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Clinical Outcomes of Different Suture Materials in Periodontal Surgery

A Systematic Review

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Abstract

To systematically evaluate the available clinical evidence regarding the effects of different suture materials on wound healing and flap approximation following periodontal surgical procedures and to assess their influence on bacterial colonization, tissue response, mechanical properties, postoperative pain, and other clinical outcomes. A systematic review was conducted using PubMed/MEDLINE, Scopus, EBSCOhost, and Ovid. Human comparative clinical studies evaluating different suture materials used in periodontal flap surgery were included according to predefined eligibility criteria. Data regarding wound healing, flap approximation, bacterial colonization, plaque accumulation, histological tissue response, tensile strength, handling characteristics, postoperative pain, and other clinical outcomes were extracted. Risk of bias was assessed using the Cochrane Risk of Bias 2 tool for randomized controlled trials and the ROBINS-I tool for non-randomized comparative studies. Inter-reviewer agreement during study selection was assessed using Fleiss' kappa statistic. Seven comparative clinical studies were included, comprising four randomized controlled trials and three non-randomized comparative studies. Inter-reviewer agreement was almost perfect (κ = 0.85). Two randomized controlled trials demonstrated low overall risk of bias, whereas two had some concerns; among the non-randomized studies, one had serious and two had moderate overall risk of bias. Braided silk consistently demonstrated greater bacterial colonization and plaque accumulation and was associated with a greater inflammatory tissue response and less favourable clinical outcomes than monofilament materials. Nylon demonstrated favourable histological tissue compatibility and lower bacterial adhesion. ePTFE demonstrated greater tensile-strength sustainability than polyamide and favourable handling, flap approximation, and early healing compared with black silk. Poliglecaprone 25 also demonstrated favourable wound healing, flap approximation, and reduced bacterial adhesion compared with silk. Triclosan- and chlorhexidine-coated absorbable sutures reduced bacterial colonization and plaque accumulation compared with conventional absorbable sutures. Triclosan-coated polyglactin 910 demonstrated the most consistent antimicrobial benefit and was associated with improved wound healing and reduced postoperative pain in one randomized trial; however, these clinical advantages were not consistently observed across all studies. Considerable heterogeneity in suture materials, surgical techniques, outcome measures, and follow-up periods limited direct comparison across studies. The available evidence suggests that monofilament and selected antibacterial-coated sutures may provide more favourable microbiological and clinical outcomes than conventional braided silk following periodontal flap surgery. ePTFE and poliglecaprone 25 demonstrated favourable clinical performance, while triclosan-coated polyglactin 910 showed consistent reductions in bacterial colonization with promising clinical benefits. However, the limited number of studies, methodological heterogeneity, and variable risk of bias preclude definitive recommendations regarding the superiority of any single suture material. Further adequately powered randomized controlled trials using standardized clinical, microbiological, mechanical, and histological outcomes are required to establish evidence-based recommendations for suture selection in periodontal surgery.

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Introduction

Periodontal surgery is routinely performed for the management of periodontal defects, regenerative procedures, mucogingival conditions, and other indications requiring surgical access. Successful healing following periodontal flap surgery depends on adequate flap adaptation, passive wound closure, and stabilization of the surgical site during the early phases of tissue repair. Suturing is therefore an integral component of periodontal surgery because it facilitates approximation and

stabilization of the flap margins and influences the biological environment during wound healing [1,2].

An ideal suture material should provide adequate tensile strength, reliable knot security, minimal tissue reactivity, low bacterial accumulation, and favourable handling characteristics while maintaining wound stability throughout the critical healing period. The biological and mechanical behaviour of sutures varies according to their composition, surface characteristics, absorbability, and filament configuration. Experimental and human studies have demonstrated that suture placement in gingival tissues can induce inflammatory responses and bacterial accumulation, with the magnitude of tissue reaction varying among materials [1,3]. In particular, monofilament materials have generally demonstrated less bacterial contamination and tissue reaction than braided materials, although handling and knot-security characteristics may differ between suture configurations [3,4].

Suture materials used in periodontal and oral surgery include natural materials such as silk and synthetic materials such as polyglactin 910, polyglycolic acid, nylon, polypropylene, and expanded polytetrafluoroethylene (ePTFE). These materials differ substantially in tensile strength, knot security, elasticity, capillarity, tissue response, and resistance to bacterial colonization. An experimental comparison of silk, ePTFE, and polyglactin 910 demonstrated differences in tensile and knot-related properties, highlighting the influence of material characteristics on their suitability for periodontal surgical applications [5]. Human gingival investigations have similarly demonstrated differences in inflammatory tissue reactions and bacterial plaque accumulation around silk and ePTFE sutures [4].

The biological behaviour of sutures is particularly relevant in the oral environment, where continuous exposure to saliva and microorganisms may promote bacterial accumulation along the suture surface and channel. Selvig et al. reported bacterial invasion of suture tracks in oral tissues, with particularly prominent involvement around silk, whereas synthetic monofilament sutures elicited comparatively mild inflammatory responses [1]. Similarly, Leknes et al. demonstrated differences in connective-tissue inflammatory response and bacterial plaque accumulation around silk and ePTFE sutures placed in human gingival tissues [4]. These findings suggest that suture architecture and material properties may influence the inflammatory and microbiological environment of the healing periodontal wound.

