Pesquisa Brasileira em Odontopediatria e Clínica Integrada 2025; 25:e230199
https://doi.org/10.1590/pboci.2025.013
ISSN 1519-0501 / eISSN 1983-4632

ORIGINAL ARTICLE

Orthodontic Retention Protocols: Evaluating the Effectiveness of Different Retention Protocols in Maintaining Post-Treatment Tooth Alignment

Snigdha Pattanaik[1], Vishnu Priya Veeraraghavan[2], Arun Kumar Dasari[3], Kaladhar Reddy Aileni[4], Santosh Rayagouda Patil[5]

[1]Department of Orthodontics, Pediatric and Community Dentistry, College of Dental Medicine, University of Sharjah, Sharjah, United Arab Emirates.

[2]Centre of Molecular Medicine and Diagnostics, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, Tamil Nadu, India.

[3]Department of Orthodontics, SVS Institute of Dental Sciences, Mahabubnagar, Telangana, India.

[4]Department of Preventive Dentistry, College of Dentistry, Jouf University, Sakaka, Saudi Arabia.

[5]Department of Oral Medicine and Radiology, Chhattisgarh Dental College & Research Institute, Chhattisgarh, India.

Corresponding author: Santosh R. Patil **E-mail:** drpsantosh@gmail.com

Academic Editor: Alessandro Leite Cavalcanti

Received: October 19, 2023 / **Review:** April 20, 2024 / **Accepted:** April 30, 2024

How to cite: Pattanaik S, Veeraraghavan VP, Dasari AK, Aileni KR, Patil SR. Orthodontic retention protocols: Evaluating the effectiveness of different retention protocols in maintaining post-treatment tooth alignment. Pesqui Bras Odontopediatria Clín Integr. 2025; 25:e230199. https://doi.org/10.1590/pboci.2025.013

ABSTRACT

Objective: To evaluate the effectiveness of various orthodontic retention protocols, including removable retainers, fixed retainers, and a combination of both. **Material and Methods:** A cohort of orthodontic patients (n=240) was divided into four groups: Removable Retainer Group, Fixed Retainer Group, Combination Protocol Group, and Control Group. Tooth alignment stability, patient satisfaction, compliance, and adverse event occurrence were assessed over two years. Data analysis included regression analysis and comparisons between groups. **Results:** Fixed retainers demonstrated superior effectiveness in maintaining tooth alignment stability compared to removable retainers and the combination protocol, with the slightest deviation from baseline alignment. The Fixed Retainer Group also reported the highest patient satisfaction and compliance rates. Adverse events and complications, such as retainer breakage and discomfort, were more frequent in the Removable Retainer Group. **Conclusion:** Fixed retainers offer superior tooth alignment stability, patient satisfaction, and compliance, while adverse events are relatively infrequent and manageable. However, patient preferences and needs should be considered when choosing the most appropriate retention strategy.

Keywords: Orthodontics; Therapeutics; Orthodontic Retainers; Orthodontic Appliances, Fixed.

Introduction

Orthodontic treatment aims to achieve optimal tooth alignment and occlusion [1]. However, the success of orthodontic interventions is not solely determined by the treatment phase; long-term stability and maintenance of the results are equally vital considerations in achieving treatment goals [2]. Post-treatment orthodontic retention plays a pivotal role in preserving the hard-earned alignment of teeth, preventing relapse, and ensuring the durability of the treatment outcome [3].

Orthodontic retention protocols encompass a spectrum of strategies, including removable retainers, fixed retainers, and combinations thereof, each with advantages and drawbacks [4]. An appropriate retention protocol should be selected based on carefully considering patient preferences, compliance, and the orthodontist's clinical judgment [5]. Nevertheless, the fundamental objective of all retention strategies remains consistent: to preserve the alignment of teeth achieved during active orthodontic treatment [6].

Retention protocols have been a subject of considerable research and clinical discussion, with varying opinions on their effectiveness, patient acceptability, and impact on long-term stability. While numerous studies have evaluated different retention methods individually, there needs to be more comprehensive research directly comparing the efficacy and patient satisfaction associated with distinct retention protocols within the same study cohort.

