Comparative Clinical Effectiveness of Fiber-Reinforced Composites versus Traditional Restorative Materials in Endodontically Treated Posterior Teeth: A Systematic Review

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ABSTRACT

Background: Endodontically treated posterior teeth are vulnerable to fractures due to structural loss, making durable restorative materials essential for preserving strength and function. Fiber-reinforced composites have emerged as a promising alternative to traditional materials, offering potential improvements in strength and longevity. However, existing evidence remains inconclusive, emphasizing the need for thorough evaluation of their performance in clinical practice.

Aim: This systematic review aimed to evaluate the clinical performance of fiber-reinforced composites (FRCs) compared to traditional restorative materials in the restoration of endodontically treated posterior teeth, focusing on outcomes such as fracture resistance, marginal adaptation, and restoration survival rates.

Methodology: A comprehensive literature search was conducted across multiple databases (PubMed, Web of Science, Cochrane, Scopus) to identify randomized controlled trials (RCTs) and prospective clinical trials investigating the use of FRCs in the restoration of endodontically treated posterior teeth. Data extraction was performed using a standardized form. Continuous outcomes (e.g., fracture resistance, marginal adaptation) were summarized as mean differences (MD) with standard deviations (SD) and 95% confidence intervals (CI). Dichotomous outcomes (e.g., survival rates) were summarized using risk ratios (RR). The GRADE approach was used to assess the quality of evidence. Due to heterogeneity in study design and methodologies, results were synthesized narratively.

Results

Seven studies were included in the review, comprising three RCTs and four non-randomized clinical trials. FRCs consistently demonstrated superior fracture resistance and marginal adaptation compared to traditional restorative materials. However, survival rates of restorations were comparable between FRCs and conventional materials. The evidence regarding patient-reported outcomes was limited, and no long-term adverse effects were reported.

Conclusion

Fiber-reinforced composites provide better fracture resistance and marginal adaptation than traditional materials for restoring endodontically treated posterior teeth, though survival rates remain similar. The heterogeneity in study designs, small sample sizes, and limited long-term data highlight the need for further high-quality randomized controlled trials to confirm these findings.

Clinical Significance

Fiber-reinforced composites may offer enhanced clinical performance in terms of fracture resistance for posterior restorations, particularly in endodontically treated teeth. However, clinicians should consider the lack of long-term data and patient-reported outcomes when selecting restorative materials.
Keywords: Fiber-reinforced composites, endodontically treated teeth, fracture resistance, marginal adaptation, restoration survival, systematic review.

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INTRODUCTION

Endodontically treated posterior teeth are more prone to structural weakness and fractures due to the loss of natural tooth structure from both decay and restorative procedures. This vulnerability highlights the need for durable restorative materials that can reinforce the tooth's strength and ensure long-term functionality [1]. Traditionally, materials such as amalgam, composite resins, and crowns have been used to restore these teeth. However, each of these materials has limitations regarding mechanical properties, longevity, and the ability to prevent secondary caries and fractures [2].

Recent advances in dental materials have introduced fiber-reinforced composites (FRCs) as a promising alternative. These composites combine a polymeric matrix with fibers like polyethylene or glass, enhancing their mechanical properties. The fibers distribute stress more evenly along the tooth, improving load-bearing capacity and fracture resistance. Studies suggest that FRCs can modify stress patterns and prevent cracks, which is crucial for maintaining restoration durability in high-stress areas [3].

Fiber-reinforced composites offer improved mechanical properties compared to traditional materials. They resist fractures better and have a longer lifespan, addressing issues like secondary caries and structural failures more effectively [4]. Despite these advantages, there is a lack of systematic reviews focusing on their clinical performance. Existing studies often provide incomplete assessments, leaving gaps in understanding the true benefits and limitations of FRCs in real-world settings.

Although FRCs show potential, their clinical performance compared to other restorative materials is still debated [5]. Traditional particulate filler composites (PFCs) face issues such as polymerization shrinkage and lower fracture toughness, especially in larger restorations. FRCs have demonstrated improved mechanical properties, including higher tensile strength and better resistance to crack propagation, which is especially important for endodontically treated teeth. FRCs also show better marginal adaptation and reduced microleakage, crucial for the long-term success of restorations [6].