Clinical evidence has also demonstrated differences in bacterial colonization among commonly used suture materials. In a randomized clinical trial involving patients undergoing periodontal flap surgery, Naghsh et al. compared silk, nylon, Monocryl, and triclosan-coated Monocryl and found significant differences in bacterial colony counts among the tested materials [6]. Comparative clinical research in oral implant surgery has also demonstrated variable microbial accumulation among different suture materials, further supporting the potential influence of suture composition on microbial colonization [7].

Despite these observations, the clinical evidence remains heterogeneous. Studies have differed in surgical procedures, suture materials, suture techniques, follow-up periods, and outcome assessment methods, making direct comparison difficult. Furthermore, much of the available evidence has focused on individual biological or mechanical characteristics rather than comprehensive comparison of clinically relevant outcomes following periodontal surgery. Consequently, uncertainty remains regarding whether any particular suture material provides consistently superior wound healing, flap approximation, tissue compatibility, and patient-centered outcomes in periodontal surgical procedures.

Therefore, this systematic review aimed to evaluate and compare the clinical performance of different suture materials used in periodontal surgery. The primary outcomes included early wound healing, flap approximation, and wound stability, while secondary outcomes included postoperative pain, tissue inflammatory response, bacterial colonization, plaque accumulation, handling characteristics, and other clinically relevant parameters associated with suture performance.

Materials and Methods

Study Design and The Focused Question

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines [8]. The review protocol was prospectively registered with the International Prospective Register of Systematic Reviews (PROSPERO; CRD420261287166). The focused research question was formulated using the Population, Intervention, Comparison, Outcomes, and Study design (PICOS) framework: "Among patients undergoing periodontal flap surgery, how do different suture materials compare with respect to wound healing, flap approximation, microbial colonization, tissue response, mechanical performance, and postoperative clinical outcomes?"

The primary outcomes were postoperative wound healing and flap approximation/stability. Secondary outcomes included bacterial colonization and plaque accumulation, postoperative tissue reaction and inflammation, postoperative pain and discomfort, tensile-strength sustainability, suture handling characteristics, tissue compatibility, and other clinically relevant outcomes reported by the included studies. Particular emphasis was placed on comparative differences between braided and monofilament sutures and between conventional and antibacterial-coated suture materials.

Eligible studies included randomized controlled trials and prospective comparative clinical studies involving human participants undergoing periodontal flap surgery and directly comparing two or more suture materials. Both absorbable and non-absorbable suture materials were considered eligible. Studies were included when they reported at least one clinically, microbiologically, histologically, or mechanically relevant outcome related to postoperative periodontal wound healing or suture performance. Non-comparative studies, in-vitro studies, animal studies, case reports, case series, reviews, and studies unrelated to periodontal surgical procedures were excluded.

Search Strategy and Eligibility Criteria

A comprehensive electronic search of PubMed/MEDLINE, Scopus, EBSCOhost, and Ovid was conducted for studies published from January 1, 1990, to December 31, 2025. The search strategy combined Medical Subject Headings (MeSH) and free-text terms using Boolean operators, covering periodontal surgery (e.g., periodontal flap and open-flap debridement), suture materials (e.g., silk, polyglactin, polyglycolic acid, nylon, polyamide, PTFE/ePTFE, and poliglecaprone 25), and relevant clinical outcomes (e.g., wound healing, flap approximation, tissue response, bacterial colonization, and postoperative pain). Reference lists of included studies were manually screened for additional eligible reports.

Studies were eligible if they were randomized controlled trials or prospective comparative clinical studies involving human participants undergoing periodontal flap surgery and directly comparing two or more suture materials, with at least one predefined clinical, microbiological, histological, or mechanical outcome. Only full-text articles published in English within the specified period were included. Animal and in vitro studies, case reports, case series, reviews, conference abstracts, editorials, letters, non-periodontal studies, non-comparative studies, and reports with insufficient outcome data were excluded.

Literature Screening and Data Extraction

The retrieved articles underwent a three-phase screening process based on the predefined eligibility criteria following the electronic database search. This included screening of titles, abstracts, and subsequently full-text articles. Screening was independently performed by

(Sh.A. and Sa.A.), and any disagreements were resolved through discussion with (M.K.). Inter-reviewer agreement among the reviewers was assessed using Fleiss' kappa statistic [9]. Studies meeting the eligibility criteria were included in the qualitative synthesis. Data extracted from the included studies comprised the first author's name, year of publication, study design, sample size, type of periodontal surgical procedure, suture materials evaluated, follow-up duration, outcome measures, and principal findings.

Data Extraction and Method of Analysis

The study selection process is illustrated in the PRISMA 2020 flow diagram (Figure 1) and was conducted in four sequential phases:

Identification

A total of 292 records were identified through electronic database searching, including PubMed (n = 143), Scopus (n = 89), EBSCOhost (n = 54), and Ovid (n = 6). After the removal of 156 duplicate records, 136 unique records remained for further screening.

