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CHARACTERIZATION OF THE PATTERN OF PARTIAL EDENTULOUSNESS IN ADULT PATIENTS BY MEANS OF THE KENNEDY CLASSIFICATION

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Abstract: Introduction. Partial edentulism represents a chronic and irreversible condition that affects oral function and quality of life. Its classification by means of the Kennedy system allows a better planning in prosthetic rehabilitation. **Objective.** To characterize the pattern of partial edentulism in adult patients seen at the Imaging Service of the Faculty of Dentistry of a Chilean university. **Methodology.** Observational and cross-sectional study. A total of 646 digital periapical radiographs of patients between 20 and 90 years of age were analyzed. Radiographic inclusion and exclusion criteria were applied, and partial edentulism was classified according to the Kennedy system (Classes I-IV). Each arch was evaluated separately. Sociodemographic and clinical variables were recorded. Statistical analysis was performed in STATA v19.0 with Chi² tests ($p<0.05$). **Results.** The sample was mostly female (66.3%) with mean age of 54.1 years (SD: 13.1). Kennedy Class III was the most prevalent in both arches (55.3% in maxilla and 47.5% in mandible), followed by Class II. Class I was more prevalent in the mandible. No significant differences by sex were observed. However, the distribution by age group showed a trend: Class III predominated in young people, while Classes I and II increased with age. Differences by age were statistically significant ($p<0.001$). **Conclusion.** The most common pattern of partial edentulism was Class III, especially in adults between 40 and 64 years of age. With advancing age, the complexity of edentulousness increases. These results can guide preventive and rehabilitation strategies based on age and clinical condition.
Keywords: Partial edentulism; Kennedy classification; Adults; Maxilla and mandible; Periapical radiography; Oral epidemiology.

INTRODUCTION

Oral diseases represent a relevant public health problem due to their high prevalence and the negative impact they have on oral health as well as on the general health of individuals. Among its most important consequences is tooth loss, one of the most common conditions in older adults, with significant effects on quality of life, as it compromises essential functions such as chewing, phonation and social interaction (GUTIERREZ-VARGAS, et al., 2015; CHUMPITAZ-DURAND et al., 2019).

Partial edentulousness corresponds to a clinical condition characterized by the absence of one or more teeth, either in the maxilla or in the mandible, which does not reach total edentulism. This situation has a multifactorial origin, but its main causes are dental caries and periodontal disease. Tooth loss generates consequences that go beyond the oral sphere, affecting other dimensions of health such as mental, emotional and nutritional. In addition, it has been associated with a deterioration of general well-being, increased risk of dementia, alterations in body image and social exclusion (MINSAL, 2020).

The prevalence of tooth loss increases progressively with age, reaching its highest point during the seventh decade of life. Globally, in 2015, the prevalence of total edentulism was estimated to be between 3.9% and 4.3% (KASSEBAUM et al., 2014). However, these figures vary considerably between countries and regions, depending on sociodemographic factors, access to dental care and local public health policies (ARTEAGA et al., 2009).

In Chile, the National Health Survey (ENS) 2016-2017 reported an average number of missing teeth of between 5.9 and 6.5 in people aged 35 to 44 years, while in the group aged 65 to 74 years the average increased significantly, standing between 15.8 and 17.46 missing teeth with 79.8% of adults with partial edentu-

lism and 17.6% total edentulism (MORALES et al., 2020). Added to this is the existence of insufficient coverage for care in dental specialties, where Oral Rehabilitation represents one of the specialties with the highest number of patients on reported waiting lists.

Several studies have attempted to characterize the patterns of edentulousness in the population. For this purpose, multiple classification systems have been proposed, considering the great variety of tooth loss combinations. Among these, the Kennedy classification is the most widely used and recognized in clinical practice, thanks to its simplicity, understanding by dental personnel and its usefulness in standardizing clinical communication (MORA et al., 2022). This classification also makes it possible to assess the patient's current condition and guide the most appropriate prosthetic treatment (AL-JOHANY, 2008).

The collection of epidemiological data on edentulousness is key for the design of public policies in oral health. The use of Kennedy's classification in population-based studies has made it possible to estimate the prevalence of partial edentulousness and to plan adequate treatments based on removable prostheses, adjusted to the real needs of the communities (MOREIRA CARNEIRO et al., 2013). However, in Chile there is little updated evidence addressing tooth loss and partial edentulism, which hinders the development of effective preventive and rehabilitation strategies. It should be noted that the last study that evaluated the prevalence of the Kennedy classes in the country was carried out in 1998 (ROCHEFORD et al., 1998).

