PAKISTAN JOURNAL OF HEALTH SCIENCES
(LAHORE)
https://thejas.com.pk/index.php/pjhs
ISSN (E): 2790-9352, (P): 2790-9344
Volume 6, Issue 11 (November 2025)

Original Article

OPEN ACCESS

Frequency of Different Fracture Patterns of Acrylic Partial Denture in the Patients Visiting Sardar Begum Dental College

Faiza Irshad[1*], Mohammad Ali Chughtai[1], Faisal Hayat[2], Sajid Ali[2], Afeen Shameem[3] and Jawad Ali[1]

[1]Department of Prosthodontics, Sardar Begum Dental College, Peshawar, Pakistan
[2]Department of Prosthodontics, Rehman College of Dentistry, Peshawar, Pakistan
[3]Department of Orthodontics, Mediciti Medical Center, United Arab Emirates

ARTICLE INFO

Keywords:
Acrylic Partial Denture, Fracture Pattern, Midline Fracture, Parafunction, Reinforcement

How to Cite:
Irshad, F., Chughtai, M. A., Hayat, F., Ali, S., Shameem, A., & Ali, J. (2025). Frequency of Different Fracture Patterns of Acrylic Partial Denture in the Patients Visiting Sardar Begum Dental College: Frequency of Different Fracture Patterns of Acrylic Partial Denture. Pakistan Journal of Health Sciences, 6(11), 108-113. https://doi.org/10.54393/pjhs.v6i11.3530

***Corresponding Author:**
Faiza Irshad
Department of Prosthodontics, Sardar Begum Dental College, Peshawar, Pakistan
faizamansoor1993@gmail.com

Received Date: 1st October, 2025
Revised Date: 15th November, 2025
Acceptance Date: 21st November, 2025
Acceptance Date: 30th November, 2025

ABSTRACT

Fracture of acrylic removable partial dentures (RPDs) is a major cause of prosthesis failure, often requiring repair or replacement. **Objective:** To determine the distribution of fracture patterns in acrylic RPDs and assess associations with demographic and clinical factors in patients at Sardar Begum Dental College. **Methods:** In this cross-sectional study (Sept 2023–Mar 2024), 96 patients with fractured acrylic partial dentures were enrolled consecutively. Fracture types (midline, clasp, connector, crack line, multiple) and variables including age, gender, reinforcement, parafunctional habits, and ridge resorption were recorded. Data were analyzed using chi-square tests and Cramer's V, with $p<0.05$ considered significant. **Results:** Midline fractures were most frequent (57.3%), followed by clasp fractures (28.1%), multiple-site (12.5%), connector (1.0%), and crack line only (1.0%). Parafunctional habits were significantly associated with fracture pattern ($p=0.042$, Cramer's V = 0.321). Reinforcement showed borderline significance ($p=0.060$). Other factors showed no significant relationship. **Conclusions:** Midline fractures predominate in acrylic RPDs. Parafunction is a significant modifiable risk factor, and reinforcement may offer a protective benefit. Screening for parafunctional habits and implementing prudent reinforcement strategies could reduce fracture incidence.

INTRODUCTION

Fracture of acrylic removable partial dentures (RPDs) remains a common clinical problem, leading to functional disability, compromised esthetics, and repeated repairs. The inherent weakness of polymethyl methacrylate (PMMA) under cyclic loading makes it prone to fatigue and midline failure [1]. International reports consistently identify acrylic denture fractures as a major cause of prosthesis failure, with higher repair rates compared to cobalt-chromium frameworks. Mohamed *et al.* demonstrated that acrylic RPDs have significantly reduced service longevity relative to metal-based prostheses, underscoring their mechanical vulnerability [2]. PMMA reinforcement has been explored to overcome this limitation. Studies report that metal mesh, glass fiber, carbon fiber, and nano-fillers can enhance flexural and impact strength, depending on their placement and bonding within the denture base [3-5]. Among these, metal mesh and glass fiber reinforcements are most commonly used in routine clinical practice and were considered in the present study when analyzing risk factors for denture fracture [6]. Recent reviews emphasize that while PMMA remains the material of choice, its low fracture toughness and fatigue resistance continue to challenge prosthodontic longevity. Alqutaibi *et al.* highlighted that

