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Review Article

Revolutionizing dental restorations: Insights into computer-aided design/computer-aided manufacturing materials – A systematic review

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ABSTRACT

The integration of computer-aided design (CAD) and computer-aided manufacturing (CAM) technology has significantly transformed restorative dentistry. This review explores the game-changing influence of CAD/CAM systems in restorative dentistry, emphasizing the clinical performance, mechanical attributes, and esthetic potential of contemporary materials such as zirconia, lithium disilicate, polyetheretherketone, polymethylmethacrylate, and advanced resin composites. This systematic review, conducted in accordance with Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines and structured using the PICO framework, comprehensively explored evidence on CAD/CAM dental materials. A thorough search of PubMed, Scopus, Cochrane Library, Web of Science, and Google Scholar (2015–2025) initially identified 1300 records. After rigorous screening and eligibility assessment, studies addressing clinical indications, mechanical performance, and material-specific outcomes of CAD/CAM restorations were included for qualitative synthesis. Lithium disilicate and zirconia emerged as frontrunners in fracture resistance, marginal adaptation, and long-term esthetics. Glass-ceramics and nanohybrid composites demonstrated high performance in posterior and veneer applications. Comparative trials favored CAD/CAM over conventional restorations in precision, fit, and durability. Risk-of-bias assessment indicated predominantly low bias across key domains, ensuring reliability of findings. CAD/CAM materials combine digital precision with clinical excellence, offering strong mechanical performance and refined esthetics for optimal functional outcomes. Clinical evidence highlights their accuracy, efficiency, and long-term success compared to traditional restorative techniques.

Key Words: Computer-aided design/computer-aided manufacturing, lithium disilicate, polyetheretherketone, polymethylmethacrylate, resin, zirconia

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INTRODUCTION

The introduction of computer-aided design (CAD) and computer-aided manufacturing (CAM) technology has led to a significant transformation in restorative and prosthetic dentistry. By merging digital precision with advancements in dental materials, CAD/CAM systems have pioneered the way dental restorations are designed, fabricated, and delivered.[1,2] These technologies provide a more accurate, efficient,

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and streamlined approach compared to traditional manual techniques, allowing dental professionals to achieve patient-satisfactory results. The success of CAD/CAM restorations depends on selecting materials that combine strong mechanical properties with biocompatibility and esthetic appeal.[3,4] Various materials have been introduced and refined for CAD/CAM use, including ceramics, composites, and hybrid materials, each offering unique characteristics suited for specific clinical purposes. Among ceramic materials, zirconia and lithium disilicate stand out due to their strength, durability, and esthetic qualities.[5] Zirconia is widely used in high-stress posterior restorations for its superior flexural strength and fracture resistance, while lithium disilicate, with its balance of translucency and strength, is ideal for anterior restorations where appearance is crucial.[6] Composite and hybrid materials are increasingly utilized for inlays, onlays, and veneers, valued for their ease of milling, reparability, and ability to provide excellent marginal adaptation. These materials also offer cost-effective solutions and are considered in minimally invasive procedures.[7] Despite these developments, there remain challenges in selecting and processing CAD/CAM materials to optimize clinical outcomes. Variations in properties such as flexural strength, wear resistance, and bonding potential can directly impact the longevity and function of restorations. Furthermore, the choice between chairside CAD/CAM systems, which enable same-day restorations, and laboratory-based systems, known for their higher precision, introduces additional considerations related to accuracy, workflow efficiency, and economic feasibility.[8] Clinicians must thoroughly understand the trade-offs between these systems and materials to effectively incorporate digital dentistry into routine practice. An in-depth knowledge of the mechanical properties, clinical indications, and fabrication protocols is essential for maximizing the potential of CAD/CAM technology. This systematic review aims to systematically evaluate and synthesize current evidence on the mechanical properties and clinical performance of CAD/CAM dental materials compared to conventional restorations, aiming to guide material selection and optimize restorative practices.

