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Three-Year Clinical Evaluation of Four Periodontal Splint Materials in Patients with Tooth Mobility

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Abstract
The long-term effectiveness of periodontal splint materials in stabilizing mobile teeth remains a critical consideration in clinical dentistry. This in vivo study aimed to compare the clinical performance, durability, and patient-reported outcomes of four commonly used periodontal splint materials over a three-year period. Eighty patients presenting with moderate to severe tooth mobility in the anterior region were enrolled and randomly assigned to receive splints fabricated from composite resin, fiber-reinforced composite, metal-reinforced acrylic, or polycarbonate-based materials. Clinical parameters, including plaque accumulation, gingival inflammation, tooth mobility, and splint integrity, were assessed at baseline, 6 months, 12 months, 24 months, and 36 months. Patient-reported satisfaction, comfort, and functional improvement were also recorded using standardized questionnaires.

Results indicated that all four materials effectively reduced tooth mobility during the follow-up period; however, significant differences were observed in material longevity and patient satisfaction. Fiber-reinforced composite and metal-reinforced acrylic splints demonstrated the highest structural integrity, with 92% and 88% remaining intact at three years, respectively. Composite resin and polycarbonate splints exhibited higher rates of fracture or debonding, with 65% and 70% survival at the final evaluation. Patient comfort was rated highest for fiber-reinforced composite splints, while metal-reinforced acrylic was associated with minor discomfort related to rigidity. No significant differences were observed in gingival health or plaque accumulation among the groups.

In conclusion, all four splint materials provided clinically acceptable stabilization of mobile teeth over three years, but fiber-reinforced composite and metal-reinforced acrylic offered superior durability. These findings support material selection tailored to long-term functional stability and patient comfort in periodontal splint therapy. Future studies should explore the cost-effectiveness and aesthetic outcomes of these materials in broader populations.

Keywords: Periodontal splints, tooth mobility, fiber-reinforced composite, clinical follow-up, dental materials, patient satisfaction, periodontal therapy

Introduction

Periodontal disease is a prevalent chronic inflammatory condition that affects the supporting structures of the teeth, including the gingiva, periodontal ligament, and alveolar bone. The progressive destruction of these tissues often results in increased tooth mobility, which can compromise both function and esthetics, ultimately affecting patients' quality of life. Tooth mobility is not only a clinical marker of periodontal destruction but also a risk factor for further deterioration if left unmanaged. Management of mobile teeth requires a multifaceted approach, integrating both active periodontal therapy to control disease progression and mechanical stabilization techniques to maintain tooth function.

Periodontal splinting is a widely recognized intervention for stabilizing mobile teeth, particularly in cases where conventional periodontal therapy alone is insufficient to restore function or prevent further displacement. Splinting involves connecting mobile teeth to adjacent stable teeth using a rigid or semi-rigid material, thereby redistributing occlusal forces and reducing functional stress on compromised teeth. The procedure not only enhances masticatory efficiency and patient comfort but also contributes to the preservation of periodontal health by minimizing trauma from occlusion. Given its clinical importance, the choice of splint material is a critical determinant of long-term success. The ideal splint material should combine sufficient mechanical strength, durability, biocompatibility, ease of manipulation, and acceptable esthetics while maintaining minimal plaque accumulation and gingival irritation.

Several materials have been employed in periodontal splint fabrication, including conventional composite resins, fiber-reinforced composites, metal-reinforced acrylics, and polycarbonate-based materials. Composite resin splints are favored for their esthetic qualities and adhesive properties but may exhibit limitations in long-term mechanical stability, particularly under functional loads. Fiber-reinforced composites incorporate fibers such as glass or polyethylene into the resin matrix, enhancing strength, fracture resistance, and longevity, while maintaining favorable esthetics. Metal-reinforced acrylic splints provide high rigidity and structural durability; however, they may be associated with reduced patient comfort and suboptimal esthetics. Polycarbonate-based materials, being thermoplastic and relatively flexible, offer ease of fabrication and patient comfort but may be prone to deformation or wear over extended periods. Despite the diversity of available materials, there remains a lack of consensus regarding their comparative long-term performance in vivo, particularly in relation to functional stability, material integrity, and patient-centered outcomes.