Given the mixed results in the literature and the need for high-quality evidence, a systematic review is necessary to evaluate FRCs comprehensively. Many studies report varying outcomes due to differences in study design, types of fibers used, and methodologies [7, 8]. This review aims to analyze the clinical performance and patient satisfaction with FRCs compared to traditional restorative materials, focusing on key outcomes like restoration survival rates, success rates, marginal integrity, and patient comfort and to assess the available scientific evidence on the effectiveness of fiber-reinforced dental composites compared to other restorative materials. This study aims to evaluate the advantages and limitations of fiber-reinforced composites in restoring endodontically treated posterior teeth, focusing on factors such as longevity, strength, marginal adaptation, fracture resistance, and patient satisfaction. The null hypothesis was that there would be no significant difference in clinical performance or patient satisfaction between fiber-reinforced composites and traditional restorative materials.

METHODOLOGY

2.1. Registration and Compliance

This systematic review was registered with PROSPERO (Approval number: CRD420251243786) and adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [9]. The data for this systematic review were analyzed to evaluate clinical performance outcomes (e.g., fracture resistance, marginal integrity) and patient satisfaction between fiber-reinforced composites (FRC) and traditional restorative materials.

2.2. Review Question and PICO Framework

The review question was: "Do fiber-reinforced dental composites demonstrate superior clinical performance compared to conventional restorative materials in the restoration of endodontically treated posterior teeth?"

The review aimed to address the above question using the PICO framework:

Population (P): Endodontically treated posterior teeth.

Intervention (I): Fiber-reinforced dental composites.

Comparison (C): Conventional restorative materials or techniques. Outcome (O): Clinical performance.

2.3. Eligibility Criteria

Inclusion Criteria

- Study Types: Clinical trials that evaluated fiber-reinforced composites used in endodontically treated posterior teeth.
- Population: Patients with endodontically treated posterior teeth.
- Intervention: Use of fiber-reinforced dental composites.
- Comparison: Conventional restorative materials or techniques.
- Outcomes: Clinical performance and patient satisfaction.
- Language and Date Range: Articles published in English from January 2000 to December 2023.

Exclusion Criteria

- Types of Studies Excluded: Systematic reviews, meta-analyses, in vitro studies, case reports, case series, opinion pieces, editorials, and abstracts lacking full text.
- Irrelevant Studies: Research involving animal studies and invitro studies unrelated to fiber-reinforced composites or the specified outcomes, and studies published before January 2000.

2.4. Outcome Measures

Primary Outcome Measures

The primary outcome measures for this study include fracture resistance, marginal adaptation (using Modified United States Public Health Service (USPHS) criteria), and survival rate of restorations.

Secondary Outcome Measures

The secondary outcome measures encompass success rate, patient satisfaction, incidence of secondary caries, radiographic outcomes, and functional outcomes related to masticatory function and overall oral health-related quality of life.

2.5. Literature Search Strategy

Information Sources

A thorough search was conducted across multiple databases:

- MEDLINE-PubMed
- Embase
- Web of Science
- Scopus
- Cochrane Library
- Google Scholar
- National Library of Medicine (NLM)

Gray literature sources, including BDTD, were also explored. References from selected articles were checked to identify additional relevant studies.

2.6. Search Terms

Keywords and Medical Subject Headings (MeSH) terms used in the search included:

- "Fiber-reinforced composite"
- "Short-fiber reinforced composite (SFRC)"
- "Endodontically treated teeth"
- "Fracture resistance"
- "Marginal adaptation"
- "Longevity"

Boolean operators ("AND" and "OR") were utilized to connect these terms, adjusted to suit the specific requirements of each database to ensure thorough and comprehensive coverage.

