

Prevalence of Kennedy Classifications in Removable Partial Denture-Treated Population: A Cross-Sectional Retrospective Study

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Abstract

The aim of the study was to assess the prevalence of Kennedy's classification and its distribution among partially edentulous individuals in the maxillary and mandibular arches separately. A cross-sectional retrospective study was performed in which 542 removable partial dentures were fabricated from 1 October 2024 to 1 May 2026. Records of 341 patients documented in the teaching hospital of the College of Dentistry, Mustansiriyah University, were reviewed and analyzed using descriptive statistics (frequency and percentage) and inferential statistics (chi-square test and multinomial regression analysis) for checking association and relation between age, gender, occupation, area of residency, and medical condition and the type of Kennedy classification. Kennedy class III had the highest prevalence in the maxilla, and Kennedy class I was reported to be dominant in the mandible. The prevalence of partial edentulism is higher among 41-50 years of age, with a male predilection. There was a significant association ($P < 0.05$) between the type of Kennedy classification in the maxillary arch and age, gender, occupation, and area of residency. Concurrently, only age, occupation, and medical history were associated with Kennedy classification in the mandible. Collectively, age, gender, residential location, occupation, and systemic disease may influence the distribution of Kennedy classification in the maxilla ($\chi^2 = 64.25$, $df = 24$, $p < 0.001$) and mandible ($\chi^2 = 43.34$, $df = 24$, $p = 0.009$), but their effect alone is limited. Classes I and II increased with age.

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Introduction

Tooth loss ranks among the most complex dental issues globally [1]. The condition of oral health and quality of life is significantly influenced by the loss of permanent teeth, which greatly affects oral-health-related quality of life by affecting physiological function, social engagement, and psychological well-being. It can lead to changes in structure, appearance, and function, making it difficult to perform important tasks such as chewing, talking, and swallowing. It can also affect how a person feels about themselves, their confidence, and their general health [2,3]. Since partial or

complete tooth loss is closely associated with various metabolic and dental disorders, it is regarded as a key indicator of access to or utilization of dental care.

Efficient history-taking and thorough clinical assessments are crucial to the organized treatment planning process for achieving successful treatment outcomes [3,4]. Partial edentulism remains one of the most common problems in prosthodontics. For many patients, particularly those for whom fixed or implant-supported options are not possible, removable partial dentures (RPDs) are the first treatment option [5].

Kennedy's classification of partially edentulous arches is considered the most widely accepted classification today. Kennedy's classification provides a quick method for visualization, identifying prosthesis support, and evaluating design features for removable partial dentures [6]. Understanding the most common Kennedy classes is important for dental students, technicians, and practitioners, as it helps predict treatment requirements.

Recording distributions of Kennedy classes aids in evaluating preventive initiatives, guides planning and educational focuses, and assists

in recognizing shifts in service use and access to oral health services [7,8].

While numerous studies have documented the distribution of Kennedy classifications across various populations, the results exhibit significant differences among countries, regions, and clinical contexts, indicating a range of demographic and oral health characteristics [7,9-11]. Research conducted in prosthodontic departments across several Iraqi dental schools revealed a high prevalence of Class III cases, with Classes I and II following. The findings also indicated that gender has minimal or no significant effect on the distribution of Kennedy classifications [12-14].

An analysis of past clinical records from a prosthodontic service can yield important epidemiologic data regarding the treated population and the most commonly addressed types of partial edentulous conditions [9]. Given the lack of prior data on this research subject at the College of Dentistry at Mustansiriyah University, the insights gained from this article will be significant. Understanding the most common classification of removable partial dentures will help dental students, practitioners, and technicians recognize patients' treatment needs, ultimately resulting in improved treatment outcomes.

The aim of the current retrospective study was to determine the frequency and distribution of the Kennedy classifications of partially edentulous patients who had received a Removable Partial Denture (RPD) at the Prosthodontics Clinic of the Teaching Hospital, College of Dentistry, Mustansiriyah University. The study also investigated the relationship between the Kennedy classification and the dental arches, medical history of patients, and some demographic variables. The results of this study may be of value in planning and delivery of RPD care as well as in planning dental education and future research.