Faced with this situation, the aim of the present study is to characterize the pattern of edentulousness in patients between 20 and 90 years of age who were seen at the Imaging Service of the Faculty of Dentistry of a Chilean university, during the period from 2019 to 2021.

METHODOLOGY

An observational and cross-sectional study was carried out, whose objective was to characterize the pattern of partial edentulousness in adult patients attended at the Imaging Service of the Faculty of Dentistry of the University, during the period between the years 2019 and 2021.

The study population consisted of men and women over 20 years of age and up to 90 years of age, who attended the Imaging Service and had a complete set of digital periapical radiographs recorded in their clinical records. Cases with poor quality images, incomplete radiographs, presence of retained teeth, supernumerary teeth or history of mandibular or maxillary resection surgery were excluded, because these conditions could interfere with the adequate classification of the edentulousness pattern.

Non-probability convenience sampling was used, including all records that met the previously established inclusion criteria. Data collection was performed by reviewing the periapical radiographs available in the institutional digital system. The information obtained was recorded in a database specially designed for this study, incorporating sociodemographic (sex and age) and clinical variables (compromised arch and type of partial edentulousness according to Kennedy's classification). Age in years was recoded into 4 groups considering young adult (20 to 39 years), adult (40 to 64 years), older adult (65 to 79 years) and senescent (80 years and older).

The Kennedy classification was applied to determine the type of partial edentulism in each patient, evaluating independently the maxilla and mandible. In cases with multiple edentulous spaces, the edentulous space plus posterior was considered as the main criterion. The four main classes of the Kennedy system (Classes I, II, III and IV) were used exclusively, without additional modifications.

The category "not applicable" was used for those cases with complete dentition or total edentulism in any of the arches.

The radiographic evaluation was performed by two previously calibrated examiners. To ensure consistency in the interpretation, an interexaminer calibration was performed, and concordance was evaluated using the Kappa coefficient, with a minimum value of 0.80 being considered acceptable as an indicator of adequate reliability.

Statistical analysis was performed using STATA version 19.0. A descriptive analysis of quantitative variables was performed, reporting means and standard deviations. Categorical variables were analyzed using absolute and relative frequencies. The distribution of the pattern of edentulousness was presented for each arch globally and also stratified by sex and age group, in order to explore possible differences. To evaluate associations between categorical variables, the Chi-square test (Chi^2) was used, considering a value of $p < 0.05$ as statistically significant.

This study was approved by the University's Scientific Ethics Committee, complying with the ethical principles established in the Declaration of Helsinki. As this was a retrospective review of radiographic records, it was not necessary to obtain individual informed consent, and the confidentiality and anonymity of the data was guaranteed at all times.

RESULTS

A total of 646 complete digital periapical radiographs of persons seen at the Imaging Service of the Faculty of Dentistry of the university during the study period were analyzed. The sample showed a clear female predominance (66.25%) and was mostly made up of middle-aged adults, with an average age of 54.12 years (SD = 13.13).

Regarding the distribution by age group, most of the participants belonged to the 40 to 64 years age group (64.4%), followed by the 65 to 79 years age group (18.3%). Young adults (20 to 39 years) accounted for 14.5% and only 2.8% were aged 80 years or older (Table 1).

Sociodemographic variables		n	%
Sex	Male	218	33.75
	Female	428	66.25
Age in years	X = 54.12 SD. 13.13		
Age group (years)	20 a 39	94	14.55
	40 a 64	416	64.40
	65 a 79	118	18.27
	80 and over	18	2.79
Total		646	1000.0

Table 1. Sociodemographic characteristics of the sample studied.

For the analysis of the pattern of partial edentulousness according to the Kennedy classification, both dental arches (maxilla and mandible) were evaluated independently, representing a total of 1,292 arches observed.

Class III was the most frequent in both arches: 55.26% in the maxilla and 47.52% in the mandible, followed by Class II (17.80% in the maxilla and 24.61% in the mandible) (Table 2). Class I showed a higher prevalence in the mandible (13.78%) compared to the maxilla (10.37%). Class IV was the least represented in both arches. Also, there were a considerable number of cases in which the Kennedy classification did not apply, corresponding to patients with complete dentition or total edentulism.

