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Multifactorial determinants of complications and patient-reported outcomes in metal clasp-retained removable partial dentures

Berk Bilgen[1]*, Berk Kaffaf[2], Olcay Şakar[1]
[1]Department of Prosthodontics, Faculty of Dentistry, Istanbul University, Istanbul, Türkiye
[2]Department of Prosthodontics, Faculty of Dentistry, Istanbul Kent University, Istanbul, Türkiye

ORCID
Berk Bilgen
https://orcid.org/0000-0002-3102-0632
Berk Kaffaf
https://orcid.org/0000-0002-7156-3770
Olcay Şakar
https://orcid.org/0000-0003-1513-4186

PURPOSE. This cross-sectional study aimed to evaluate the distribution of complications in clasp-retained removable partial dentures (C-RPDs) and to investigate the influence of denture design parameters, denture age, and Kennedy and Eichner classifications on complication patterns and patient-reported outcomes. **MATERIALS AND METHODS.** 134 patients wearing 205 metal C-RPDs were included. Biological and mechanical complications were recorded. Denture design parameters (major connector type, clasp type and number, and rest number) were documented. Oral health-related quality of life Oral health-related quality of life (OHRQoL) and patient satisfaction were assessed using the OHIP-14 and a visual analog scale (VAS). Associations between complication patterns, design parameters, denture age, classifications and patient-reported outcomes were statistically analyzed. **RESULTS.** Mechanical complications were the most frequently observed complications. Mechanical complications and ulcerations were significantly associated with reduced OHRQoL. Denture age demonstrated a significant association with mechanical complications and patient-reported outcomes. Classifications showed limited associations with complications and did not influence patient-reported outcomes. Palatal plate and anteroposterior palatal strap designs were associated with physical pain and reduced speech satisfaction. In the mandible, dentures incorporating both circumferential and bar clasps demonstrated higher satisfaction, whereas the exclusive use of bar clasps was associated with increased physical disability. Higher numbers of rests and clasps were associated with lower overall OHIP-14 scores. **CONCLUSION.** Denture age and design characteristics were associated with complication patterns and patient-reported outcomes. Mechanical complications were more frequently observed in older dentures and, together with mucosal ulcerations, were associated with reduced OHRQoL. These findings suggest that individualized design strategies, regular follow-up, and timely maintenance may contribute to better mechanical stability and patient-centered outcomes in C-RPDs. [J Adv Prosthodont 2026;18:208-26]

KEYWORDS
Removable partial dentures; Oral health-related quality of life; Denture complications; Kennedy classification; Major connectors; Denture design

Corresponding author
Berk Bilgen
Department of Prosthodontics, Faculty of Dentistry, Istanbul University, Suleymaniye, Prof. Dr. Cavit Orhan Tutengil Street, Fatih-Istanbul-Türkiye, Zip code: 34116
Tel +90-212-44-00000
E-mail berk.bilgen@istanbul.edu.tr

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INTRODUCTION

Partial edentulism remains a prevalent clinical condition, particularly in aging populations, where increasing life expectancy has reshaped prosthetic treatments. In many developing countries, elderly individuals tend to retain their dentures for extended periods, making long-term denture use a common clinical reality. Within this context, clasp-retained removable partial dentures (C-RPDs) continue to represent an essential treatment option, offering an affordable and minimally invasive treatment alternative.[1-4]

Although C-RPDs can provide significant improvements, their long-term success is strongly influenced by mechanical reliability and patient adaptation.[5-8] Patient satisfaction has been associated with denture function, esthetic performance and individual adaptability. Nonetheless, complications and design- or use-related factors may compromise function, reduce longevity and impair oral health–related quality of life (OHRQoL).[9-12]

Recent systematic reviews reported generally high satisfaction rates following RPDs; however, patient satisfaction was emphasized as a multifactorial outcome influenced by a range of variables. Age emerged as a consistent determinant, with older patients generally reporting higher satisfaction levels, whereas gender appears to influence only specific domains such as esthetics.[10,12] In addition, socioeconomic status, prior denture experience, and the extent of tooth loss have been associated with variations in satisfaction levels. Pain, esthetic concerns, and hygiene-related difficulties remain common sources of dissatisfaction in clinical practice.[8,12-15]

The clinical use of C-RPDs is frequently associated with mechanical and biological complications. These complications may compromise denture survival, reduce retention and stability, and negatively influence patient satisfaction.[16-19] Although systematic reviews indicate that cast framework C-RPDs generally demonstrate stable survival rates during the early years of use when properly maintained, several clinical investigations have reported that complication rates increase particularly after five years of service, with mechanical failures and loss of retention being the most commonly encountered problems. In addition, mandibular dentures have been shown to present higher complication rates compared with maxillary dentures.[2,6,17]

Despite the documented prevalence of RPD complications, their direct impact on patient-reported outcomes has been investigated in a very limited number of studies. Bilhan *et al.*[11] reported that denture-related ulcerations impaired both chewing ability and speech, while loss of retention negatively affected chewing performance. Similarly, Al-Imam *et al.*[9] observed significantly higher OHIP-14 scores after five years of denture use in patients presenting with complications, such as loss of retention and mucosal inflammation, compared with those without complications. Other clinical studies have likewise demonstrated that technical and biological complications adversely influence OHRQoL.[10,12,14]

Denture design characteristics have also been identified as key determinants of patient-reported outcomes. The extent of soft tissue coverage by major connectors has been shown to influence comfort, adaptation, and satisfaction, with maxillary connector designs involving reduced palatal coverage—such as U-shaped connectors, bars, and palatal straps—generally associated with higher patient satisfaction.[20-23] Similarly, the lingual bar has been reported to be perceived more favorably than the lingual plate in terms of mastication, speech, and comfort.[23] In contrast, evidence regarding the role of clasps and rests remains inconclusive. Although clasp type alone may not be a decisive factor in patient-reported outcomes, the number and configuration of clasps and rests have been suggested to improve retention and long-term adaptation.[5,13,17] Nevertheless, the long-term effects of clasp and rest type and number on patient satisfaction and OHRQoL remain insufficiently characterized, particularly in long-term denture use.

Evidence regarding the relationship between classification systems, such as the Kennedy and Eichner classifications, and patient-reported outcomes or denture-related complications remains limited. To date, no study has directly investigated the relationship between the Eichner classification and OHRQoL. Only Koyama *et al.*[5] reported that the number of

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occluding teeth had no clear effect on overall patient satisfaction. Similarly, only a small number of studies have examined the impact of Kennedy classification on patient-reported outcomes. Although Shams *et al.*[15] reported no direct relationship between Kennedy classification and overall satisfaction, weak associations have been identified, with lower esthetic satisfaction observed in Kennedy Class IV patients, and higher speech-related satisfaction reported in Kennedy Class III patients.[12,13] Although the impact of C-RPD use on patient-reported outcomes has been previously examined, no study has comprehensively evaluated the combined influence of denture design parameters, such as major connector type, clasp configuration, clasp number, and rest number, classification systems, denture age, and biological and mechanical complications on patient-reported outcomes. Therefore, the present study aimed to comprehensively evaluate the effects of these factors on OHRQoL and patient satisfaction, as assessed using the OHIP-14 and VAS scores, within a single study population, while also analyzing the distribution of complications in both arches and their associations with relevant clinical variables. The null hypothesis was that denture design parameters, complication patterns, denture age, and classification systems would not be significantly associated with patient-reported outcomes.

MATERIALS AND METHODS

This cross-sectional clinical study was approved by the Research Ethics Board of Istanbul Kent University with protocol number: E-10420511-051-44387 and conducted in accordance with the principles of the Declaration of Helsinki. The study population consisted of patients wearing metal C-RPDs for at least three years, who presented to the prosthodontics clinics of Istanbul Kent University and Istanbul University, Faculty of Dentistry between 2023 and 2025 for routine follow-up, maintenance procedures, or the management of denture-related complaints, including renewal, repair, or adjustment. Only dentures fabricated in the prosthodontics clinics of these institutions by senior dental students, with every clinical procedure supervised and verified by specialist faculty members to ensure procedural standardization, were included in the study. Data collection procedures, examination protocols and outcome assessment methods were standardized across both participating centers to ensure comparability.

Inclusion criteria were the regular use of the C-RPD for at least three years, the ability to read and sign the informed consent form, the absence of any systemic, physical or mental condition that could interfere with denture hygiene, and willingness to participate. Of the 167 patients initially examined, 21 were excluded because they had undergone tooth extractions after denture delivery, 5 declined to participate and 7 were excluded due to uncertain duration or irregular use of their dentures. After applying these criteria, a total of 134 patients with 205 RPDs were included in the final analysis.

Demographic and clinical information was recorded, including patient age, sex, arch distribution of the dentures, number of remaining teeth, and denture age. Patient age and sex were recorded as potential confounding variables and their associations with clinical variables and patient-reported outcomes were examined accordingly. Each arch was classified according to the Kennedy classification (Classes I – IV) and Eichner classification (Groups A – C with subgroups A1 – C3).[4,24] For each C-RPD, the major connector type, clasp number, clasp type (akers or bar) and the total number of rests were documented separately for the maxilla and mandible.

