfaction, although the authors cautioned that further large-scale randomized trials are required before adhesives can be considered a standard replacement [13]. A scoping review synthesizing 17 studies on suture materials and cyanoacrylate application in impacted third molar surgery reached a comparable conclusion, noting that cyanoacrylate has emerged as a promising alternative to traditional sutures owing to its rapid polymerization and association with early healing, while acknowledging that the optimal choice of suture material in this setting remains a subject of ongoing debate [14].

Equivalence testing of branded silk products continues to inform contemporary practice, ensuring that clinicians selecting silk retain confidence in consistent clinical performance across manufacturers. A single-blind randomized equivalence trial comparing two commercial silk suture brands for mucosal closure after impacted third molar removal confirmed clinically equivalent outcomes in pain, swelling, trismus, and suture handling, with no suture-related adverse events, reinforcing that quality assurance in silk manufacturing remains a relevant, albeit less prominent, trend supporting the material's continued clinical use [3].

Conclusions

Silk sutures continue to hold a meaningful, albeit evolving, role in contemporary dental practice. Their low cost, familiar handling, and predictable clinical performance sustain their widespread use in routine dentoalveolar surgery, particularly in training environments and resource-limited settings. However, accumulating evidence on bacterial colonization and reduced tensile durability under dietary exposure has clarified the specific clinical scenarios in which monofilament, coated, or non-suture alternatives may offer measurable advantages over other types of sutures. Clinicians should weigh the procedure-specific infection risk, expected suture retention time, and patient susceptibility to inflammatory or allergic reactions when selecting between silk and its alternatives, reserving silk for indications where its handling benefits outweigh its microbiological and mechanical limitations, while remaining attentive to the expanding evidence base supporting knotless, coated, and adhesive-based closure technologies.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

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References

1. Davide S, Domenico M, Fabio C, Francesco T, Giorgia LM, Enrico M: Evaluation of 4 different suture threads in a sample of dentistry suture-naïve students: a randomised controlled trial [in press]. *Eur J Dent Educ*. 2026, [10.1111/eje.70134](#)
2. Maksoud M, Koo S, Barouch K, Karimbux N: Popularity of suture materials among residents and faculty members of a postdoctoral periodontology program. *J Investig Clin Dent*. 2014, 5:45-50. [10.1111/jicd.12032](#)
3. Balakrishna R, Poojary D, R A, Sali S, Moharana AK, Ts D: Single blind, randomized study comparing clinical equivalence of Trusilk (®) and Mersilk (®) silk sutures for mucosal closure following surgical removal of mesioangular impacted mandibular third molar. *F1000Res*. 2022, 11:689. [10.12688/f1000research.122678.1](#)
4. Sen A, Dhupar V, Akkara F: Analysing inflammatory responses after mandibular third molar extraction: a comparison of suture-less and multiple suture techniques. *Oral Maxillofac Surg*. 2024, 28:1587-94. [10.1007/s10006-024-01287-2](#)
5. Yaman D, Paksoy T, Ustaoglu G, Demirci M: Evaluation of bacterial colonization and clinical properties of different suture materials in dentoalveolar surgery. *J Oral Maxillofac Surg*. 2022, 80:313-26. [10.1016/j.joms.2021.09.014](#)
6. Parrini S, Bovicelli A, Chisci G: Microbiological retention on PTFE versus silk suture: a quantitative pilot