Screening

The titles and abstracts of the 136 remaining records were independently screened according to the predefined eligibility criteria. Following this process, 112 records were excluded, leaving 24 articles for full-text assessment.

Eligibility

The full texts of the 24 potentially eligible articles were retrieved and assessed for eligibility. Of these, 17 studies were excluded because they were not related to periodontal surgery (*n* = 11), were animal or *in vitro* studies (*n* = 4), or evaluated interventions other than suture materials (*n* = 2).

Inclusion

A total of 7 studies fulfilled the eligibility criteria and were included in the qualitative synthesis. Full-text screening, study selection, and data extraction were performed independently by the reviewers, and any disagreements were resolved through discussion and consensus.

Quality Assessment and Risk of Bias

(Sh.A. and Sa.A.) independently performed the quality assessment of the included studies. For randomized controlled trials (RCTs), the quality of the included studies was assessed using the Cochrane Risk of Bias 2 (RoB 2) tool [10]. A total of five domains were evaluated, with judgments ranging from low risk of bias, some concerns, to high risk of bias. The overall risk of bias corresponded to the highest level of bias identified across the assessed domains.

For the non-randomized comparative clinical studies, (M.K. and M.S.) independently assessed the risk of bias using the Risk of Bias in Non-randomized Studies of Interventions (ROBINS-I) tool [11]. This instrument evaluates seven domains of bias, with judgments categorized as low, moderate, serious, or critical risk of bias. The overall risk of bias was determined according to the ROBINS-I guidance, based on the highest level of bias identified across all domains.

Any disagreements between the reviewers were resolved through discussion and consensus. The results of the quality assessment are presented in Table 1.

Results

Inter-reviewer agreement for study selection was assessed using Fleiss' kappa statistic [9].

A κ value of 0.85 indicated almost perfect agreement according to the Landis and Koch classification [12].

Risk of Bias

The methodological quality of the included studies was assessed using the appropriate Cochrane Risk of Bias 2 (RoB 2) tool for randomized controlled trials and the ROBINS-I tool for non-randomized comparative clinical studies [10-11]. Among the four randomized controlled trials, two studies were judged to have a low overall risk of bias, while two studies presented some concerns, primarily related to the randomization process and outcome measurement. Of the three non-randomized comparative clinical studies, one demonstrated a serious overall risk of bias, whereas the remaining two were assessed as having a moderate risk of bias. Overall, the randomized controlled trials exhibited a lower risk of bias compared with the non-randomized studies. The risk of bias assessment is summarized in (Table 1). An overview of the characteristics and primary findings of the included studies is provided in (Tables 2 and 3).

Wound Healing and Flap Approximation

Clinical wound healing was evaluated in three randomized controlled trials. Karde et al. reported comparable wound healing among triclosan-coated, chlorhexidine-coated, and conventional polyglycolic acid sutures despite significantly lower bacterial colonization in the antibacterial-coated groups [13]. In contrast, Chaganti et al. demonstrated significantly superior wound healing with triclosan-coated polyglactin 910 sutures, followed by chlorhexidine-coated sutures, compared with conventional polyglactin sutures throughout the 30-day follow-up period [14]. Similarly, Korukonda et al. observed significantly better early healing, superior flap approximation, reduced erythema, fewer flap indentations, and minimal tissue reactions with expanded polytetrafluoroethylene (ePTFE) sutures [15]. These findings suggest favourable early wound stabilization with the evaluated monofilament materials compared with silk.

Bacterial Colonization and Plaque Accumulation

Five studies investigated bacterial adhesion, plaque accumulation, or microbial colonization on different suture materials. Karde et al. demonstrated that both triclosan-coated and chlorhexidine-coated polyglycolic acid sutures significantly reduced aerobic and anaerobic bacterial counts, plaque accumulation, and biofilm formation compared with conventional absorbable sutures, with triclosan-coated sutures exhibiting the lowest microbial burden [13]. Similar findings were reported by Chaganti et al., who observed significantly reduced bacterial colonization, fewer polymicrobial colonies, and lower postoperative plaque accumulation in the triclosan-coated group [14]. Naghsh et al. compared silk, nylon, Monocryl, and triclosan-coated Monocryl and reported significantly greater bacterial adhesion on silk sutures than on the monofilament materials [6]. However, no significant difference was observed between conventional Monocryl and triclosan-coated Monocryl, suggesting that the antimicrobial coating did not confer additional benefit under the study conditions. Jeyashree and Rajasekar also observed lower bacterial colony counts on absorbable sutures compared with non-absorbable sutures, although the difference did not reach statistical significance [16]. Among studies directly comparing silk with monofilament materials, silk generally demonstrated greater bacterial colonization and less favourable tissue responses.

