IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 24, Issue 9 Ser. 5 (September. 2025), PP 87-98
www.iosrjournals.org

Comparative Evaluation Of Stability, Survival Rate, Periodontal Health And Oral Health Related Quality Of Life Between PEEK And Conventional Two-Stranded Stainless Steel Fixed Bonded Lingual Retainers: One Year Follow Up Randomized Controlled Study

Dr. Yashraj Kharade, Dr. Romilkumar Shah, Dr. Prishita Mehta,
Dr. Nancy Agrawal, Dr. Anjali Ganatra

(Post Graduate Student, Department Of Orthodontics And Dentofacial Orthopedics, K.M. Shah Dental College And Hospital/ Sumandeep Vidyapeeth Deemed To Be University, India)
(Professor, Department Of Orthodontics And Dentofacial Orthopedics, K.M. Shah Dental College And Hospital/ Sumandeep Vidyapeeth Deemed To Be University, India)
(Post Graduate Student, Department Of Orthodontics And Dentofacial Orthopedics, K.M. Shah Dental College And Hospital/ Sumandeep Vidyapeeth Deemed To Be University, India)
(Post Graduate Student, Department Of Orthodontics And Dentofacial Orthopedics, K.M. Shah Dental College And Hospital/ Sumandeep Vidyapeeth Deemed To Be University, India)
(Post Graduate Student, Department Of Orthodontics And Dentofacial Orthopedics, K.M. Shah Dental College And Hospital/ Sumandeep Vidyapeeth Deemed To Be University, India)

Abstract:
Background*: Retention is a critical phase of orthodontic treatment aimed at preserving the results achieved during active therapy. Fixed lingual retainers are widely preferred over removable appliances due to their superior stability and reduced reliance on patient compliance. Conventional two-stranded stainless-steel retainers have been the standard choice, but they are prone to debonding and plaque accumulation. Polyetheretherketone (PEEK), a high-performance thermoplastic with favorable biomechanical and biocompatible properties, has recently been introduced as a retainer material. Evidence comparing PEEK retainers with conventional stainless-steel retainers in terms of stability, survival rate, periodontal health, and oral health-related quality of life remains limited, necessitating further clinical evaluation.*
Materials and Methods*: A randomized controlled clinical trial was conducted with 42 participants (21 per group) aged 18–45 years. Group 1 received PEEK Retainers, while Group 2 received Conventional Retainers. Stability was assessed using Little's Irregularity Index (LII), survival rates were recorded, and periodontal health was evaluated using the Simplified Oral Hygiene Index (OHI-S) and Community Periodontal Index (CPI). OHRQoL was measured using the OHIP-14 questionnaire. Follow-ups were conducted at baseline (T0), 3 months (T1), 6 months (T2), 9 months (T3), and 12 months (T4). Statistical analyses performed using independent t-tests.*
Results*:The study included 42 participants with mean ages of 24.04±4.94 years (Group 1) and 27.95±7.27 years (Group 2), showing balanced gender distribution (52.4% male in Group 1 vs 42.9% in Group 2). Stability assessment using LLI revealed no Statistically Significant differences between PEEK and Conventional Retainers across all timepoints with mean LII scores of 1.33±1.23 vs 1.90±1.30 at T4 and p value of >0.05. However, PEEK Retainers demonstrated significantly Greater Survival Rates (322.85±69.02 days vs 268.80±83.78 days, p=0.028). Both groups showed comparable Periodontal Health outcomes (OHI-S: 2.00±0.43 vs 1.94±0.57; CPI: 1.23±0.62 vs 1.33±0.57 at T4, p>0.05) and similar improvements in OHRQoL (OHIP-14: 1.66±0.79 vs 2.04±0.86 at T4, p>0.05), though PEEK Retainers showed marginally better scores.*
Conclusion: *PEEK Retainers demonstrated superior Survival Rates and comparable Stability and Periodontal Health outcomes compared to Conventional Retainers. Although both materials performed acceptably, PEEK may offer enhanced durability, making it a viable alternative for long-term retention.*
Key Word: *Fixed lingual retainers, PEEK, orthodontic retention, stability, survival rate, periodontal health, OHIP-14.*

Date of Submission: 17-09-2025 Date of Acceptance: 27-09-2025

I. Introduction

Orthodontic treatment consists of two phases, where first phase is active phase which include further two phases i.e. levelling & alignment phase & extraction & space closure phase & second phase is retention phase. Achieving a well-aligned occlusion marks a significant milestone in orthodontic treatment, but the true challenge lies in preserving these results over time. This critical phase, known as retention & it is essential to prevent relapse—the natural tendency of teeth & skeletal structures to revert toward their original, pre-treatment positions. Relapse not only compromises dental alignment but also affects facial aesthetics, occlusal function, & overall treatment success.

Retention serves multiple biological & functional purposes like it supports periodontal & gingival reorganization, accommodates residual growth, facilitates neuromuscular adaptation, & preserves intentionally adjusted tooth positions made for aesthetic or functional compromises. Therefore, retention is not merely an afterthought—it is a fundamental component of comprehensive orthodontic care. Effective retention planning begins at diagnosis & must be seamlessly integrated throughout treatment to ensure long-term stability & patient satisfaction.

The evolution of orthodontic retention can be broadly divided into two eras: pre-1970, before the widespread adoption of acid etch techniques, & post-1970, marked by the introduction of enamel etching & modern adhesives enabling bonded retainers. Early discussions on the necessity of retention date back to the 19th century, with pioneers like Angle & Kingsley emphasizing the need to stabilize teeth post-treatment. Kingsley developed one of the earliest removable retainers, while Angle later introduced fixed methods using bands & spurs to address rotational relapse.[1]

The early 20th century saw innovations like Case's metal removable retainers & Hawley's design, which remains in use today. The mid-century brought advances in materials, including acrylic & thermoplastics, leading to devices like Kesling's positioner & Nahoum's vacuum-formed retainers (VFRs), valued for aesthetics & patient comfort.[1]

From the 1970s onward, bonded retainers became the standard, thanks to adhesive breakthroughs. Zachrisson's work in the late 1970s & early 1980s introduced various wire configurations for fixed retention, favoring thin, multi-stranded wires for their flexibility & aesthetics.