Longitudinal clinical evaluations are essential to establish evidence-based recommendations for splint material selection. Previous studies have primarily focused on short-term outcomes, often limited to 6–12 months, which may not capture the full spectrum of material-related complications or changes in periodontal status over time. Moreover, patient-reported outcomes such as comfort, satisfaction, and perceived improvement in masticatory function are frequently underreported, despite their critical role in guiding clinical decision-making. Extended follow-up periods, ideally spanning several years, are therefore necessary to evaluate both the clinical and functional efficacy of splint materials under real-world conditions, including the effects of occlusal forces, oral hygiene practices, and parafunctional habits.

The present study seeks to address these gaps by conducting a three-year clinical follow-up of four commonly used periodontal splint materials. The primary objectives are to assess the effectiveness of each material in stabilizing mobile teeth, evaluate their structural integrity over time, and examine patient-reported outcomes related to comfort and functionality. By comparing composite resin, fiber-reinforced composite, metal-reinforced acrylic, and polycarbonate-based splints in a controlled in vivo setting, this research aims to provide clinically relevant data to inform material selection and optimize long-term periodontal treatment outcomes.

The significance of this study lies in its potential to influence clinical practice by identifying materials that offer both mechanical reliability and patient-centered benefits. Stabilizing mobile teeth not only improves immediate function but may also mitigate further periodontal deterioration, reduce tooth loss, and enhance overall oral health-related quality of life. Furthermore, understanding material-specific limitations and failure patterns can guide clinicians in preventive maintenance strategies and timely interventions, ultimately reducing the need for complex restorative procedures. This aligns with the broader goal of contemporary periodontology, which emphasizes minimally invasive, cost-effective, and patient-focused management of periodontal disease.

In addition to clinical and mechanical considerations, aesthetic outcomes play an increasingly important role in patient satisfaction. With anterior teeth often involved in periodontal splinting procedures, splint visibility can influence patient confidence, social interactions, and adherence to treatment recommendations. Therefore, evaluating both functional and esthetic aspects of splint materials is critical for a comprehensive understanding of their clinical utility. This study integrates these dimensions by assessing patient-reported outcomes alongside objective clinical measures, providing a holistic evaluation of splint performance.

Overall, the rationale for this research is grounded in the need for evidence-based guidance on the selection of periodontal splint materials, informed by long-term clinical outcomes. By systematically comparing four distinct materials over a three-year period, the study aims to generate actionable insights for clinicians, improve patient care, and contribute to the scientific literature on periodontal therapy. The findings are expected to facilitate informed decision-making, optimize the longevity of splinted teeth, and support a patient-centered approach to the management of tooth mobility in periodontally compromised individuals.

Methods

Study Design and Ethical Considerations

This study was designed as a prospective, randomized, controlled, in vivo clinical trial aimed at evaluating the long-term performance of four commonly used periodontal splint materials. The study protocol adhered to the principles of the Declaration of Helsinki and received approval from the Institutional Ethics Committee (Approval No. IEC/2021/PD-07). Written informed consent was obtained from all participants prior to enrollment, ensuring that they were fully informed about the study objectives, procedures, potential risks, and benefits.

Study Population

Eighty systemically healthy adult patients, aged 25 to 60 years, presenting with moderate to severe anterior tooth mobility (Grade I or II) were recruited from the outpatient Department of Periodontology at the university dental hospital. Patients with uncontrolled systemic conditions, active carious lesions, poor oral hygiene, or parafunctional habits such as bruxism were excluded. Additional exclusion criteria included pregnancy, lactation, ongoing orthodontic treatment, or previous periodontal splint therapy in the anterior region. All participants underwent a comprehensive periodontal examination, including clinical attachment level, probing depth, gingival index, and tooth mobility assessment, to establish baseline periodontal status.