The importance of comparing various retention strategies lies in the need to guide evidence-based decision-making in orthodontic practice. Understanding which retention protocols offer superior tooth alignment stability, patient satisfaction, and compliance can inform treatment planning and enhance the overall quality of care for orthodontic patients.

This study addresses this gap in the orthodontic literature by comprehensively evaluating the effectiveness of different orthodontic retention protocols in maintaining post-treatment tooth alignment. We will assess the outcomes of three distinct retention methods: removable retainers, fixed retainers, and a combination of both, compared to a control group without any retention protocol. This comparative approach will enable us to ascertain which protocol offers superior post-treatment tooth alignment stability while also considering patient satisfaction, compliance, and adverse events.

Through meticulous data collection, statistical analysis, and a multidimensional assessment, we aim to provide orthodontists and patients with valuable insights that can guide the selection of the most appropriate and effective retention protocol, ensuring the long-term success of orthodontic treatment.

Material and Methods

Study Design

This research employed a prospective cohort study design to assess the effectiveness of different orthodontic retention protocols in maintaining post-treatment tooth alignment. The study involved several stages, including participant recruitment, data collection, analysis, and reporting of the findings.

Ethical Considerations

This research study obtained approval from the Institutional Review Board (IRB) and adhered to all ethical guidelines and regulations regarding human research.

Participants

The inclusion criteria were as follows:

- Patients who had recently completed their orthodontic treatment.
- Patients aged between 15 and 30 years.
- Patients who agreed to provide informed consent.

Sample Size Calculation

Determining an appropriate sample size for this study involved several considerations to ensure robust results:

Statistical Power Determination: The concept of statistical power, denoting the probability of detecting actual effects, underscores the significance of adequately powered studies to minimize the likelihood of Type II errors. To uphold methodological soundness, we aimed for a minimum power threshold of 80%, a standard medical and dental research practice.

1. Type I Error Rate (α) Specification: The Type I error rate, symbolized by α, delineates the probability of erroneously rejecting the null hypothesis when it holds true. Adhering to conventions in scientific inquiry, we established α at 0.05, a customary significance level signifying a stringent criterion for asserting statistical significance.
2. Effect Size Estimation (Cohen's d): Cohen's d, a widely employed metric for quantifying effect size, is pivotal in gauging the substantive differences between groups under investigation. Grounded in existing orthodontic literature and expert consensus, we conservatively approximated a moderate effect size of 0.5, indicative of meaningful distinctions in post-treatment tooth alignment outcomes.
3. Consideration of Variability: Variability, encompassing individual treatment responses and measurement errors within the study cohort, necessitated meticulous scrutiny. Leveraging insights gleaned from pilot data analyses, we meticulously estimated the anticipated variability in post-treatment tooth alignment measurements.

By synthesizing these critical components within our sample size determination framework and conducting a rigorous power analysis, we derived a requisite sample size of $n = \frac{2(Z\alpha/2 + Z\beta)2.\sigma2}{d2}$, where n denotes the sample size, $Z_{\alpha/2,}$ and Z_{β} represents the critical values corresponding to the Type I and Type II error rates, σ^2 signifies the variance, and d represents the effect size. This judicious approach ensures the robustness and integrity of our statistical interferences and underscores our commitment to delivering clinically meaningful insights within the orthodontic domain.

We determined that a total sample size of 240 participants was required to detect statistically significant differences between the groups with sufficient power.

Group Allocation

To ensure that the study had a balanced representation of participants in each retention protocol group, we allocated participants as follows:

- Removable Retainer Group (RRG): This group comprised 60 participants who were provided with removable retainers as their retention protocol.
- Fixed Retainer Group (FRG): 60 participants received fixed retainers as their retention protocol.
- Combination Protocol Group (CPG): 60 participants received a combination of both removable and fixed retainers.

- Control Group (CG): 60 participants did not receive any retention protocol and served as the control group to assess natural post-treatment changes.

This distribution resulted in a total sample size of 240 participants, with each group representing a distinct retention protocol, i.e., Removable retainer (Figure 1), Fixed lingual retainer (Figure 2), Removable retainer in combination with Fixed lingual retainer (Figure 3) and No retention appliance (Figure 4). By having an equal number of participants in each group, we aimed to maintain balance and ensure that the statistical analysis would be adequately powered to detect differences between the retention protocols.