Over the past decade, retention strategies have been rigorously evaluated through clinical trials. Comparisons have been made between fixed & removable devices, bonding techniques, & wire types. Digital technologies, such as CAD/CAM, have also begun shaping the future of customized retainers, aiming to enhance precision & patient outcomes.[1]

Fixed lingual retainers are widely preferred over removable retainers due to their superior stability, higher survival rates, & better compliance, making them an effective long-term solution for maintaining orthodontic results. Unlike removable retainers, which rely on patient adherence, fixed lingual retainers provide continuous retention, minimizing the risk of relapse. Studies indicate that fixed retainers exhibit greater stability in preserving mandibular incisor alignment, particularly in cases with high pretreatment crowding.[2] Additionally, bonded retainers demonstrate higher survival rates, with multi-strand wire retainers showing lower failure rates compared to removable alternatives.[3]

From a periodontal health perspective, fixed lingual retainers are well-tolerated if properly bonded & maintained, with minimal impact on plaque accumulation or gingival health when oral hygiene is optimal.[4] However, improper placement can lead to calculus deposition & gingival irritation, emphasizing the need for precise bonding techniques. In terms of oral health-related quality of life (OHRQoL), patients often prefer fixed retainers due to their convenience, eliminating the need for daily insertion & removal, which can be cumbersome with removable options.[5]

Fixed lingual bonded retainers are a common choice for maintaining post-orthodontic tooth alignment, with various designs available to suit clinical needs. The primary types include multi-strand twisted wires, fiber-reinforced composite (FRC) retainers, braided stainless steel wires, & CAD/CAM customized retainers. Among these, the 2-stranded (double-stranded) flexible spiral wire retainer, typically made of 0.0175" or 0.0195" stainless steel, is often preferred due to its superior balance of flexibility & strength. Compared to thicker braided wires or fiber-reinforced alternatives, the 2-stranded retainer provides optimal stability while minimizing the risk of bond failure, making it a reliable long-term solution for preventing relapse. Studies indicate that multi-strand wires exhibit lower fracture rates & better adaptability to tooth surfaces, reducing the likelihood of debonding. Additionally, their flexibility allows slight physiological tooth movement, which may be beneficial for periodontal health by reducing excessive rigidity that could contribute to gingival irritation or bone loss.

The survival rate of 2-stranded retainers is notably higher than that of single-stranded or fiber-based retainers, primarily due to their resistance to fatigue & deformation under occlusal forces. Their design distributes stress more evenly across bonded teeth, reducing localized pressure that could lead to adhesive failure. From a periodontal perspective, properly bonded 2-stranded retainers accumulate less plaque compared

to bulkier alternatives, provided patients maintain good oral hygiene. Research suggests that thinner, flexible wires cause less interference with interdental cleaning, thereby lowering the risk of gingival inflammation & calculus buildup. Furthermore, patient satisfaction with 2-stranded retainers is generally high, as they are less noticeable & do not interfere with speech or chewing, enhancing oral health-related quality of life (OHRQoL) compared to rigid or removable options.

Two-stranded fixed lingual retainer is favoured for its optimal combination of stability, durability, & biocompatibility. Its design minimizes clinical complications while maximizing patient comfort, making it a well-supported choice in contemporary orthodontic retention protocols.

Polyetheretherketone (PEEK) has emerged as an innovative material for fixed lingual bonded retainers, offering a unique combination of mechanical strength, biocompatibility, & aesthetic advantages over conventional stainless steel or fiber-reinforced retainers. PEEK is a high-performance thermoplastic with excellent fatigue resistance, low moisture absorption, & a modulus of elasticity closer to dentin, reducing the risk of excessive rigidity that could lead to enamel stress or bond failure. The design of PEEK retainers is typically customized using CAD/CAM technology, where digital scans of the patient's dentition are used to mill a precise, patient-specific retainer that conforms perfectly to the lingual tooth surfaces. The milling process involves computer-guided fabrication from a PEEK blank, ensuring a smooth, thin, & lightweight structure that enhances patient comfort while maintaining retention efficacy. Unlike traditional multi-strand wires, PEEK retainers are monolithic, eliminating the crevices that can trap plaque in twisted wire designs, thus promoting better periodontal health.

This study aims to Evaluate & Compare Stability, Survival Rate, Periodontal Health & Oral Health Related Quality of Life of PEEK Fixed Lingual Bonded Retainer (PEEK Retainer) with the Conventional Two-Stranded Stainless Steel Ligature Wire Fixed Bonded Lingual Retainer (Conventional Retainer).

II. Material And Methods

This prospective comparative study was carried out in the Department of Orthodontics and Dentofacial Orthopaedics, K. M. Shah Dental College & Hospital, Sumandeep Vidyapeeth Deemed to be University, Piparia, Waghodia, Vadodara, Gujarat – 391760. Patients who had completed the active phase of fixed mechanotherapy and were about to begin the retention phase were included. The study duration was 24 months, after obtaining ethical clearance from the Sumandeep Vidyapeeth Institutional Ethical Committee (SVIEC/ON/DENT/BNPG/MAY/23/72)

Study Design: Prospective comparative randomized controlled study.

Study Location: Department of Orthodontics and Dentofacial Orthopaedics, K. M. Shah Dental College & Hospital, Sumandeep Vidyapeeth Deemed to be University, Piparia, Waghodia, Vadodara, Gujarat – 391760.

Study Duration: May 2023 to May 2025.

Sample size: 42 patients. (Group 1: 21 patient, Group 2: 21 patient)

Sample size calculation: The sample size was calculated using OpenEpi software (v3.0) with 95% confidence interval and 80% power, based on values for force of failure of debonding from the study conducted by Kadhum A. and Alhuwaizi A.[7] The calculated sample size was 21 patients per group, giving a total of 42 participants.

Subjects & selection method: Patients were allocated into two groups using lottery method of randomization (21 in each group):

- **Group 1** – PEEK Fixed Lingual Bonded Retainer
- **Group 2** – Conventional Two-Stranded Stainless Steel Ligature Wire Fixed Bonded Lingual Retainer

Inclusion criteria:

1. Patients who completed active phase of fixed mechanotherapy and about to begin retention phase
2. Age group 18–45 years
3. Little's Irregularity Index score = 0
4. No dental caries, restorations, or fractures
5. No parafunctional habits (bruxism, etc.)