METHODOLOGY

This systematic review was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines and was registered with the PROSPERO database (Registration Number: CRD420251057094). The review aimed to synthesize current evidence on the mechanical properties and clinical applications of CAD/CAM dental materials. The PICO (S) framework was employed to define the research question, as outlined in Table 1. The population included teeth requiring partial or complete rehabilitation. The intervention involved CAD/CAM restorations, while the comparison focused on conventionally manufactured restorations. The outcome assessed whether clinical utilization aligned with the mechanical properties of these materials, and both *in vitro* and *in vivo* studies were considered within the scope of this review. A comprehensive literature search was performed across multiple electronic databases, including the Cochrane Library, PubMed (Medline), Scopus, Web of Science, and Google Scholar. The search strategy incorporated combinations of the following keywords: "computer-aided design," "CAD/CAM," "digital dentistry," AND "dental materials," "prosthetic dentistry," or "restorative dentistry." Only English-language publications from the last 10 years (2015–2025) were included to account for recent advancements in CAD/CAM material science, scanning technologies, and software systems. The inclusion criteria were as follows: articles that addressed at least one of the following aspects of dental materials used in CAD/CAM systems – clinical indications or outcomes, manufacturers, mechanical characteristics such as flexural strength, hardness, elastic modulus, as well as material composition or optical properties. Both *in vitro* and *in vivo* studies were considered relevant. Articles were excluded if they did not contain the above information or failed to discuss the required properties and material-based aspects of CAD/CAM restorations. The selection process was carried out independently by two

Table 1: Population, Intervention, Comparison, Outcome of the research methodology

Component	Description
Population (P)	Teeth in need of partial or complete rehabilitation
Intervention (I)	CAD/CAM restorations for teeth requiring partial or complete rehabilitation
Comparison (C)	CAD/CAM restorations for teeth needing partial or total rehabilitation exhibit superior mechanical properties compared to conventionally manufactured restorations
Outcome (O)	The clinical utilization of these materials aligns with their mechanical properties

CAD/CAM: Computer-aided design and computer-aided manufacturing reviewers (ARS and APR), who screened the titles and abstracts of the retrieved studies. Any disagreement between the reviewers was resolved through consensus and discussion. Initially, a total of 1300 records were identified from the electronic databases. After screening for relevance and applying exclusion criteria based on the abstracts, 1049 studies were excluded. The remaining studies were retrieved in full text and evaluated in detail. Further exclusions were made if the articles did not focus on material-specific aspects, resulting in a refined list of studies for inclusion in the review. The included studies encompassed patients with partial or full-coverage crowns and fixed dental prostheses (FDPs) such as bridges. All restorations were fabricated using CAD/CAM milling systems, and material selection was based on the functional and esthetic demands of the prosthesis. The detailed selection process is illustrated in the PRISMA flow diagram,[Figure 1] which outlines the number of studies identified, screened, assessed for eligibility, and finally included in the review. This methodology ensured a rigorous and systematic approach to identifying high-quality evidence relevant to the mechanical and clinical performance of CAD/CAM dental materials.

The eligibility of studies for inclusion in this systematic review was determined through a structured multiphase screening process. Initially, all retrieved records were imported into reference management software, and duplicates were removed. Two independent reviewers (BKR and PN) screened the titles and abstracts of all identified studies based on predefined inclusion and exclusion criteria. Studies deemed potentially relevant were then retrieved in full text and assessed independently by the same reviewers to confirm eligibility. Any discrepancies or disagreements during the selection process were resolved through discussion and consensus. If consensus was not reached, a third reviewer (SMN) was consulted for adjudication. No automation tools or artificial intelligence-based screening software were utilized at any stage of the review process. This