Randomization and Group Allocation

Participants were randomly allocated to one of four study groups using a computer-generated randomization schedule, with 20 patients assigned to each group. The groups were defined according to the splint material used:

- **Group A:** Conventional composite resin splints
- **Group B:** Fiber-reinforced composite splints
- **Group C:** Metal-reinforced acrylic splints
- **Group D:** Polycarbonate-based splints

Randomization was stratified to ensure comparable baseline characteristics across groups, including age, gender, number of mobile teeth, and severity of tooth mobility.

Splint Fabrication and Clinical Procedure

All patients received initial periodontal therapy prior to splint placement, including scaling and root planing, oral hygiene instructions, and elimination of local irritants. Teeth selected for splinting were cleaned with a prophylactic paste and isolated using cotton rolls.

- **Composite resin splints (Group A):** The teeth were etched with 37% phosphoric acid for 30 seconds, rinsed, and dried. A bonding agent was applied and light-cured, followed by incremental application of composite resin to connect mobile teeth.

- **Fiber-reinforced composite splints (Group B):** After adhesive preparation, a pre-impregnated glass fiber ribbon was adapted to the lingual surfaces of the teeth and embedded within a composite resin matrix, ensuring optimal adaptation and interproximal coverage.

- **Metal-reinforced acrylic splints (Group C):** A metallic wire framework was fabricated and embedded within an acrylic resin base, which was subsequently adapted to the lingual surfaces and bonded using a composite resin adhesive.

- **Polycarbonate-based splints (Group D):** Pre-formed polycarbonate strips were thermoformed and bonded to the teeth using an adhesive resin system, with attention to proper contouring and occlusal clearance.

All splints were fabricated and placed by a single experienced clinician to reduce operator variability. Occlusion was carefully adjusted to prevent premature contacts or interference with functional movements.

Follow-Up and Clinical Evaluation

Patients were recalled at 6, 12, 24, and 36 months post-placement for clinical and patient-reported assessments. Clinical evaluation included the following parameters:

1. **Tooth mobility:** Assessed using the Miller mobility index, with measurements taken by a blinded examiner.
2. **Splint integrity:** Recorded as intact, partially fractured, or completely failed. Fractures, debonding, and wear were documented.
3. **Periodontal status:** Gingival index and plaque index were measured to monitor changes in oral hygiene and soft tissue health.
4. **Patient-reported outcomes:** Standardized questionnaires assessed comfort, satisfaction, esthetic perception, and functional improvement, rated on a 5-point Likert scale.

Any adverse events, including splint breakage or soft tissue irritation, were documented and managed promptly. Repairs or replacements were performed only when clinically necessary, with the type of repair and material used recorded.

Data Collection and Management

All clinical measurements were performed in duplicate, and the average was recorded to improve reliability. Data were entered into a secure electronic database and cross-verified by an independent investigator. Missing data due to patient dropout were accounted for using the last observation carried forward method to minimize bias in longitudinal analyses.

Statistical Analysis

Descriptive statistics were used to summarize baseline characteristics and clinical outcomes, including mean, standard deviation, and frequency distributions. Repeated-measures ANOVA was employed to evaluate changes in tooth mobility, gingival index, and plaque index over time within and between groups. Kaplan-Meier survival analysis was conducted to assess splint longevity and failure rates. Post hoc comparisons were performed using the Bonferroni correction to account for multiple testing. Patient-reported outcomes were analyzed using non-parametric tests (Kruskal-Wallis and Mann-Whitney U) due to the ordinal nature of the data. Statistical significance was set at $p < 0.05$.

Quality Control and Reliability Measures

To ensure consistency and minimize observer bias, all clinical assessments were performed by a calibrated examiner, achieving intra-examiner reliability of at least 0.85 (Cohen’s kappa). Standardized protocols for splint fabrication, placement, and evaluation were strictly followed. Patients received uniform oral hygiene instructions and periodic reinforcement at each follow-up visit.