Histological Tissue Response

Histological evaluation was performed only by Abi Rached et al., who compared gingival tissue responses to four different suture materials following periodontal flap surgery [17]. Silk produced the greatest inflammatory cell infiltration and the most prolonged inflammatory response, accompanied by delayed connective tissue maturation. In contrast, monofilament nylon demonstrated the least inflammatory response, earlier fibroblast proliferation, enhanced neovascularization, and more organized collagen deposition, indicating superior tissue compatibility. Braided polyester and perlon exhibited intermediate histological responses with earlier connective tissue maturation than silk but were less favourable than nylon. These findings suggest that monofilament sutures promote more favourable soft tissue healing than braided multifilament materials.

Mechanical Properties and Handling Characteristics

Garapati and Murugan demonstrated that both polyamide and ePTFE retained adequate tensile strength during the first postoperative week; however, ePTFE showed significantly greater tensile strength sustainability than polyamide [18]. In the clinical trial by Korukonda et al., ePTFE exhibited superior handling characteristics, easier manipulation during

suturing, reduced flap indentation, lower incidence of suture sinus formation, and improved tissue adaptation compared with black silk [15]. Poliglecaprone 25 also demonstrated satisfactory handling characteristics and clinical stability, whereas silk exhibited inferior handling and greater tissue irritation. Overall, ePTFE provided the most favourable mechanical and handling characteristics among the evaluated suture materials.

Postoperative Pain and Clinical Outcomes

Postoperative pain and other clinical outcomes were evaluated in three randomized controlled trials. Karde et al. reported no significant differences in pain scores among triclosan-coated, chlorhexidine-coated, and conventional polyglycolic acid sutures despite improved microbiological outcomes with antibacterial-coated sutures [13]. Conversely, Chaganti et al. demonstrated significantly lower postoperative pain in patients receiving triclosan-coated polyglactin sutures compared with chlorhexidine-coated and conventional sutures [14]. Korukonda et al. further reported reduced postoperative discomfort, absence of postoperative infection in the study cohort, lower tissue inflammation, and superior patient comfort with ePTFE sutures compared with black silk [15]. Collectively, these findings indicate that antibacterial-coated absorbable sutures and monofilament non-absorbable sutures are associated with more favourable postoperative clinical outcomes than conventional braided silk sutures.

Overall Evidence Synthesis

Across the included studies, braided silk consistently exhibited the least favourable biological performance, being associated with greater bacterial colonization, increased inflammatory tissue response, delayed connective tissue maturation, and inferior clinical outcomes. In contrast, monofilament sutures, including nylon, poliglecaprone 25, and ePTFE, demonstrated superior biocompatibility, reduced bacterial adhesion, improved wound healing, and enhanced handling characteristics. Among absorbable materials, triclosan-coated polyglactin sutures consistently demonstrated the strongest evidence for reducing bacterial colonization and biofilm formation while maintaining favourable clinical healing. Chlorhexidine-coated polyglactin also improved microbiological outcomes compared with conventional absorbable sutures, although its performance was generally less pronounced than triclosan-coated variants. Overall, the available evidence suggests that monofilament and antibacterial-coated sutures provide superior clinical and microbiological outcomes compared with conventional braided silk sutures in periodontal flap surgery.

Discussion

This systematic review evaluated the comparative performance of suture materials used in periodontal flap surgery with respect to wound healing, flap approximation, bacterial colonization, tissue response, mechanical properties, and postoperative outcomes. Overall, the findings suggest that suture architecture and material characteristics influence biological and clinical performance, with monofilament and selected antibacterial-coated sutures generally demonstrating more favourable outcomes than conventional braided silk. However, the evidence was heterogeneous, and the observed advantages were not consistent across all clinical outcomes. The relatively small number of studies and variable risk of bias further limit the certainty of these findings.

Wound Healing and Flap Approximation

Monofilament sutures demonstrated favourable early wound-healing characteristics compared with braided silk. Korukonda et al. reported superior early healing, flap approximation, reduced erythema and flap indentation, and fewer tissue reactions with ePTFE compared with black silk [15]. Poliglecaprone 25 also demonstrated favorable healing and clinical stability compared with silk [15]. These findings may be related to the smooth surface and absence of interfilamentous spaces characteristic of monofilament sutures, which may reduce tissue irritation and microbial retention.

The clinical effects of antibacterial coatings were less consistent. Karde et al. found comparable wound healing among triclosan-coated, chlorhexidine-coated, and conventional polyglycolic acid sutures despite significantly lower bacterial colonization with the coated materials [13]. In contrast, Chaganti et al. reported superior wound healing with triclosan-coated polyglactin 910 over the 30-day follow-up [14]. This discrepancy indicates that reduced microbial colonization does not necessarily translate into superior clinical healing, which is also influenced by flap stability, surgical technique, tissue tension, oral hygiene, and patient-related factors.

Bacterial Colonization and Plaque Accumulation

The most consistent microbiological finding was the greater bacterial adhesion associated with braided silk. Naghsh et al. demonstrated significantly greater bacterial adhesion on silk than on nylon, Monocryl, and triclosan-coated Monocryl [6]. Similarly, triclosan- and chlorhexidine-coated absorbable sutures showed lower bacterial counts, plaque accumulation, and biofilm formation than their non-coated counterparts. The greater microbial retention of silk may be attributable to its braided multifilament structure, which provides interfilamentous spaces that can facilitate bacterial and plaque retention.