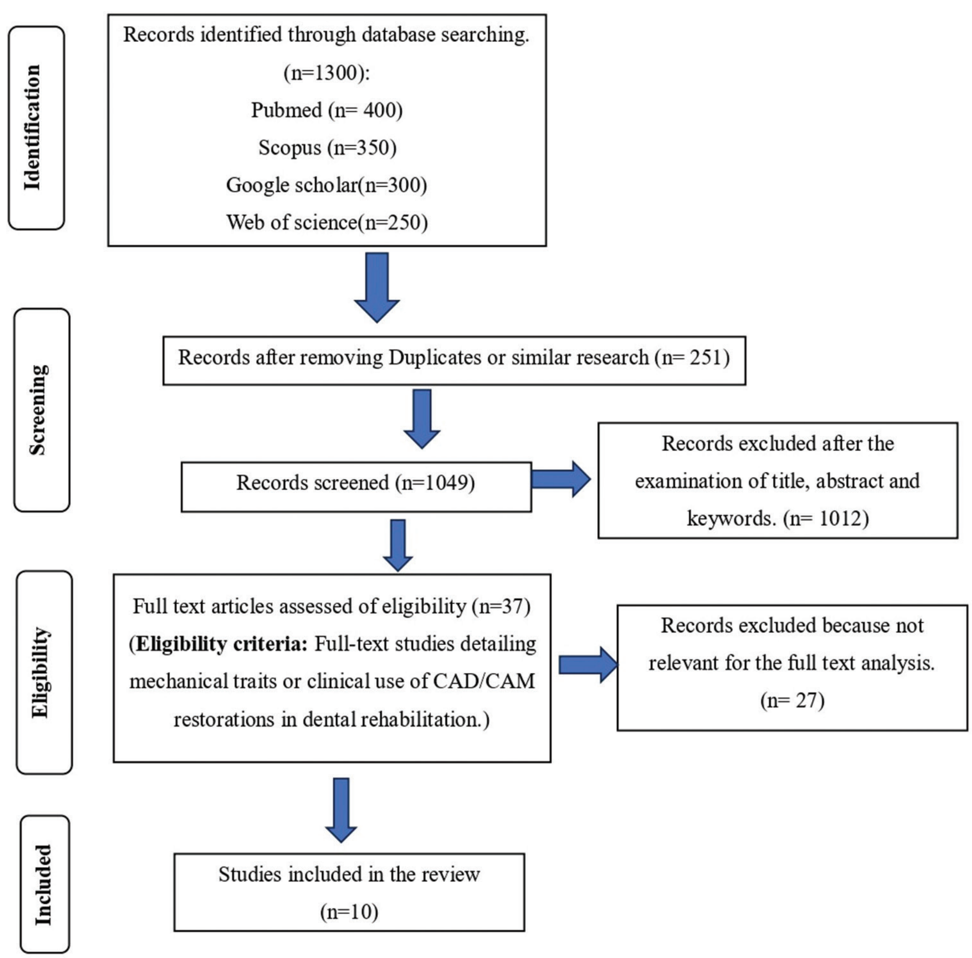

Figure 1: Preferred Reporting Items for Systematic Reviews and Meta-Analyses flowchart.

rigorous and blinded screening methodology ensured objectivity and minimized selection bias in identifying high-quality evidence related to CAD/CAM dental materials. The review sought data on mechanical properties (flexural strength, fracture resistance, hardness, and elastic modulus), marginal adaptation, wear resistance, esthetic outcomes (shade stability, translucency, and gloss), patient satisfaction (comfort, function, and appearance), clinical longevity, and material-specific failures (chipping and debonding). All compatible results across measures, time points, and analysis methods were extracted without restriction or prioritization, ensuring a comprehensive inclusion of relevant data from each study. Data on participant demographics, intervention specifics, comparator details, study design, and funding sources were extracted wherever reported; missing or unclear information was assumed unreported without imputation. Risk of bias (RoB) was independently assessed by two reviewers using the Cochrane RoB tool, without automation assistance. Continuous outcomes were synthesized using mean differences, while dichotomous outcomes utilized risk ratios or odds ratios to enable consistent comparison across studies. Studies were selected for each synthesis by systematically tabulating intervention characteristics and comparing them against predefined inclusion criteria aligned with the review's objectives. Missing data were imputed or requested, and data were standardized for synthesis. Results were tabulated in summary tables and visually presented using RoB traffic light plots and comparative graphs for clear synthesis. Results were synthesized qualitatively due to study heterogeneity, using systematic comparison; meta-analysis was not performed to maintain data integrity. We explored heterogeneity by comparing study designs, materials tested, follow-up durations, and outcome measures, highlighting variations in clinical performance and methodological quality across included studies. Sensitivity analyses were performed by excluding studies with a high RoB to confirm the stability and robustness of the overall findings. RoB due to missing results was assessed through funnel plot analysis and Egger's test to detect potential publication bias in the present review. Certainty in the body of evidence was assessed using the GRADE approach, considering study design quality, consistency of results, RoB, and precision, as reflected by the overall low-to-moderate RoB and robust findings across included studies. Publication bias was evaluated through qualitative assessment of study protocols, outcome reporting patterns, and consistency across reported results. The GRADE approach was applied to assess the certainty of evidence, evaluating study design, RoB, consistency, directness, and precision across included outcomes.