DOI: https://doi.org/10.54393/pjhs.v6i11.3530

reinforcement strategies remain critical to improving PMMA's performance [3]. Similarly, Chen *et al.* showed that connector geometry and clasp design directly influence stress concentration in acrylic bases [6]. Finite element analyses and experimental models, such as those by Qin *et al.* demonstrate that optimized reinforcement placement significantly reduces displacement and fracture risk [4]. Despite global advancements, regional data remain limited. In South Asia, fracture frequency and pattern distribution have been insufficiently reported. An Iraqi study by Mohsen *et al.* noted frequent acrylic denture fractures but did not specify fracture types or associated factors [7]. In Pakistan, available studies are largely descriptive and lack a detailed evaluation of fracture locations and patient-related influences. This gap in local evidence highlights the need for region-specific research. Understanding the frequency and distribution of fracture patterns and their association with variables such as parafunctional habits, ridge resorption, and reinforcement can guide clinicians in adopting better preventive and reinforcement strategies.

This study aimed to evaluate the fracture patterns of acrylic partial dentures among patients visiting Sardar Begum Dental College and to identify key demographic and clinical risk factors associated with these fractures.

METHODS

This cross-sectional descriptive study was conducted in the Department of Prosthodontics, Sardar Begum Dental College, Gandhara University, Peshawar, to evaluate the frequency and distribution of fracture patterns in acrylic partial dentures and their association with demographic and clinical factors. The study period extended from September 2023 to March 2024, following ethical approval from the institutional review board (Ref: GU/Ethical Committee/2023/210). Informed consent was obtained from all participants before data collection. The sample size (n = 96) was calculated using the World Health Organization (WHO) sample size calculator, assuming a previously reported denture fracture prevalence of 45% as reported by Mohsen *et al.* [7], with a 95% confidence level and 5% margin of error. To enhance the reliability and representativeness of the findings, the final sample was slightly increased beyond the minimum estimated value of 92 participants. A non-probability consecutive sampling technique was employed, whereby all eligible patients presenting during the study period were included until the sample size was achieved. Although consecutive sampling can potentially introduce selection bias, this was minimized by applying consistent inclusion and exclusion criteria throughout the six months and by recruiting patients from a diverse clinical pool to capture variability in demographics and prosthesis types. Patients aged 20 years and above presenting with fractured acrylic removable partial dentures (RPDs) were included, irrespective of gender. Exclusion criteria comprised patients with metal framework dentures, congenital craniofacial anomalies, systemic bone diseases (e.g., osteoporosis), and those with fractures resulting from laboratory errors before clinical use. Data were collected using a structured proforma that documented demographic details (age, gender, socioeconomic and educational status), prosthesis-related characteristics (arch involved, Kennedy classification, opposing dentition, and presence or absence of reinforcement), and clinical variables (ridge resorption, parafunctional habits, and previous denture repairs). Each denture was examined under standard illumination and magnification by the principal investigator. To ensure intra-examiner reliability, a subset of 10 dentures was re-examined after one week, yielding a kappa value of 0.86, indicating strong agreement. Fracture patterns were categorized into five operational groups adapted from Kamble *et al.* and Zheng *et al.* to ensure comparability with prior literature [8, 9]. The categories were as follows: (1) Midline fracture, a complete fracture along the mid-palatal line; (2) Clasp assembly fracture, involving the clasp, rest, or minor connector; (3) Connector fracture, through major or minor connectors excluding clasps; (4) Crack line only, referring to incomplete visible cracks without separation; and (5) Multiple fracture sites, representing dentures exhibiting more than one fracture type simultaneously. Residual ridge resorption was graded clinically as mild, moderate, or severe, in accordance with the Atwood (1971) classification, based on ridge contour and height on intraoral examination. Although no radiographic measurements were performed, a standardized clinical calibration protocol was followed to maintain consistency across all assessments. Reinforcement assessment was carried out by visually examining each denture base and reviewing clinical records to determine the presence of reinforcement materials such as metal mesh, glass fiber, or carbon fiber, which are most commonly used in the reinforcement of acrylic prostheses in the study region. All data were analyzed using IBM SPSS Statistics version 25.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics, including frequencies and percentages, were computed for categorical variables. The Chi-square test and Cramer's V were applied to examine associations between fracture patterns and selected variables. Due to the cross-sectional and descriptive nature of the study, no causal inference or multivariate regression analysis was conducted; however, potential confounders such as age, ridge resorption, and parafunctional habits were discussed in the interpretation of findings. A p-value<0.05 was considered statistically significant.