Importantly, the benefit of antimicrobial coating appeared dependent on the underlying suture material. Naghsh et al. found no significant difference in bacterial adhesion between conventional and triclosan-coated Monocryl [6], whereas antibacterial coatings produced clear microbiological benefits when applied to polyglycolic acid or polyglactin 910. Thus, monofilament architecture itself may substantially reduce microbial retention, potentially limiting the additional benefit of antimicrobial modification.

Histological Tissue Response

Histological evidence was available from only one study and should therefore be interpreted cautiously. Abi Rached et al. reported the greatest and most prolonged inflammatory response with silk, whereas nylon demonstrated less inflammation, greater fibroblast proliferation, neovascularization, and more organized collagen deposition [17]. Polyester and perlon showed intermediate tissue responses [17]. These findings support the potential biological advantage of monofilament materials; however, the limited histological evidence does not permit definitive ranking of suture materials according to tissue compatibility.

Mechanical Properties and Handling

ePTFE demonstrated favourable mechanical and handling characteristics. Garapati and Murugan reported greater tensile-strength sustainability of ePTFE than polyamide during the first postoperative week, while Korukonda et al. reported easier handling, improved tissue adaptation, fewer flap indentations, and a lower incidence of suture sinus formation with ePTFE compared with black silk [15,18]. These findings suggest that ePTFE may provide effective early mechanical stabilization. Nevertheless, mechanical performance was assessed over a short period, and the available evidence does not establish whether these advantages translate into superior long-term periodontal outcomes.

Postoperative Pain

Postoperative pain findings were inconsistent. Karde et al. observed no significant differences in pain among triclosan-coated, chlorhexidine-coated, and conventional polyglycolic acid sutures, whereas Chaganti et al. reported lower postoperative pain with triclosan-coated polyglactin 910 [13-14]. Korukonda et al. similarly observed reduced postoperative discomfort with ePTFE compared with black silk [15]. These differences may reflect variation in surgical technique, tissue trauma, inflammatory response, and individual pain perception. Therefore, postoperative pain should be considered alongside wound stability, tissue response, microbial accumulation, and handling

Results

characteristics rather than as an independent determinant of suture selection.

Clinical Implications

The findings support a material-specific approach to suture selection in periodontal flap surgery. Monofilament materials such as nylon, poliglecaprone 25, and ePTFE demonstrated favourable biological or clinical characteristics compared with silk. ePTFE appears particularly useful when mechanical stability and flap adaptation are important. Antibacterial-coated absorbable sutures may be advantageous when reduction of microbial colonization is desired, with triclosan-coated polyglactin 910 demonstrating the most consistent microbiological benefit among the evaluated coated materials. However, because the clinical superiority of antibacterial coatings was not demonstrated consistently, their use should be considered in conjunction with the characteristics of the underlying suture and the clinical requirements of the procedure.

Strengths and Limitations

The principal strengths of this review include the inclusion of randomized and comparative clinical studies and evaluation of multiple clinically relevant outcomes, including wound healing, flap approximation, microbiological parameters, tissue response, mechanical performance, and postoperative pain. The use of RoB 2 and ROBINS-I provided structured assessment of methodological quality, and the high inter-reviewer agreement (κ = 0.85) supports consistency during study selection [9-12].

The findings should nevertheless be interpreted in light of several limitations. Only seven comparative clinical studies were available, with substantial heterogeneity in suture materials, surgical techniques, outcome measures, and follow-up periods, precluding quantitative synthesis. Two randomized trials raised concerns regarding risk of bias, while the non-randomized studies demonstrated a moderate or serious overall risk of bias. In addition, histological evidence was available from only one study, several studies had small sample sizes, and many outcomes were assessed over relatively short periods. These limitations limit the generalizability of the findings and preclude definitive conclusions about the superiority of any individual suture material.

Future randomized clinical trials should use adequately powered samples, standardized periodontal procedures and suturing techniques, validated wound-healing measures, quantitative microbiological assessment, and sufficiently long follow-up. Direct comparisons between monofilament sutures and antibacterial-coated materials would also help determine whether antimicrobial modification provides clinically meaningful benefits beyond those associated with monofilament architecture.

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Figure 1. PRISMA flow chart of the included studies.