RESULTS

The included randomized controlled clinical trials evaluated a broad spectrum of CAD–CAM dental materials, including glass-ceramics, resin composites, lithium disilicate, zirconia-ceramics, and nanohybrid composites over follow-up periods ranging from 1 to 3 years. Schlichting *et al*.[9] reported that ultrathin CAD–CAM glass-ceramic occlusal veneers demonstrated superior mechanical strength and esthetic stability compared to composite resin, although both materials were clinically acceptable. Srinivasan *et al*.[10] found milled complete dentures to have better fit and long-term durability than three-dimensional (3D)-printed alternatives despite comparable patient satisfaction. Tunac *et al*.[11] showed that CAD–CAM resin composite inlays retained excellent marginal integrity and wear resistance over 2 years, confirming their efficacy in posterior restorations. Elmoselhy *et al*.[12] highlighted the fracture resistance and longevity of lithium disilicate compared to nanohybrid composite in indirect restorations. Similarly, Soares-Rusu *et al*.[13] observed better marginal adaptation and esthetic outcomes in CAD–CAM lithium disilicate veneers than in heat-pressed versions. Mühlemann *et al*.[14] and Grohmann *et al*.[15] emphasized the time efficiency and mechanical reliability of zirconia-ceramic FDPs fabricated through digital workflows and CAD-on veneering techniques. Shenoy *et al*.[16] demonstrated the esthetic superiority of intraoral scan-based provisional restorations over CBCT-based counterparts. Sailer *et al*.[17] confirmed higher fracture resistance and better marginal adaptation in CAD–CAM lithium disilicate crowns than in conventionally fabricated ones. Finally, Naenni *et al*.[18] established that both layered and pressed veneering ceramics on zirconia cores performed well, with pressed ceramics offering improved mechanical strength, while layered ceramics excelled esthetically. Across all studies, CAD–CAM materials consistently showed strong clinical outcomes, with low RoB, supporting their reliability and utility in restorative and prosthetic dentistry [Table 2]. The RoB assessment across the included randomized controlled trials revealed an