Subsequently, all RPDs and the intraoral tissues were carefully examined by two independent observers, both specialist prosthodontists with a minimum of five years of clinical experience. Prior to data collection, the observers independently examined a pilot sample of patients and assessed complications according to predefined criteria; discrepancies were discussed and resolved through consensus to establish a uniform interpretation of each complication category. During the main data collection phase, any disagreements were referred to a third experienced specialist prosthodontist until consensus was reached. Through these examinations, mechanical and biological complications were identified and recorded. The complications were assessed under the following categories: inflammatory papil-

lary hyperplasia, denture stomatitis, need for relining or rebasing, loss of retention, epulis fissuratum, mucosal ulcerations, and mechanical complications. Mechanical complications were further subdivided into three main groups: denture base fracture, clasp fracture, and loss or fracture of artificial teeth.[2] Each mechanical complication subtype was recorded independently as a binary variable (present or absent) for each denture, allowing a single denture to contribute to more than one subtype if multiple complications were simultaneously present. Analyses were conducted to determine the prevalence and distribution of complications and to explore their associations with denture arch (maxilla/mandible), denture age, and established classification systems (Kennedy and Eichner), as well as with patient-reported outcomes measured by OHIP-14 and VAS

Patient-reported outcomes were assessed using the validated OHIP-14, which comprises 14 items across seven domains: functional limitation, physical pain, physical disability, psychological discomfort, psychological disability, social disability, and handicap. Each item was scored on a five-point Likert scale (0 = never to 4 = very often), with higher scores indicating greater impairment of OHRQoL.[25] In addition, denture-related satisfaction was evaluated using an 8-item visual analog scale (VAS). Each item was presented on a 10 cm line anchored by "not satisfied at all" and "completely satisfied". The VAS covered overall satisfaction, retention, chewing ability, overall expectation, esthetic satisfaction, effect on speech, ease of cleaning and pain.[11] Marks made by patients were measured in millimeters with higher values reflecting greater satisfaction.

Patient-reported outcomes were recorded once per patient and reflected the overall perception of OHRQoL and satisfaction, rather than being specific to individual dentures or arches. Patients wearing both maxillary and mandibular dentures were instructed to complete OHIP-14 and VAS questionnaires by considering their overall experience with all dentures collectively. Therefore, each patient constituted a single independent observation for analyses involving OHIP-14 and VAS scores. Clinical and prosthetic variables were recorded separately for maxillary and mandibular dentures; and arch-specific analyses were subsequently performed to evaluate whether particular denture characteristics or complication types were associated with the patient's overall OHRQoL or satisfaction scores. Associations between OHIP-14, VAS and clinical parameters (denture age, Kennedy and Eichner classifications, major connector type, clasp type, clasp number, rest number, and complication types) were analyzed accordingly.

All statistical analyses were performed using NCSS 2007 Statistical Software (NCSS, Kaysville, UT, USA). Descriptive statistics (mean, standard deviation, frequency, and percentage) were calculated for demographic and clinical variables. The Shapiro–Wilk test was used to assess the normality of continuous variables. For normally distributed variables, intergroup comparisons were conducted using one-way analysis of variance (ANOVA). For non-normally distributed data, the Kruskal–Wallis test was applied, with post-hoc pairwise comparisons performed using Dunn's test. Comparisons between two independent groups were analyzed with the Mann-Whitney U test. Correlations between continuous variables were examined using Spearman's rho correlation analysis. Categorical variables were compared using the chi-square test. A significance level of $P < .05$ was considered statistically significant.

RESULTS

A total of 134 individuals (64 women, mean age 61.24 ± 10.55; 70 men, mean age 67.79 ± 10.57) with 205 RPDs were included. Among these patients, 71 wore dentures in both arches, whereas 35 wore only mandibular dentures and 28 wore only maxillary dentures. Of these dentures, 106 (51.7%) were mandibular and 99 (48.3%) were maxillary. The distributions of denture age, Kennedy-Eichner classifications and major connectors are presented in Table 1. The distribution of clasp type, clasp number, and rest number is presented in Table 2.

The OHIP-14 scores ranged from 0 to 38, with a mean of 11.32 ± 9.01. Among the domains, the highest mean values were observed for physical disability (2.22 ± 2.04) and physical pain (2.09 ± 1.82), followed by psychological discomfort (1.94 ± 1.93). Lower mean scores were noted for psycholog-

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Table 1. Distribution of denture age, Kennedy-Eichner classification and major connectors among the study population

		n	%
Mandibular Kennedy Classification	Class I	64	60.4
	Class II	24	22.6
	Class III	14	13.2
	Class IV	4	3.8
Maxillary Kennedy Classification	Class I	57	57.6
	Class II	20	20.2
	Class III	19	19.2
	Class IV	3	3
Denture Age	3 – 5 years	58	28.29
	5 – 10 years	51	24.88
	10 – 15 years	39	19.02
	> 15 years	57	27.80
Eichner Classification	A2	4	2.99
	A3	8	5.97
	B1	8	5.97
	B2	15	11.19
	B3	30	22.39
	B4	24	17.91
	C1	7	5.22
	C2	38	28.36
Mandibular Major Connector	Lingual Plate	95	89.6
	Lingual Bar	11	10.4
Maxillary Major Connector	Antero-posterior Strap	13	13.1
	U-Shaped Connector	19	19.2
	Palatal Plate	40	40.4
	Palatal Bar	3	3.1
	Palatal Strap	24	24.2

n: number of dentures; %: percentage

Table 2. Distribution of Clasp Type, Clasp Number, and Rest Number in Maxillary and Mandibular RPDs

Variable		n	%
Mandibular Clasp Number	1	12	11.3
	2	69	65.1
	3	21	19.8
	4	4	3.8
Mandibular Clasp Type	Akers	23	21.7
	Bar	28	26.4
	Combined	55	51.9
Mandibular Rest Number	0	1	0.9
	1	16	15.1
	2	75	70.8
	3	11	10.4
	4	3	2.8
Maxillary Clasp Number	1	8	8.1
	2	50	50.5
	3	34	34.3
	4	7	7.1
Maxillary Clasp Design	Akers	20	20.2
	Bar	30	30.3
	Combined	49	49.5
Maxillary Rest Number	0	1	1
	1	17	17.2
	2	64	64.6
	3	12	12.1
	4	5	5.1

n: number of dentures; %: percentage

ical disability (1.17 ± 1.53), social disability (1.09 ± 1.68) and handicap (1.09 ± 1.94). VAS assessments indicated favorable denture satisfaction, with mean scores ranging from 7.06 to 7.96 across all domains. The highest ratings were observed for ease of cleaning (7.96 ± 2.48) and absence of pain (7.71 ± 2.45), while satisfaction categories showed comparably high values (7.06–7.36). No statistically significant associations were found between patient age or gender and either OHIP-14 or VAS scores ($P > .05$).

The overall distribution of C-RPD complications according to jaw is illustrated in Figure 1. Mechanical complications represented the most frequent category in both arches. Among these, the most common finding was loss or fracture of artificial teeth, accounting for 66.7% of mandibular and 48.8% of maxillary complications. Clasp fractures were the second most frequent event, representing 47.4% and 46.3% of mandibular and maxillary mechanical complications, respectively. In the mandible, 10.8%

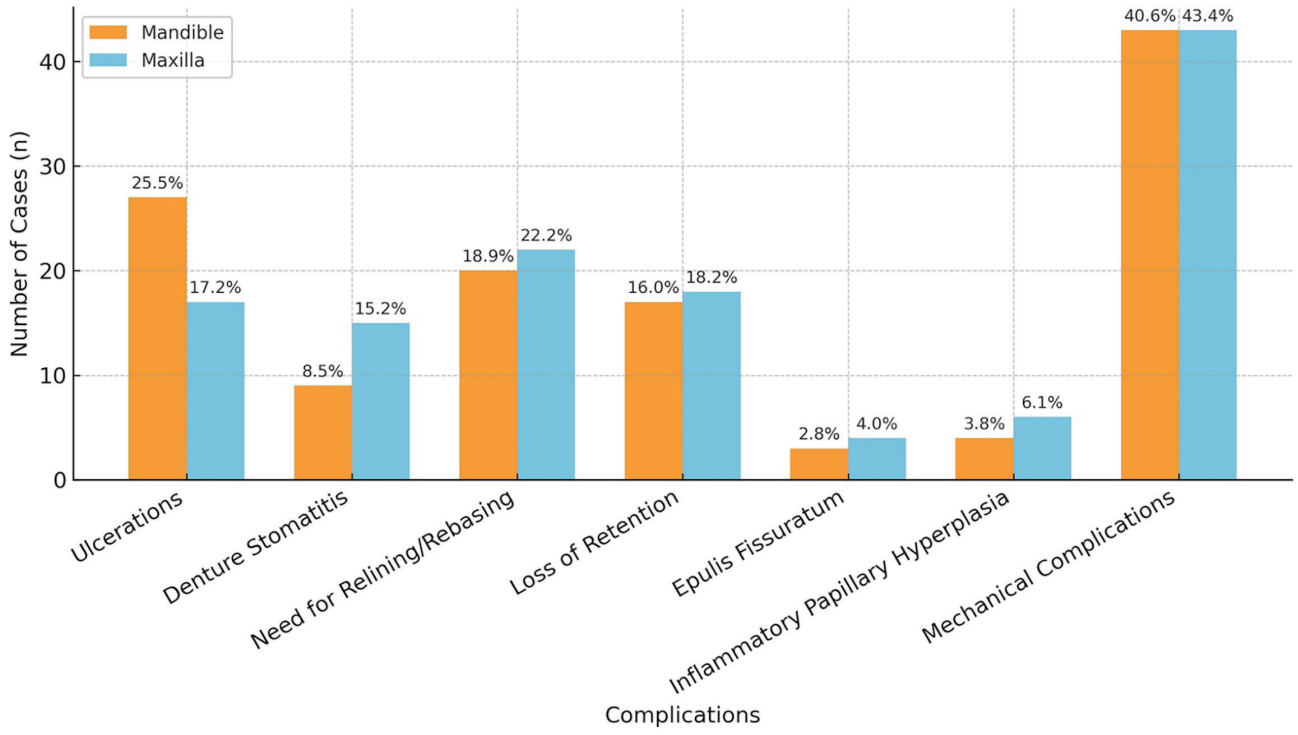

Fig. 1. Distribution of biological and mechanical complications observed in clasp-retained removable partial dentures according to jaw (mandible vs maxilla).