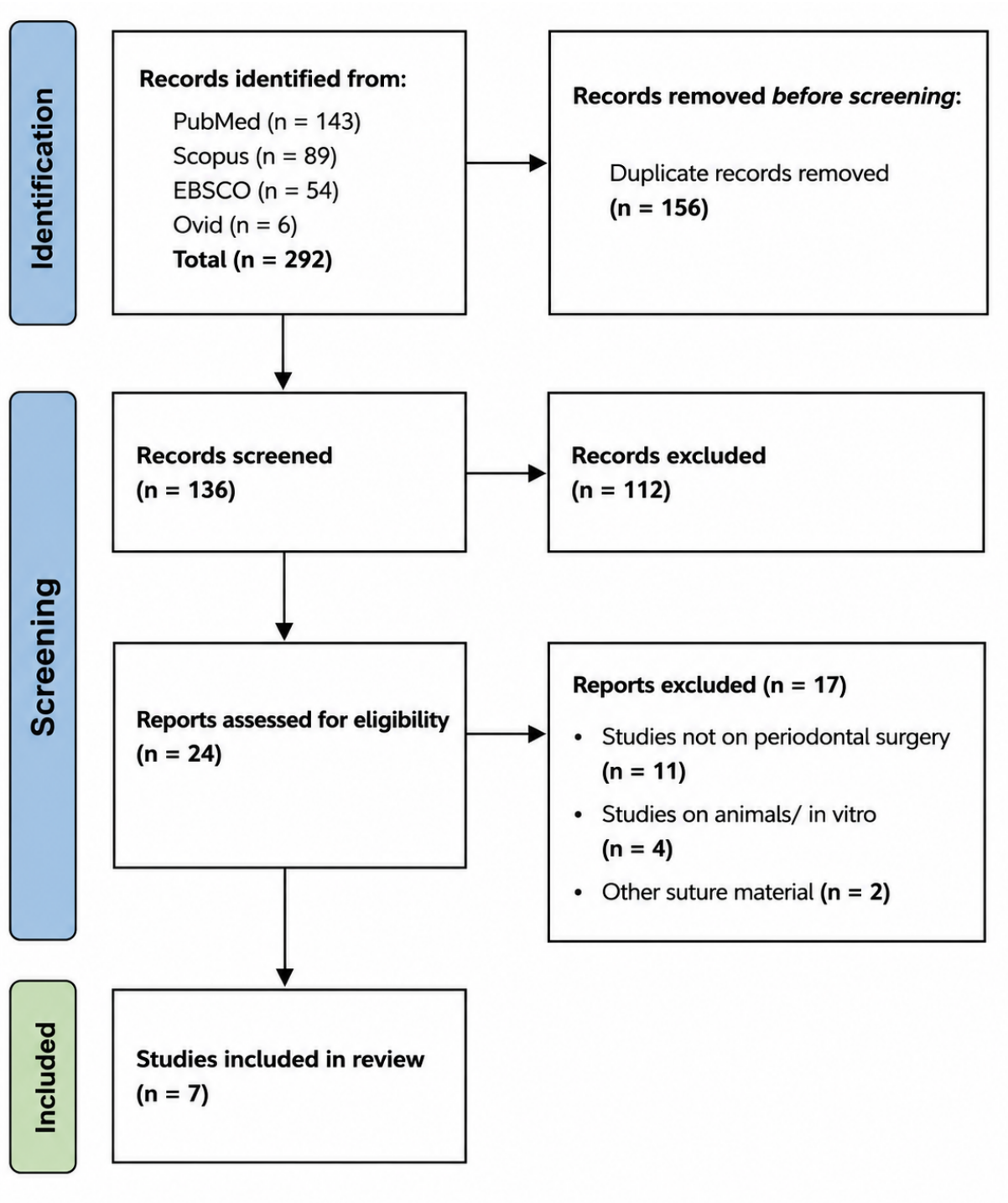

Table 1. Quality assessment and risk of bias of the included studies.

	Study	D1 Bias arising from the randomisation process	D2 Bias due to deviation from intended intervention	D3 Bias due to missing outcome data	D4 Bias in measurement of the outcome	D5 Bias in selection of the reported results	—	—	Overall risk of bias
Randomized controlled trials	Karde et al., 2019 [13]	Low	Low	Low	Low	Low	—	—	Low
	Chaganti et al., 2023 [14]	Low	Low	Low	Low	Low	—	—	Low
	Naghsh et al., 2023 [6]	Some concerns	Low	Low	Low	Low	—	—	Some concerns
	Korukonda et al., 2025 [15]	Low	Low	Low	Some concerns	Low	—	—	Some concerns
	Study	D1 Same experimental condition	D2 Blinding during study	D3 Incomplete data	D4 Exposure characterisation	D5 Outcome assessment	D6 Reporting	D7 Other	Overall risk of bias
Non-randomized comparative clinical studies	Abi Rached et al., 1991 [17]	Serious	Moderate	Low	Low	Low	Moderate	Low	Serious
	Jeyashree & Rajasekar, 2021 [16]	Moderate	Moderate	Low	Low	Low	Moderate	Low	Moderate
	Garanati & Murugan, 2022 [18]	Moderate	Low	Low	Low	Low	Low	Low	Moderate

Table 2. Characteristics of the included studies.