Exclusion criteria:

1. Poor periodontal status

2. Restorative or surgical treatment history
3. Occlusal trauma
4. Developmental dental anomalies (Enamel Hypoplasia, Amelogenesis Imperfecta, Dentinogenesis Imperfecta, Dens in Dente, Microdontia)
5. Fluorosis

Procedure methodology

After obtaining written informed consent, participants were introduced to the aims and procedures of the study. Patients were randomized into two groups:

Group 1 – PEEK Retainer

- Digital impression recorded and converted into .stl file
- Model 3D-printed using stereolithography technique (SLA)
- Retainer designed using Exocad software, fabricated in PEEK (0.8 mm thickness) with CAD/CAM milling machine (Dental Plus RS5, South Korea)
- Bonded using Tetric N-Bond Universal primer and Tetric N-Flow Flowable Composite after etching tooth surfaces with 37% phosphoric acid and etching the PEEK surface with 98% sulfuric acid.

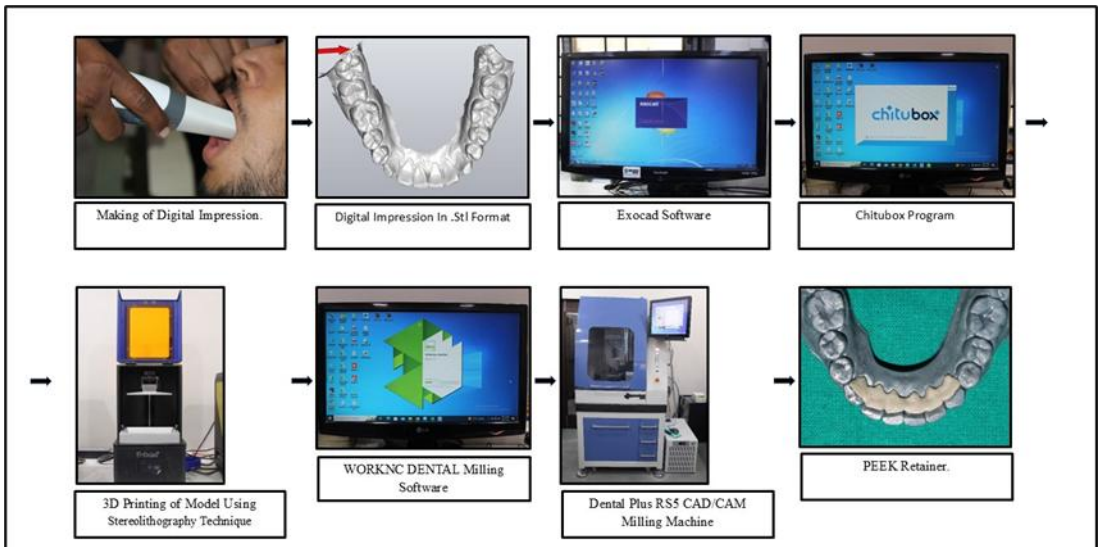


Figure 1: Steps for Fabrication of PEEK Fixed Lingual Bonded Retainer

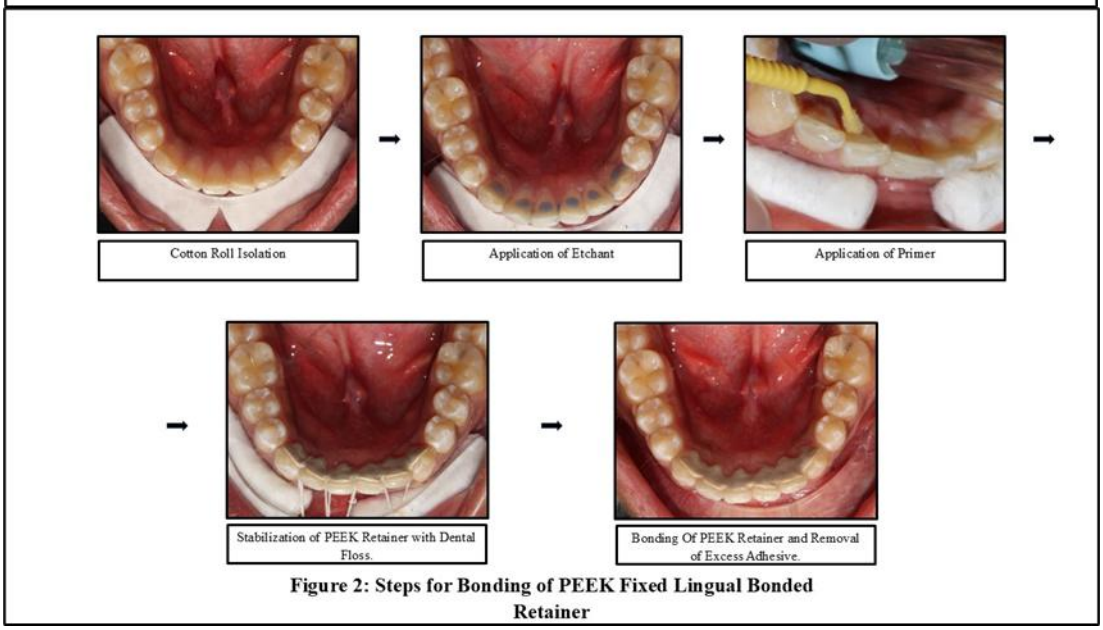


Figure 2: Steps for Bonding of PEEK Fixed Lingual Bonded Retainer

Group 2 – Conventional Retainer

- Alginate impression made with perforated trays, cast poured in Class III orthodontic stone
- Two strands of 0.010″ stainless steel ligature wire twisted and adapted on cast
- Retainer bonded using same bonding protocol as Group 1.