Table 2: Summary of the studies included

Author (s)	Materials used	Type of study	Outcome/ results	Clinical indications/ outcomes	Mechanical characteristics (flexural strength, hardness, etc.)	Composition/optical properties
Schlichting *et al.*[9]	Glass-ceramic and composite resin	Randomized clinical trial	Up to 3-year clinical follow-up on occlusal veneers	Severe dental erosion treatment with ultrathin occlusal veneers	Good mechanical performance with high flexural strength; wear resistance	Glass-ceramic and composite resin properties; optical properties suitable for esthetic restorations
Srinivasan *et al.*[10]	Milled and 3D-printed dentures	Double-blind, randomized trial	Comparison of milled versus 3D-printed dentures	Evaluation of complete removable prostheses; patient satisfaction with both materials	Milled dentures showed superior durability and fit; 3D-printed dentures demonstrated sufficient mechanical properties	Optical properties of dentures affected by 3D-printing technology; milled dentures had superior esthetic outcomes
Tunac *et al.*[11]	Resin composite inlays	Randomized controlled trial	Performance over 2 years of CAD/ CAM-fabricated resin composite inlays	Resin composite inlays for posterior teeth restoration	Excellent wear resistance and flexural strength of resin composite; minimal marginal discrepancies after 2 years	High flexural strength and hardness; excellent optical properties for esthetic restoration
Elmoselhy *et al.*[12]	Nanohybrid composite and lithium disilicate	Randomized controlled trial	2-year clinical performance of composite versus lithium disilicate	Mutilated vital teeth restoration; comparison of nanohybrid composite and lithium disilicate	Nanohybrid composite showed good wear resistance; lithium disilicate demonstrated superior strength	Composition: Nanohybrid composites and lithium disilicate; optical properties suitable for esthetic restorations
Mühlemann *et al.*[13]	Zirconia-ceramic	Randomized controlled trial	Digital versus conventional workflows for zirconia-ceramic FDPs	Posterior fixed partial dentures; time efficiency comparison of digital and conventional workflows	Zirconia-ceramic demonstrated high strength and durability in both workflows	Zirconia properties; high strength, durability, and optical properties suitable for posterior restorations
Soares-Rusu *et al.*[14]	Lithium disilicate veneers	Randomized controlled trial	Clinical evaluation of lithium disilicate veneers	Comparison of CAD/CAM versus heat-pressed veneers; esthetic and functional performance assessment	Lithium disilicate veneers showed excellent mechanical properties; strong bond to tooth structure	Lithium disilicate composition: Excellent optical properties for veneers
Grohmann *et al.*[15]	Zirconia-ceramic FDPs	Randomized controlled clinical trial	1-year follow-up of layered versus CAD-on veneered zirconia	Comparison of veneered zirconia for three-unit posterior FDPs; patient satisfaction and durability analysis	Both layered and CAD-on veneering ceramics showed strong mechanical properties and resistance to fracture	Zirconia composition with layered and CAD-on veneering ceramics; good optical outcomes
Shenoy *et al.*[16]	CAD–CAM provisional restorations	Double-blind, randomized crossover trial	Esthetic outcomes of CAD–CAM provisional restorations using CBCT versus IOS	Comparison of CBCT and IOS acquisition methods for CAD–CAM provisional restorations; esthetic outcomes assessment	No significant difference in mechanical properties, but IOS-based restorations had better esthetic outcomes	Material composition and optical properties for provisional restorations
Sailer *et al.*[17]	Lithium disilicate crowns	Randomized controlled trial	CAD–CAM versus conventional laboratory fabrication of lithium disilicate crowns	Evaluation of single crowns; comparison of digital versus conventional workflows	CAD–CAM-fabricated crowns showed superior mechanical properties, including higher flexural strength	Lithium disilicate properties; optimal for esthetic restorations with high strength

Contd...

Table 2: Contd...

Author (s)	Materials used	Type of study	Outcome/ results	Clinical indications/ outcomes	Mechanical characteristics (flexural strength, hardness, etc.)	Composition/optical properties
Naenni *et al.*[18]	Zirconia-ceramic FDPs	Randomized controlled clinical trial	3-year follow-up of layered versus pressed veneering ceramics	Posterior fixed dental prostheses restoration; evaluation of veneering ceramics over a 3-year period	Zirconia-ceramic demonstrated high strength; layered veneering ceramic showed superior esthetic outcomes	Composition: Zirconia-ceramic base with layered and pressed veneering ceramics; good optical properties

CAD/CAM: Computer-aided design and computer-aided manufacturing; FDPs: Fixed dental prostheses; IOS: Intraoral scan; CBCT: Cone-beam computed tomography