Material and Methods

Ethical approval

This study was approved by the Research Ethics Committee of Mustansiriyah University, College of Dentistry (approval no. MUPRO3).

Study design

In this cross-sectional retrospective study including analytical sub-analyses, patients of the Prosthodontics Clinics of the Teaching Hospital, College of Dentistry, Mustansiriyah University, were selected. The study included outpatients who attended the clinics between 1 October 2024 and 1 May 2026. The research was planned, conducted, and documented according to the STROBE guidelines for observational studies [15]. Possible sources of bias, including selection bias associated with the teaching

hospital environment and refusal bias, were considered during the research framework and analysis.

Sample size calculation

To determine the intended number of participants for the planned chi-square tests of independence, a priori sample size calculation was conducted using G*Power version 3.1.9.4. To achieve medium effect size (Cohen's $w = 0.3$), with significance level (α) of 0.05, and with statistical power ($1-\beta$) of 80% for the intended tests, the minimum number of participants that were required for the intended analyses was 232 participants. However, this was a retrospective study based on available patient records, therefore all eligible patient records were included in the analyses. In total, 341 records of eligible for the intended analyses were identified and included in the study. Thus, the actual number of participants included in the study was greater than the minimum required number of participants, thereby increasing the statistical power and precision of the intended analyses.

Data collection

The data was collected from diagnosis and treatment-planning documents (case sheets). The data were then analyzed to ensure that no identifying information was present. The study did not involve clinical procedures or interactions with patients nor was it involved with their treatment in any capacity.

Outcome variables

All patients were assessed for the prevalence of partial edentulism based on Kennedy's classification. The inclusion criteria specified individuals aged 20–70 years, regardless of gender, race, community, or socioeconomic status, who exhibited partial edentulism in the maxilla, mandible, or both and were treated with RPD. Conversely, individuals with complete edentulism, fewer than three missing teeth, craniofacial deformities, or physical or cognitive impairments were excluded from the study.

The primary outcome will be the distribution of each Kennedy class (I, II, III, IV) among RPD-treated patients according to age group (e.g., 20–40, 41–50, 51–70 years), gender (male versus female), residency (urban versus rural), occupation (not employed - student, retired, or housewife versus employed - employee or freelancer) and associated medical condition (no systemic disease versus systemic disease - hypertension and/or diabetes mellitus).

1.

Data Analysis

The required data were collected and entered in SPSS version 32 for statistical analysis (SPSS

Inc., Chicago, IL, USA). Frequencies and percentages were used as descriptive statistics. The chi-square (χ^2) test was used to analyze the association between the Kennedy classification and the study variables, including age, gender, residency, and systemic disease status. Additionally, multinomial logistic regression was employed to predict the probability of Kennedy categorization from the previously given variables. The computation assumed a 95% confidence level and a 5% margin of error.

Results

In total, 416 patients were provided with a partial denture at the Prosthodontics Clinics of the Teaching Hospital, College of Dentistry, Mustansiriyah University, during the previously mentioned study period. Out of the 416 patients, 75 were not included. Nevertheless, 341 patients satisfied the inclusion criteria established in this study.

Table 1 indicates that dentures created for the mandibular arch outnumber those made for the maxillary arch. The allocation of examined cases based on the analyzed attributes. People aged 41 to 50 years (28.2%) make up the largest demographic, while those aged 20 to 40 years account for just 25.8% of the sample. There were slightly more males than females (54.3% compared to 45.7%). Participants consisted of employed individuals (63.3%), while not employed adults made up 36.7%. Almost all participants lived in urban areas (88%). In the maxillary arch, Kennedy class III was more frequently observed (42.7%), whereas class IV was rarely seen (3.7%). In the same way, the mandibular arch was primarily represented by class I (39.0%), while class IV was seen in just 3.2% of cases. Most participants reported no systemic disease (80.4%).

Tables 2 and 3 present the specific relationship between Kennedy classification in the upper and lower arches and other study variables. Chi-square analysis showed notable associations between the Kennedy classification and various demographic, clinical, and social factors across both arches. Age showed a significant correlation with the maxillary Kennedy classification ($\chi^2 = 15.602$, $p = 0.048$) and the mandibular Kennedy classification ($\chi^2 = 16.776$, $p = 0.033$), suggesting that patterns of partial edentulism differed across age groups. Older individuals (51–70 years) showed a greater occurrence of Kennedy class II (maxilla) and class I (mandible).