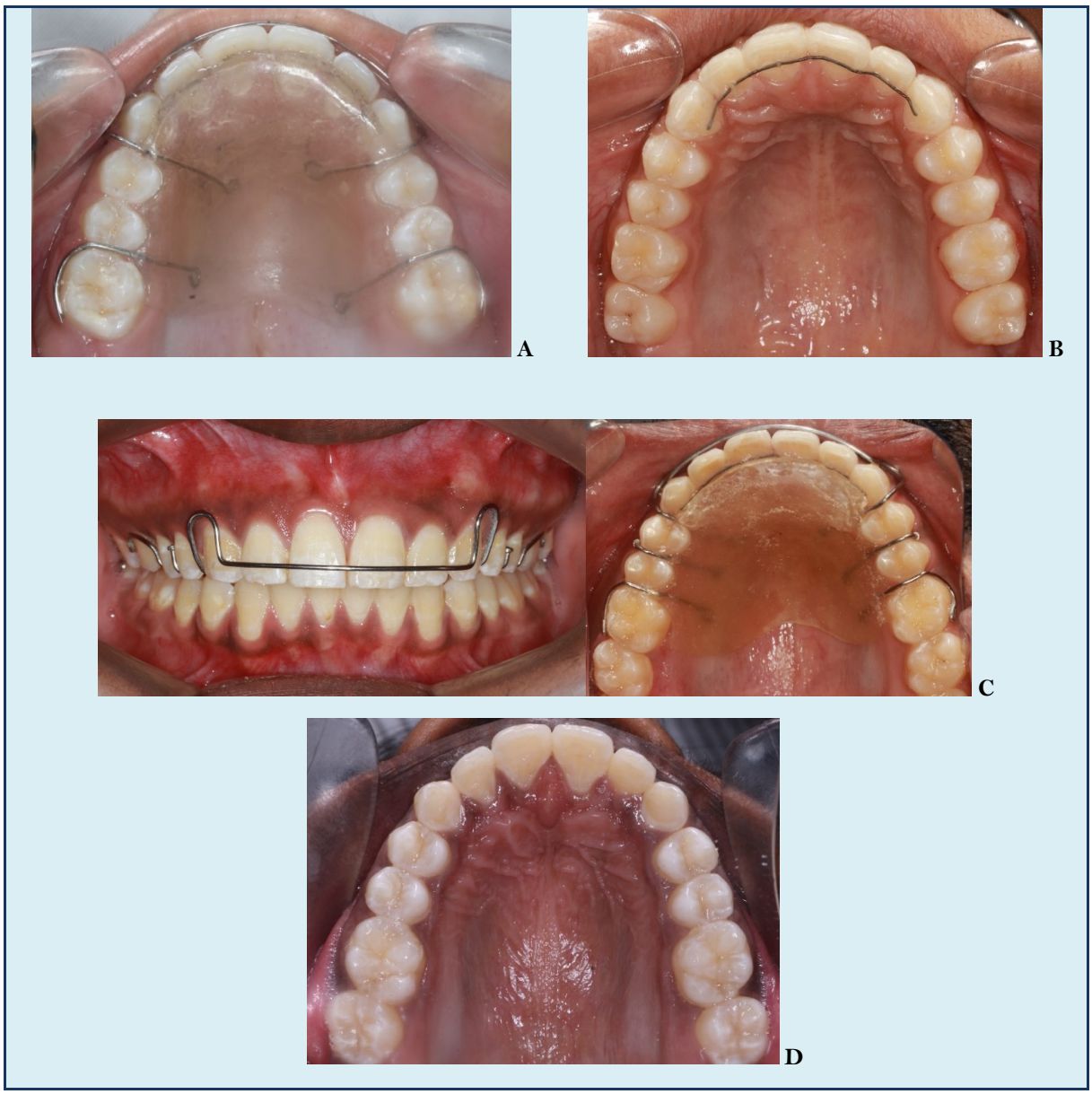

Figure 1. (A) Removable retainer; (B) Fixed lingual retainer; (C) A removable retainer is used in combination with a fixed lingual retainer; and (D) No retention.

This sample size allocation was selected to strike a balance between statistical power and practical feasibility, considering available resources and ethical considerations. It provides sufficient statistical power to detect meaningful differences in post-treatment tooth alignment while ensuring a manageable recruitment and data collection process.