Search engine / database	Search Strategy
MedLine by PubMed	(("Endodontically Treated Tooth"[Mesh] OR "Endodontically Treated Teeth"[Title/Abstract] OR "Root Canal Treated Teeth"[Title/Abstract] OR "Nonvital Teeth"[Title/Abstract] OR "Nonvital Tooth"[Title/Abstract] OR "Endodontic Treatment"[Title/Abstract] OR "Pulp Necrosis"[Title/Abstract] OR "Pulpless Teeth"[Title/Abstract] OR "Devitalized Teeth"[Title/Abstract] OR "Restored Endodontically Treated Teeth"[Title/Abstract]) AND ("Fiber-Reinforced Composites"[Mesh] OR "Fiber-Reinforced Composite"[Title/Abstract] OR "FRC"[Title/Abstract] OR "Glass Fiber Composite"[Title/Abstract] OR "Polyethylene Fiber Composite"[Title/Abstract] OR "Fiber-Reinforced Dental Materials"[Title/Abstract] OR "Fiber-Reinforced Resin Composite"[Title/Abstract] OR "Fiber-Reinforced Restorations"[Title/Abstract] OR "Short Fiber-Reinforced Composite"[Title/Abstract] OR "Direct Fiber-Reinforced Composite Restorations"[Title/Abstract]) AND ("Composite Resins"[Mesh] OR "Composite Resin"[Title/Abstract] OR "Amalgam Restorations"[Title/Abstract] OR "Dental Amalgam"[Mesh] OR "Dental Crowns"[Mesh] OR "Crowns"[Title/Abstract] OR "Ceramic Crowns"[Title/Abstract] OR "Indirect Restorations"[Title/Abstract] OR "Direct Restorations"[Title/Abstract] OR "Bulk-Fill Composites"[Title/Abstract]) AND ("Patient Satisfaction"[Mesh] OR "Clinical Performance"[Title/Abstract] OR "Longevity"[Title/Abstract] OR "Fracture Resistance"[Title/Abstract] OR "Marginal Adaptation"[Title/Abstract] OR "Survival Rate"[Title/Abstract] OR "Success Rate"[Title/Abstract] OR "Marginal Integrity"[Title/Abstract] OR "Secondary Caries"[Title/Abstract] OR "Restoration Retention"[Title/Abstract]))
Web of Science	("endodontically treated teeth" OR "endodontically treated posterior teeth" OR "root canal treated teeth" OR "root filled teeth") AND ("fiber-reinforced composite" OR "fiber reinforced dental composite" OR "fiber-reinforced resin" OR "EverX Posterior" OR "FRC restorations") AND ("conventional restorative materials" OR "composite resin" OR "ceramic crowns" OR "PFC" OR "amalgam restorations") AND ("clinical performance" OR "fracture resistance" OR "restoration survival" OR "patient satisfaction" OR "oral health-related quality of life")
Scopus	(TITLE-ABS-KEY("endodontically treated teeth" OR "root canal treated teeth" OR "posterior teeth" OR "nonvital teeth") AND TITLE-ABS-KEY("fiber-reinforced composite" OR "fiber reinforced dental composite" OR "FRC restorations" OR "fiber-reinforced material" OR "EverX Posterior") AND TITLE-ABS-KEY("conventional restorative materials" OR "composite resin" OR "amalgam restorations" OR "ceramic crowns" OR "PFC" OR "traditional materials") AND TITLE-ABS-KEY("clinical performance" OR "fracture resistance" OR "restoration survival" OR "patient satisfaction" OR "OHRQoL" OR "marginal adaptation"))

Screening Process

2.7. Study Selection

Initial screening involved reviewing article titles and abstracts to determine relevance. Articles meeting preliminary criteria were selected for a full-text review.

Eligibility Assessment

Further assessment was conducted to ensure that studies met the inclusion and exclusion criteria, focusing on study design, population, intervention, and outcomes.

Data Extraction

Data were extracted by two reviewers using a standardized form. and any discrepancies were resolved through consensus. For graphical data, WebPlotDigitizer was used to extract numerical values. Extracted information included: - Authors and publication year

- Study design and study setting
- Sample details and characteristics
- Type of fiber-reinforced composite used
- Comparative materials
- Outcome measures
- Duration of assessment
- Blinding
- Follow up and retention
- Results
- Limitations

Disagreements were resolved by consulting a third reviewer.