Gender demonstrated a significant association with the maxillary arch ($\chi^2 = 27.828$, $p < 0.01$), as males primarily exhibited class II patterns, whereas females displayed comparatively greater proportions of class III in the maxilla. Simultaneously, no association was discovered with mandibular classifications ($\chi^2 = 3.029$, $p =$

0.553). Similarly, residential location showed a significant association with Kennedy classification in the maxillary arch ($\chi^2 = 10.123$, $p = 0.038$) but not with the mandibular classification ($\chi^2 = 7.815$, $p = 0.99$).

Occupation was associated with maxillary ($\chi^2 = 14.428$, $p = 0.006$) and mandibular Kennedy classification ($\chi^2 = 9.841$, $p = 0.043$). Workers mostly showed a greater frequency of class III patterns in the maxilla and class II in the mandible. In comparison, the status of systemic disease showed no association with maxillary classification ($\chi^2 = 8.537$, $p = 0.074$). A statistically significant association was found with mandibular Kennedy classification ($\chi^2 = 10.150$, $p = 0.038$).

Kennedy class III as the reference category in the maxilla and Kennedy class I as the reference category in the mandible were used in the multinomial logistic regression analysis to investigate independent factors further. The relationship between Kennedy classification and age, gender, occupation, residence, and systemic illness was assessed using multinomial logistic regression. For the maxillary arch classification ($\chi^2 = 64.25$, degrees of freedom = 24, $p < 0.001$) and mandibular arch classification ($\chi^2 = 43.34$, degrees of freedom = 24, $p = 0.009$), the overall model was statistically significant, suggesting that the examined predictors were significantly associated with Kennedy classification in both the maxilla and mandible (Table 4).

Likelihood ratio tests revealed that gender was the sole significant overall predictor of maxillary Kennedy categorization. In the multinomial regression model, none of the variables evaluated for the mandibular arch were substantially linked with Kennedy classification (Table 5).

The likelihood ratio tests determined the total contribution of each predictor to the multinomial logistic regression model. Tables 6 and 7 show parameter estimates, including adjusted odds ratios (ORs), 95% confidence intervals (CIs), and corresponding p-values, for each comparison between Kennedy classes.

Discussion

Classifying removable partial dentures aids in their identification and improves training. Kennedy's classification was utilized in this research for its straightforward visualization of the partially edentulous arch, its logical approach to design challenges, and its overall suitability as a classification method.

The findings of this study indicated a higher prevalence of partial tooth loss in the mandible than in the maxilla within the studied group, consistent with those of Tirado-Amador et al. and Emad Eldeen et al. [16,17]. The present

study evaluated the distribution and determinants of partial edentulism in maxillary and mandibular arches using Kennedy's classification and demonstrated that Kennedy class I in the mandible and class III in the maxilla share the most prevalent pattern, followed by class II in both the maxillary and mandibular arches, and reported class IV as the least prominent. The higher prevalence of mandibular tooth eruption in the oral cavity, which predisposes them to higher caries rates and increased risks of tooth extraction, could explain the higher incidence of class I in the mandibular arch [18]. This result was in agreement with previously reported findings across diverse populations [12,14].

Age is significantly related to the maxillary and mandibular Kennedy classifications, suggesting that patterns of partial edentulism vary across age groups (Tables 2 and 3). While the 51–70-year group had the highest number of cases, the 41–50-year group had the highest percentage of cases, suggesting that adults aged 40–50 are more likely to seek treatment. Patients aged ≤ 40 years presented with mainly Class II and III in both dental arches while those ≥ 41 years were characterized mainly by distal extension of the mandible and maxilla (classes I and II). Similar to the findings of Al-Angari et al. and Deeksheetha et al. [7,19] the relationships established in the descriptive and inferential statistics were further assessed using multinomial logistic regression to determine whether outcome variables were independent predictors of Kennedy's classification in the maxillary and mandibular arches. While comparing Kennedy classes I and III in the maxilla and Kennedy classes I and II in the mandible, a statistically significant difference was revealed (Table 6 and Table 7). However, age was not an independent predictor of maxillary and mandibular classifications (Tables 6 and 7). Age may influence the distribution of classification, but its effect appears limited. Male participants comprised the largest proportion of the study population, suggesting greater use of removable partial denture treatment among males than females (Table 1).