Kennedy class	Maxilla n (%)	Mandible n (%)	Total n (%)
Class I	67 (10.37)	89 (13.78)	156 (12.07)
Class II	115 (17.80)	159 (24.61)	274 (21.21)
Class III	357 (55.26)	307 (47.52)	664 (51.39)
Class IV	15 (2.32	6 (0.93)	21 (1.63)
Not applicable	92 (14.24)	85 (13.16	177 (13.70)
Total	646 (50.0)	646 (50.0)	1292 (100.0)

Table 2. Distribution of Kennedy's classification according to arch

On analyzing the distribution of the Kennedy classes in the maxilla according to sex, Class III was the most frequent, representing 55.26% of the total number of maxillary cases. Of these, 64.15% corresponded to females and 35.85% to males, proportions in accordance with the general composition of the sample. Classes I and II presented a similar distribution between sexes. No statistically significant differences were observed in the type of maxillary edentulousness according to sex (p = 0.737) (Table 3).

Kennedy's class in the maxilla	Male n (%)	Female n (%)	Total n (%)
Class I	22 (32.84)	45 (67.16)	67 (10.37)
Class II	37 (32.17)	78 (67.83)	115 (17.80)
Class III	128 (35.85)	229(64.15)	357 (55.26)
Class IV	4 (26.67)	11 (73.33)	15 (2.32)
Not applicable	27 (29.35)	65 (70.65)	92 (14.24)
Total	218 (33.75)	428 (66.25)	646 (100.0)

Significance of Chi2 test, p-value: 0.737

Distribution of the Kennedy classification for the maxilla according to sex.

In relation to the analysis of the Kennedy classification of the mandible according to sex, Class III was also the most frequent. The distribution by sex remained proportional to the total sample (approximately two thirds females and one third males), without observing statistically significant differences in the type of edentulism between males and females (Table 4).

Kennedy's class in the mandible	Male n (%)	Female n (%)	Total n (%)
Class I	30 (33.71)	59 (66.29)	89 (13.78)
Class II	57 (35.85)	102 (65.15)	159 (24.61)
Class III	99 (32.25)	208(67.75)	307 (47.52)
Class IV	4 (66.67)	2 (73.33)	6 (0.93)
Not applicable	28 (32.94)	57 (33.33)	85 (13.16)
Total	218 (33.75)	428 (66.25)	646 (100.0)

Significance of Chi2 test, p-value: 0.469

Table 4. Distribution of the Kennedy classification for the mandible according to sex.

Figure 1 shows the distribution of the pattern of edentulousness in the maxilla according to age group. Although Class III remains the most frequent in all groups, it shows a decreasing trend with increasing age. At the same time, an increase in Classes I and II was observed. The proportion of cases in which the Kennedy classification "does not apply" increases in the extreme age groups. The differences observed between the age groups in the pattern of maxillary edentulism were statistically significant (p < 0.001).

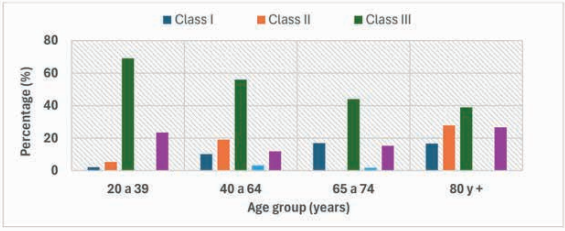

Figure 1. Distribution of the Kennedy classification for the maxilla according to age group.

Similarly, Figure 2 shows the distribution of the pattern of edentulousness in the mandible according to age group. Class III is the most frequent and decreases progressively with age. Class I increases markedly in the 80 years and older age group. Class II also shows an increase with age, although to a lesser degree. The "not applicable" category rises in the

extreme age groups. The differences were statistically significant ($p < 0.001$).

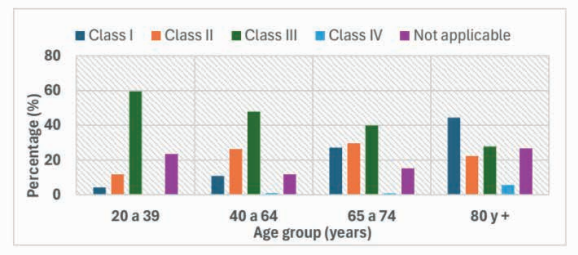

Figure 2. Distribution of the Kennedy classification for the mandible according to age group.