DOI: https://doi.org/10.54393/pjhs.v6i11.3530

RESULTS

Out of 96 patients, most were aged 41–50 years (29.2%) and over 50 years (29.2%), indicating that denture fractures occurred predominantly in mid-to-late adulthood. Females (54.2%) slightly outnumbered males (45.8%), and the middle socioeconomic class (43.8%) formed the largest group, followed by the lower (39.6%) and higher classes (16.7%). A sedentary lifestyle was more common (60.4%) than active occupations (39.6%). In terms of education, 33.3% had schooling up to the matric level, while 27.1% held graduate or higher qualifications. These trends suggest that socioeconomic and educational factors may influence denture maintenance and fracture risk (Table 1).

Table 1: Demographic Characteristics of Patients (n=96)

Variables	Category	Frequency (%)
Age (Years)	20–30	18 (18.8%)
	31–40	22 (22.9%)
	41–50	28 (29.2%)
	>50	28 (29.2%)
Gender	Male	44 (45.8%)
	Female	52 (54.2%)
Socioeconomic Status	Low	38 (39.6%)
	Middle	42 (43.8%)
	High	16 (16.7%)
Occupation	Sedentary	58 (60.4%)
	Active	38 (39.6%)
Education Level	Illiterate	12 (12.5%)
	Primary-Matric	32 (33.3%)
	Intermediate	26 (27.1%)
	Graduate+	26 (27.1%)

Maxillary dentures showed more fractures (60.4%) than mandibular dentures (39.6%). According to Kennedy's classification, Class III (37.5%) and Class II (27.1%) designs were most common. Over half of the cases (56.3%) had natural opposing dentition, while 25.0% had partial and 18.8% complete denture antagonists. Reinforcement was absent in 68.8% of dentures, suggesting that the lack of reinforcement may contribute to fracture risk (Table 2).

Table 2: Clinical and Prosthesis-Related Variables (n=96)

Variables	Category	Frequency (%)
Arch Involved	Maxillary	58 (60.4%)
	Mandibular	38 (39.6%)
Kennedy Class	I	22 (22.9%)
	II	26 (27.1%)
	III	36 (37.5%)
	IV	12 (12.5%)
Opposing Dentition	Natural Teeth	54 (56.3%)
	Partial Denture	24 (25.0%)
	Complete Denture	18 (18.8%)
Reinforcement	Present	30 (31.3%)
	Absent	66 (68.8%)

Fractures occurred most frequently after 1–3 years (39.6%) and over 3 years (39.6%) of denture use, with 20.8% developing within the first year. Parafunctional habits were present in 29.2% of patients, indicating a key behavioral risk factor. Moderate ridge resorption (45.8%) was most common, followed by mild (29.2%) and severe (25.0%). Nearly one-third (31.3%) had a history of previous denture repairs, suggesting that repeated stress and prior structural weakness may predispose to recurrent fractures (Table 3).

Table 3: Distribution of Habits, Oral Condition, and Duration of Denture Use among Patients (n=96)

Variables	Category	Frequency (%)
Duration of Denture Use	<1 Year	20 (20.8%)
	1–3 Years	38 (39.6%)
	>3 Years	38 (39.6%)
Parafunctional Habits	Yes	28 (29.2%)
	No	68 (70.8%)
Residual Ridge Resorption	Mild	28 (29.2%)
	Moderate	44 (45.8%)
	Severe	24 (25.0%)
History of Previous Denture Repairs	None	66 (68.8%)
	≥1 Repair	30 (31.3%)

The most frequent fracture pattern was the midline fracture (57.3%), confirming its well-documented status as the most common site due to stress concentration and flexural fatigue. Fractures around the clasp assembly accounted for 28.1%, while 12.5% involved multiple fracture sites. Fractures around connectors (1.0%) and crack lines (1.0%) were rare. This distribution reinforces that design-related stresses and occlusal forces at the palatal midline and clasp regions are the most critical factors influencing fracture occurrence (Table 4).

Table 4: Distribution of Fracture Patterns among Patients (n = 96)

Variables	Frequency (%)
Midline Fracture	55 (57.3%)
Around the Clasp Assembly	27 (28.1%)
Around Connectors	1 (1.0%)
Crack Line Only	1 (1.0%)
Multiple Fracture Sites	12 (12.5%)

Chi-square analysis showed a significant association between parafunctional habits and fracture pattern ($p = 0.042$, Cramer's $V = 0.321$), indicating a moderate relationship. Patients with bruxism were more prone to midline and clasp fractures. Reinforcement demonstrated a borderline association ($p=0.060$), suggesting higher fracture susceptibility in unreinforced dentures. Other variables, gender, Kennedy class, duration of use, and ridge resorption were not significant. These results highlight the multifactorial nature of denture fracture, with

DOI: https://doi.org/10.54393/pjhs.v6i11.3530

parafunctional habits as a key modifiable factor (Table 5).