of clasp fractures involved bar clasps and 5.2% involved circumferential clasps, while in the maxilla these proportions were 9.5% and 6.2%, respectively. Denture base fractures accounted for 39.5% of mandibular and 43.9% of maxillary mechanical complications. No statistically significant differences in complication distribution were observed between the arches ($P > .05$).

When the association between denture age and complication types was analyzed, only mechanical complications demonstrated a statistically significant relationship with denture age. In the mandible, dentures older than 10 years exhibited a significantly higher frequency of mechanical complications ($P = .0001$), whereas in the maxilla, a significantly higher frequency was observed in dentures older than 15 years ($P = .005$). However, when mechanical complication subtypes were evaluated separately, no significant association with denture age was detected in either arch.

No statistically significant association was found between any complications and the Kennedy classification in maxillary CRPDs. In contrast, in mandibular CRPDs, only denture stomatitis and inflammatory papillary hyperplasia showed significant associations with Kennedy classes, with stomatitis being more frequent in Class III dentures ($P = .032$), whereas inflammatory papillary hyperplasia was observed exclusively in four Class II cases ($P = .003$). Regarding the Eichner classification, no significant association with complications was found in the mandible; however, in the maxilla, epulis fissuratum was significantly associated with Eichner Class A3 ($P = .003$), occurring in 40% of dentures within this subgroup. In terms of patient-reported outcomes, neither Kennedy nor Eichner classifications demonstrated a consistent relationship with overall OHIP-14 or VAS scores. Overall OHIP-14 scores were comparable across Kennedy classes in both arches (mandible: $P = .448$; maxilla: $P = .865$), and VAS scores were largely similar among groups, except for higher handicap scores in mandibular Class I and II dentures ($P = .010$) and

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lower pain scores in maxillary Class III dentures (P = .029).

Analysis of patient satisfaction using the VAS revealed significant associations between several complication types. Mechanical complications were associated with significantly lower esthetic satisfaction, overall expectation, and perceived effect on speech in both arches. In the mandible, clasp fractures were specifically related to reduced satisfaction scores, whereas no significant effect was observed in the maxilla. The need for relining or rebasing significantly decreased overall satisfaction, chewing ability, and stability during eating in maxillary dentures, while no significant association was identified in mandibular dentures. Denture stomatitis did not significantly affect any VAS domain in either arch (Table 3). Analysis of OHIP-14 scores also demonstrated significant associations between

Table 3. Association between complications and VAS scores in mandibular and maxillary removable partial dentures

Complications	Jaw		Overall satisfaction	Dislodgement while eating	Chewing ability	Esthetic satisfaction	Overall expectation	Effect on speech	Cleaning difficulty	Pain
			Avg ± SD (median)	Avg ± SD (median)	Avg ± SD (median)	Avg ± SD (median)	Avg ± SD (median)	Avg ± SD (median)	Avg ± SD (median)	Avg ± SD (median)
Ulceration	Mandible	Absent	7.23 ± 2.52 (8)	7.25 ± 2.55 (8)	7.68 ± 2.29 (8)	7.88 ± 2.21 (8)	7.7 ± 2.18 (8)	8.06 ± 2.09 (8)	7.84 ± 2.56 (8)	7.84 ± 2.41 (8)
		Present	6.38 ± 2.82 (7)	6.15 ± 3.02 (6.5)	6.77 ± 2.53 (7.5)	6.58 ± 2.93 (7)	6.19 ± 2.77 (6)	6.88 ± 2.6 (7)	7.69 ± 2.46 (8)	6.81 ± 2.81 (7.5)
		P	.216	.119	.109	.046	.013	.033	.709	.104
	Maxilla	Absent	7.43 ± 2.46 (8)	7.43 ± 2.75 (8)	7.86 ± 2.35 (8)	7.76 ± 2.52 (8)	7.31 ± 2.47 (8)	8.11 ± 2.05 (9)	8.04 ± 2.5 (9)	8.2 ± 2.21 (9)
		Present	5.88 ± 2.33 (6)	5.94 ± 2.54 (6)	5.69 ± 2.18 (5)	6.13 ± 2.6 (6)	6.44 ± 1.93 (7)	6.5 ± 2.48 (6.5)	6.94 ± 2.41 (7)	6 ± 2.56 (6)
		P	.012	.020	.001	.015	.059	.013*	.056	.001
Mechanical Complications	Mandible	Absent	7.23 ± 2.56 (8)	7.29 ± 2.83 (8)	7.77 ± 2.24 (8)	8.18 ± 2.08 (8)	7.54 ± 2.48 (8)	8.32 ± 1.98 (9)	8.22 ± 2.47 (10)	8.02 ± 2.46 (9)
		Present	6.68 ± 2.67 (7.5)	6.49 ± 2.43 (7)	6.95 ± 2.51 (8)	6.56 ± 2.7 (7)	7 ± 2.3 (7)	6.9 ± 2.45 (7)	7.15 ± 2.52 (7)	6.9 ± 2.55 (8)
		P	.318	.048	.113	.002	.141	.002	.010	.011
	Maxilla	Absent	7.43 ± 2.3 (8)	7.26 ± 2.88 (8)	7.72 ± 2.42 (8)	7.96 ± 2.36 (8)	7.53 ± 2.41 (8)	8.23 ± 2.24 (9)	8.04 ± 2.67 (10)	7.96 ± 2.34 (8)
		Present	6.83 ± 2.73 (7.5)	7.1 ± 2.63 (8)	7.21 ± 2.48 (8)	6.86 ± 2.78 (8)	6.69 ± 2.34 (7)	7.33 ± 2.06 (8)	7.62 ± 2.27 (8)	7.69 ± 2.49 (8.5)
		P	.356	.524	.258	.036	.037	.009	.157	.684
Denture Stomatitis	Mandible	Absent	7.08 ± 2.6 (8)	7.03 ± 2.72 (8)	7.56 ± 2.34 (8)	7.61 ± 2.51 (8)	7.43 ± 2.42 (8)	7.84 ± 2.31 (8)	7.87 ± 2.59 (9)	7.6 ± 2.56 (8)
		Present	6.25 ± 2.66 (7)	6.44 ± 2.6 (8)	6.33 ± 2.55 (7)	7 ± 1.8 (7)	6.22 ± 2.22 (6)	7.11 ± 1.69 (7)	7.11 ± 1.62 (7)	7.44 ± 2.46 (8)
		P	.322	.459	.112	.178	.084	.133	.138	.689
	Maxilla	Absent	7.18 ± 2.49 (8)	7.22 ± 2.84 (8)	7.56 ± 2.44 (8)	7.46 ± 2.69 (8)	7.12 ± 2.48 (8)	7.86 ± 2.24 (8)	7.98 ± 2.43 (9)	8.02 ± 2.31 (9)
		Present	7.15 ± 2.64 (9)	7 ± 2.32 (8)	7.14 ± 2.57 (8)	7.71 ± 1.98 (8)	7.5 ± 1.95 (8)	7.79 ± 1.97 (8)	7.14 ± 2.88 (8)	6.79 ± 2.72 (7)
		P	.882	.540	.550	.902	.760	.647	.259	.061
Need for Relining and Rebasing	Mandible	Absent	7.23 ± 2.49 (8)	7.1 ± 2.64 (8)	7.59 ± 2.2 (8)	7.61 ± 2.56 (8)	7.51 ± 2.31 (8)	7.88 ± 2.19 (8)	7.81 ± 2.63 (8.5)	7.59 ± 2.58 (8)
		Present	5.94 ± 2.97 (6)	6.39 ± 2.99 (7)	6.78 ± 3.08 (7.5)	7.28 ± 1.93 (7)	6.44 ± 2.79 (6.5)	7.28 ± 2.63 (7.5)	7.78 ± 2.05 (7)	7.56 ± 2.38 (8)
		P	.094	.366	.442	.231	.120	.372	.647	.766