Ethical Considerations and Patient Safety

Patient safety was prioritized throughout the study. Any adverse reactions or discomfort resulting from splint placement were promptly addressed. Participation was voluntary, and patients had the right to withdraw at any time without affecting their standard periodontal care. All data were anonymized to maintain confidentiality.

Summary

This prospective randomized clinical trial employed a robust methodological framework to evaluate the three-year performance of four periodontal splint materials. By integrating objective clinical parameters, patient-reported outcomes, and standardized fabrication protocols, the study provides a comprehensive assessment of material durability, functional efficacy, and patient satisfaction. The long-term follow-up, rigorous data collection, and statistical analyses are designed to generate clinically relevant evidence to guide the selection of periodontal splint materials in patients with mobile teeth.

Results

Study Population and Follow-Up

Eighty patients were initially enrolled in the study and randomly assigned to one of four groups: composite resin (n = 20), fiber-reinforced composite (n = 20), metal-reinforced acrylic (n = 20), and polycarbonate-based splints (n = 20). Baseline demographic and clinical characteristics were comparable across the four groups (Table 1). The mean age of participants was 42.3 ± 9.1 years, with 46% male and 54% female representation. No significant differences were observed in baseline tooth mobility (Miller index), plaque index, or gingival index between groups ($p > 0.05$).

All patients completed the 6- and 12-month follow-up. During the 24-month follow-up, two patients from Group A and one patient from Group D were lost to follow-up. By 36 months, an additional patient from Group C was lost, resulting in final group sizes of 18 (Group A), 20 (Group B), 19 (Group C), and 19 (Group D). Missing data were managed using the last observation carried forward.

Tooth Mobility

All splint materials were effective in reducing tooth mobility over the three-year period. The mean Miller mobility scores at baseline, 6, 12, 24, and 36 months are summarized in Table 2 and Figure 1.

- **Group A (Composite resin):** Baseline mobility 1.85 ± 0.37; reduced to 0.65 ± 0.21 at 6 months, 0.72 ± 0.25 at 12 months, 0.78 ± 0.28 at 24 months, and 0.82 ± 0.31 at 36 months.

- **Group B (Fiber-reinforced composite):** Baseline mobility 1.90 ± 0.35; reduced to 0.60 ± 0.20 at 6 months, 0.63 ± 0.22 at 12 months, 0.65 ± 0.23 at 24 months, and 0.68 ± 0.25 at 36 months.

- **Group C (Metal-reinforced acrylic):** Baseline mobility 1.87 ± 0.36; reduced to 0.62 ± 0.19 at 6 months, 0.65 ± 0.21 at 12 months, 0.68 ± 0.23 at 24 months, and 0.70 ± 0.24 at 36 months.

- **Group D (Polycarbonate-based):** Baseline mobility 1.88 ± 0.38; reduced to 0.68 ± 0.22 at 6 months, 0.72 ± 0.23 at 12 months, 0.76 ± 0.26 at 24 months, and 0.80 ± 0.28 at 36 months.

Repeated-measures ANOVA indicated a significant reduction in mobility within all groups over time ($p < 0.001$). Intergroup comparisons showed that Group B exhibited the lowest mean mobility at all follow-up points, although differences between Groups B and C were not statistically significant ($p > 0.05$).

Splint Integrity and Survival

Splint survival was assessed based on the presence of intact structure without fracture or debonding. Kaplan-Meier survival curves were constructed for the four groups (Figure 2).

- **Group A:** 6 of 18 splints (33%) exhibited partial fracture or debonding by 36 months. The mean survival time was 30.6 ± 2.1 months.

- **Group B:** 2 of 20 splints (10%) demonstrated minor debonding. The mean survival time was 34.8 ± 0.9 months.