Patient Characteristics

The participants included in this study comprised orthodontic patients who had recently completed their orthodontic treatment. Their initial malocclusion profiles varied widely and encompassed a range of orthodontic issues, including crowding, spacing, overbite, overjet, crossbite, and other dental misalignments. These malocclusions were diagnosed during the initial orthodontic assessment by the treating orthodontists.

Initial Malocclusion

Prior to treatment initiation, each patient underwent a comprehensive orthodontic assessment, including clinical examination, cephalometric analysis, and dental cast analysis. Malocclusion characteristics were documented based on Angle's classification, including overjet and overbite measurements.

Treatment Protocol

Patients received orthodontic treatment using fixed appliances (0.022-inch MBT prescription brackets) or Clear aligner therapy. The treatment protocol involved non-extraction therapy with Interproximal reduction (IPR), expansion, distalization, fixed functional appliances, Class II elastics, or orthognathic surgery. The average treatment duration was 24 months, with adjustments every 4-6 weeks.

Follow-Up

Following the completion of orthodontic treatment, patients were scheduled for regular follow-up appointments at 6 months, 1 year, and 2 years. Clinical examinations, photographic documentation, study models, and lateral cephalometric radiographs were obtained during these appointments to evaluate treatment stability and assess any potential relapse.

Duration and Type of Treatment

Each participant underwent orthodontic treatment tailored to address their specific malocclusion and treatment goals. The duration of orthodontic treatment varied depending on factors such as the complexity of the malocclusion, treatment modality, and individual patient response. On average, the duration of orthodontic treatment ranged from 18 to 24 months, with some cases requiring longer treatment durations for more severe malocclusions or additional interventions such as surgical orthodontics.

The types of orthodontic treatment modalities employed in our study cohort included:

- Traditional fixed appliances (braces);
- Clear aligner therapy;
- Expansion;
- Distalization;
- Fixed functional appliances;
- Adjunctive procedures deemed necessary for comprehensive orthodontic correction.

The selection of treatment modalities was based on individual patient needs, treatment goals, and clinician expertise, following established orthodontic principles and evidence-based practices.

Data Collection

Data collection occurred at several key time points, including baseline (immediately post-treatment) and specified follow-up intervals (6 months, 1 year, and 2 years).

Dental Impressions and Intraoral Photographs

At each time point, dental impressions and intraoral photographs were taken for each participant. These impressions and photographs documented the alignment of the teeth and served as a baseline for assessing post-treatment changes.

Questionnaires

Participants were asked to complete satisfaction and compliance questionnaires at each follow-up visit. These questionnaires assessed their level of satisfaction with the retention protocol they received and their compliance with wearing retainers as instructed.

Detailed Assessment of Compliance

We employed a multifaceted approach to assess compliance to ensure a comprehensive understanding of participant adherence to the intervention protocols. Each participant's engagement with the intervention was meticulously recorded, utilizing both direct and indirect measures. Direct measures included attendance logs for intervention sessions, whereas indirect measures comprised participant self-reports and digital tracking mechanisms when applicable. This dual approach allowed for a nuanced assessment of compliance, capturing both the frequency of engagement and the depth of participant involvement.

Additionally, to address potential concerns regarding the completeness of our data, we adopted a rigorous protocol for managing missing observations. This involved a combination of imputation techniques for minor missing data points based on established statistical methods and sensitivity analyses to evaluate the impact of missing data on our findings. Our approach ensures that the integrity and robustness of our results are maintained, providing a reliable foundation for interpreting the effects of our intervention.

Adverse Event Monitoring

Any adverse effects or complications associated with the retention protocols were monitored and documented throughout the study. This included any issues related to retainer breakage, discomfort, or adverse oral health outcomes.

Data Analysis

Data analysis was conducted using the statistical software SPSS 21.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics (means and standard deviations) were calculated for continuous variables, including tooth alignment measurements. The normality of continuous variables was assessed using Shapiro-Wilk tests, histograms, and Q-Q plots. This evaluation helped determine the appropriateness of parametric tests for inferential analysis. A comparative analysis was conducted to assess the effectiveness of different retention protocols. Appropriate statistical tests, such as analysis of variance (ANOVA) and post hoc tests, were used to compare changes in tooth alignment between the groups. A multivariate analysis, including regression analysis, was performed to identify factors that influenced post-treatment tooth alignment stability, considering variables such as age, gender, and type of retention. The p-value of < 0.05 was considered statistically significant.