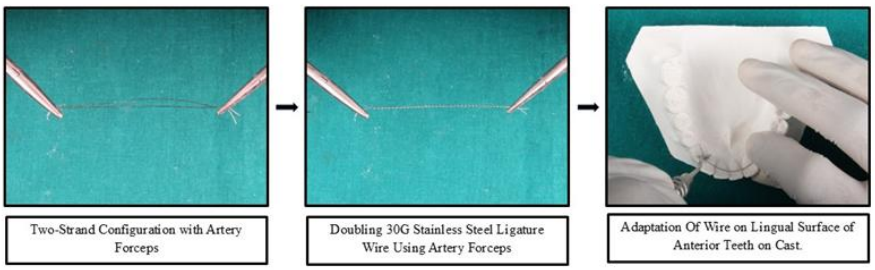


Figure 3: Steps for Fabrication of Conventional Two-Stranded Stainless Steel Ligature Wire Fixed Bonded Lingual Retainer

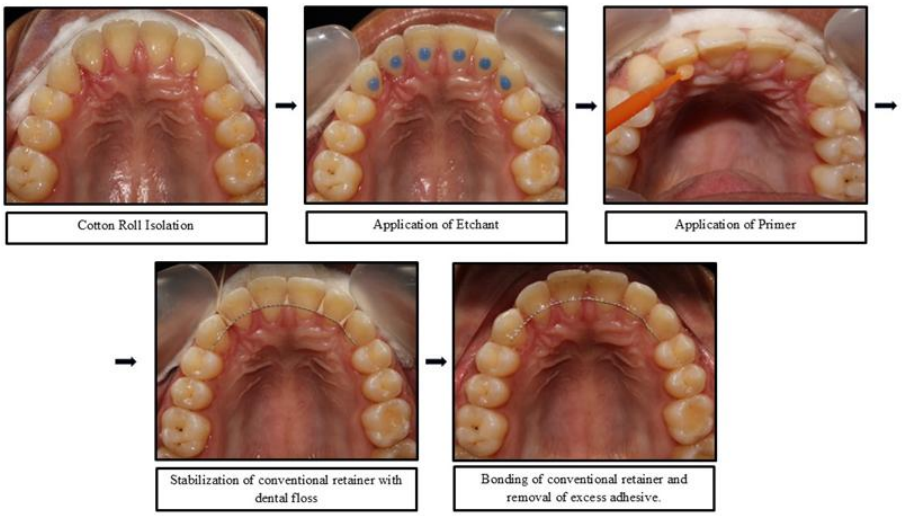


Figure 4: Steps for Bonding of Conventional Two-Stranded Stainless Steel Ligature Wire Fixed Bonded Lingual Retainer

Evaluation Methods

1. **Stability** – measured using Little's Irregularity Index[16] (T0, T1, T2, T3, T4).
2. **Survival Rate** – assessed using Kaplan-Meier survival analysis (failure = debonding at any site).
3. **Periodontal Health** – evaluated using:
   - Simplified Oral Hygiene Index (OHI-S)
   - Community Periodontal Index (CPI)
4. **Oral Health-Related Quality of Life (OHRQoL)** – assessed with OHIP-14 questionnaire (Slade GD, 1997)[18].

Statistical analysis

Data were entered in Microsoft Excel (2017) and analyzed using SPSS version 26.0 (IBM Corp., Chicago, IL). Independent t-test was used for intergroup comparison of continuous variables, while Kaplan-Meier test was used for survival analysis. A p-value <0.05 was considered statistically significant.

III. Result

Table 1 presents Mean the age of participants across two study groups. Both groups consisted of 21 participants each. In Group 1, Mean age was 24.04 years & participant ages ranged from 18 to 34 years, while in Group 2, Mean age was 27.95 years & participant ages ranged from 18 to 42 years.

Table no 1: Demographic data of Age (in years) of the study participants

Age (in years)	N	Minimum	Maximum	Mean	Std. Deviation
Group 1	21	18	34	24.04	4.94
Group 2	21	18	42	27.95	7.27

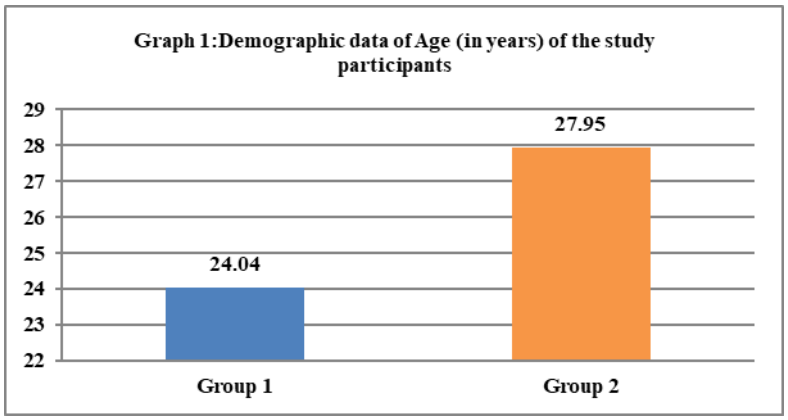


Table 2 shows Gender distribution of participants within each group. In Group 1 there were 11 Male (52.4%) & 10 Female (47.6%) while in Group 2 there were 9 Male (42.9%) & 12 Female (57.1%).

Table no 2: Demographic data of Gender distribution of study participants

Gender	Group 1		Group 2	
	Frequency (n)	Percent (%)	Frequency (n)	Percent (%)
Male	11	52.4	9	42.9
Female	10	47.6	12	57.1
Total	21	100	21	100

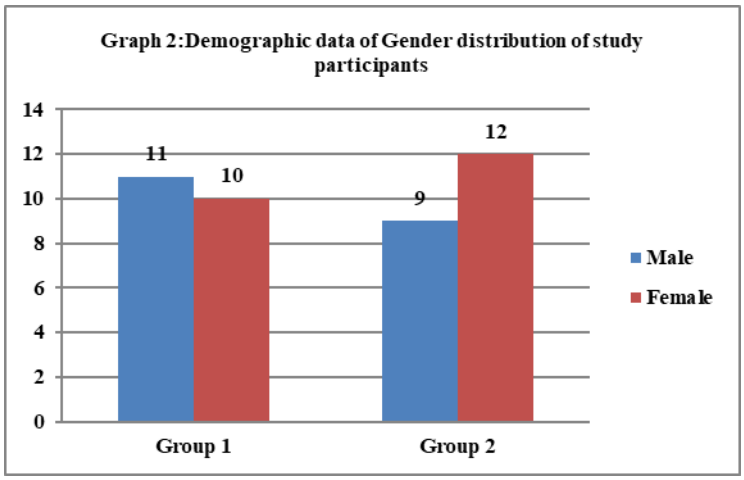


Table 3 shows no statistically significant difference between Group 1 & Group 2 across the all-time interval (T0-T4) with p value greater than 0.05 indicating that both Groups had similar Stability over the time (T0-T4).