Table 3. (Continued) Association between complications and VAS scores in mandibular and maxillary removable partial dentures

Complications	Jaw		Overall satisfaction	Dislodgement while eating	Chewing ability	Esthetic satisfaction	Overall expectation	Effect on speech	Cleaning difficulty	Pain
			Avg ± SD (median)	Avg ± SD (median)	Avg ± SD (median)	Avg ± SD (median)	Avg ± SD (median)	Avg ± SD (median)	Avg ± SD (median)	Avg ± SD (median)
Need for Relining and Rebasing	Maxilla	Absent	7.44 ± 2.36 (8)	7.54 ± 2.64 (8)	7.79 ± 2.28 (8)	7.6 ± 2.67 (8)	7.29 ± 2.39 (8)	8.06 ± 2.06 (8.5)	8.1 ± 2.38 (9)	8.08 ± 2.3 (9)
		Present	6.19 ± 2.77 (6)	5.9 ± 2.88 (6)	6.43 ± 2.8 (7)	7.1 ± 2.3 (8)	6.71 ± 2.45 (7)	7.05 ± 2.54 (8)	6.95 ± 2.8 (8)	7 ± 2.61 (8)
		P	.045	.014	.037	.175	.291	.080	.055	.064
Loss of Retention	Mandible	Absent	7.14 ± 2.47 (8)	7.07 ± 2.6 (8)	7.54 ± 2.19 (8)	7.62 ± 2.38 (8)	7.44 ± 2.24 (8)	7.86 ± 2.13 (8)	7.78 ± 2.59 (8)	7.63 ± 2.51 (8)
		Present	6.27 ± 3.33 (7)	6.5 ± 3.25 (7.5)	6.94 ± 3.26 (8)	7.19 ± 2.9 (8)	6.69 ± 3.24 (7.5)	7.31 ± 2.98 (8.5)	7.94 ± 2.24 (8.5)	7.31 ± 2.8 (8)
		P	.439	.651	.767	.699	.564	.741	.989	.701
	Maxilla	Absent	7.16 ± 2.49 (8)	7.32 ± 2.73 (8)	7.59 ± 2.41 (8)	7.5 ± 2.63 (8)	7.07 ± 2.46 (7.5)	7.83 ± 2.24 (8)	7.95 ± 2.42 (9)	8.01 ± 2.29 (9)
		Present	7.24 ± 2.59 (7)	6.59 ± 2.94 (7)	7.12 ± 2.64 (7)	7.47 ± 2.5 (8)	7.65 ± 2.12 (8)	7.94 ± 2.05 (8)	7.41 ± 2.9 (8)	7.06 ± 2.82 (8)
		P	.842	.315	.518	.766	.425	.958	.476	.170
Denture Base Fracture	Mandible	Absent	7.07 ± 2.61 (8)	7.1 ± 2.72 (8)	7.62 ± 2.35 (8)	7.77 ± 2.35 (8)	7.4 ± 2.43 (8)	7.97 ± 2.19 (8)	7.9 ± 2.56 (8)	7.73 ± 2.54 (8)
		Present	6.73 ± 2.63 (8)	6.27 ± 2.58 (7)	6.47 ± 2.33 (6)	6.27 ± 2.79 (6)	6.93 ± 2.4 (7)	6.6 ± 2.44 (7)	7.2 ± 2.27 (7)	6.73 ± 2.43 (8)
		P	.670	.186	.060	.043	.403	.033	.120	.075
	Maxilla	Absent	7.4 ± 2.36 (8)	7.4 ± 2.67 (8)	7.76 ± 2.35 (8)	7.78 ± 2.44 (8)	7.52 ± 2.24 (8)	8.06 ± 2.15 (8)	7.89 ± 2.56 (9)	7.96 ± 2.32 (8.5)
		Present	6.12 ± 2.91 (7)	6.18 ± 3.07 (7)	6.29 ± 2.59 (7)	6.12 ± 2.93 (7)	5.47 ± 2.5 (6)	6.82 ± 2.19 (7)	7.71 ± 2.28 (7)	7.29 ± 2.73 (8)
		P	.084	.089	.023	.023	.001	.019	.634	.386
Loss or Fracture of Artificial Teeth	Mandible	Absent	7.33 ± 2.58 (8)	7.23 ± 2.75 (8)	7.7 ± 2.27 (8)	8.06 ± 2.12 (8)	7.56 ± 2.42 (8)	8.14 ± 2.09 (8)	8.23 ± 2.39 (9.5)	7.99 ± 2.4 (9)
		Present	6.08 ± 2.51 (6)	6.23 ± 2.44 (6.5)	6.69 ± 2.56 (6.5)	6 ± 2.8 (5.5)	6.62 ± 2.3 (7)	6.65 ± 2.46 (7)	6.5 ± 2.55 (6.5)	6.35 ± 2.61 (6)
		P	.019	.045	.084	.001	.042	.005	.001	.002
	Maxilla	Absent	7.42 ± 2.43 (8)	7.24 ± 2.87 (8)	7.59 ± 2.49 (8)	7.88 ± 2.39 (8)	7.37 ± 2.5 (8)	8.12 ± 2.1 (8)	8.21 ± 2.41 (9.5)	8.09 ± 2.25 (9)
		Present	6.29 ± 2.59 (7)	7 ± 2.37 (7)	7.19 ± 2.32 (8)	6.05 ± 2.85 (7)	6.43 ± 1.89 (7)	6.86 ± 2.31 (7)	6.57 ± 2.46 (6)	6.95 ± 2.75 (8)
		P	.048	.401	.374	.007	.026	.014	.003	.088
Clasp Fracture	Mandible	Absent	7.13 ± 2.64 (8)	7.17 ± 2.74 (8)	7.66 ± 2.33 (8)	7.81 ± 2.43 (8)	7.47 ± 2.41 (8)	8.07 ± 2.15 (8.5)	7.9 ± 2.59 (9)	7.69 ± 2.54 (8)
		Present	6.47 ± 2.4 (7)	6.06 ± 2.36 (6)	6.44 ± 2.36 (6)	6.33 ± 2.25 (6.5)	6.67 ± 2.4 (7)	6.33 ± 2.33 (6.5)	7.33 ± 2.2 (7)	7.06 ± 2.55 (7.5)
		P	.256	.047	.038	.007	.151	.003	.191	.255
	Maxilla	Absent	7.18 ± 2.49 (8)	7.22 ± 2.84 (8)	7.6 ± 2.45 (8)	7.53 ± 2.65 (8)	7.21 ± 2.47 (8)	8.04 ± 2.18 (8)	8 ± 2.55 (9)	7.91 ± 2.35 (8)
		Present	7.17 ± 2.57 (8)	7.06 ± 2.46 (8)	7.06 ± 2.46 (7.5)	7.33 ± 2.4 (8)	7 ± 2.14 (7)	7 ± 2.14 (7)	7.22 ± 2.21 (7)	7.56 ± 2.66 (8.5)
		P	.933	.664	.314	.545	.465	.034	.083	.678

Mann Whitney U test; *$P < .05$; Avg: Average; SD: Standard Deviation.

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specific domain scores. Mechanical complications were consistently associated with higher OHIP-14 scores across nearly all domains, except for physical disability. Ulcerations represented the second most influential factor, demonstrating strong associations with OHIP-14 scores in both arches. In contrast, denture stomatitis did not show a statistically significant relationship with OHIP-14 scores in the maxilla (Table 4).

In the maxilla, significant differences were observed

Table 4. Association between complications and OHIP-14 domains and overall score in mandibular and maxillary removable partial dentures