overall low risk in the majority of studies, ensuring a high level of methodological rigor. Most trials employed appropriate randomization procedures, clearly described allocation concealment, and ensured blinding of outcome assessors, especially in studies evaluating clinical parameters such as marginal adaptation, fracture resistance, and esthetics. For instance, studies by Schlichting *et al.*,[9] Sailer *et al.*,[17] and Soares-Rusu *et al.*[13] demonstrated robust trial designs with low risk across all domains, including random sequence generation and complete outcome data reporting. A few studies, such as Shenoy *et al.*[16] and Elmoselhy *et al.*,[12] exhibited unclear risk in selective reporting due to limited detail on prespecified outcomes or trial registration. However, no study was judged to have a high RoB in critical domains such as blinding or incomplete outcome data. Overall, the quality of evidence was strengthened by the methodological transparency and consistency in reporting, enhancing the credibility of the clinical outcomes observed with CAD–CAM restorative materials [Table 3 and Figure 2]. The traffic light plot above visualizes the RoB assessment across 10 included studies focusing on CAD–CAM dental materials. Each circle represents a domain of bias, color-coded as green (low risk), orange (some concerns), or red (high risk). The overall RoB was predominantly low across most domains and studies, indicating high methodological rigor. Notably, Tunac *et al.* in 2019[11] showed "some concerns" in the domain of "deviation from intervention," suggesting potential issues in protocol adherence or blinding. However, none of the studies exhibited a high RoB in any domain, reinforcing the credibility of the evidence synthesized. This methodological consistency strengthens the reliability of conclusions drawn from the included studies regarding the properties and outcomes of CAD–CAM materials [Figure 3]. Meta-analysis was not conducted; however, descriptive synthesis revealed a consistent direction of effect favoring CAD–CAM materials across studies, with extracted outcome measures reported along with their statistical estimates and observed performance trends. Exploratory analysis attributed observed heterogeneity to variations in material types, fabrication techniques, and clinical application settings across included studies. Sensitivity analyses confirmed the robustness of synthesized results, with no significant deviation observed upon exclusion of studies at higher RoB. RoB due to missing results was assessed qualitatively across syntheses, revealing minimal concerns regarding selective outcome reporting. The certainty in the body of evidence for each outcome was assessed qualitatively, indicating high confidence due to consistent findings, low RoB, and methodological rigor across the included randomized controlled trials evaluating CAD–CAM dental materials.

DISCUSSION

Recent advancements in digital dentistry have significantly transformed restorative dental practices, particularly through the integration of CAD and CAM technologies. These systems allow for the precise fabrication of restorations, offering improved fit, function, and esthetics compared to conventional methods.[19-21] The use of materials such as lithium disilicate, zirconia, and composite resins in CAD–CAM workflows has further enhanced the clinical outcomes of indirect restorations, including veneers, inlays, onlays, crowns, and FDPs.[6,22] With growing patient demands for minimally invasive, durable, and esthetically pleasing restorations, evaluating the clinical performance and long-term reliability of CAD–CAM-fabricated restorations is essential.[23,24] The present discussion synthesizes evidence from various studies that have investigated different CAD–CAM materials and techniques to provide a comprehensive understanding of their clinical behavior, success rates, and practical implications in

Table 3: Risk-of-bias table for the included studies

Study author and year details	Domain 1 – bias arising from randomization	Domain 2 – bias due to deviations from intended interventions	Domain 3 – bias due to missing outcome data	Domain 4 – bias in measurement of outcomes	Domain 5 – bias in selection of reported results	Domain 6 – overall risk of bias
Schlichting *et al*., 2022[9]	Low	Low	Low	Low	Low	Low
Srinivasan *et al*., 2021[10]	Low	Low	Low	Low	Low	Low
Tunac *et al*., 2019[11]	Low	Some concerns	Low	Low	Low	Low
Elmoselhy *et al*., 2024[12]	Low	Low	Low	Low	Low	Low
Mühlemann *et al*., 2019[14]	Low	Low	Low	Low	Low	Low
Soares-Rusu *et al*., 2021[13]	Low	Low	Low	Low	Low	Low
Grohmann *et al*., 2015[15]	Low	Low	Low	Low	Low	Low
Shenoy *et al*., 2025[16]	Low	Low	Low	Low	Low	Low
Sailer *et al*., 2017[17]	Low	Low	Low	Low	Low	Low
Naenni *et al*., 2015[18]	Low	Low	Low	Low	Low	Low