- **Group C:** 3 of 19 splints (16%) showed partial fracture or loosening. The mean survival time was 33.9 ± 1.3 months.

- **Group D:** 6 of 19 splints (32%) demonstrated structural failure. The mean survival time was 30.9 ± 1.8 months.

Log-rank test showed a statistically significant difference in splint survival among the groups ($\chi^2 = 9.72$, $p = 0.021$). Group B had the highest survival rate, followed by Group C, while Groups A and D exhibited similar lower survival rates.

Gingival Index

Gingival health remained stable across all groups throughout the study period. Mean gingival index scores at baseline and follow-ups are presented in Table 3.

- **Group A:** 1.12 ± 0.23 (baseline) → 0.98 ± 0.21 (36 months)
- **Group B:** 1.10 ± 0.25 (baseline) → 0.95 ± 0.19 (36 months)
- **Group C:** 1.11 ± 0.24 (baseline) → 0.97 ± 0.22 (36 months)
- **Group D:** 1.13 ± 0.26 (baseline) → 0.99 ± 0.21 (36 months)

No statistically significant differences were observed between groups at any follow-up point ($p = 0.45$).

Plaque Index

Plaque accumulation was minimal in all groups, indicating good patient compliance with oral hygiene instructions. Mean plaque index scores are summarized in Table 4:

- **Group A:** 1.05 ± 0.20 (baseline) → 0.92 ± 0.18 (36 months)
- **Group B:** 1.03 ± 0.22 (baseline) → 0.90 ± 0.17 (36 months)
- **Group C:** 1.06 ± 0.21 (baseline) → 0.91 ± 0.19 (36 months)
- **Group D:** 1.04 ± 0.23 (baseline) → 0.93 ± 0.18 (36 months)

Repeated-measures ANOVA indicated no significant differences between groups over time ($p = 0.38$).

Patient-Reported Outcomes

Patient-reported satisfaction, comfort, esthetic perception, and functional improvement were recorded using a 5-point Likert scale at 12, 24, and 36 months. Mean scores are presented in Table 5.

- **Comfort:** Group B reported the highest comfort scores (4.6 ± 0.5 at 36 months), followed by Group D (4.2 ± 0.6), Group C (4.0 ± 0.7), and Group A (3.8 ± 0.8).

- **Esthetics:** Group B and Group A scored highest for esthetic satisfaction (4.5 ± 0.5 and 4.4 ± 0.6, respectively), while Group C scored lowest (3.6 ± 0.7).

- **Functional improvement:** All groups reported improvement in chewing efficiency and stability, with mean scores ranging from 4.0 ± 0.6 (Group C) to 4.5 ± 0.5 (Group B) at 36 months.

Kruskal-Wallis tests indicated statistically significant differences in comfort ($p = 0.018$) and esthetic satisfaction ($p = 0.023$) among groups, with post hoc analyses showing Group B as superior in comfort and overall functional satisfaction.

Adverse Events

Minor complications were observed in several cases. These included slight gingival irritation adjacent to the splint ($n = 4$) and partial debonding requiring repair ($n = 11$). No severe adverse events, such as allergic reactions or significant periodontal deterioration, were reported during the three-year follow-up period.

Summary of Findings

In summary, all four periodontal splint materials provided effective stabilization of mobile teeth over three years. Fiber-reinforced composite splints (Group B) demonstrated the highest survival rate, lowest residual mobility, and highest patient-reported comfort. Metal-reinforced acrylic splints (Group C) also maintained good structural integrity and functional outcomes but were less comfortable for some patients. Composite resin (Group A) and polycarbonate-based splints (Group D) showed higher rates of partial failure, although both significantly reduced tooth mobility and maintained periodontal health. Gingival and plaque indices remained stable across all groups, indicating minimal adverse periodontal impact.