Table 5: Association of Key Variables with Fracture Pattern (n=96)

Variables	χ^2 (df)	p-value	Cramer's V	Interpretation
Gender × Fracture Pattern	χ^2 = 4.72 (df = 4)	0.318	–	Not Significant
Kennedy Class × Fracture	χ^2 = 6.63 (df = 12)	0.881	–	Not Significant
Reinforcement × Fracture	χ^2 = 9.06 (df = 4)	0.060	–	Borderline (Trend Toward Sig.)
Duration of Use × Fracture	χ^2 = 5.95 (df = 8)	0.653	–	Not Significant
Parafunction × Fracture	χ^2 = 9.89 (df = 4)	0.042	0.321	Significant (Moderate Association)
Ridge Resorption × Fracture	χ^2 = 6.78 (df = 8)	0.560	–	Not Significant

p<0.05 considered significant; Cramer's V values: 0.1 = weak, 0.3 = moderate, 0.5+ = strong

Midline fractures were the most frequent (57.3%), followed by fractures around the clasp assembly (28.1%). Multiple fracture sites accounted for 12.5%, whereas fractures around connectors (1.0%) and crack line only (1.0%) were rare. This highlights the midline as the predominant site of denture failure, consistent with the mechanical stress concentration in that region (Figure 1).

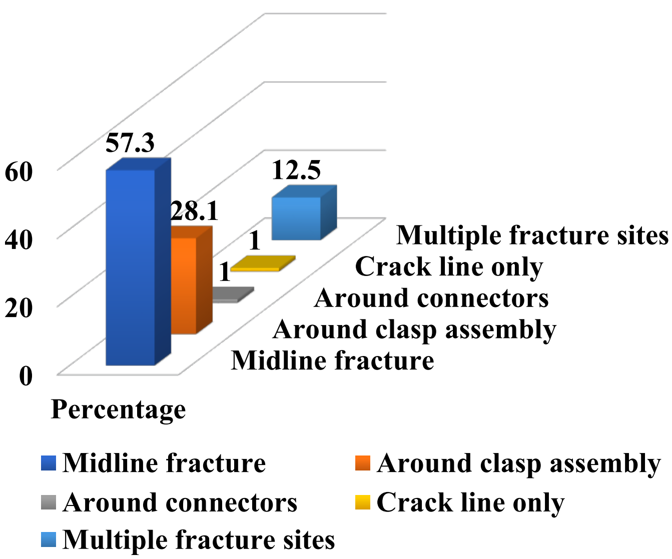

Figure 1: Distribution of Fracture Patterns among Patients with Acrylic Partial Dentures (n=96)

DISCUSSIONS

The present study identified midline and clasp-related fractures as the predominant patterns in acrylic partial dentures, consistent with previous literature describing midline failure as the classic fatigue path caused by flexural bending across the palatal vault. Mohamed *et al.* noted that denture fracture commonly arises from fatigue along high-stress zones such as the midline [2]. Similar findings by Kamble *et al.* and Iris *et al.* confirmed midline dominance due to repeated cyclic loading and stress concentration [8, 10]. Clasp-related fractures were the second most frequent pattern, aligning with biomechanical evidence showing that junctions of clasps, rests, and minor connectors act as stress risers during function and insertion-removal cycles. Zheng *et al.* reported that cyclic loading and undercut depth influence clasp fatigue and adjacent acrylic failure [9]. while Chen *et al.* demonstrated that clasp geometry strongly affects retention force and stress distribution [5]. A significant association was found between parafunctional habits and fracture pattern, supporting evidence that bruxism increases risk through greater occlusal forces and more frequent loading cycles. Chrcanovic *et al.* observed higher fracture incidence among bruxers, reinforcing the importance of behavioral screening [11]. Likewise, Ionfrida *et al.* emphasized preventive approaches such as night guards and occlusal adjustments for patients with parafunction [12]. Although reinforcement showed only a borderline association, its protective potential is supported by recent studies. Hussein *et al.* reported enhanced fracture resistance with metal mesh and glass fiber reinforcements [13], while Pavlin *et al.* found improved load tolerance with carbon fiber bases [14]. Other investigations also confirm that fiber or mesh reinforcement increases PMMA's flexural and impact strength [14-16]. These findings suggest that reinforcement remains beneficial, particularly for high-stress cases or long-span dentures. Advances in materials and design continue to reduce classical failure modes. Alqutaibi *et al.* reviewed PMMA modifications and substitutes to address fatigue limitations [3]. Digital frameworks using PEEK have demonstrated superior fit and reduced stress transmission compared to Co-Cr, as reported by Barbosa *et al.* [17]. Similarly, Naka *et al.* found digital fabrication to produce accurate RPD frameworks, potentially lowering fracture risk [18]. From a clinical perspective, proper repair protocols also contribute to denture longevity. Chladek *et al.* emphasized that surface treatments and standardized repair methods improve PMMA strength [19]. In addition, graphene-modified PMMA and nanocomposites offer promising improvements in flexural and impact performance, though further long-term studies are required [13, 20]. Overall, the current findings align with contemporary research: midline and clasp failures remain the most common, parafunctional habits are a major modifiable risk, and reinforcement and design optimization are crucial preventive strategies. Future studies incorporating objective bruxism assessment, digital design accuracy, and standardized reinforcement protocols across larger cohorts could refine clinical recommendations.