Table no 3: Intergroup comparison of STABILITY (Little's irregularity index) at different time intervals using Independent T test

Time intervals	Groups	N	Mean	Std. Deviation	Mean difference	t value	p value
T0	**Group 1**	21	.85	.79	-.33	-1.17	.24
	Group 2	21	1.19	1.03			
T1	**Group 1**	21	1.00	.89	-.23	-.81	.42
	Group 2	21	1.23	.99			
T2	**Group 1**	21	1.28	1.18	-.38	-1.05	.29
	Group 2	21	1.66	1.15			
T3	**Group 1**	21	1.33	1.23	-.57	-1.45	.15
	Group 2	21	1.90	1.30			
T4	**Group 1**	21	1.33	1.23	-.57	-1.45	.15
	Group 2	21	1.90	1.30			

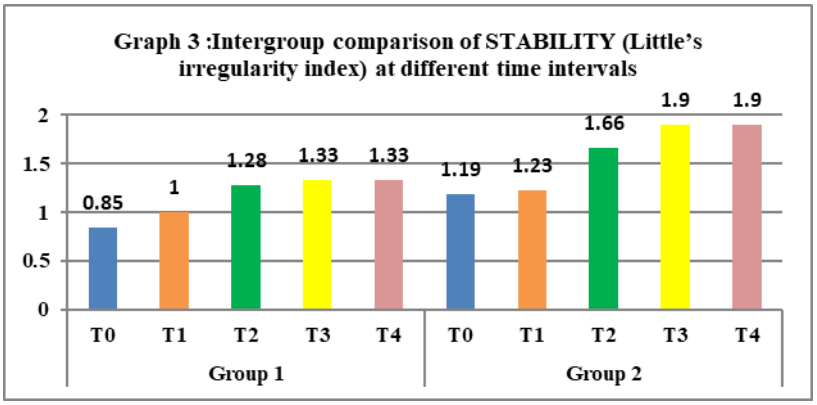
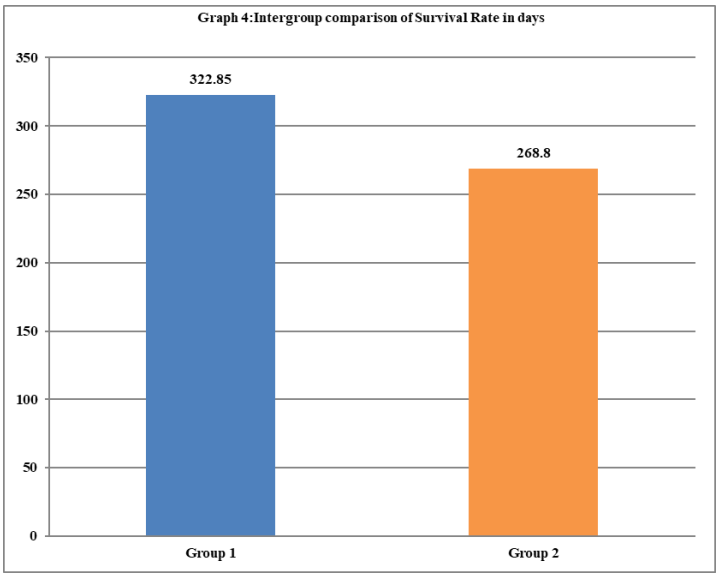


Table 4 presents the intergroup comparison of Survival Rate in days. The results show that Group 1 had a significantly higher Mean Survival Rate of 322.86 days (±69.03), compared to Group 2, which had a Mean Survival Rate of 268.81 days (±83.79). The mean difference between the two groups was 54.05 days, with p value of 0.028 which is statistically significant, indicating that Group 1 had a significantly longer Survival Rate than Group 2.

Table no 4: Intergroup comparison of Survival Rate in days using Independent T test

Parameter	Groups	N	Mean	Std. Deviation	Mean difference	t value	p value
Survival time in days	**Group 1**	21	322.85	69.02	54.04	2.28	.028*
	Group 2	21	268.80	83.78			

*p value <0.05 statistically significant, <0.001 highly significant, <0.001 very highly significant.

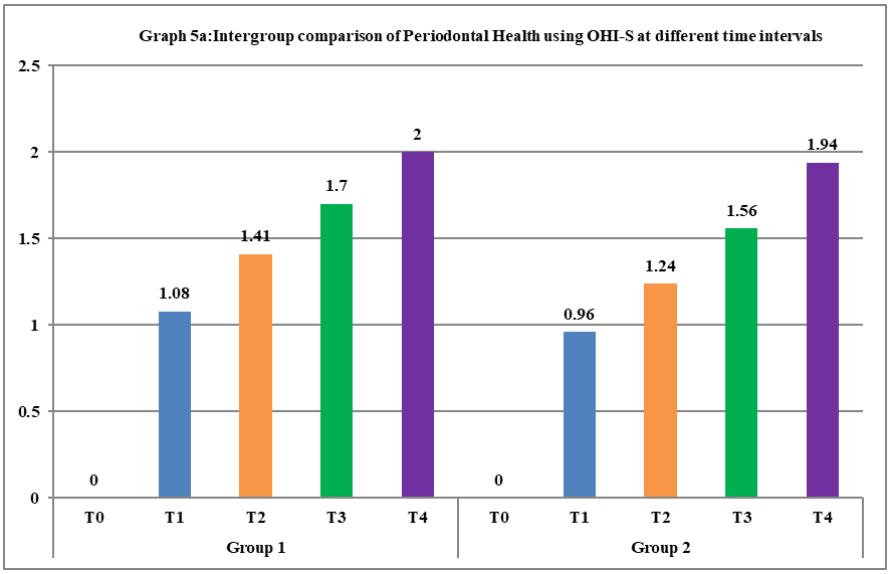


In Table 5a Independent T test showed no statistically significant difference between Group 1 & Group 2 at any time point from T0-T4 with p value greater than 0.05 suggesting that the Periodontal Health was comparable between Group 1 & Group 2 throughout the time period (T0-T4).