Data were synthesized descriptively, summarizing the continuous outcomes (e.g., fracture resistance, marginal adaptation) as mean differences (MD) with standard deviations (SD) and confidence intervals (CI). Dichotomous outcomes (e.g., survival and success rates) were summarized using risk ratios (RR). The I^2 statistic was calculated to assess heterogeneity between studies, with an I^2 value above 40% indicating moderate to high heterogeneity. Appropriate statistical methods were employed to account for variability among studies and ensure robustness in the findings. It was preplanned to pool data with good similarity for quantitative analysis using Review Manager (RevMan, version 5.3, Copenhagen: The Nordic Cochrane Centre, The Cochrane Collaboration, 2014). The I^2 statistic was calculated to assess heterogeneity between studies, with an I^2 value above 40% indicating moderate to high heterogeneity. If I^2 was more than 50%, a random-effects model would be adopted. In cases of significant clinical and methodological heterogeneity among the included studies, a detailed narrative description of the findings was preplanned. Appropriate statistical methods were employed to account for variability among studies and ensure robustness in the findings.

Subgroup and Sensitivity Analysis

Subgroup analyses were planned based on material type, follow-up duration, and study design. Sensitivity analyses were conducted by excluding studies with a high risk of bias to assess the robustness of the findings. Additionally, the authors preplanned to use subgroup analysis for different interventions in a meta-analysis if applicable.

2.7. Quality Assessment

Biases in the included randomized clinical trials (RCTs) were evaluated using the Cochrane Collaboration's risk of bias (RoB 2) assessment tool. Non-randomized clinical trials (N-RCTs) were assessed using the ROBINS-I assessment tool. Two reviewers independently assessed the risk of bias, focusing on domains such as selection bias, performance bias, detection bias, attrition bias, reporting bias, and other sources of bias. Discrepancies were resolved through discussion or by consulting a third reviewer. Each study was classified as having low, medium, or high risk of bias based on the criteria.

Certainty of Evidence

The certainty of evidence for each outcome was evaluated using the GRADE (Grading of Recommendations Assessment, Development, and Evaluation) approach, categorizing the evidence as very low, low, moderate, or high. The risk of bias across studies and additional analyses were assessed, with publication bias evaluated using Egger's linear regression test and visually inspecting a contour-enhanced funnel plot if sufficient trials (> 10 trials) addressing the same intervention and outcome were aggregated.

RESULTS

3.1. Study Search and Selection

A total of 2151 records were identified from initial database searches, including PubMed, Web of Science, Cochrane, Embase, Scopus, and other sources. After removing duplicates, 89 studies were screened by title and abstract. Following screening, 85 reports were sought for full-text retrieval, of which 7 studies were assessed for eligibility. After applying exclusion criteria (e.g., inappropriate study design, population, or outcome measures), 7 studies were included in the qualitative and quantitative synthesis (Figure 1).