DOI: https://doi.org/10.54393/pjhs.v6i11.3530

CONCLUSIONS

This study evaluated the frequency and distribution of fracture patterns in acrylic partial dentures and their association with clinical and demographic factors. Midline fractures were the most frequent, followed by clasp-related fractures, reflecting areas of highest stress concentration. A significant link between parafunctional habits and fracture pattern indicates that behavioral factors play a key role in denture failure. Although reinforcement showed a borderline protective effect, other variables such as gender, Kennedy classification, duration of use, and ridge resorption were not significant. These findings underscore the need to screen for parafunctional habits and incorporate reinforcement strategies during denture fabrication to reduce fracture risk and enhance prosthesis longevity.

Authors Contribution

Conceptualization: FI
Methodology: MAC, FH, AS, JA
Formal analysis: FH, AS
Writing review and editing: FI, FH, SA, AS, JA

All authors have read and agreed to the published version of the manuscript

Conflicts of Interest

All the authors declare no conflict of interest.

Source of Funding

The author received no financial support for the research, authorship and/or publication of this article.

REFERENCES

[1] Zahel A, Roehler A, Kaucher-Fernandez P, Spintzyk S, Rupp F, Engel E. Conventionally and Digitally Fabricated Removable Complete Dentures: Manufacturing Accuracy, Fracture Resistance and Reparability. Dental Materials. 2024 Oct 1; 40(10): 1635-42. doi: 10.1016/j.dental.2024.07.022.
[2] Mohamed SZ, Ghobashy MM, Taymour N, Abdelwahab S, Srimaneepong V, Rokaya D. Accuracy of Repaired Maxillary Dentures from Two Different Repairing Techniques: In Vitro Study. Heliyon. 2024 Nov; 10(21). doi: 10.1016/j.heliyon.2024.e40017.
[3] Alqutaibi AY, Baik A, Almuzaini SA, Farghal AE, Alnazzawi AA, Borzangy S *et al.* Polymeric Denture Base Materials: A Review. Polymers. 2023; 15: 3258. doi: 10.3390/polym15153258.
[4] Qin LX, Zhou T, Wang X, Jiang YB, Liu F, Xiao Z *et al.* Precipitation Behavior of A New Cu-Ni-Co-Si-Fe-Mg Alloy Designed with Low Cobalt Content. Materials and Design. 2024 Apr; 240: 112833. doi: 10.1016/j.matdes.2024.112833.
[5] Chen Y, Caneli G, Almousa R, Xie D. A Novel Antibacterial Zirconia-Containing PMMA Bone Cement. Journal of the Mechanical Behavior of Biomedical Materials. 2022 May; 129: 105135. doi: 10.1016/j.jmbbm.2022.105135.
[6] Chen R, Chen Y, Zheng Z, Lin J. Effect of Geometry on Clasp Retention Force: A Finite Element Analysis Study. BioMed Central Oral Health. 2024 Dec; 24(1): 1522. doi: 10.1186/s12903-024-05334-y.
[7] Mohsen N, Elmaroush M, Hamida SB, Abusua F. In Vitro Evaluation of the Fracture Strength among Three Different Denture Base Materials. Al-Qalam Journal of Medical and Applied Sciences. 2025 Feb: 230-5. doi: 10.54361/ajmas.258135.
[8] Kamble VB, Mangalvedhekar MS, Desai RG, Arabbi KC, Patil SM, Dessai DS *et al.* Assessment of Incidence, Causes and Types of Removable Denture Fractures: A Cross-sectional Clinical Survey from Northern Karnataka, India. Journal of Clinical and Diagnostic Research. 2021 Nov; 15(11). doi: 10.7860/JCDR/2021/48087.15614.