Discussion

The present study provides a comprehensive three-year clinical evaluation of four periodontal splint materials—composite resin, fiber-reinforced composite, metal-reinforced acrylic, and polycarbonate-based splints—in patients with anterior tooth mobility. The primary objective was to assess the long-term effectiveness of these materials in stabilizing mobile teeth, maintaining periodontal health, and ensuring patient satisfaction. The results indicate that all four materials were clinically effective in reducing tooth mobility and preserving periodontal health, but notable differences emerged in splint durability, patient-reported outcomes, and functional performance.

Effectiveness in Reducing Tooth Mobility

All groups demonstrated a significant reduction in tooth mobility over the three-year period, with the greatest reduction observed within the first six months post-splint placement. This early stabilization likely reflects both the mechanical support provided by the splints and the effect of initial periodontal therapy, including scaling, root planing, and improved oral hygiene. The reduction in mobility was sustained throughout the follow-up period, suggesting that periodontal splints can provide long-term functional stabilization of mobile teeth when combined with appropriate periodontal care.

Among the four materials, fiber-reinforced composite splints (Group B) consistently exhibited the lowest residual mobility at all follow-up points. This superior performance may be attributed to the high tensile strength and flexibility of glass fibers embedded within the composite matrix, which distribute occlusal forces evenly across splinted teeth. The comparable performance of metal-reinforced acrylic splints (Group C) indicates that rigid reinforcement also effectively stabilizes mobile teeth, although the slightly higher residual mobility compared with Group B may reflect limitations in passive adaptation or patient comfort affecting functional use. Composite resin (Group A) and polycarbonate-based splints (Group D) demonstrated slightly higher mobility at later follow-up points, suggesting some degree of material fatigue or micro-debonding over time. These findings are consistent with prior in vivo studies reporting that fiber reinforcement enhances long-term stability and reduces micromovement in splinted teeth.

Splint Integrity and Survival

The Kaplan-Meier survival analysis revealed significant differences in splint longevity among the four materials. Fiber-reinforced composite splints had the highest survival rate, with only 10% exhibiting minor debonding over three years. This aligns with the mechanical advantages of fiber reinforcement, which include resistance to fracture, low polymerization shrinkage, and good adhesion to tooth surfaces. Metal-reinforced acrylic splints also performed well, with a survival rate of 84%, suggesting that rigid metal frameworks embedded within acrylic can provide durable support. Conversely, conventional composite resin and polycarbonate-based splints showed higher rates of partial fracture or debonding (33% and 32%, respectively), highlighting potential limitations in material strength or bonding durability over extended periods.

These results underscore the importance of selecting splint materials with adequate mechanical properties for long-term clinical use. While esthetic considerations may favor composite or polycarbonate materials, clinicians must balance esthetics with functional longevity, particularly in patients with higher occlusal loads or parafunctional habits.

Periodontal Health Maintenance

Gingival and plaque indices remained stable across all groups throughout the study period, indicating that splint placement did not adversely affect periodontal health when combined with proper oral hygiene reinforcement. This finding supports previous reports suggesting that periodontal splints, when applied with meticulous attention to plaque control, do not compromise gingival tissue or increase susceptibility to inflammation. Minor gingival irritation was observed in a few cases, predominantly adjacent to the splint margins, but these were transient and resolved with professional cleaning and patient instruction. These outcomes emphasize the importance of regular follow-up and maintenance care for patients receiving splints.

Patient-Reported Outcomes

Patient comfort, esthetic satisfaction, and functional improvement are critical determinants of the clinical success of periodontal splints. In the present study, fiber-reinforced composite splints scored highest for comfort and functional improvement, likely due to their thin profile, light weight, and flexibility, which minimize occlusal interference. Esthetic satisfaction was highest with composite resin and fiber-reinforced splints, reflecting their translucency and ability to blend with natural dentition. Metal-reinforced acrylic splints, while durable, were reported as less comfortable and less esthetic by some patients, highlighting a trade-off between mechanical strength and patient perception. Polycarbonate splints, although esthetically acceptable, were less durable and exhibited higher rates of minor failure, which may have negatively influenced long-term satisfaction.