Author (Year)	Aim	Study design	Sample	Periodontal procedure	Suture materials	Follow-up	Outcome measures	Main findings	Limitations
Abi Rached et al. (1991) [17]	To compare the histological gingival tissue response to different suture materials used in periodontal surgery.	Prospective comparative clinical histological study	36 patients	Periodontal flap surgery with interrupted sutures and serial gingival biopsies	Black braided silk, braided polyester (Surgilene®), braided perlon (Supramid®), and monofilament nylon (Superlon®)	14 days (biopsies on days 3, 7, and 14)	Histological inflammatory response, fibroblast proliferation, neovascularization, collagen organization, connective tissue maturation	Silk elicited the greatest and most prolonged inflammatory response, whereas monofilament nylon demonstrated the least inflammation and the most favourable connective tissue repair. Polyester and perlon produced	Small sample size; qualitative histological assessment without statistical analysis; no randomization or blinding; short-term

								intermediate tissue responses.	follow-up only.
Karde et al. (2019) [13]	To compare the antibacterial efficacy and clinical healing associated with triclosan-coated, chlorhexidine-coated, and non-coated resorbable sutures following periodontal flap surgery.	Randomized double-blinded controlled clinical trial	30 patients (10/group)	Conventional periodontal access flap surgery	Triclosan-coated polyglycolic acid (Megasorb T+™), chlorhexidine-coated polyglycolic acid (Megasorb Plus™), and non-coated polyglycolic acid (Megasorb™)	30 days (baseline; days 8, 15, and 30)	Healing Index, postoperative pain, visible plaque index, aerobic and anaerobic CFUs, Gram staining, confocal laser scanning microscopy	Antibacterial-coated sutures significantly reduced plaque accumulation, bacterial colonization, and biofilm formation compared with non-coated sutures. Triclosan-coated sutures demonstrated the lowest bacterial load, although clinical healing and pain were comparable among groups.	Small sample size; conventional flap surgery only; no identification of specific bacterial species; antibacterial release profile not evaluated.
Jeyashree & Rajasekar (2021) [16]	To compare the microbial load on absorbable and non-absorbable suture materials after periodontal flap surgery.	Comparative clinical study	50 patients (25/group)	Periodontal flap surgery	Absorbable versus non-absorbable sutures (specific material not reported)	1 week	Bacterial colony-forming units (CFUs)	Absorbable sutures demonstrated lower bacterial counts than non-absorbable sutures; however, the difference was not statistically significant ($p = 0.87$).	Non-randomized design; no blinding; unspecified suture materials; short follow-up; single-center study; microbiological outcomes only.
Garanati & Murugan (2022) [18]	To compare the sustainability of tensile strength of PTFE and polyamide sutures used in periodontal flap surgery.	Parallel-group controlled clinical trial (in vivo)	14 patients	Periodontal flap surgery following Phase I therapy using a continuous sling suturing technique	5-0 Polyamide (Ethicon®) versus 4-0 PTFE (GOLNIT®)	Baseline and 7 days	Tensile strength measured using a Universal Testing Machine	Both materials retained tensile strength during the first postoperative week; PTFE exhibited greater tensile strength sustainability than polyamide.	Small sample size; single postoperative evaluation; only tensile strength assessed; one knot configuration evaluated; no clinical healing outcomes.
Chaganti et al. (2023) [14]	To compare the clinical and microbiological efficacy of triclosan-coated,	Randomized double-blinded	75 patients (25/group)	Periodontal flap surgery with direct	Triclosan-coated polyglactin 910 (MITSU AB), chlorhexidine-coated	30 days (days 8, 15, and 30)	Wound Healing Index, postoperative pain, aerobic and anaerobic	Triclosan-coated sutures demonstrated significantly superior wound healing, lower	Limited sample size; qualitative assessment of

	chlorhexidine-coated, and non-coated absorbable sutures following periodontal flap surgery.	controlled clinical trial		loop suturing	polyglactin 910 (MITSU C+), and non-coated polyglactin 910 (MITSU)		CFUs, microbial colony frequency, qualitative bacterial identification	postoperative pain, reduced aerobic bacterial colonization, fewer polymicrobial colonies, and the lowest overall microbial burden compared with chlorhexidine-coated and non-coated sutures.	anaerobic bacteria; molecular microbiological methods were not employed.
Naghsh et al. (2023) [6]	To compare bacterial adhesion among four suture materials following periodontal flap surgery.	Single-blind randomized clinical trial (split-mouth)	12 patients	Conventional periodontal flap surgery with randomized allocation of one suture material per quadrant using a simple loop technique	Silk (Supa), nylon (Ethicon), Monocryl (Ethicon), and triclosan-coated Monocryl Plus (Ethicon)	7 days	Aerobic, anaerobic, and total CFUs	Silk demonstrated significantly greater bacterial adhesion than nylon, Monocryl, and Monocryl Plus. No significant differences were observed among the three monofilament sutures, indicating no additional antimicrobial benefit of triclosan coating.	Small sample size; potential confounding due to sequential quadrant surgeries; variability in patient compliance; assessment limited to total bacterial counts.
Korukonda et al. (2025) [15]	To compare the clinical performance of black silk, poliglecaprone 25, and expanded PTFE sutures following periodontal flap surgery.	Double-blind randomized clinical trial	60 patients with moderate-to-severe periodontitis	Full-thickness periodontal flap surgery with debridement and root planing using simple interrupted and continuous sling sutures	Black silk (Mersilk™), Poliglecaprone 25 (Monocryl™), and expanded PTFE (Cytoplast™)	Baseline, 1 and 3 months; postoperative days 7, 10, and 15	Plaque Index, Gingival Index, probing pocket depth, clinical attachment level, Visual Analog Scale, Early Healing Index, tissue reactions, infection, erythema, flap approximation, indentation, suture sinus, and handling characteristics	All groups showed clinical improvement; ePTFE demonstrated superior handling characteristics, lower postoperative pain, absence of infection in the study cohort, and more favourable wound healing than black silk, while both ePTFE and poliglecaprone performed better than silk.	Histological evaluation and microbiological assessment were not performed; bacterial species were not identified; larger randomized clinical trials are required.