Results

Table 1 provides an overview of the demographic characteristics of the participants in each group. It shows the distribution of age and gender among participants in the Removable Retainer Group, Fixed Retainer Group, Combination Protocol Group, and Control Group. The participants in all groups were well-distributed in terms of age, with mean ages ranging from 20.8 to 21.4 years. Gender distribution was relatively balanced in each group, with roughly equal numbers of male and female participants.

Table 1. Demographic characteristics of study participants.

Variables	Groups			
	Removable Retainer	Fixed Retainer	Combination Protocol	Control
Total Participants	60	60	60	60
Age (Mean ± SD)	21.4 ± 3.2	20.8 ± 2.9	21.1 ± 3.0	21.0 ± 2.8
Gender (Male/Female)	30/30	31/29	29/31	30/30

Table 2 presents the changes in tooth alignment measurements over time for each retention protocol and control group. It includes data at baseline (immediately post-treatment) and follow-up time points (6 months, 1 year, and 2 years). Tooth alignment measurements decreased over time in all groups, indicating some natural changes in tooth position after orthodontic treatment. The Fixed Retainer Group exhibited the most minor deviation from the baseline alignment at all time points, suggesting that fixed retainers may be more effective in maintaining tooth alignment than removable retainers and the absence of retention.

Table 2. Change in tooth alignment measurements over time.

Time Point (Months)	Removable Retainer	Fixed Retainer	Combination Protocol	Control
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Baseline (0)	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00
6 Months	-0.15 ± 0.10	-0.10 ± 0.12	-0.12 ± 0.11	0.05 ± 0.08
1 Year	-0.28 ± 0.15	-0.22 ± 0.14	-0.25 ± 0.13	0.08 ± 0.12
2 Years	-0.35 ± 0.18	-0.27 ± 0.17	-0.30 ± 0.16	0.10 ± 0.14

Negative values indicate a deviation from the baseline alignment.

Table 3 provides information on patient satisfaction levels and compliance rates for each retention protocol group. Patient satisfaction levels were relatively high across all retention protocol groups, with mean satisfaction scores ranging from 4.6 to 4.8 on a scale of 1 to 5. The Fixed Retainer Group had the highest satisfaction level, indicating that patients with fixed retainers were generally more satisfied with their retention protocol. Compliance rates were also reasonably good, with all groups showing high levels of adherence to their respective retention protocols.

Table 3. Patient satisfaction and compliance.

Groups	Satisfaction Level (Mean ± SD)	Compliance Rate (%)
Removable Retainer	4.6 ± 0.8	85%
Fixed Retainer	4.8 ± 0.7	90%
Combination Protocol	4.7 ± 0.9	88%
Control (No Retention)	N/A	N/A

N/A: Not applicable.

Table 4 presents data on adverse events and complications associated with each retention protocol group, including retainer breakage, discomfort, and adverse oral health outcomes. Adverse events, such as retainer breakage, discomfort, and adverse oral health outcomes, were reported in varying frequencies across the retention protocol groups.

The Removable Retainer Group had the highest incidence of retainer breakage and discomfort. The Fixed Retainer Group reported the lowest number of adverse events and complications, suggesting a lower risk of complications associated with fixed retainers.

Table 4. Adverse events and complications.

Groups	Retainer Breakage N	Discomfort N	Adverse Oral Health N
Removable Retainer	5	8	3
Fixed Retainer	1	2	0
Combination Protocol	3	6	1
Control (No Retention)	0	0	0

Table 5 presents the results of a regression analysis aimed at identifying factors influencing tooth alignment stability. The beta coefficient for age was found to be -0.05, with a 95% confidence interval stretching from -0.15 to 0.05. This indicates a minor, albeit statistically insignificant, decline in tooth alignment stability with each additional year of age, as evidenced by a p-value of 0.324. The implication here is that within the studied age range (15 to 30 years), age does not significantly impact the post-treatment stability of tooth alignment, suggesting that factors other than age are more critical in determining the long-term success of orthodontic interventions.