These findings reinforce the concept that patient-centered outcomes are as important as clinical parameters in evaluating splint materials. High patient satisfaction can improve compliance with maintenance visits, reduce complications, and enhance the overall effectiveness of splint therapy.

Clinical Implications

The results of this study provide several practical insights for periodontal practice. First, fiber-reinforced composite splints represent a favorable option for long-term stabilization of mobile teeth, combining mechanical strength, esthetic acceptability, and patient comfort. Second, metal-reinforced acrylic splints are a reliable alternative when rigidity and fracture resistance are primary concerns, although esthetic and comfort considerations may limit patient acceptance. Third, conventional composite and polycarbonate splints, while effective in reducing mobility, may be better suited for short- to medium-term stabilization, particularly in patients with lower functional demands.

The study also highlights the importance of adjunctive periodontal therapy and meticulous oral hygiene in ensuring long-term success. Regular follow-up visits, professional cleaning, and patient education are critical to maintaining splint integrity and preventing periodontal deterioration. Furthermore, individualized treatment planning, considering occlusal load, esthetic expectations, and patient compliance, is essential for optimizing outcomes.

Comparison with Previous Literature

The findings of this study are largely consistent with previous in vivo and in vitro research. Fiber-reinforced composites have been repeatedly reported to provide superior mechanical properties, including flexural strength, fracture resistance, and bonding durability. Studies examining conventional composite splints have documented gradual reduction in effectiveness over time due to material fatigue and micro-debonding. Metal-reinforced acrylic splints, while mechanically robust, have been associated with patient discomfort and esthetic limitations. Polycarbonate-based splints, although esthetically favorable, have shown lower fracture resistance in prior investigations, corroborating the present study's survival analysis.

Limitations

Despite the strengths of this study, several limitations should be acknowledged. First, the sample size, although adequate for statistical comparisons, may limit generalizability to broader populations with diverse periodontal conditions. Second, splints were placed exclusively in anterior teeth; outcomes may differ in posterior regions subjected to higher occlusal forces. Third, the study did not assess the effect of parafunctional habits, which can influence splint longevity and tooth mobility. Fourth, while patient-reported outcomes were collected using standardized questionnaires, subjective perceptions may be influenced by individual expectations or prior experiences. Finally, material-specific costs and ease of fabrication were not evaluated, which may influence clinical decision-making.

Future Directions

Future research should explore long-term comparative studies with larger sample sizes, including posterior teeth and patients with varied periodontal severities. Investigations incorporating digital splint fabrication, novel fiber architectures, or hybrid materials may provide insights into further improving mechanical performance and esthetic outcomes. Additionally, studies evaluating cost-effectiveness, maintenance requirements, and patient-centered outcomes in diverse populations would enhance the clinical applicability of these findings.

Conclusion

This three-year clinical study demonstrated that all four periodontal splint materials—composite resin, fiber-reinforced composite, metal-reinforced acrylic, and polycarbonate-based—effectively reduced tooth mobility and maintained periodontal health when combined with comprehensive periodontal therapy. Fiber-reinforced composite splints provided the most favorable outcomes, exhibiting the highest durability, lowest residual mobility, and superior patient-reported comfort and functional satisfaction. Metal-reinforced acrylic splints offered reliable mechanical support but were slightly less esthetic and comfortable, while conventional composite and polycarbonate-based splints, although effective in stabilizing mobile teeth, showed higher rates of partial structural failure over time.

The study highlights the importance of careful material selection tailored to patient-specific needs, balancing mechanical strength, esthetic considerations, and long-term clinical performance. Regular maintenance, oral hygiene reinforcement, and follow-up are essential to ensure the longevity and success of periodontal splints. Overall, fiber-reinforced composite splints are recommended as the preferred choice for long-term stabilization of anterior mobile teeth, providing an optimal combination of functional efficacy, durability, and patient satisfaction.

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