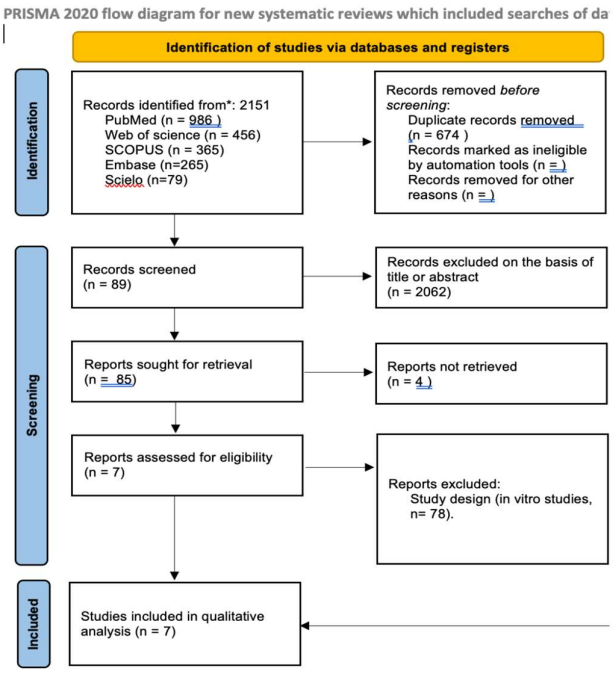

Figure 1: PRISMA flowchart

The included studies comprised 3 randomized controlled trials (RCTs) and 4 prospective clinical trials, evaluating the clinical performance of fiber-reinforced composites (FRCs) compared to traditional restorative materials in the restoration of endodontically treated posterior teeth. A total of 500 patients (age range 18–70 years) were analyzed, with outcomes measured over periods ranging from 6 months to 3 years.

Risk of Bias

The Cochrane Risk of Bias Tool (RoB 2) was used to assess the included RCTs. Among the 3 RCTs, 2 had some concerns regarding bias due to deviations from intended interventions, while 1 study was judged as low risk of bias. For the 4 prospective studies, the ROBINS-I tool indicated moderate risk of bias due to potential confounding and selection bias. The quality of available evidence using the GRADEpro[44] ranged between high for the randomized clinical trials [14,15] to moderate quality of evidence for the non-randomized clinical trials (figures 2-4).

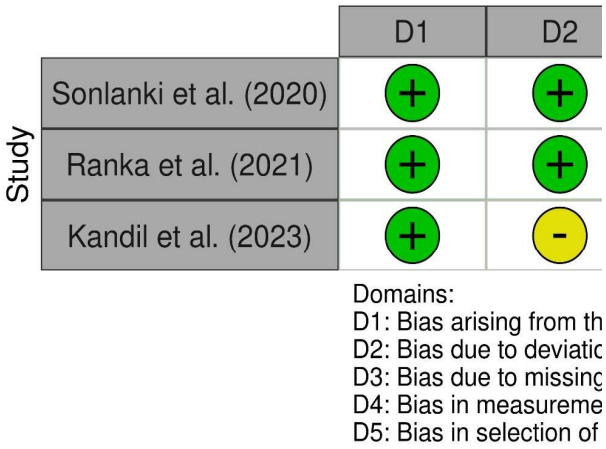

Figure 2: Quality assessment for RCTs based on Revised Cochrane risk of bias tool for randomized trials (RoB 2). RCT, randomized clinical trial.