Table no 5a: Intergroup comparison of Periodontal Health using OHI-S at different time intervals using Independent T test

Time intervals	Groups	N	Mean	Std. Deviation	Mean difference	t value	p value
T0	**Group 1**	21	.00	.00[a]	-	-	-
	Group 2	21	.00	.00[a]			
T1	**Group 1**	21	1.08	.42	.11	.88	.38
	Group 2	21	.96	.44			
T2	**Group 1**	21	1.41	.40	.16	1.18	.24
	Group 2	21	1.24	.50			
T3	**Group 1**	21	1.70	.42	.13	.96	.34
	Group 2	21	1.56	.50			
T4	**Group 1**	21	2.00	.43	.06	.42	.67
	Group 2	21	1.94	.57			

*p value <0.05 statistically significant, <0.001 highly significant, <0.001 very highly significant.

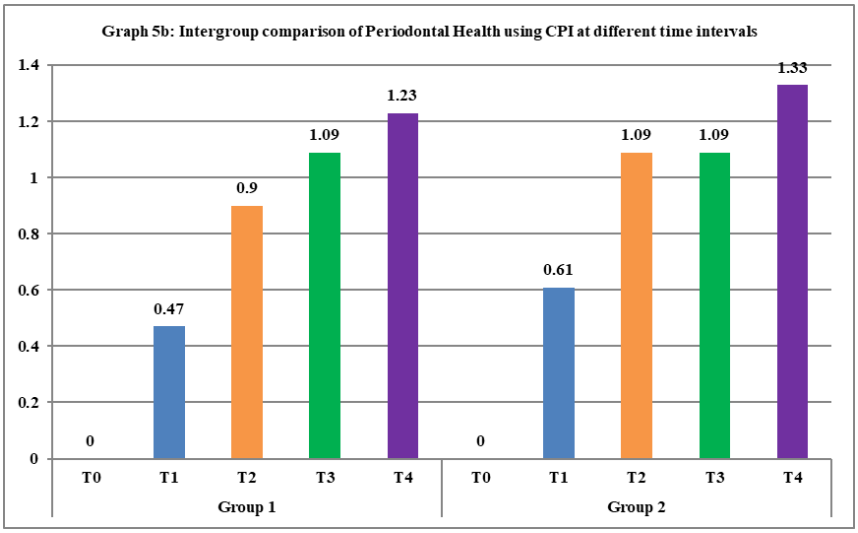


In Table 5b, in terms of Periodontal Health, no statistically significant difference was observed between the Group 1 & Group 2, across all time interval (T0-T4) with p value greater than 0.05. Although variation in mean score was noted between the Group1 & Group 2 & Subsequent time point, none of these differences were statistically significant.

Table no 5b: Intergroup comparison of Periodontal Health using CPI at different time intervals using Independent T test

Time intervals	Groups	N	Mean	Std. Deviation	Mean difference	t value	p value
T0	**Group 1**	21	.00	.00[a]	-	-	-
	Group 2	21	.00	.00[a]			
T1	**Group 1**	21	.47	.51	-.14	-.91	.36
	Group 2	21	.61	.49			
T2	**Group 1**	21	.90	.70	-.19	-.93	.35
	Group 2	21	1.09	.62			
T3	**Group 1**	21	1.09	.70	.00	.00	1.00
	Group 2	21	1.09	.62			
T4	**Group 1**	21	1.23	.62	-.09	-.51	.61
	Group 2	21	1.33	.57			

*p value <0.05 statistically significant, <0.001 highly significant, <0.001 very highly significant

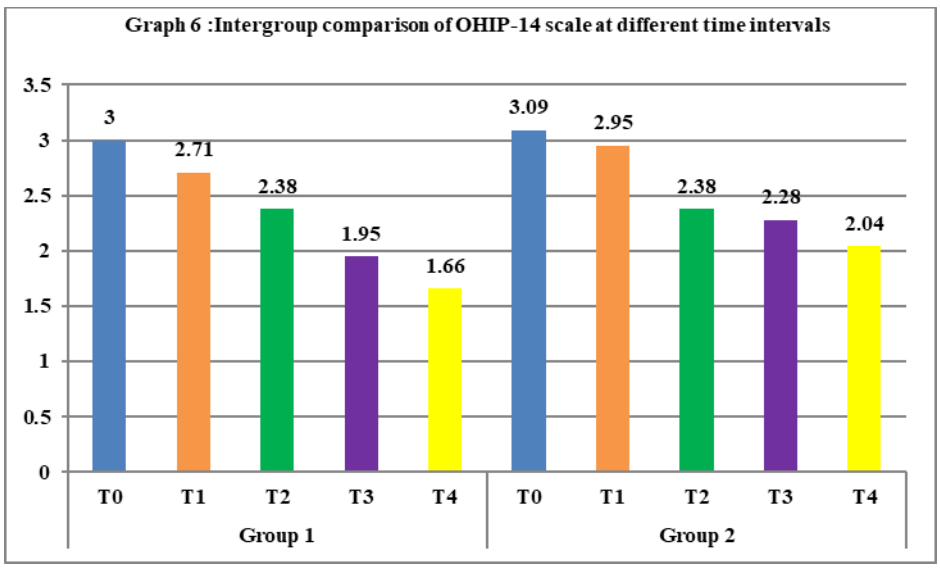


In Table 6, In terms of Oral Health Related Quality of Life, no statistically significant difference was observed between the Group 1 & Group 2, across all time interval (T0-T4) with p value greater than 0.05. over the time both Groups showed steady Decrease in OHIP score reflecting an overall improvement in the impact of oral health.