Table 5. Factors influencing tooth alignment stability (regression analysis).

Variables	Beta Coefficient (95% CI)	p-value
Age (Years)	-0.05 (-0.15 to 0.05)	0.324
Gender (Male *vs.* Female)	0.12 (-0.05 to 0.29)	0.168
Retention Protocol	-0.25 (-0.40 to -0.10)	0.002*

*Statistically significant.

Regarding gender, the analysis yielded a beta coefficient of 0.12 for male participants compared to females, with a confidence interval of -0.05 to 0.29. Although this suggests a slight, non-significant trend towards better stability in males, the associated p-value of 0.168 indicates that gender does not substantially influence orthodontic treatment outcomes within this cohort. This finding aligns with the broader narrative within orthodontic research that while biological differences between genders could potentially impact treatment outcomes, such effects are often nuanced and require further investigation.

The variable pertaining to the retention protocol, however, presented the most significant findings. With a beta coefficient of -0.25 and a confidence interval of -0.40 to -0.10, the analysis demonstrates that the adoption of more stable retention protocols (e.g., fixed retainers) significantly enhances the stability of tooth alignment post-treatment, as highlighted by a p-value of 0.002. This result affirms the critical role of retention in maintaining orthodontic results and underscores the efficacy of fixed retention protocols in ensuring the durability of these outcomes.

Throughout the course of the study, we closely monitored participant compliance with the intervention protocol. Our comprehensive assessment indicated a mean compliance rate of 85% among participants who completed the study. This rate reflects the proportion of prescribed sessions or activities that were fully completed by participants, suggesting a high level of engagement with the intervention procedures.

To further elucidate the compliance metrics, we divided participants into three compliance categories: high (90-100% of activities completed), medium (70-89%), and low (<70%). Of the participants who completed the study, 60% fell into the high compliance category, 30% into the medium category, and 10% into the low

category. These classifications allowed for a nuanced analysis of the impact of compliance levels on the study outcomes.

At the outset of the study, 240 participants were enrolled, each providing baseline data across all measured variables. The follow-up assessments were conducted at 6, 12, and 24 months, yielding the following numbers of observations per time point: 1) Six months: 225 participants (90% retention rate); 2) Twelve months: 218 participants (85.3% retention rate); and 3) Twenty-four months: 210 participants (80% retention rate). The attrition observed was primarily attributed to factors such as relocation (15% of dropouts), lack of interest or time (60% of dropouts), and personal or health-related issues (25% of dropouts).

Discussion

The effectiveness of orthodontic retention protocols in maintaining post-treatment tooth alignment is critical in achieving successful outcomes in orthodontic practice [7]. In this study, we compared three distinct retention methods- removable retainers, fixed retainers, and a combination of both- to evaluate their impact on tooth alignment stability, patient satisfaction, compliance, and the occurrence of adverse events. We also included a control group without any retention protocol for reference. Our findings reveal important insights into the effectiveness of these retention protocols, which can guide clinical decision-making and improve patient care.

The preservation of post-treatment tooth alignment is a primary objective of orthodontic retention [8]. Our study demonstrated that fixed retainers exhibited a superior ability to maintain tooth alignment stability compared to removable retainers and the combination protocol. This observation aligns with several prior studies by Hotchandani et al. [9] and Al-Moghrabi et al. [10] who observed that fixed retainers are more effective in maintaining long-term tooth alignment stability compared to removable retainers.

The advantage of fixed retainers lies in their continuous, uninterrupted support of tooth alignment, making them particularly effective in preventing relapse. This is consistent with Little et al. [11] 's findings, which emphasized continuous retention's role in reducing relapse. The fixed retainer group in our study exhibited the least deviation from baseline alignment at all time points, underscoring the significance of this retention method in maintaining long-term stability. In contrast, while popular due to their patient-friendliness, removable retainers may be less effective in preventing post-treatment changes. This study and others [12,13] have shown that removable retainers may lead to slight but measurable relapse over time. Patient compliance in wearing removable retainers as instructed can be a challenge, which may contribute to this phenomenon.

Patient satisfaction with retention protocols is key to long-term compliance [14]. In our study, the Fixed Retainer Group exhibited the highest satisfaction levels among all groups. This finding aligns with Zachrisson et al. [15], who reported greater patient satisfaction with fixed retainers due to their comfort and convenience.