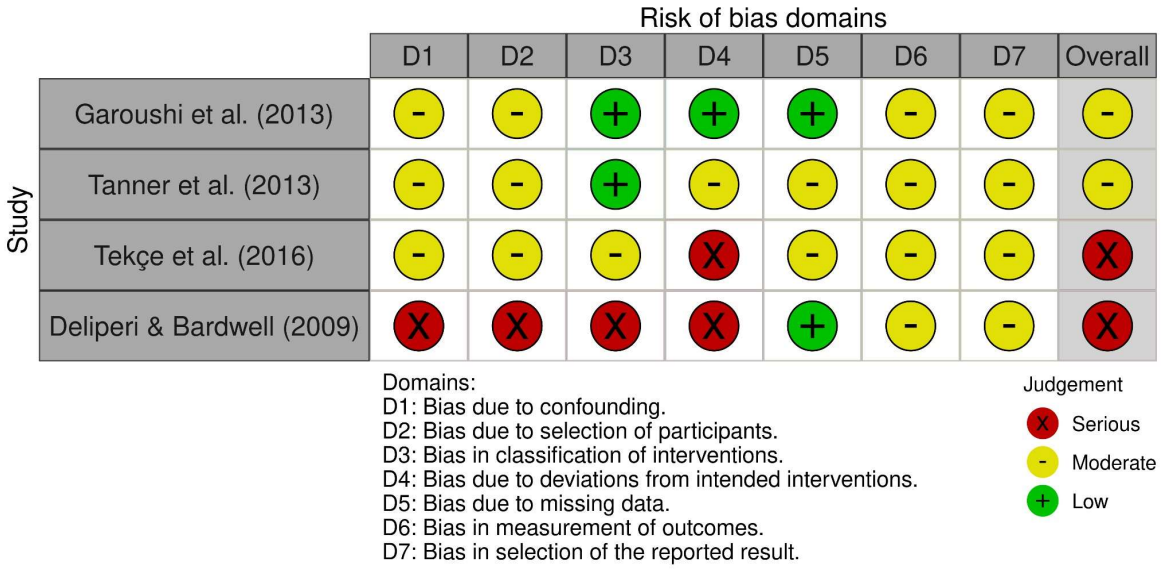

Figure 3: Quality assessment for N-RCTs based on ROBINS-I tool (Risk of Bias in Non-randomized Studies of Interventions). N-RCT, nonrandomized clinical trial.

Table 1: GRADE Assessment Table

Studies	Study Design	Quality assessment					Effect Quality	Overall Quality
		Risk of Bias	Inconsistency	Indirectness	Imprecision	Other		
Kandil et al. (2021)	RCT	Not serious	Not serious	Not serious	Not serious	-	++	⊕⊕⊕⊕High
Solanki et al. (2021) [10]	RCT	Not serious	Not serious	Not serious	Not serious	-	++	⊕⊕⊕⊕High
Garoushi S. et al. (2012)[11]	RCT	Serious	Not serious	Not serious	Serious	-	+	⊕⊕⊕◪Moderate
Tanner J. et al.	Non-RCT	Not serious	Not serious	Not serious	Not serious	-	++	⊕⊕⊕⊕High

(2018)[12]								
Tekçe et al. [13]	Non-RCT	Serious	Not serious	Not serious	Serious	-	+	⊕⊕⊕◯Moderate
Ranka et al. (2022)[14]	Non-RCT	Serious	Not serious	Not serious	Serious	-	+	⊕⊕⊕◯Moderate
Deliperi et al. (2009) [15]	Non-RCT	Serious	Serious	Serious	Serious	-	+	⊕⊕◯◯Low

Quantitative Synthesis of Results

Due to the heterogeneity in the design and methodologies of the included trials, it was not feasible to pool the results quantitatively or conduct subgroup analyses. Therefore, the findings are presented in a narrative format in this review.

Results of Individual Studies

The results and parameters of the individual studies are summarized in Table 2

Fracture Resistance

The methods for assessing fracture resistance varied across the included studies. **Garoushi et al. (2012)** measured the fracture resistance of restorations using a modified United States Public Health Service (USPHS) criteria, focusing on marginal integrity and bulk fracture. In their study, the majority of restorations received an "A" score, indicating optimal performance, with only minor marginal leakage reported. Solanki et al. (2022) compared Ever-X Posterior (a premixed glass fiber-reinforced composite) to Interlig, measuring the prevention of tooth fractures. Ever-X Posterior performed significantly better in preventing tooth fractures, though there were no significant differences in marginal discoloration or integrity between the groups.

Marginal Adaptation

Marginal adaptation was assessed in studies like Tanner et al. (2018), who evaluated restorations using a modified USPHS criteria, photographs, and X-rays. Results showed a high survival rate (97.2%) and a success rate of 88.9%, with three minor fractures and some superficial marginal discoloration observed. Kandil et al. (2021) also used the USPHS criteria to evaluate the marginal adaptation of restorations, finding no significant differences between Ever-X Posterior and G-aenial Posterior, except in color match, which favored G-aenial Posterior.

Survival Rates

The survival rates of restorations were reported in several studies. Tanner et al. (2018) found that 97.2% of the restorations remained intact over a follow-up period averaging 30.6 months. Deliperi et al. (2009), in a pilot study, reported 100% retention of restorations, with no failures observed over one year of follow-up.