Table no 6: Intergroup comparison of OHIP-14 scale at different time intervals using Independent T test

Time intervals	Groups	N	Mean	Std. Deviation	Mean difference	t value	p value
T0	Group 1	21	3.00	.70	-.09	-.43	.66
	Group 2	21	3.09	.70			
T1	Group 1	21	2.71	.56	-.23	-1.17	.24
	Group 2	21	2.95	.74			
T2	Group 1	21	2.38	.66	.00	.00	1.00
	Group 2	21	2.38	.74			
T3	Group 1	21	1.95	.74	-.33	-1.41	.16
	Group 2	21	2.28	.78			
T4	Group 1	21	1.66	.79	-.38	-1.48	.14
	Group 2	21	2.04	.86			

*p value <0.05 statistically significant, <0.001 highly significant, <0.001 very highly significant



IV. Discussion

The retention phase in fixed orthodontic treatment is just as important as the active phase. Once the teeth have been moved into their corrected positions, they naturally have a tendency to return to their original alignment. This is why retention is critical. The main goal of any retainer is to hold the teeth securely in their new positions until the surrounding periodontal ligament fibers & other soft tissues have adapted to the changes. The present research aimed to evaluate & compare various parameters related to Dental Stability, Survival Rate, Periodontal Health, & Oral Health-Related Quality of Life of PEEK Retainer with Conventional Retainer for a period of one year.

In the present study both study groups i.e. PEEK Retainer & Conventional Retainer demonstrated broadly similar demographic profiles, with both Groups comprising a balanced mix of male & female participants. As these demographic variables were not primary outcomes of the investigation, formal statistical testing for between-group differences was not performed.

In the present study there was no statistically significant difference between PEEK Retainer Group & Conventional Retainer Group across the entire time interval of one year. This finding suggests that both PEEK Retainer Group & Conventional Retainer Group exhibited similar stability over time. The LII was selected as a measurement tool to assess stability due to its frequent use in prior studies[19-22] & clinical trials. In contrast to present study, according to Esraa Salman Jasim[13] PEEK retainers maintained better stability over time with minimal changes, while DSC retainers exhibited a gradual & significant increase in LII. Intragroup comparisons confirmed that the PEEK group remained stable, whereas the DSC group showed a significant difference over a time period of 6 months.

In the present study the comparative analysis revealed a statistically significant difference in survival rates for PEEK Retainers over Conventional Retainers. The findings suggest that PEEK Retainers demonstrate greater durability & clinical longevity in orthodontic retention. According to Kadhum, A. S., and Alhuwaizi[7] statistically significant difference in survival rates for PEEK Retainers over Conventional Retainers was observed which is similar to present study & in contrast to present study, according to Esraa Salman Jasim[13] statistically non-significant differences in survival rates between PEEK Retainer & Conventional Retainer was found. The superior survival rates of PEEK Retainers observed in present study may be attributed to enhanced bonding efficacy achieved through surface treatments like sandblasting & sulfuric acid etching, which significantly improve composite adhesion by increasing surface roughness & creating micro-mechanical retention sites. Additionally, PEEK's inherent properties—including high fatigue resistance, biocompatibility, & reduced susceptibility to corrosion—contribute to its long-term durability compared to Conventional Retainers.

The present study found comparable periodontal health outcomes between PEEK Retainer & Conventional Retainers, with no statistically significant differences in OHI-S & CPI scores at any time point. This suggests that both retainer types were equally effective in maintaining Periodontal Health throughout the observation period of one year. Esraa Salman Jasim[14] found statistically non-significant differences in Periodontal Health between PEEK Retainer & Conventional Retainer which is similar to present study. Al-Moghrabi et al. (2018)[3] and Pandis et al[23] no statistically significant differences in periodontal health outcomes were observed which is similar to present study. In contrast to present study Anne-Marie Renkema[2] found statistically significant differences in periodontal health outcomes.

The present study found comparable improvements in Oral Health-Related Quality of Life (OHRQoL) between the two retainer groups over the observation period, with no statistically significant differences observed at any time point. According to Esraa Salman Jasim[13] statistically non-significant differences in terms of Oral Health-Related Quality of Life (OHRQoL) between PEEK Retainer & Conventional Retainer Group was found which is similar to present study.

One of the key limitations of this study was the relatively short follow-up period of one year, which may not have fully captured the long-term clinical performance & durability of the retainers, particularly for PEEK, a relatively novel material in orthodontic retention. Longer-term studies would be needed to evaluate whether the observed benefits of PEEK retainers persisted over extended periods. Additionally, the study did not control for several potential confounding factors, such as patient compliance, dietary habits, & differences in occlusal forces, all of which could have significantly influenced retainer survival rates & periodontal health outcomes. Furthermore, pre-treatment malocclusion severity & the status of third molars were not accounted for, which might have affected post-treatment stability.

Future studies should assess additional parameters like bone density, gingival biotype, neuromuscular adaptation, & residual mandibular growth to better understand their influence on retention outcomes. Longer follow-ups & larger, multi-center trials would strengthen the evidence. Advanced imaging & digital tools could optimize retainer selection based on individual patient characteristics. These refinements may lead to more personalized & effective retention protocols.

V. Conclusion

The present research was undertaken to evaluate & compare the Stability, Survival Rate, Periodontal Health, & Oral Health-Related Quality of Life associated with PEEK Retainers in comparison to Conventional Retainers. With increasing interest in advanced biomaterials for orthodontic applications, this study aimed to determine whether PEEK retainers offer advantages over traditional retention methods. By analysing both clinical performance and patient-centered outcomes, this investigation provides meaningful insight into the effectiveness and potential benefits of PEEK retainers in orthodontic practice & Its conclusion is as follows:

- Stability: - Both PEEK & Conventional Retainers effectively maintained tooth alignment over 12 months, with no statistically significant differences in stability. The findings suggest that PEEK is equally capable as conventional retainers in preventing relapse, making it a viable alternative for post-orthodontic retention.
- Survival Rate: -PEEK Retainers exhibited significantly higher survival rates compared to Conventional Retainers. The enhanced longevity of PEEK Retainers reduces the need for frequent repairs.
- Periodontal Health: -Both PEEK & Conventional Retainer types led to a gradual decline in periodontal health (OHI-S & CPI scores), with no significant differences between groups. Despite PEEK's smooth, non-porous surface, it did not outperform conventional retainers in reducing plaque or gingival inflammation, emphasizing the need for consistent oral hygiene regardless of retainer type.
- Oral Health-Related Quality of Life: - OHIP-14 scores improved similarly in both PEEK & Conventional Retainers groups, indicating that neither retainer type negatively affected patients' comfort, speech, or daily function. The absence of significant differences in OHRQoL suggests that clinicians can choose between PEEK & conventional retainers based on durability & patient preference without compromising quality of life