Complications	Jaw		Functional Limitation	Physical Pain	Physical Disability	Psycho-logical Discomfort	Psycho-logical Disability	Social Disability	Handicap	Overall Score
			Avg ± SD (median)	Avg ± SD (median)	Avg ± SD (median)	Avg ± SD (median)	Avg ± SD (median)	Avg ± SD (median)	Avg ± SD (median)	Avg ± SD (median)
Ulceration	Mandible	Absent	1.35 ± 1.62 (1)	1.88 ± 1.84 (2)	1.84 ± 1.85 (2)	1.7 ± 1.71 (2)	1.1 ± 1.37 (0)	1.16 ± 1.67 (0)	1.16 ± 1.63 (0)	10.19 ± 7.92 (8)
		Present	2.62 ± 2.16 (2)	2.96 ± 1.75 (3)	3.35 ± 1.92 (3.5)	2.81 ± 1.92 (3)	1.5 ± 1.66 (2)	1.69 ± 1.89 (1)	1.38 ± 1.63 (1)	16.31 ± 9.83 (15.5)
		P	.006	.005	.001	.008	.338	.123	.450	.005
	Maxilla	Absent	1.45 ± 1.72 (1)	1.72 ± 1.67 (1)	2.02 ± 2 (2)	1.75 ± 1.89 (2)	1.01 ± 1.5 (0)	0.96 ± 1.51 (0)	0.94 ± 1.57 (0)	9.86 ± 7.97 (8)
		Present	3.13 ± 2.03 (3)	3.25 ± 1.53 (3)	2.75 ± 2.14 (2.5)	2.56 ± 1.86 (2)	1.81 ± 1.64 (2)	1.88 ± 2 (2)	1.56 ± 1.55 (1)	16.94 ± 9.39 (14.5)
		P	.002	.002	.161	.072	.034	.045	.031	.003
Mechanical Complications	Mandible	Absent	1.28 ± 1.7 (1)	1.74 ± 1.86 (1)	2.15 ± 2.06 (2)	1.62 ± 1.66 (1)	0.74 ± 1.23 (0)	0.78 ± 1.32 (0)	0.8 ± 1.37 (0)	9.11 ± 8.22 (7)
		Present	2.27 ± 1.9 (2)	2.78 ± 1.74 (3)	2.29 ± 1.83 (2)	2.54 ± 1.94 (2)	1.93 ± 1.49 (2)	2.1 ± 2.01 (2)	1.88 ± 1.79 (1)	15.78 ± 8.15 (14)
		P	.004	.002	.558	.014	.001	.001	.001	.001
	Maxilla	Absent	1.25 ± 1.71 (1)	1.67 ± 1.7 (1)	2.19 ± 1.99 (2)	1.47 ± 1.51 (1)	0.81 ± 1.59 (0)	0.77 ± 1.48 (0)	0.79 ± 1.64 (0)	8.95 ± 8.19 (7)
		Present	2.36 ± 1.9 (2)	2.38 ± 1.71 (2)	2.07 ± 2.1 (2)	2.43 ± 2.23 (2)	1.6 ± 1.38 (2)	1.57 ± 1.71 (1.5)	1.38 ± 1.43 (1)	13.79 ± 8.38 (14)
		P	.001	.041	.714	.045	.001	.004	.001	.001
Denture Stomatitis	Mandible	Absent	1.59 ± 1.79 (1)	2.07 ± 1.9 (2)	2.18 ± 1.98 (2)	1.87 ± 1.79 (2)	1.08 ± 1.43 (0)	1.26 ± 1.77 (0)	1.11 ± 1.53 (0)	11.15 ± 8.71 (9)
		Present	2.44 ± 2.24 (2)	2.89 ± 1.45 (3)	2.56 ± 1.88 (3)	3.11 ± 1.83 (3)	2.44 ± 1.13 (2)	1.67 ± 1.32 (2)	2.33 ± 2.24 (2)	17.44 ± 7.91 (16)
		P	.206	.114	.521	.045	.003	.230	.027	.022
	Maxilla	Absent	1.75 ± 1.93 (1)	1.94 ± 1.69 (2)	2.19 ± 2.07 (2)	1.8 ± 1.89 (1)	1.09 ± 1.57 (0)	1.08 ± 1.59 (0)	0.96 ± 1.48 (0)	10.82 ± 8.97 (9)
		Present	1.5 ± 1.51 (1)	2.14 ± 2.03 (2)	1.86 ± 1.79 (2)	2.36 ± 1.98 (2)	1.43 ± 1.4 (1)	1.29 ± 1.86 (0)	1.5 ± 2.07 (1)	12.07 ± 5.8 (12.5)
		P	.856	.873	.666	.257	.186	.748	.142	.230
Need for Relining and Rebasing	Mandible	Absent	1.48 ± 1.7 (1)	2.02 ± 1.88 (2)	2.2 ± 2 (2)	1.9 ± 1.83 (2)	1.07 ± 1.34 (0)	1.19 ± 1.75 (0)	0.99 ± 1.47 (0)	10.85 ± 8.58 (8)
		Present	2.56 ± 2.23 (2)	2.72 ± 1.81 (3)	2.22 ± 1.9 (2)	2.33 ± 1.78 (2)	1.83 ± 1.82 (2)	1.78 ± 1.59 (2)	2.33 ± 1.91 (2)	15.78 ± 8.85 (16.5)
		P	.046	.088	.942	.278	.092	.070	.002	.019
	Maxilla	Absent	1.59 ± 1.76 (1)	1.78 ± 1.58 (2)	2.14 ± 2 (2)	1.82 ± 1.98 (1)	0.95 ± 1.33 (0)	0.87 ± 1.4 (0)	0.95 ± 1.59 (0)	10.1 ± 7.98 (8)
		Present	2.19 ± 2.2 (2)	2.67 ± 2.13 (3)	2.14 ± 2.2 (2)	2.1 ± 1.61 (2)	1.86 ± 2.06 (2)	2 ± 2.07 (2)	1.38 ± 1.53 (1)	14.33 ± 10.02 (13)
		P	.351	.092	.902	.292	.042	.015	.069	.065

Table 4. (Continued) Association between complications and OHIP-14 domains and overall score in mandibular and maxillary removable partial dentures

Complications	Jaw		Functional Limitation	Physical Pain	Physical Disability	Psycho-logical Discomfort	Psycho-logical Disability	Social Disability	Handicap	Overall Score
			Avg ± SD (median)	Avg ± SD (median)	Avg ± SD (median)	Avg ± SD (median)	Avg ± SD (median)	Avg ± SD (median)	Avg ± SD (median)	Avg ± SD (median)
Loss of Retention	Mandible	Absent	1.59 ± 1.76 (1)	2.07 ± 1.85 (2)	2.16 ± 1.95 (2)	1.91 ± 1.77 (2)	1.03 ± 1.29 (0)	1.14 ± 1.64 (0)	1.06 ± 1.46 (0)	10.96 ± 8.09 (9)
		Present	2.06 ± 2.24 (1)	2.56 ± 2 (2.5)	2.5 ± 2.13 (2.5)	2.31 ± 2.09 (2)	2.13 ± 1.93 (2)	2.13 ± 2.06 (2.5)	2.13 ± 2.19 (1)	15.81 ± 11.42 (15)
		P	.545	.327	.561	.507	.021	.054	.038*	.130
	Maxilla	Absent	1.6 ± 1.77 (1)	1.85 ± 1.66 (2)	2.18 ± 2.07 (2)	1.77 ± 1.95 (1)	1.02 ± 1.47 (0)	0.98 ± 1.53 (0)	0.99 ± 1.61 (0)	10.39 ± 8.16 (8.5)
		Present	2.29 ± 2.26 (2)	2.53 ± 2 (2)	1.94 ± 1.85 (2)	2.41 ± 1.62 (2)	1.71 ± 1.83 (1)	1.76 ± 1.92 (2)	1.29 ± 1.4 (1)	13.94 ± 10.12 (11)
		P	.300	.222	.805	.048	.119	.043	.178	.163
Denture Base Fracture	Mandible	Absent	1.42 ± 1.64 (1)	1.99 ± 1.77 (2)	2.1 ± 1.94 (2)	1.86 ± 1.75 (2)	1.01 ± 1.38 (0)	1.13 ± 1.67 (0)	1.12 ± 1.6 (0)	10.63 ± 8.09 (8)
		Present	3.13 ± 2.29 (3)	3.07 ± 2.25 (3)	2.87 ± 2.07 (3)	2.67 ± 2.09 (2)	2.33 ± 1.4 (2)	2.27 ± 1.83 (2)	1.8 ± 1.74 (1)	18.13 ± 10.3 (14)
		P	.006	.072	.154	.144	.001	.004	.095	.006
	Maxilla	Absent	1.44 ± 1.71 (1)	1.77 ± 1.68 (2)	1.96 ± 1.94 (2)	1.66 ± 1.82 (1)	0.98 ± 1.5 (0)	0.94 ± 1.5 (0)	0.9 ± 1.55 (0)	9.65 ± 7.79 (8)
		Present	3.06 ± 2.08 (3)	2.94 ± 1.71 (3)	3 ± 2.29 (3)	2.94 ± 1.98 (3)	1.94 ± 1.56 (2)	1.94 ± 1.95 (2)	1.71 ± 1.57 (2)	17.53 ± 9.41 (17)
		P	.001	.008	.067	.009	.009	.022	.021	.001
Loss or Fracture of Artificial Teeth	Mandible	Absent	1.48 ± 1.74 (1)	1.85 ± 1.83 (2)	2.1 ± 1.97 (2)	1.69 ± 1.66 (1.5)	1.03 ± 1.44 (0)	1.05 ± 1.56 (0)	1.13 ± 1.64 (0)	10.31 ± 8.48 (8)
		Present	2.23 ± 2.03 (2)	3.04 ± 1.75 (3)	2.54 ± 1.98 (2.5)	2.85 ± 2.03 (2.5)	1.73 ± 1.37 (2)	2.04 ± 2.05 (1)	1.5 ± 1.58 (1)	15.92 ± 8.5 (14)
		P	.087	.003	.282	.009	.010	.011	.115	.002
	Maxilla	Absent	1.51 ± 1.81 (1)	1.81 ± 1.76 (1.5)	2.18 ± 2.08 (2)	1.64 ± 1.69 (1.5)	1.04 ± 1.58 (0)	0.86 ± 1.5 (0)	0.87 ± 1.56 (0)	9.91 ± 8.37 (8)
		Present	2.48 ± 1.94 (2)	2.57 ± 1.54 (2)	2 ± 1.87 (2)	2.76 ± 2.39 (2)	1.52 ± 1.36 (2)	2.05 ± 1.75 (2)	1.67 ± 1.53 (1)	15.05 ± 8.3 (16)
		P	.025	.056	.816	.047	.058	.001	.002	.006
Clasp Fracture	Mandible	Absent	1.41 ± 1.68 (1)	1.9 ± 1.79 (2)	2.1 ± 1.94 (2)	1.72 ± 1.71 (2)	0.95 ± 1.29 (0)	1.11 ± 1.62 (0)	1.01 ± 1.5 (0)	10.2 ± 7.96 (8)
		Present	2.89 ± 2.11 (2.5)	3.33 ± 1.88 (3)	2.72 ± 2.08 (3)	3.22 ± 1.86 (3)	2.39 ± 1.65 (2)	2.17 ± 2.04 (2)	2.22 ± 1.9 (2)	18.94 ± 9.22 (18)
		P	.004	.003	.216	.002	.001	.018	.003	.001
	Maxilla	Absent	1.59 ± 1.82 (1)	1.81 ± 1.63 (2)	2.19 ± 2.03 (2)	1.78 ± 1.8 (2)	1.02 ± 1.58 (0)	0.96 ± 1.54 (0)	0.99 ± 1.64 (0)	10.35 ± 8.27 (8)
		Present	2.28 ± 2.02 (2)	2.67 ± 2.06 (2)	1.94 ± 2.1 (1.5)	2.33 ± 2.3 (2)	1.67 ± 1.28 (2)	1.78 ± 1.83 (2)	1.28 ± 1.27 (1)	13.94 ± 9.52 (12.5)
		P	.140	.124	.632	.416	.016	.040	.042	.116