The descriptive statistics revealed a statistically significant association between gender and Kennedy classification, indicating that patterns of partial edentulism varied between males and females, with a greater proportion of males exhibiting class II and females showing class III in the maxilla (Table 2). The same classification is observed in males for the mandible, whereas females exhibit a predominance of class I classifications (Table 3). Other researchers discovered no link between gender and Kennedy classification [14]. These results were inconsistent with the results of Gopal et al., who reported an increase in male

participants compared to females but discovered no significant correlation between Kennedy classification and gender [11], and the results of Ahluwalia, who claimed that female patients dominate dental practices due to the emphasis on aesthetics and their flexible schedules from varying work hours [20]. According to the multinomial logistic regression results, gender is the only factor that significantly and independently predicts maxillary Kennedy classification. Still, it does not serve as an independent predictor for mandibular classification overall (Table 5). While most pairwise comparisons across Kennedy classes in both dental arches did not reach statistical significance, the findings suggest that gender has an independent effect on the distribution of maxillary classifications (Tables 6 and 7).

Working individuals were more likely to show Kennedy class III in the maxilla and Kennedy class II in the mandible than unemployed participants (Table 1). Inferential analysis revealed a statistically significant association between career status and Kennedy classification in both the arches, i.e., maxillary and mandibular arches (Tables 2 and 3). However, the multinomial logistic regression analysis (Tables 6 and 7) did not recognize occupation as an independent predictor of Kennedy classification in either dental arch. This indicates that the correlation observed in the univariate analysis may have been influenced by other demographic or clinical variables, rather than solely by employment status.

The study group consisted mainly of urban residents (Table 1), with Kennedy class III being the most prevalent in the maxilla and Kennedy class I in the mandible. In contrast, most of the rural residents were distributed among the distal extension cases. The inferential analysis revealed that the place of residence was significantly associated with the maxillary but not the mandibular Kennedy classification (Tables 2 and 3). Moreover, the multinomial logistic regression analysis did not reveal place of residence as an independent predictor of Kennedy classification in either the maxilla or the mandible. Still, a strong association was observed between the place of residence and the tendency to have one Kennedy classification against the other. For instance, there was a higher likelihood of observing class IV than class III Kennedy classification in the maxilla and class III rather than class I Kennedy classification in the mandible. This implies that the place of residence could be used to predict specific contrasts between the Kennedy classifications but not the overall distribution (Tables 5, 6, and 7). This observation was consistent with the findings of Sonkesariya et al. [21].

Most of the participants were systemically healthy (Table 2). Contrary to expectations, the association between the presence of systemic disease and the maxillary Kennedy classification did not demonstrate statistically significant differences. However, for the mandibular arch, a significant association was found between systemic disease and Kennedy classification (Tables 2 and 3). Nevertheless, this relationship was not found to be consistent in the multinomial logistic regression analysis (Table 5). Notably, the only statistically significant associations were observed between systemic disease and the absence of teeth in class IV versus III for the maxilla (Table 6). Similar findings were reported for the mandibular arch (Table 7). Thus, it can be postulated that the presence of systemic diseases may aggravate certain forms of partially edentulous spaces, particularly those classified under class IV, rather than the other Kennedy classifications. It should also be mentioned that the impact of systemic diseases on mandibular and maxillary Kennedy classifications appeared limited to general distributions and was not evident in the differential relationships.

The study's limitations encompass its retrospective cross-sectional design, which does not allow for causal inference; its single-center, clinic-based sample; and the relatively small number of participants in some Kennedy classification subgroups. To further establish causal pathways, future studies should use longitudinal designs and include additional variables such as duration of edentulism, dietary habits, smoking, and oral hygiene routines.

The results of this study are clinically important because this arch-focused approach offers a better understanding of the trends in partial edentulism. The information gathered can contribute to future dental research, as well as the improvement of the oral health policy.