Secondary Outcomes

Only Solanki et al. (2022) measured secondary outcomes, including fracture of the core build-up, tooth fracture, and secondary caries. They found that Ever-X Posterior was superior in preventing tooth fractures compared to Interlig. None of the other included studies reported secondary outcomes such as cost, total treatment duration, or patient-reported outcomes. Additionally, no adverse effects related to the use of fiber-reinforced composites were noted in any of the included studies

Table 2: Characteristics of included studies

Author Name	Study Design	Study Setting	Sample Size	Sample Characteristics	Type of fiber-reinforced composite used	Comparison Groups	Outcome measures	Duration of Assessment	Blinding	Follow-up and Retention	Limitations	Results Obtained
Garoushi S. et al (2012)	Preliminary clinical trial [Prospective]	Private practice, Finland	37	Adult patients, molars, premolars, specific occlusion and exclusion criteria	Short fiber-reinforced composite resin + hybrid composite	N/A	Modified USPHS criteria, photographs, X-rays	12 months	Not specified	Not specified	Short-term duration, limited sample size, multi-center variations	Majority of restorations exhibited A scores; minor issues with marginal leakage, no secondary caries or bulk fracture
Tanner J. et al. (2018)	Clinical trial [Prospective]	Private practice, Finland	36 restorations in 33 patients	Molars and premolars, vital and non-vital teeth	Short fiber-reinforced composite (SFRC) restorations	N/A	Modified USPHS criteria, photographs, X-rays	Average 30.6 months (2.5 years), 16.2-51.3 months	Not specified	Not specified	Short follow-up period, lack of control group, variations in patient selection and restoration manufacturing	97.2% survival rate, 88.9% success rate, one restoration failure, three minor fractures, superficial marginal discoloration in seven cases
Tekce et al. (2020)	Prospective clinical trial	Not specified	24 patients (mean age 32.5 years)	Endodontically treated molars	G-aenial Bond/fiber-reinforced composite (everX Posterior GC)	G-aenial Bond/microhybrid composite (G-aenial Posterior)	Modified USPHS criteria, photographs, X-rays	3 years	Not specified	1-, 2-, and 3-year follow-ups	Small sample size, lack of blinding, potential bias in patient selection	78.3% success rate for everX Posterior, 91.3% for G-aenial Posterior, higher failure rate for everX due to fractures

Solanki et al. (2022)	Randomized Clinical Trial (RCT)	University setting, India	50 participants (25 in each group)	Patients aged 18-60 years with deep occlusal carious lesions requiring root canal treatment	Ever-X Posterior (premixed glass fiber-reinforced composite)	Interlig (E-glass fibers mixed with nanohybrid composite)	Modified USPHS criteria: marginal discoloration, marginal integrity, fracture of core build-up, tooth fracture, and secondary caries	Evaluated at 3 months, 6 months, and 1 year	Doubleblinded (both patient and evaluator unaware of materials used)	10 participants did not return for follow-up, resulting in a 20% dropout rate; final analysis included 40 participants	Short follow-up period, limited to specific restoration types (deep occlusal carious lesions)	Ever-X Posterior performed significantly better in preventing tooth fractures compared to Interlig, with no significant differences in other outcomes (e.g., marginal discoloration, marginal integrity)
Ranka et al. (2022)	Randomized Clinical Trial (RCT)	University setting, India	50 participants (25 in each group)	Patients aged 18-60 years with permanent molars having class I defects requiring primary endodontic treatment	EverX Posterior (packable composite) with SolareX (nano-hybrid composite)	EverX Flow (flowable composite) with G-aenial Universal Injectable (flowable composite)	Modified USPHS criteria (e.g., anatomic contour, marginal discoloration, fracture)	Evaluated at baseline, 6 months, and 1 year	Doubleblinded (co-investigator unaware of materials used)	3 participants lost to follow-up in Group A, 4 participants lost to follow-up in Group B	Small sample size, short follow-up period, limited to deep class I lesions requiring endodontic treatment	No statistically significant difference between the two groups in terms of clinical performance across all assessed outcomes
Kandil et al.(2021)	Randomized Clinical Trial (RCT)	University setting, Cairo University	56 participants	Endodontically treated lower molars with moderate remaining tooth structure, aged 18-55 years, both genders	Ever X Posterior (short fiber reinforced resin composite) covered by G-aenial Posterior	G-aenial Posterior resin composite only	Modified USPHS criteria for clinical evaluation (e.g., gross fracture, color match, marginal integrity, marginal discoloration)	6 months and 12 months	Not specified	Not specified	No significant differences in most outcomes except color match, which favored G-aenial Posterior	G-aenial Posterior favored in color match, no significant differences in other outcomes