- study in third molar surgery. *Antibiotics (Basel)*. 2023, 12:562. [10.3390/antibiotics12030562](https://doi.org/10.3390/antibiotics12030562)
7. Baliutaviciute A, Kosys V, Stucinskaite-Maracinskiene J: Microbiological analysis of bacterial plaque on various suture types used in third molar surgical extraction: a systematic review. *J Oral Maxillofac Res*. 2025, 16:e3. [10.5037/jomr.2025.16203](https://doi.org/10.5037/jomr.2025.16203)
8. Abullais SS, Alqahtani NA, Alkhulban RM, Alamer SH, Khan AA, Pimple S: In-vitro evaluation of commonly used beverages on tensile strength of different suture materials used in dental surgeries. *Medicine (Baltimore)*. 2020, 99:e19831. [10.1097/MD.00000000000019831](https://doi.org/10.1097/MD.00000000000019831)
9. Silver E, Wu R, Grady J, Song L: Knot security- how is it affected by suture technique, material, size, and number of throws?. *J Oral Maxillofac Surg*. 2016, 74:1304-12. [10.1016/j.joms.2016.02.004](https://doi.org/10.1016/j.joms.2016.02.004)
10. Uysal AE, Sencimen M, Ozkan A, Hosbul T, Samur Erguven S, Parlak F: Clinical and microbiological comparison of knotless/barbed and silk sutures for impacted third-molar surgery. *Minerva Dent Oral Sci*. 2023, 72:161-7. [10.23736/S2724-6329.23.04764-2](https://doi.org/10.23736/S2724-6329.23.04764-2)
11. Sharma K, Mehrotra S: Cyanoacrylate adhesive with low-level laser therapy for sutureless periodontal flap closure: a pilot randomized controlled trial. *Lasers Surg Med*. 2026, 58:418-28. [10.1002/lsm.70133](https://doi.org/10.1002/lsm.70133)
12. Baygar T, Sarac N, Ugur A, Karaca IR: Antimicrobial characteristics and biocompatibility of the surgical sutures coated with biosynthesized silver nanoparticles. *Bioorg Chem*. 2019, 86:254-8. [10.1016/j.bioorg.2018.12.034](https://doi.org/10.1016/j.bioorg.2018.12.034)
13. Jeevitha M, Kaarthikeyan G, Natarajan PM: Comparison of clinical effectiveness between tissue adhesives and sutures for wound closure in periodontal flap surgery: a systematic review and meta-analysis. *Front Oral Health*. 2025, 6:1556690. [10.3389/froh.2025.1556690](https://doi.org/10.3389/froh.2025.1556690)
14. Scribante A, Ghizzoni M, Pellegrini M, Poli PP, Maiorana C, Spadari F: Microbiological and clinical assessments of suture materials and cyanoacrylate application in impacted third molar surgeries: a scoping review. *J Funct Biomater*. 2023, 14:529. [10.3390/jfb14100529](https://doi.org/10.3390/jfb14100529)
15. Patil T, Kalsi HS, Kharkar VR, Savant S, Wagh A, Sachdev SS: Comparison of effects of the interrupted and vertical mattress sutures on pain, swelling, and probing depth following extraction of impacted mandibular third molars: a split-mouth randomized clinical trial. *J Maxillofac Oral Surg*. 2025, 24:1474-80. [10.1007/s12663-024-02405-z](https://doi.org/10.1007/s12663-024-02405-z)
16. Kumar MG, Rajan SY, Khanna SS, et al.: Comparison of suturing techniques on wound healing and patient-centered outcomes after non-impacted tooth extraction: an observational study. *Cureus*. 2026, 18:e110820. [10.7759/cureus.110820](https://doi.org/10.7759/cureus.110820)
17. Koyuncu Ş, Gürses G: Comparison of interrupted and locked continuous suture techniques in oral surgery regarding wound healing: a split-mouth clinical trial. *J Korean Assoc Oral Maxillofac Surg*. 2025, 51:41-5. [10.5125/jkaoms.2025.51.1.41](https://doi.org/10.5125/jkaoms.2025.51.1.41)
18. Vijayakumar KC, Sridharan G, Prasad TS, Deepanjali M, Parthasarathy B, Evelyn R N: Comparative evaluation of V-Loc knotless closure system and silk sutures in impacted mandibular third molar surgery: a split-mouth randomized controlled trial. *Oral Maxillofac Surg*. 2025, 29:141. [10.1007/s10006-025-01438-z](https://doi.org/10.1007/s10006-025-01438-z)
19. Alarcón Cordovilla JM, Olmedo-Gaya MV, Arias-Moliz MT, Baca García A, Sánchez-Porras D, Quesada-García MP, Romero-Olíd MN: Comparative assessment of microbial colonization and tissue reaction among three suture materials: a randomized controlled trial. *Antibiotics (Basel)*. 2025, 14:1265. [10.3390/antibiotics14121265](https://doi.org/10.3390/antibiotics14121265)
20. Ömezli MM, Torul D, Doğanay Z: Investigation of the effectiveness of different suture materials used in impacted mandibular third molar extraction on wound healing and clinical features. *Quintessence Int*. 2026, 57:574-81. [10.3290/j.qi.b7021105](https://doi.org/10.3290/j.qi.b7021105)
21. Khan AA, Abullais SS, Alqahtani AF, et al.: Evaluation of tensile strength and knot security of commonly used sutures in commonly consumed beverages, an in-vitro study. *Sci Rep*. 2026, 16:2645. [10.1038/s41598-025-31854-w](https://doi.org/10.1038/s41598-025-31854-w)
22. Isella B, Drinic A, Heim A, Leemhuis H, Kröger N, Tolba R, Kopp A: Reproducibility in the morphological and mechanical properties of a natural polymer for guided bone regeneration applications. *J Mech Behav Biomed Mater*. 2026, 175:107306. [10.1016/j.jmbbm.2025.107306](https://doi.org/10.1016/j.jmbbm.2025.107306)