Conclusion

This research shows that Kennedy class III was the most prevalent type of maxillary partial edentulism and Kennedy class I was the most prevalent type of mandibular partial edentulism in the population studied. Age, gender, place of residence, occupation, and systemic disease, when combined, may affect the distribution of classification, but none is considered an independent predictor of maxillary or mandibular Kennedy classification.

Declaration of conflicting interests

The authors declared no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

Data availability

The data used to support the findings of this study are available from the corresponding author upon request.

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Table 1. Frequency of the studied cases according to the study variables.

Study variables		No.	Percentage (%)
Age	20-40 years	88	25.8
	41-50 years	96	28.2
	51-70 years	157	46
Gender	Male	185	54.3
	Female	156	45.7
Occupation	Not employed	125	36.7
	Employed	216	63.3
Residency	Urban	300	88
	Rural	41	12
Medical history	No systemic disease	274	80.4
	Systemic disease	67	19.6
Arch	Maxilla	267	78.2
	Mandible	275	80.6
	Both	205	60.1
Kennedy classification (Maxilla)	CL I	37	13.9
	CL II	106	39.7
	CL III	114	42.7
	CL IV	10	3.7
Kennedy classification (Mandible)	CL I	107	39.0
	CL II	95	34.5
	CL III	64	23.3
	CL IV	9	3.2

Table 2. Kennedy classification (maxilla) distribution in the study variables.

Study variables		Kennedy classification (Maxilla)				Chi-Square (χ^2)	P-value
		CL I	CL II	CL III	CL IV		
Age	20-40 years	4	35	30	1	15.602	0.048
	41-50 years	11	23	41	4		
	51-70 years	22	48	43	5		
Gender	Male	23	72	64	4	27.828	≤ 0.01
	Female	14	34	50	6		
Occupation	Not employed	17	31	34	4	14.428	0.006
	Employed	20	75	80	6		
Residency	Urban	34	90	104	6	10.123	0.038
	Rural	3	16	10	4		
Medical history	No systemic disease	31	90	92	5	8.537	0.074
	Systemic disease	6	16	22	5		

Table 3. Kennedy classification (mandible) distribution in the study variables.

Study variables		Kennedy classification (Mandible)				Chi-Square (χ^2)	P-value
		CL I	CL II	CL III	CL IV		
Age	20-40 years	15	32	16	2	16.77	0.033
	41-50 years	33	21	18	4		
	51-70 years	59	42	30	3		
Gender	Male	53	56	38	4	3.029	0.553
	Female	54	39	26	5		
Occupation	Not employed	48	33	19	6	9.841	0.043
	Employed	59	62	45	3		
Residency	Urban	88	82	60	8	7.815	0.99
	Rural	19	13	4	1		
Medical history	No systemic disease	87	82	50	4	10.15	0.038
	Systemic disease	20	13	14	5		

Table 4. Model fitting information for multinomial logistic regression analysis of factors associated with Kennedy classification in the maxillary and mandibular arches.

	χ^2	Degrees of freedom	P-value
Maxillary arch	64.25	24	< 0.001
Mandibular arch	43.34	24	0.009

Table 5. Likelihood ratio for multinomial logistic regression analysis of factors associated with Kennedy classification in the maxillary and mandibular arches.

Predictor	Kennedy classification (Maxilla)		Kennedy classification (Mandible)	
	χ^2	P-value	χ^2	P-value
Age	14.003	0.082	15.458	0.051
Gender	21.505	<0.001*	1.94	0.747
Occupation	5.14	0.273	6.64	0.156
Location	8.033	0.09	8.476	0.076
Medical history	6.828	0.145	7.105	0.13

Table 6. Parameter estimates from the multinomial logistic regression analysis of factors associated with Kennedy classification in the maxillary arch.