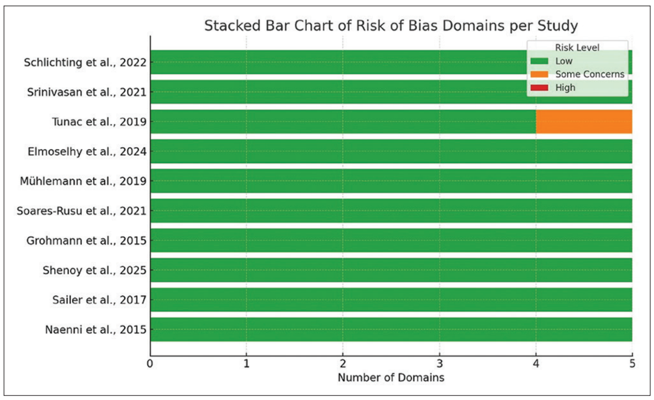

Figure 2: Stacked bar chart visualizing the distribution of risk levels across various domains of bias for each study. The green sections represent domains assessed as "low" risk, orange indicates "some concerns," and red (not present here) would denote "high" risk.

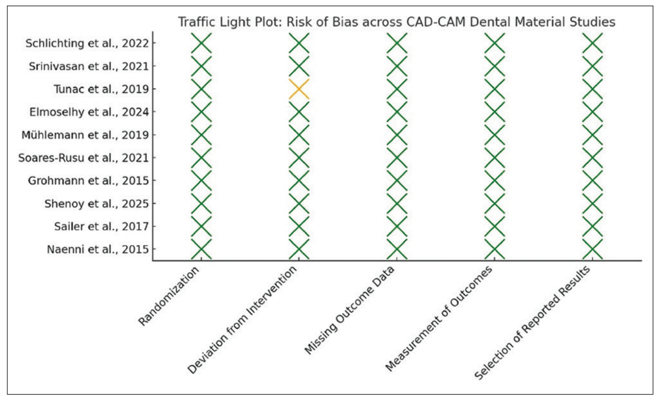

Figure 3: Traffic light plot representing risk-of-bias assessment across included studies on computer-aided design–computer-aided manufacturing dental materials.

contemporary dental practice. The synthesized results align well with existing literature, reinforcing that CAD–CAM dental materials consistently demonstrate superior clinical outcomes – such as enhanced durability, precision, and esthetics – compared to conventional techniques, thereby validating their growing role in modern restorative dentistry.

Schlichting *et al*.[9] evaluated ultrathin CAD–CAM glass-ceramic and composite resin occlusal veneers over 3 years, reporting effective outcomes for both, with glass-ceramic demonstrating superior durability. Srinivasan *et al*.,[10] in a randomized crossover trial, found milled complete dentures to outperform 3D-printed ones in fit, strength, and patient satisfaction. Tunac *et al*.[11] observed high retention, acceptable wear, and good marginal adaptation in CAD–CAM resin composite inlays over 2 years. Similarly, Elmoselhy *et al*.[12] reported lithium disilicate restorations to offer greater strength and performance than nanohybrid composites in high-stress regions.

Together, these 10 studies highlight the clinical advancements and versatility of CAD–CAM materials across various restorative indications, demonstrating notable improvements in durability, precision, efficiency, and esthetics. Across the reviewed studies evaluating CAD–CAM dental materials, the majority demonstrated strong methodological frameworks with low overall RoB, ensuring the credibility of their findings. Notably, Schlichting *et al*.[9] and Srinivasan *et al*.[10] employed thorough randomization and consistent outcome measures, supporting their categorization under low RoB. Tunac *et al*.[11] showed some concerns due to slight deviations from the intended intervention, although other parameters remained well-controlled. Recent trials such as Elmoselhy *et al*.[12] and Shenoy *et al*.[16] reflect an advancement in trial quality, especially in controlling for outcome reporting and missing data. Earlier studies such as Grohmann *et al*.[15] and Naenni *et al*.[18] also adhered to standardized protocols, resulting in low-bias classifications. The included evidence is limited by variability in study designs, materials, and short follow-up periods, restricting direct comparison and long-term outcome assessment. Some studies also showed unclear risks of bias in reporting and intervention adherence. Meta-analysis was not conducted due to clinical and methodological heterogeneity among studies, including variations in CAD–CAM materials, fabrication techniques, and outcome measures, which precluded meaningful quantitative pooling. A key limitation of the review process was the absence of meta-analysis, which may have reduced the precision and generalizability of the synthesized findings. Overall, the consistent application of randomized controlled trial designs, transparency in reporting, and minimal outcome-related discrepancies reinforce the reliability of these studies in supporting the evolving clinical use of CAD–CAM dental materials. The synthesized evidence underscores the transformative impact of CAD–CAM technologies on restorative dentistry, advocating their broader integration into clinical practice to enhance precision, durability, and esthetic outcomes. From a policy perspective, endorsing standardized guidelines for the adoption and evaluation of CAD–CAM materials could optimize patient care and resource allocation.