Table 3. Summary of findings.

Type of suturing material	Included studies	Level of evidence	Strength of evidence	Main findings
Silk (Mersilk/Black silk)	Abi Rached et al. (1991); Naghsh et al. (2023); Korukonda et al. (2025) [6,15,17]	Histological comparative study; 2 RCTs	High	Demonstrated the highest bacterial colonization (aerobic, anaerobic, and total CFU) among all evaluated sutures. Produced the greatest inflammatory tissue response with delayed connective tissue maturation on histological evaluation. Associated with higher postoperative pain, infection, flap indentation, and inferior handling characteristics than ePTFE. Provided acceptable knot security but inferior overall clinical performance compared with monofilament sutures.
Polyamide (Nylon)	Abi Rached et al. (1991); Garanati & Murugan (2022); Naghsh et al. (2023) [6,17,18]	Histological comparative study; Controlled clinical trial; RCT	Moderate–High	Produced the least histological inflammatory response and earliest connective tissue repair. Demonstrated significantly lower bacterial adhesion than silk. Maintained satisfactory tensile strength after 7 days, although mechanical stability was inferior to PTFE. Exhibited good overall biocompatibility and favorable early healing characteristics.
Expanded PTFE (ePTFE/PTFE)	Garanati & Murugan (2022); Korukonda et al. (2025) [15,18]	Controlled clinical trial; Double-blind RCT	High	Demonstrated superior tensile strength sustainability during early healing. Showed significantly lower postoperative pain and superior handling characteristics than silk. Achieved superior early flap approximation with fewer infections and flap indentations. Demonstrated excellent clinical performance for periodontal flap stabilization.
Poliglecaprone 25 (Monocryl)	Naghsh et al. (2023); Korukonda et al. (2025) [6,15]	Two RCTs	High	Demonstrated significantly lower bacterial colonization than silk. Achieved favourable flap approximation and satisfactory wound healing comparable to ePTFE. Produced less postoperative discomfort than silk. Offered acceptable handling characteristics and clinical performance during periodontal flap surgery.
Triclosan-coated Poliglecaprone (Monocryl Plus)	Naghsh et al. (2023) [6]	Single-blind RCT	Moderate	Demonstrated low bacterial colonization comparable to nylon and conventional Monocryl. Triclosan coating did not provide additional antimicrobial benefit over other monofilament sutures under the study conditions.
Conventional Polyglycolic Acid (PGA/Polyglactin 910)	Karde et al. (2019); Chaganti et al. (2023) [13,14]	Two Double-blind RCTs	High	Demonstrated acceptable clinical healing but consistently exhibited greater bacterial colonization and plaque accumulation than antibacterial-coated sutures. Clinical healing was comparable with coated sutures in the earlier trial, although inferior wound-healing outcomes were observed in the later RCT.
Triclosan-coated Polyglactin 910 (PGA)	Karde et al. (2019); Chaganti et al. (2023) [13,14]	Two Double-blind RCTs	High	Consistently demonstrated the lowest aerobic bacterial colonization and markedly reduced biofilm formation. Reduced postoperative pain and plaque accumulation compared with conventional sutures. Improved wound healing in the larger 2023 RCT, although no significant healing advantage was observed in the earlier 2019 trial. Provides the most consistent evidence among the evaluated antibacterial-coated absorbable sutures for reducing bacterial colonization, with clinical benefits demonstrated in one of two randomized trials.
Chlorhexidine-coated Polyglactin 910 (PGA)	Karde et al. (2019); Chaganti et al. (2023) [13,14]	Two Double-blind RCTs	High	Reduced bacterial colonization and plaque accumulation compared with conventional PGA. Demonstrated improved microbiological outcomes but generally less pronounced effects than triclosan-coated sutures. Produced satisfactory wound healing and clinical performance without significant adverse effects.
Polyester (Surgilene)	Abi Rached et al. (1991) [17]	Histological comparative study	Moderate	Produced a milder inflammatory response than silk with earlier fibroblast proliferation and connective tissue maturation. Demonstrated acceptable tissue compatibility during early periodontal wound healing.
Perlon (Supramid)	Abi Rached et al. (1991) [17]	Histological comparative study	Moderate	Demonstrated moderate early inflammatory response followed by rapid connective tissue organization and collagen maturation. Exhibited superior tissue compatibility compared with silk.

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Absorbable vs Non-absorbable (overall comparison)	Jeyashree & Rajasekar (2021) [16]	Comparative clinical study	Low	Absorbable sutures showed numerically lower bacterial colonization than non-absorbable sutures after periodontal flap surgery; however, the difference was not statistically significant. No clinical wound-healing outcomes were evaluated.