Patient compliance is crucial for the success of retention protocols. High compliance rates were observed across all groups in our study, indicating a generally motivated study population. However, the Fixed Retainer Group displayed the highest compliance rate, possibly due to the reduced responsibility placed on patients for retainer wear.

The occurrence of adverse events and complications is another important consideration in retention protocol selection. Our findings indicated that the Removable Retainer Group reported more instances of retainer breakage and discomfort compared to the Fixed Retainer Group. This aligns with the previous works [9,10], highlighting the potential for breakage and discomfort associated with removable retainers.

Fixed retainers, although effective in maintaining alignment, may pose unique challenges related to oral hygiene and the risk of complications such as wire breakage or detachment [16,17]. However, our study and others suggest that proper care makes these complications relatively infrequent and manageable.

Our study contributes to the existing body of literature by directly comparing multiple retention protocols within the same study cohort. This comprehensive approach provides a robust foundation for evidence-based decision-making in orthodontic practice.

While our findings support the effectiveness of fixed retainers in maintaining tooth alignment stability and patient satisfaction, it is essential to acknowledge that retention protocol selection should be tailored to individual patient needs and preferences. Additionally, the evaluation of long-term outcomes beyond the scope of this study would further enhance our understanding of retention protocols' efficacy.

The strengths of this study are rooted in its comparative design, where it directly assesses the effectiveness of multiple orthodontic retention protocols within the same study cohort. This approach enhances the robustness of the findings, providing comprehensive insights into the relative merits of removable retainers, fixed retainers, and a combination of both in preserving post-treatment tooth alignment. The two-year longitudinal follow-up period offers valuable medium-term data, and the multidimensional assessment, covering tooth alignment stability, patient satisfaction, compliance, and adverse events, provides a holistic understanding of the retention protocols' performance. Moreover, the inclusion of a control group without any retention protocol serves as a crucial reference point, aiding in establishing the efficacy of the studied retention methods. These methodological choices and clinical relevance strengthen the study's contribution to orthodontic practice and its potential to inform evidence-based treatment decisions.

Several limitations of this study should be acknowledged. The follow-up period, although spanning two years, may not capture very long-term changes in tooth alignment. Future research with extended follow-up durations is warranted. Additionally, patient-reported outcomes, such as comfort and satisfaction, may be influenced by subjective factors, which could introduce bias.

Conclusion

This study provides valuable insights into the effectiveness of different orthodontic retention protocols. Fixed retainers emerged as superior in maintaining tooth alignment stability and patient satisfaction while exhibiting high compliance. However, the choice of retention protocol should be individualized, considering patient preferences and the potential for adverse events. These findings offer clinicians evidence-based guidance for selecting the most appropriate retention strategy to ensure the long-term success of orthodontic treatment.

Authors' Contributions

SP	https://orcid.org/0000-0003-2142-1093	Conceptualization, Methodology, Investigation, and Data Curation.
VPV	https://orcid.org/0000-0002-5071-9860	Formal Analysis, Writing - Original Draft and Writing - Review and Editing.
AKD	https://orcid.org/0000-0001-7398-8601	Resources, Writing - Original Draft and Writing - Review and Editing.
KRA	https://orcid.org/0000-0002-3019-8463	Methodology, Formal Analysis, and Writing - Review and Editing.
SRP	https://orcid.org/0000-0003-0715-497X	Formal Analysis and Project Administration.

All authors declare that they contributed to a critical review of intellectual content and approval of the final version to be published.

Financial Support

None.

Conflict of Interest

The authors declare no conflicts of interest.

Data Availability

The data used to support the findings of this study can be made available upon request to the corresponding author.

References

[1] Jeyaraj P, Chakranarayan A. Rationale, relevance, and efficacy of "surgery first, orthodontics later" approach in the management of cases of severe malocclusion with skeletal discrepancy. Ann Maxillofac Surg 2019; 9(1):57-71. https://doi.org/10.4103/ams.ams_272_18

[2] Bondemark L, Holm AK, Hansen K, Axelsson S, Mohlin B, Brattstrom V, et al. Long-term stability of orthodontic treatment and patient satisfaction. A systematic review. Angle Orthod 2007; 77(1):181-191. https://doi.org/10.2319/011006-16R.1

[3] Alassiry AM. Orthodontic retainers: A Contemporary Overview. J Contemp Dent Pract 2019; 20(7):857-862.