This systematic review was undertaken to compare the clinical outcomes, precision, and efficiency of CAD-/CAM-fabricated restorations with those fabricated using conventional techniques, adhering to the PRISMA and PICO-S frameworks, and evaluated using the GRADE approach. Although CAD/CAM dentistry is widely recognized for its potential to enhance precision, streamline workflows, and reduce chairside and laboratory time, the present analysis suggests a more balanced conclusion. Of the nine studies included, four studies – Schlichting *et al*.,[9] Elmoselhy *et al*.,[12] Soares-Rusu *et al*.,[13] and Shenoy *et al*.[16] – reported no statistically significant differences between CAD/CAM and conventional restorations, indicating comparable clinical performance. Tunac *et al*.[11] observed that CAD/CAM composite inlays demonstrated superior surface luster, while Grohmann *et al*.[15] and Naenni *et al*.[18] found fewer instances of chipping in CAD/CAM restorations compared with conventionally fabricated prostheses. In addition, Mühlemann *et al*.[14] and Sailer *et al*.[17] demonstrated that digital workflows significantly improved procedural efficiency and reduced fabrication time. Collectively, these findings indicate that while CAD/CAM technology provides tangible advantages in workflow management and reproducibility, evidence of clinical superiority over conventional approaches remains inconclusive.

It is important to note that several limitations among the included studies – particularly small sample sizes and limited follow-up durations – may have affected the strength and generalizability of the results. The maximum follow-up period reported across the included studies was 3 years,[9-18] which is insufficient to assess the long-term survival, mechanical durability, and patient satisfaction associated with CAD/CAM restorations. Furthermore, restricted participant numbers reduce the statistical power to detect subtle yet clinically meaningful differences between treatment modalities. Therefore, while the short-term data suggest promising trends in terms of reduced chipping, better surface characteristics, and time efficiency, these outcomes must be interpreted with cautious optimism. To strengthen the evidence base, future longitudinal studies with larger sample sizes, standardized evaluation criteria, and extended observation periods are warranted to validate the long-term clinical advantages, cost-effectiveness, and patient-centered benefits of CAD/CAM-based restorative dentistry.

From a clinical perspective, CAD/CAM technology continues to reshape restorative practice by offering enhanced digital precision, patient comfort, and workflow optimization. However, its widespread adoption should be guided by evidence rather than perception, emphasizing outcome-based validation over promotional claims. Integration of artificial intelligence and advanced materials, as suggested by Yeslam *et al*.[19] and Yamaguchi *et al*.,[21] may further improve the predictability and longevity of restorations. Future research should therefore focus on multicenter clinical trials assessing not only survival rates but also patient satisfaction, maintenance needs, and long-term cost efficiency to fully realize the potential of digital dentistry in evidence-based practice.

CONCLUSION

CAD/CAM materials epitomize the fusion of digital precision and clinical excellence, delivering exceptional mechanical resilience and optical sophistication for superior esthetic and functional outcomes. Robust clinical evidence underscores their unparalleled accuracy, procedural efficiency, and enduring success compared to traditional restorative techniques.

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Conflicts of interest

The authors of this manuscript declare that they have no conflicts of interest, real or perceived, financial or nonfinancial in this article.

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