Kennedy classification (Maxilla)					
Predictor	Comparison	(ORs)	95% CIs	p-value	
Age	≥ 51 years vs ≤40 years	Class I vs Class III	0.29	0.09-0.9	0.044
		Class II vs Class III	1.02	0.5-1.9	0.931
		Class IV vs Class III	0.3	0.03-2.9	0.305
	≥ 51 years vs 41-50 years	Class I vs Class III	0.64	0.2-1.5	0.32
		Class II vs Class III	0.5	0.2-1.07	0.07
		Class IV vs Class III	0.8	0.2-3.7	0.873
Gender	Male vs Female	Class I vs Class III	1.9	0.7-4.6	0.148
		Class II vs Class III	1.6	0.8-3.03	0.114
		Class IV vs Class III	0.4	0.1-2.2	0.354
Residency	Urban vs Rural	Class I vs Class III	1.1	0.2-4.3	0.883
		Class II vs Class III	0.6	0.2-1.4	0.242
		Class IV vs Class III	0.1	0.02-0.5	0.006
Occupation	Not employed vs employed	Class I vs Class III	2.3	0.9-5.7	0.059
		Class II vs Class III	1.1	0.6-2.3	0.615
		Class IV vs Class III	0.7	0.1-3.7	0.747
Medical history	No systemic disease vs systemic disease	Class I vs Class III	1.2	0.4-3.4	0.642
		Class II vs Class III	1.3	0.6-2.7	0.46
		Class IV vs Class III	0.2	0.05-0.8	0.033

Table 7. Parameter estimates from the multinomial logistic regression analysis of factors associated with Kennedy classification in the mandibular arch.

Kennedy classification (Mandible)					
Predictor		Comparison	(ORs)	95% CIs	p-value
Age	≥ 51 years vs ≤40 years	Class II vs Class I	2.8	1.3-6.08	0.005*
		Class III vs Class I	1.9	0.8-4.5	0.131
		Class IV vs Class I	2.9	0.4-20.06	0.279
	≥ 51 years vs 41–50 years	Class II vs Class I	0.8	0.4-1.7	0.685
		Class III vs Class I	0.9	0.4-1.9	0.89
		Class IV vs Class I	2.4	0.4-12.7	0.31
Gender	Male vs Female	Class II vs Class I	1.2	0.6-2.2	0.558
		Class III vs Class I	1.1	0.5-2.3	0.675
		Class IV vs Class I	1.6	0.2-9.1	0.584
Residency	Urban vs Rural	Class II vs Class I	1.5	0.7-3.4	0.276
		Class III vs Class I	3.4	1.1-10.8	0.033
		Class IV vs Class I	1.5	0.1-13.9	0.685
Occupation	Not employed vs employed	Class II vs Class I	0.8	0.4-1.5	0.553
		Class III vs Class I	0.5	0.2-1.2	0.154
		Class IV vs Class I	2.9	0.5-17.1	0.226
Medical history	No systemic disease vs systemic disease	Class II vs Class I	1.3	0.6-3.02	0.409
		Class III vs Class I	0.7	0.3-1.6	0.502
		Class IV vs Class I	0.2	0.05-0.9	0.042