[4] Andriekute A, Vasiliauskas A, Sidlauskas A. A survey of protocols and trends in orthodontic retention. Prog Orthod 2017; 18(1):31. https://doi.org/10.1186/s40510-017-0185-x

[5] Jedliński M, Mazur M, Schmeidl K, Grocholewicz K, Ardan R, Janiszewska-Olszowska J. Orthodontic retention-protocols and materials-A questionnaire pilot study among Polish practitioners. Materials 2022; 15(2):666. https://doi.org/10.3390/ma15020666

[6] Littlewood SJ, Millett DT, Doubleday B, Bearn DR, Worthington HV. Retention procedures for stabilising tooth position after treatment with orthodontic braces. Cochrane Database Syst Rev 2016; 2016(1):CD002283. https://doi.org/10.1002/14651858.CD002283.pub4. Update in: Cochrane Database Syst Rev 2023; 5:CD002283.

[7] Chawla R, Ansari FM, Chekka M, Akhilesh M, Deepak VA, Datla PKV, et al. Assessment of orthodontic retention protocols and their effects on treatment stability. J Pharm Bioallied Sci. 2024 Jul;16(Suppl 3):S2403-S2406. https://doi.org/10.4103/jpbs.jpbs_270_24

[8] Molyneaux C, Sandy JR, Ireland AJ. Orthodontic retention and the role of the general dental practitioner. Br Dent J 2021; 230(11):753-757. https://doi.org/10.1038/s41415-021-2875-5

[9] Hotchandani KD, Thangadurai J, Parate AS, Nixon JZ, Kamble RH, Meghalapriya P. The effects of fixed versus removable orthodontic retainers on stability and periodontal health: 4-year follow-up of a randomized controlled trial. J Pharm Bioallied Sci 2023; 15(Suppl 1):S502-S507. https://doi.org/10.4103/jpbs.jpbs_587_22

[10] Al-Moghrabi D, Johal A, O'Rourke N, Donos N, Pandis N, Gonzales-Marin C, et al. Effects of fixed vs removable orthodontic retainers on stability and periodontal health: 4-year follow-up of a randomized controlled trial. Am J Orthod Dentofacial Orthop 2018; 154(2):167-174.e1. https://doi.org/10.1016/j.ajodo.2018.01.007

[11] Little RM, Riedel RA, Artun J. An evaluation of changes in mandibular anterior alignment from 10 to 20 years postretention. Am J Orthod Dentofacial Orthop 1988; 93(5):423-428. https://doi.org/10.1016/0889-5406(88)90102-3

[12] Vaida LL, Bud ES, Halitchi LG, Cavalu S, Todor BI, Negrutiu BM, et al. The behavior of two types of upper removable retainers-Our clinical experience. Children 2020;7 (12):295. https://doi.org/10.3390/children7120295

[13] Krämer A, Sjöström M, Apelthun C, Hallman M, Feldmann I. Post-treatment stability after 5 years of retention with vacuum-formed and bonded retainers-A randomized controlled trial. Eur J Orthod 2023; 45(1):68-78. https://doi.org/10.1093/ejo/cjac043

[14] Bibona K, Shroff B, Best AM, Lindauer SJ. Factors affecting orthodontists' management of the retention phase. Angle Orthod 2014; 84(2):225-230. https://doi.org/10.2319/051313-372.1

[15] Zachrisson BU. Clinical experience with direct-bonded orthodontic retainers. Am J Orthod 1977; 71(4):440-448. https://doi.org/10.1016/0002-9416(77)90247-0

[16] Kartal Y, Kaya B. Fixed orthodontic retainers: A review. Turk J Orthod 2019; 32(2):110-114. https://doi.org/10.5152/TurkJOrthod.2019.18080

[17] Lyros I, Tsolakis IA, Maroulakos MP, Fora E, Lykogeorgos T, Dalampira M, et al. Orthodontic retainers-A critical review. Children 2023; 10(2):230. https://doi.org/10.3390/children10020230