Mann Whitney U test; *$P < .05$; Avg: Average; SD: Standard Deviation.

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in VAS scores only for the effect on speech, with palatal plates showing significantly lower mean values compared with other connector types. For OHIP-14 domains, a statistically significant variation was found exclusively for physical pain, where higher scores were recorded in dentures with a palatal plate and anteroposterior palatal strap (Table 5). In contrast, mandibular major connector design showed no significant associations with either OHIP-14 or VAS scores ($P > .05$).

In the mandible, overall satisfaction was significantly higher in dentures incorporating both akers and bar clasp types compared with those featuring either type alone ($P = .039$). Additionally, the sole use of bar clasps was associated with significantly higher OHIP-14 scores in the physical disability domain ($P = .037$). In the maxilla, no statistically significant associations were observed between clasp type and either VAS satisfaction or OHIP-14 domains ($P > .05$).

No significant associations were found between the number of clasps or rests and any patient-reported outcomes in the maxilla. In the mandible, however, rest number demonstrated significant relationships with several VAS domains, including chewing ability, overall expectation and effect on speech. It was also associated with lower OHIP-14 scores in physical pain and psychological discomfort, as well as with the overall OHIP-14 score. Mandibular clasp number, on the other hand, was significantly correlated with both physical pain and the overall OHIP-14 score (Table 6).

Denture age demonstrated significant associations with both VAS and OHIP-14 scores. Chewing ability was significantly higher in dentures aged 0 – 5 years compared with older age groups, whereas cleaning difficulty was significantly lower in dentures older than 15 years. Moreover, dentures aged 0 – 5 years showed significantly lower OHIP-14 overall scores and reduced impairment in several domains, including

Table 5. Comparison of VAS and OHIP-14 Scores According to Maxillary Major Connector Design

	Maxillary Major Connector					
	Palatal Strap	Antero-posterior Strap	U-Shaped Connector	Palatal Plate	Palatal Bar	
	Avg ± SD (median)	Avg ± SD (median)	Avg ± SD (median)	Avg ± SD (median)	Avg ± SD (median)	*P*
VAS						
Overall satisfaction	7.75 ± 2.23 (8)	8.25 ± 1.48 (8.5)	7.11 ± 2.47 (7)	6.55 ± 2.75 (7)	7 ± 3.46 (9)	.244
Dislodgement while eating	7.25 ± 3.19 (8)	7.23 ± 2.35 (8)	8.37 ± 2.5 (10)	6.58 ± 2.66 (7)	7.33 ± 2.89 (9)	.085
Chewing ability	7.92 ± 2.24 (8)	7.85 ± 1.99 (8)	8.42 ± 2.04 (9)	6.8 ± 2.75 (7)	6.33 ± 2.08 (7)	.109
Esthetic satisfaction	8.33 ± 1.63 (8.5)	8.15 ± 1.46 (9)	8 ± 2.92 (10)	6.58 ± 2.96 (7)	7 ± 2.65 (8)	.103
Overall expectation	7.75 ± 2.11 (8)	8.15 ± 1.52 (9)	7.42 ± 2.5 (8)	6.48 ± 2.64 (7)	6 ± 1.73 (7)	.102
Effect on speech	8.63 ± 1.58 (9)	8.77 ± 1.24 (9)	8.53 ± 2.04 (10)	6.88 ± 2.48 (8)	7.33 ± 1.15 (7)	.004*
Cleaning difficulty	8.04 ± 2.96 (10)	8.38 ± 1.61 (8)	8.37 ± 2.24 (10)	7.48 ± 2.58 (8)	6 ± 1.73 (7)	.259
Pain	8.46 ± 2.23 (9)	8.69 ± 1.32 (9)	8.21 ± 1.9 (9)	7.08 ± 2.8 (8)	7.33 ± 2.52 (7)	.205
OHIP-14						
Functional limitation	1.46 ± 1.61 (1)	1.46 ± 1.81 (1)	1.05 ± 1.35 (0)	2.35 ± 2.14 (2)	0.67 ± 0.58 (1)	.134
Physical pain	1.58 ± 1.61 (1.5)	2.38 ± 1.8 (3)	1.21 ± 1.55 (0)	2.48 ± 1.78 (3)	1.33 ± 0.58 (1)	.042*
Physical disability	1.83 ± 1.83 (1)	1.69 ± 1.38 (2)	1.95 ± 1.81 (2)	2.55 ± 2.4 (2)	2.33 ± 2.08 (3)	.804
Psychological discomfort	1.42 ± 1.69 (1)	2.23 ± 2.13 (2)	1.79 ± 2.12 (2)	2.08 ± 1.83 (2)	2 ± 2.65 (1)	.583
Psychological disability	0.71 ± 1.3 (0)	1.85 ± 1.57 (2)	0.74 ± 1.19 (0)	1.38 ± 1.76 (1)	1 ± 1 (1)	.066
Social disability	0.79 ± 1.56 (0)	0.85 ± 1.07 (0)	0.74 ± 1.19 (0)	1.43 ± 1.78 (0.5)	3 ± 3 (3)	.206
Handicap	0.63 ± 1.13 (0)	1.62 ± 2.06 (1)	0.74 ± 1.33 (0)	1.28 ± 1.74 (0)	0.67 ± 0.58 (1)	.264
Overall score	8.42 ± 6.33 (7)	12.08 ± 7.11 (15)	8.21 ± 7.69 (5)	13.53 ± 10.11 (11)	11 ± 5 (11)	.117

Kruskal Wallis test; *$P < .05$, VAS: Visual analog scale, Avg: Average, SD: Standard deviation.

Table 6. Comparison of VAS and OHIP-14 Scores According to Mandibular and Maxillary Clasp and Rest Number

		Number of clasp (Mandible)	Number of clasp (Maxilla)	Number of rest (Mandible)	Number of rest (Maxilla)
VAS					
Overall satisfaction	r	0.106	0.062	0.163	0.121
	P	0.283	0.547	0.096	0.235
Dislodgement while eating	r	0.024	-0.015	0.160	0.025
	P	0.807	0.886	0.101	0.805
Chewing ability	r	0.119	0.059	0.274	-0.033
	P	0.224	0.565	0.004*	0.747
Esthetic satisfaction	r	0.154	0.098	0.190	-0.053
	P	0.115	0.334	0.055	0.599
Overall expectation	r	0.095	0.022	0.216	-0.056
	P	0.335	0.828	0.026*	0.580
Effect on speech	r	0.052	0.037	0.216	-0.063
	P	0.598	0.716	0.026*	0.534
Cleaning difficulty	r	-0.130	-0.087	0.093	-0.094
	P	0.183	0.394	0.343	0.356
Pain	r	-0.052	0.085	0.193	-0.050
	P	0.593	0.400	0.047*	0.621
OHIP-14					
Functional limitation	r	-0.092	-0.164	-0.143	0.014
	P	0.347	0.105	0.144	0.893
Physical pain	r	-0.193	-0.190	-0.215	-0.031
	P	0.048*	0.097	0.027*	0.762
Physical disability	r	-0.054	0.078	-0.140	0.157
	P	0.579	0.441	0.151	0.122
Psychological discomfort	r	-0.177	-0.070	-0.353	-0.055
	P	0.069	0.489	0.001*	0.589
Psychological disability	r	-0.167	0.040	-0.149	0.103
	P	0.086	0.694	0.128	0.309
Social disability	r	-0.161	0.043	-0.141	0.096
	P	0.099	0.672	0.150	0.346
Handicap	r	-0.155	0.081	-0.125	0.075
	P	0.112	0.428	0.202	0.462
Overall score	r	-0.194	-0.087	-0.275	0.004
	P	0.046*	0.392	0.004*	0.969

Spearman's rho test; *$P < .05$.