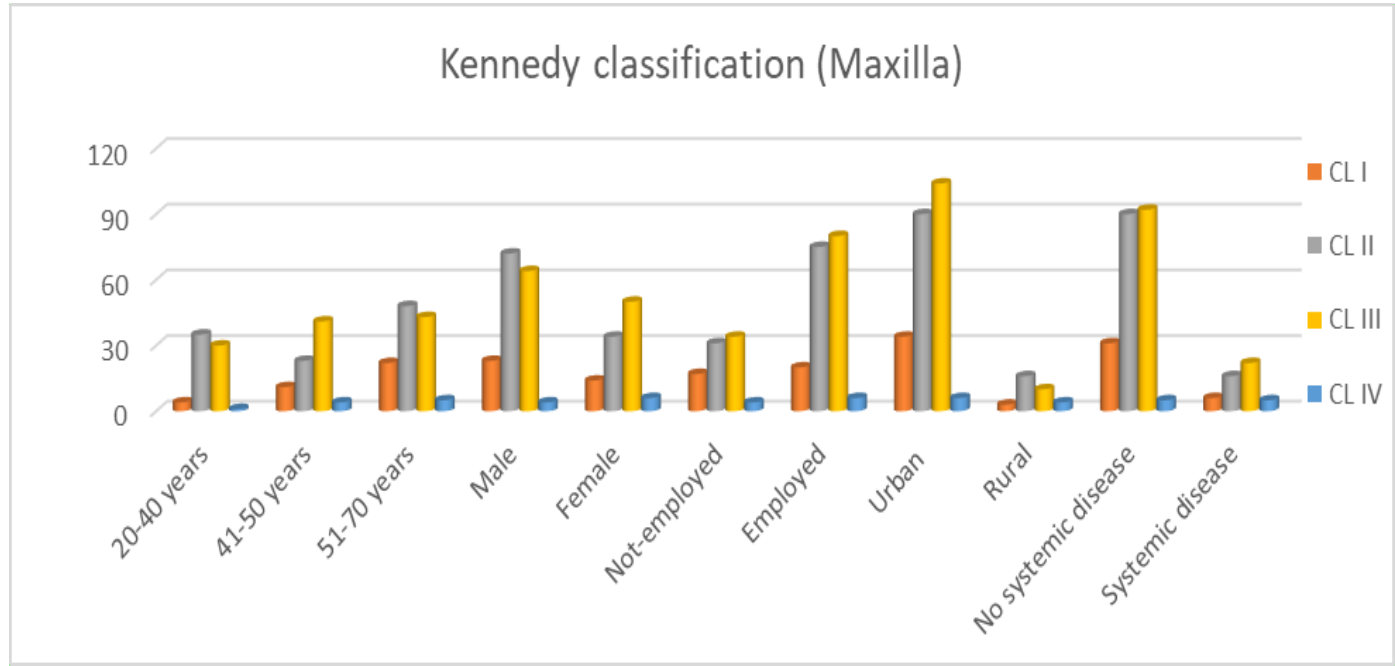


Figure 1. Distribution of Kennedy classification (maxilla) according to age, gender, occupation, residency, and medical history.

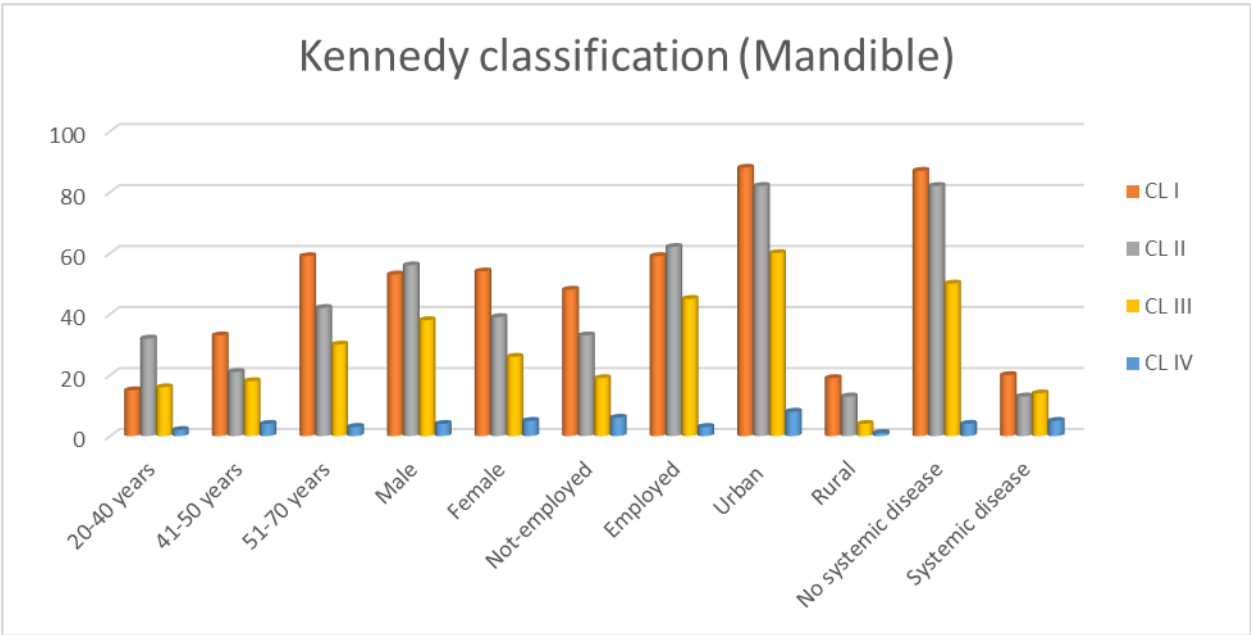


Figure 2. Distribution of Kennedy classification (mandible) according to age, gender, occupation, residency, and medical history.