[9] Zheng J, Aarts JM, Ma S, Waddell JN, Choi JJ. Fatigue Behavior of Removable Partial Denture Cast and Laser-Sintered Cobalt-Chromium (COCR) and Polyetheretherketone (PEEK) Clasp Materials. Clinical and Experimental Dental Research. 2022 Dec; 8(6): 1496-504. doi: 10.1002/cre2.645.
[10] Iris GS. Midline Deviation Treatment Mechanics: A Systematic Review. 2024.
[11] Chrcanovic BR, Bergengren T, Stanisic N, Sohrabi S, Larsson C, Svensson P *et al.* Relationship Between Bite Force, Bruxism, and Fractures of Teeth and Dental Restorations. Scientific Reports. 2025 Jul; 15(1): 22752. doi: 10.1038/s41598-025-07772-2.
[12] Ionfrida JA, Stiller HL, Kämmerer PW, Walter C. Dental Implant Failure Risk in Patients with Bruxism—A Systematic Review and Meta-Analysis of the Literature. Dentistry Journal. 2024 Dec; 13(1): 11. doi: 10.3390/dj13010011.
[13] Hussein LA, Mahmoud MR, Hussein MO, Rayyan M, Naguib A, Sayed M. Impact of Graphene-Incorporated Nanofillers on Material Properties and Performance of Polymers Used for Prosthodontic Patients: A Systematic Review and Meta-Analysis. BioMed Central Oral Health. 2025 Sep; 25(1): 1420. doi: 10.1186/s12903-025-06867-6.
[14] Pavlin M, Gubeljak N, Predan J, Ćelić R. Evaluation of the Bond Strength Between the Acrylic Teeth and Reinforced or Non-Reinforced Complete Denture Base. Acta Stomatologica Croatica: International Journal of Oral Sciences and Dental Medicine. 2024 Oct; 58(3): 218-32. doi: 10.15644/asc58/3/3.

DOI: https://doi.org/10.54393/pjhs.v6i11.3530

[15] Szymlet P, Jedliński M, Frąckiewicz W, Jankowska A, Wdowiak-Szymanik A, Sobolewska E. Characteristics of Acrylic Produced Additively by 3D Printing in Dentistry: Comparison of Mechanical and Surface Parameters—A Systematic Review with Meta-Analysis of Novel Reports. Materials. 2025 Sep; 18(18): 4409. doi: 10.3390/ma18184409.
[16] Negm HM, Elkharadly DY, Badawy S, Taha RR. Fracture Resistance in Fibre-Reinforced Resin Composite Restorations in Deciduous and Permanent Molars: An Ex Vivo Study. The Saudi Dental Journal. 2024 Sep; 36(9): 1197-202. doi: 10.1016/j.sdentj.2024.06.017.
[17] Barbosa L, Figueiral MH, Neves CB, Malheiro R, Sampaio-Fernandes MA, Oliveira SJ et al. Fit Accuracy of Cobalt–Chromium and Polyether Ether Ketone Prosthetic Frameworks Produced Using Digital Techniques: In Vitro Pilot Study. Applied Sciences. 2023 Dec; 14(1): 118. doi: 10.3390/app14010118.
[18] Naka O, Kamalakidis SN, Anastassiadou V. The Impact of Current Fabrication Methods on the Fit Accuracy of Removable Partial Dentures: A Systematic Review and Meta-Analysis. Applied Sciences. 2024 Nov; 14(23): 11034. doi: 10.3390/app142311034.
[19] Chladek G, Adeeb S, Pakieła W, Coto NP. Effect of Different Surface Treatments as Methods of Improving the Mechanical Properties After Repairs of PMMA for Dentures. Materials. 2024 Jul; 17(13): 3254. doi: 10.3390/ma17133254.
[20] Wu S, Qian C, Jiao T, Sun J. Comparison of the Retention and Fit of Polyether Ether Ketone Clasps during Fatigue Circulation Tests. Heliyon. 2023 Sep; 9(9). doi: 10.1016/j.heliyon.2023.e19959.