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functional limitation, psychological discomfort, psychological disability, social disability, and handicap, compared with older dentures (Table 7).

DISCUSSION

As C-RPDs remain an essential treatment option for partially edentulous patients, increasing attention has shifted from solely mechanical performance to their impact on OHRQoL and patient satisfaction.[8,10-12] The present study comprehensively evaluated the combined influence of denture design parameters, structural classification systems, denture age, and biological and mechanical complications on patient-reported outcomes within a single clinical population. In addition, it analyzed the distribution of complication patterns according to arch, denture age, and classification systems. The findings demonstrated that denture age and specific C-RPD components were significantly associated with several domains of patient satisfaction and OHRQoL. Mechanical complications demonstrated a significant relationship with denture age and were associated with impaired patient-reported outcomes, whereas associations involving Kennedy and Eichner classifications were limited and confined to specific complication types or isolated domains. Thus, the null hypothesis was partially rejected.

A previous study reported mean OHIP-14 scores of approximately 16 and mean satisfaction scores of around 7.7 among C-RPD wearers, with the handicap domain exhibiting the lowest scores, whereas psychological discomfort was the highest.[14] Although the overall OHIP-14 and satisfaction scores were slightly lower in the current study (11.32 and 7.1, respectively), the relative ranking of domains remained comparable. Consistent with previous reports, physical pain and psychological discomfort emerged as the most affected domains, underscoring the central role of functional discomfort and psychosocial factors

Table 7. Comparison of VAS and OHIP-14 Scores According to Denture Age

	Denture Age				
	3 – 5 years	5 – 10 years	10 – 15 years	15+ years	
	Avg ± SD (median)	Avg ± SD (median)	Avg ± SD (median)	Avg ± SD (median)	*P*
VAS					
Overall satisfaction	7.51 ± 2.34 (8)	6.87 ± 3.13 (6)	8.19 ± 1.96 (9)	6.69 ± 2.44 (7)	.126
Dislodgement while eating	7.36 ± 3 (8)	6.37 ± 2.96 (7)	8 ± 2.2 (8)	7 ± 2.56 (8)	.130
Chewing ability	8.36 ± 1.98 (9)	6.83 ± 2.91 (8)	7.7 ± 2.2 (8)	6.94 ± 2.61 (8)	.046*
Esthetic satisfaction	8.1 ± 2.91 (10)	7.43 ± 2.36 (8)	7.85 ± 2.25 (8)	6.97 ± 2.54 (7)	.064
Overall expectation	7.74 ± 2.39 (8)	6.86 ± 2.88 (7)	7.59 ± 2.26 (7)	6.85 ± 2.39 (7)	.261
Effect on speech	8.59 ± 1.57 (9)	7.34 ± 2.71 (8)	7.89 ± 2.28 (8)	7.42 ± 2.45 (8)	.154
Cleaning difficulty	8.41 ± 2.68 (10)	7.86 ± 2.66 (8)	8.52 ± 1.65 (10)	7.06 ± 2.42 (7)	.019*
Pain	7.97 ± 2.58 (9)	7.57 ± 2.86 (9)	8 ± 1.75 (8)	7.48 ± 2.36 (8)	.690
OHIP-14					
Functional limitation	1.23 ± 1.71 (1)	2 ± 2.14 (1)	1.37 ± 1.92 (0)	1.85 ± 1.66 (2)	.157
Physical pain	1.56 ± 1.77 (1)	2.11 ± 2.29 (1)	2.19 ± 1.66 (2)	2.61 ± 1.6 (3)	.053
Physical disability	2.18 ± 2.05 (2)	2.51 ± 2.36 (2)	2.19 ± 2.13 (2)	2 ± 1.6 (2)	.919
Psychological discomfort	1.33 ± 1.72 (0)	1.91 ± 1.77 (2)	2.07 ± 1.96 (2)	2.58 ± 2.14 (2)	.048*
Psychological disability	0.49 ± 1.17 (0)	1.14 ± 1.78 (0)	1.56 ± 1.48 (1)	1.7 ± 1.4 (2)	.001*
Social disability	0.59 ± 1.31 (0)	1.11 ± 1.55 (0)	1.59 ± 2 (1)	1.67 ± 1.74 (1)	.005*
Handicap	0.38 ± 0.91 (0)	1.06 ± 1.51 (0)	1.37 ± 1.57 (1)	1.73 ± 1.96 (1)	.001*
Overall score	7.77 ± 8.22 (6)	11.86 ± 9.88 (8)	12.33 ± 9.62 (11)	14.12 ± 7.33 (14)	.002*

Kruskal Wallis test; *$P < .05$, VAS: Visual analog scale, Avg: Average, SD: Standard deviation.

in shaping OHRQoL among C-RPD wearers.[8,14,15,25]

In the present study, neither age nor gender demonstrated a significant association with OHIP-14 or VAS scores. Gender has been reported to influence only specific domains of satisfaction, rather than overall OHRQoL, in line with previous findings.[12,15,23] Age-related findings in the literature are heterogeneous; while some studies reported no significant differences in satisfaction among individuals over 50 years, younger patients frequently express greater dissatisfaction, particularly related to esthetic concern.[1,4,15,23] The predominance of older individuals in the present study likely explains the absence of significant age-related differences in patient-reported outcomes.

Mechanical complications were the most frequently observed, followed by mucosal ulcerations and the need for relining or rebasing, consistent with previous reports.[9,11,15,16,18] Relining requirements have been reported to be more frequent in free-end saddles, where increased functional load and rotational forces compromise stability.[16] Although no direct association with Kennedy classification was detected, 82.5% of relining or rebasing cases occurred in free-end RPDs. The need for relining or rebasing significantly reduced chewing ability and perceived stability, particularly in maxillary dentures, whereas simple loss of retention showed no significant effect on VAS domains. This may be explained by the structural characteristics of C-RPDs, in which clasps and metal frameworks provide partial retention even when relining is required.[10,11] Importantly, relining or rebasing was also associated with higher OHIP-14 scores, suggesting that maintenance procedures may affect both functional and psychological confidence. Papillary hyperplasia (Newton type III stomatitis) was identified in nearly 5% of cases, and showed no significant arch-related difference. This may be explained by predisposing factors, such as Candida adherence to saliva-coated acrylic surfaces and denture hygiene.[26,27]

Ulcerations in the maxilla were strongly associated with reduced patient satisfaction, impaired speech in both arches, and diminished chewing ability, particularly in maxillary dentures. Mechanical complications—especially loss or fracture of artificial teeth and clasp fractures in the mandible—were similarly associated with reduced satisfaction and compromised speech performance across arches. These findings may reflect the structural characteristics of C-RPDs, in which biomechanical disturbances and component failures can directly impair functional performance, thereby underscoring the substantial influence of local tissue trauma and mechanical instability on perceived comfort and function.[10,12,15] Although previous reports suggested that removable denture complications exert minimal influence on esthetics,[11] the present study demonstrated that both ulcerations and mechanical complications significantly reduced esthetic satisfaction. This discrepancy may be partly explained by psychological factors, as reflected by increases in OHIP-14 psychological discomfort and disability domains. These results support the view that esthetic perception extends beyond visual appearance and is influenced by comfort, confidence, and overall psychosocial well-being.[14] In line with Al-Imam *et al.*,[9] who reported poorer OHRQoL outcomes among patients experiencing RPD complications, the present findings showed that ulcerations and mechanical failures were strongly associated with higher physical pain, psychological discomfort, and social disability scores. Collectively, these observations indicate that local tissue trauma and mechanical instability influence not only oral function but also psychological and social dimensions of well-being, reinforcing the concept that OHRQoL in C-RPD wearers is determined by a multidimensional interplay of biological, mechanical, and psychosocial factors.[9,14]

Beyond complication-related factors, denture design characteristics demonstrated domain-specific influences on patient-reported outcomes. In the mandible, broader tissue coverage associated with the lingual plate has been reported to adversely affect speech intelligibility, mastication, and comfort, thereby negatively influencing OHRQoL when compared with lingual bars.[21,23] This discrepancy with our findings may partly be explained by the small sample sizes and short observation periods of earlier studies, whereas long-term adaptation in larger cohorts appears to minimize these differences. Campbell *et al.*[22] emphasized that increases in the

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area covered by mandibular major connectors may not influence OHRQoL as same as maxillary connectors. Thus, mandibular major connector design may be less critical to long-term satisfaction than assumed.