References

[1]. Fudalej PS, Renkema A-M. A Brief History Of Orthodontic Retention. Br Dent J [Internet]. 2021;230(11):777–80.
[2]. Renkema AM. Permanent Retention From The Long-Term Perspective (Doctoral Dissertation, Sl: Sn).
[3]. 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 [Internet]. 2018;154(2):167-174.E1.
[4]. Katsaros C, Livas C, Renkema A-M. Unexpected Complications Of Bonded Mandibular Lingual Retainers. Am J Orthod Dentofacial Orthop [Internet]. 2007;132(6):838–41.
[5]. Littlewood SJ, Kandasamy S, Huang G. Retention And Relapse In Clinical Practice. Aust Dent J [Internet]. 2017;62 Suppl 1:51–7.
[6]. Sobouti F, Rakhshan V, Saravi MG, Zamanian A, Shariati M. Two-Year Survival Analysis Of Twisted Wire Fixed Retainer Versus Spiral Wire And Fiber-Reinforced Composite Retainers: A Preliminary Explorative Single-Blind Randomized Clinical Trial. Korean J Orthod [Internet]. 2016;46(2):104–10.
[7]. Kadhum AS, Alhuwaizi AF. The Efficacy Of Polyether-Ether-Ketone Wire As A Retainer Following Orthodontic Treatment. Clin Exp Dent Res [Internet]. 2021;7(3):302–12.
[8]. Węgrodzka E, Kornatowska K, Pandis N, Fudalej PS. A Comparative Assessment Of Failures And Periodontal Health Between 2 Mandibular Lingual Retainers In Orthodontic Patients. A 2-Year Follow-Up, Single Practice-Based Randomized Trial. Am J Orthod Dentofacial Orthop [Internet]. 2021;160(4):494-502.El.
[9]. Adanur-Atmaca R, Çokakoğlu S, Öztürk F. Effects Of Different Lingual Retainers On Periodontal Health And Stability. Angle Orthod [Internet]. 2021;91(4):468–76.
[10]. Gera A, Pullisaar H, Cattaneo PM, Gera S, Vandevska-Radunovic V, Cornelis MA. Stability, Survival, And Patient Satisfaction With CAD/CAM Versus Conventional Multistranded Fixed Retainers In Orthodontic Patients: A 6-Month Follow-Up Of A Two-Centre Randomized Controlled Clinical Trial. Eur J Orthod [Internet]. 2023;45(1):58–67.
[11]. Alabbadi AA, Abdalla EM, Hanafy SA, Yousry TN. A Comparative Study Of CAD/CAM Fabricated Polyether Ether Ketone And Fiber-Glass Reinforcement Composites Versus Metal Lingual Retainers Under Verticalload (An In Vitro Study). BMC Oral Health [Internet]. 2023;23(1):583.
[12]. Roser CJ, Bauer C, Hodecker L, Zenthöfer A, Lux CJ, Rues S. Comparison Of Six Different CAD/CAM Retainers Vs. The Stainless Steel Twistflex Retainer: An In Vitro Investigation Of Survival Rate And Stability. J Orofac Orthop [Internet]. 2025;86(2):119–28.
[13]. Jasim ES, Kadhum AS. Poly-Ether-Ether-Ketone (PEEK) Versus Dead-Soft Coaxial Bonded Retainers: A Randomized Clinical Trial. Part 1. Stability, Retainer Failure, And Participant Satisfaction. Eur J Orthod [Internet]. 2024;46(5).
[14]. Jasim ES, Kadhum AS. Poly-Ether-Ether-Ketone Versus Dead-Soft Coaxial Bonded Retainers: A Randomized Clinical Trial. Part 2: Periodontal Health And Microbial Biofilm Assessment. Eur J Orthod [Internet]. 2024;46(5).
[15]. Kravitz ND, Grauer D, Schumacher P, Jo Y-M. Memotain: A CAD/CAM Nickel-Titanium Lingual Retainer. Am J Orthod Dentofacial Orthop [Internet]. 2017;151(4):812–5.
[16]. Little RM. The Irregularity Index: A Quantitative Score Of Mandibular Anterior Alignment. Am J Orthod [Internet]. 1975;68(5):554–63.
[17]. Greene JG, Vermillion JR. The Simplified Oral Hygiene Index. The Journal Of The American Dental Association. 1964 Jan 1;68(1):7-13.
[18]. Slade GD. Derivation And Validation Of A Short-Form Oral Health Impact Profile. Community Dent Oral Epidemiol [Internet]. 1997;25(4):284–90.
[19]. 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 [Internet]. 2016;2016(1):CD002283.

[20]. Martin C, Littlewood SJ, Millett DT, Doubleday B, Bearn D, Worthington HV, Et Al. Retention Procedures For Stabilising Tooth Position After Treatment With Orthodontic Braces. Cochrane Database Syst Rev [Internet]. 2023;5(5):CD002283.
[21]. Alrawas MB, Kashoura Y, Tosun Ö, Öz U. Comparing The Effects Of CAD/CAM Nickel-Titanium Lingual Retainers On Teeth Stability And Periodontal Health With Conventional Fixed And Removable Retainers: A Randomized Clinical Trial. Orthod Craniofac Res [Internet]. 2021;24(2):241–50.
[22]. Freitas KMS, Massaro C, Miranda F, De Freitas MR, Janson G, Garib D. Occlusal Changes In Orthodontically Treated Subjects 40 Years After Treatment And Comparison With Untreated Control Subjects. Am J Orthod Dentofacial Orthop [Internet]. 2021;160(5):671–85.
[23]. Pandis N, Vlahopoulos K, Madianos P, Eliades T. Long-Term Periodontal Status Of Patients With Mandibular Lingual Fixed Retention. Eur J Orthod [Internet]. 2007;29(5):471–6.