Deliperi et al. (2009)	Pilot Clinical Study [Prospective]	Clinical Setting	30 patients (35 teeth)	Nonvital posterior teeth needing Class II fiber-reinforced composite restorations	Direct fiber-reinforced composite restorations	No direct comparison groups; historical data might be considered	Modified USPHS criteria	6 months and 1 year	Not specified	High retention; all 35 restorations evaluated	Short duration, lack of control group, small sample size	100% retention of restorations, no failures, radiographic improvements

DISCUSSION

Fiber-reinforced composites (FRCs) have gained attention for their potential to enhance the strength and longevity of dental restorations, especially in endodontically treated teeth [16, 17]. This systematic review aimed to assess the clinical performance of FRCs compared to traditional restorative materials. The included studies consisted of both randomized controlled trials (RCTs) and non-randomized prospective clinical trials. The evidence was evaluated using the GRADE approach, and the findings were presented narratively due to methodological heterogeneity across the studies. The review covered outcomes such as fracture resistance, marginal adaptation, and restoration survival rates.

The methods used to evaluate fracture resistance varied across the studies. The most common approach was the use of modified United States Public Health Service (USPHS) criteria [18], supplemented with radiographic analysis. Despite some variations in the specific measurements and timeframes used across the studies, FRCs generally demonstrated better fracture resistance and marginal adaptation compared to traditional materials [19]. However, some studies lacked appropriate blinding, and several studies reported inconsistent follow-up periods.

Fracture resistance was consistently superior in the FRC group, with Solanki et al. (2022) and Ranka et al. (2022) reporting significant differences in favor of FRCs. However, survival rates of restorations were similar between FRC and conventional materials, as reported in studies like Tanner et al. (2018) and Deliperi et al. (2009). These findings suggest that while FRCs may offer advantages in specific clinical parameters, their overall long-term performance remains comparable to that of traditional materials.

Strengths and Limitations

This review is strengthened by the inclusion of a mix of RCTs and non-randomized trials, providing a broader view of the evidence. The use of validated risk-of-bias tools and the GRADE approach to evaluate the quality of the evidence ensures a rigorous appraisal of the studies included. The narrative synthesis provides a comprehensive overview of the current evidence on FRCs, identifying key trends and areas for future research.

Despite the promising results, several limitations exist in the current body of evidence. The most prominent limitation is the heterogeneity in study design, including variations in sample sizes, follow-up periods, and the methodologies used to measure outcomes. This heterogeneity prevented the pooling of data for meta-analysis, limiting the ability to draw strong, quantitative conclusions. Furthermore, the included studies showed inconsistencies in reporting patient-reported outcomes, making it difficult to assess the impact of FRCs on patient satisfaction. Another limitation is the small sample sizes in many of the included studies, which may affect the generalizability of the results. Additionally, none of the studies assessed long-term adverse effects or costs associated with FRCs, which are crucial factors for clinical decision-making.

CONCLUSIONS

This systematic review provides moderate evidence that fiber-reinforced composites offer improved fracture resistance and marginal adaptation compared to traditional restorative materials in endodontically treated posterior teeth. However, survival rates appear to be comparable between FRCs and conventional materials. The evidence regarding patient satisfaction and long-term clinical performance remains inconclusive due to inconsistencies in study design and reporting. Further high-quality randomized controlled trials with larger

sample sizes and consistent methodologies are needed to confirm these findings and assess the long-term outcomes and cost-effectiveness of FRCs. Despite these limitations, the current evidence suggests that FRCs may be a viable option for improving the strength and durability of restorations in specific clinical contexts.

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