In the maxilla, palatal plates and anteroposterior palatal straps were associated with greater physical pain as well as higher, though not statistically significant, OHIP-14 total scores and lower speech-related satisfaction. These findings suggest that the impact of maxillary major connector design may be domain-specific rather than global, predominantly affecting functions closely related to palatal coverage, such as phonetics. It has been reported that patients tend to prefer U-shaped connectors, palatal straps or palatal bars, due to their reduced palatal coverage and easier adaptation.[20-22] Nonetheless, the appropriate selection of the major connector remains a key determinant of patient satisfaction, as clinical conditions such as abutment tooth support, mucosal characteristics, and biomechanical requirements may necessitate the use of more extensive palatal coverage in certain cases. In situations where such coverage is not clinically indicated, the use of less bulky connector designs may directly enhance patient satisfaction.[12,21,22]

Alageel *et al.*[13] reported that C-RPDs incorporating three or more clasps yielded significantly higher patient satisfaction, due to increased retention. However, their analysis did not differentiate between arches and did not demonstrate a significant relationship between indirect retainers and satisfaction, despite the recognized biomechanical importance of indirect retention, particularly in free-end saddles.[2,4,6] In the present study, clasp number was significantly associated with several OHIP-14 domains only in mandibular dentures, while no direct effect on VAS scores was observed. This suggests that while increased retention may contribute to improved functional perception in specific clinical contexts, it does not necessarily bring higher patient-reported outcomes. Rather, these outcomes appear to be determined by a combination of mechanical performance and patients' subjective experience, including comfort, functional acceptance, and long-term adaptation.[9,11,12,14]

Rest number, in contrast, demonstrated a direct association with both satisfaction and OHRQoL in the mandible, underscoring the importance of rests not only for biomechanical support but also for perceived comfort and adaptation. A higher number of well-distributed rests enhances denture stability and physiological load distribution, contributing to improved long-term acceptance.[5] Therefore, type and adequacy of rests play a key role in long-term acceptance and functional success of C-RPDs. Taken together, particularly in the mandible, increasing the number of well-distributed clasps and rests may enhance denture retention and patient adaptation. However, in areas where clasp placement is not possible, the use of appropriately designed guide planes and proximal plates becomes particularly critical. By providing effective bracing and guidance, these components help control denture movement, reduce soft-tissue impingement, and maintain prosthesis stability during function.[28]

In a long-term evaluation of approximately 300 conventional C-RPDs, akers and bar clasps were identified as the most frequently employed types, underscoring their clinical relevance.[17] In the present study, which exclusively analyzed akers and bar clasps, no significant associations with patient satisfaction were detected in the maxilla, consistent with previous reports.[13,17] In the mandible, however, dentures incorporating both types yielded higher overall satisfaction compared with either type alone, likely reflecting the complementary functional and esthetic contributions of each design. Bar clasp fractures were more frequent than circumferential clasp fractures in both arches. Long-term data indicate that bar or RPI designs account for the majority of clasp fractures after 10 years, whereas circumferential clasps demonstrate greater durability

A distinctive aspect of the present study is that nearly 45% of the C-RPDs had been in service for more than 10 years. This enabled a comprehensive assessment of long-term effects on patient-reported outcomes. Dentures used for < 5 years were associated with more favorable outcomes than those used for over 10 years, including higher chewing ability on VAS and lower OHIP-14 scores. This finding may be explained by progressive occlusal wear of

denture teeth over time, which compromises cusp morphology and masticatory efficiency. Preservation of occlusal anatomy through the use of wear-resistant denture teeth, such as highly cross-linked acrylic teeth, and periodic clinical evaluation may therefore be critical for maintaining chewing ability and favorable patient-reported outcomes during long-term denture use.[29] Consistent with previous reports indicating a decline in satisfaction after five years of C-RPD use due to loss of retention, tissue changes, and esthetic deterioration, the present study also found that prolonged service time was associated with reduced perceived function.[5,12,14]

In parallel with previous reports indicating a marked increase in mechanical complications after 6 – 10 years of service, the present study demonstrated a significant association between mechanical complications and denture age above 10 years.[2,18,30] In contrast, ulcerations and denture stomatitis, two of the most frequently observed biological complications, did not show a significant association with denture age. This observation is consistent with earlier studies describing these conditions as common early complications of RPD use.[11,15,19]

No significant relationship was observed between Kennedy classes and complication types in the maxilla, which may be explained biomechanically, as broad palatal coverage provides cross-arch stabilization and distributes occlusal forces more evenly, thereby reducing class-dependent differences.[18,30] In the mandible, denture stomatitis was significantly more frequent in Kennedy Class III dentures, which may be related to plaque accumulation and reduced self-cleansing in bounded edentulous spaces, potentially facilitating fungal colonization.[26,27] Since the Kennedy classification primarily describes the distribution of edentulous spaces and does not incorporate key determinants such as mucosal resilience, occlusal support, or denture design, its ability to predict complication patterns and patient-reported outcomes may be inherently limited.[2,9]

Neither overall OHIP-14 scores nor VAS scores varied significantly across Kennedy classes, in either arch, consistent with findings of Shams *et al.*[15] Although weak domain level associations were detected, particularly higher handicap scores in mandibular Kennedy Class I and II dentures and fewer pain-related complaints in maxillary Class III cases, the overall influence of the Kennedy classification on patient satisfaction and OHRQoL remained limited. These findings may be explained by the biomechanical characteristics of free-end saddle designs. Distal extension C-RPDs are more susceptible to rotational movements and uneven mucosal loading, which can increase tissue displacement, accelerate residual ridge resorption, and contribute to discomfort over time compared with tooth-bounded configurations.[5,12,13]

Consistent with findings of Koyama *et al.*,[5] no significant associations were detected between Eichner classifications and patient-reported outcomes, indicating that occlusal support distribution alone did not influence OHRQoL. Although reduced posterior support has been associated with reduced masticatory performance and difficulties in denture adaptation, these functional limitations are not reflected in OHIP-14 or VAS assessments.[7] Additionally, epulis fissuratum was significantly associated with the Eichner A3 category in the maxilla. This finding should be interpreted cautiously and it may be related to altered stress distribution in cases of partially reduced posterior occlusal support.[19] Overall, while the Eichner index provides a general overview of occlusal support, it appears insufficient as an independent predictor of RPD complications or patient-reported outcomes.

Several limitations of the present study should be acknowledged. The relatively small sample size, together with the uneven distribution of complications across certain subgroups, inevitably limited statistical power. In particular, the absence or low frequency of complications in some subclasses may have constrained the robustness and interpretability of specific comparisons. Additionally, given the large number of univariable comparisons conducted across multiple clinical variables and outcome domains, the risk of type I error represents an important limitation of the present study. Although post-hoc pairwise comparisons were performed using Dunn's test with Bonferroni correction, the analyses were designed to evaluate multiple clinically distinct variables across different outcome domains rather than to test a single

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confirmatory hypothesis. Therefore, the findings should be interpreted with caution, particularly in subgroup analyses. Additionally, as OHIP-14 and VAS scores were obtained at the patient level, reflecting each patient's cumulative prosthetic experience, arch-specific associations should be interpreted with caution. In patients wearing dentures in both arches, the reported outcomes may not exclusively reflect the influence of a single arch, which represents an inherent limitation of the patient-level outcome assessment approach adopted in the present study. Future studies aiming to compare denture- or arch-specific effects on patient reported outcomes may benefit from collecting OHIP-14 and VAS assessments separately for each denture. Furthermore, although examiner calibration was performed and disagreements were resolved through a consensus with a third examiner, the absence of a formal inter-examiner agreement represents a methodological limitation.

Only two clasp types were evaluated, whereas a wide range of direct retainers, including wrought wire clasps and precision attachments, are commonly employed. Moreover, the cross-sectional design precluded assessment of baseline OHIP-14 and VAS scores, thereby restricting the ability to capture longitudinal changes in satisfaction and OHRQoL over time. While all dentures were fabricated at the same centers, they were not under the control of a single operator, and therefore the influence of initial denture quality on subsequent complications could not be fully assessed. Furthermore, although the present study adopted the original seven-domain scoring framework of the OHIP-14,[25] it has been suggested that OHIP may be better represented by four dimensions.[31] Since no definitive consensus exists regarding the factorial structure of the OHIP-14, future investigations employing alternative dimensional frameworks may yield complementary insights. Finally, the study sample was drawn from a university-based clinical population, which may not fully reflect the broader diversity of patients encountered in general practice. Future multicenter longitudinal studies incorporating standardized fabrication protocols, baseline OHRQoL measurements, and a wider range of retainer systems are warranted to provide a more comprehensive understanding of how C-RPD design variables and complication patterns influence patient-reported outcomes over time.

CONCLUSION

Within the limitations of this cross-sectional and exploratory study, C-RPDs exhibited a high prevalence of complications, with mechanical failures being the most frequent and associated with denture age. Dentures exceeding 10 years of service exhibited greater functional impairment. Kennedy and Eichner classifications showed only weak, subgroup-restricted effects and did not demonstrate a consistent influence on patient-reported outcomes or overall complication patterns. As the observed associations were domain-specific and arch-specific in several instances, findings should be interpreted with caution.

Beyond structural classifications, denture design parameters showed domain-specific effects on patient-reported outcomes. Major connector design influenced satisfaction primarily in the maxilla, while in the mandible, the combined use of akers and bar clasps and an increased number of rests were associated with improved functional perception and OHRQoL. Both ulcerations and mechanical complications were associated with reduced patient satisfaction, underscoring that the impact of C-RPD complications may extend beyond denture survival to functional and psychosocial dimensions. Collectively, these findings suggest the potential importance of individualized prosthetic planning, strategic component selection, regular maintenance, and timely intervention to optimize long-term clinical performance and patient-centered outcomes in C-RPD therapy.

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