DISCUSSION

Edentulism constitutes a chronic and irreversible condition that negatively impacts both the function of the stomatognathic system and the quality of life of individuals. Understanding its distribution in the population is essential to guide oral health strategies, both in the preventive field and in prosthetic rehabilitation. In this context, the present study aimed to characterize the pattern of partial edentulousness in patients between 20 and 90 years of age attended at the Imaging Service of the Faculty of Dentistry of a Chilean university. The results revealed that posterior partial edentulism with the presence of remnant abutments, corresponding to Class III of the Kennedy classification, was the most frequent pattern observed, both in the maxilla and the mandible, with no differences by sex, but by age group.

This finding is consistent with previous studies that have identified Kennedy Class III as the most prevalent form of partial edentulism in adult populations, especially between the ages of 40 and 64 years, a stage in which significant functional tooth loss begins to be evident (KARADI et al., 2024; AL-ANGARI et al., 2021; GHIȚĂ et al., 2019; FAYAD et al., 2016). This pattern is of particular clinical importance, since by preserving a posterior abutment, Class III allows for a more stable and functional rehabilitation, offering better masticatory performance and greater comfort compared to Classes I and II, which usually require more complex prosthetic designs due to the absence of distal support (CARRIÓN ACOSTA et al., 2018).

Comparatively, the prevalence of partial edentulism according to Kennedy's classification varies among different geographical contexts, although the predominance of Class III prevails. KARADI, (2024) reports that the rate of Class III edentulism in the maxillary arch was significantly higher than in the mandibular arch and Class IV was the least frequent in both arches. The frequency of Class I and Class II partial edentulism increased with age, while Class III was more frequent at younger ages. CHUMPITAZ-DURAND (2019) highlights a prevalence of Class III partial edentulism of 42.4% in maxilla 36.4% in mandible.

Some countries in the Middle East and Asia report variable results. In Saudi Arabia, FAYAD (2016) reported a 64.4% frequency of Class III, particularly in young adults (75-85% between 21 and 40 years). However, GAD (2019) found higher proportions of Class I and II in mandible (50.3 % and 26.9 % respectively). This observed heterogeneity may be attributed to differences in oral health habits present in the population, possibility of access to dental treatment and the different sampling methodologies used in the studies.

In Europe, MOREIRA CARNEIRO (2022) describes a similar distribution in a Portuguese population: 39.6 % Class III in the maxilla compared to 35.1 % Class I in the mandible, with a higher frequency of Class III in women (63.7 %). Among the various factors that have been studied, age is the key factor that has a significant relationship with the occurrence of partial edentulism (GHIȚĂ et al., 2019).

In Chile, patterns of partial edentulism have shown a remarkable evolution. An initial study by ROCHEFORT (1998) found that Ke-

nnedy Class I was the most prevalent, with a frequency of 31%, especially in the mandible. However, this study reveals a different situation: Class III was confirmed as the predominant form of partial edentulism, with an overall prevalence of 59.6%, being more frequent in the maxilla (64.4%) versus the mandible (54.7%). This transition suggests a decrease in chronic loss of posterior teeth and an increase in patterns with remaining abutments, which probably reflects improvements in access and quality of dental care in the country.

Regarding the sex variable, the results do not show statistically significant differences in the distribution of the Kennedy classes, although a greater female numerical representation was observed, in accordance with the composition of the sample. This is in agreement with that reported by AL-ANGARI et al. (2021) and GHIȚĂ et al., 2019 and ABDE-L-RAHMAN (2013), who also found similar proportions between males and females with respect to the pattern of edentulousness, with no significant association. However, some studies, such as that of KARADI et al., 2024 point to a higher prevalence of Class IV in men, which could be linked to differences according to sociocultural context.

When analyzing the distribution of partial edentulism according to age, the results show a clear trend: Kennedy Class III was more frequent in young adults (20-39 years), while Classes I and II increased progressively with age. This pattern has been documented in multiple international studies. For example, DEVISHREE et al. (2018) and Zaigham AM (2023) observed that in people younger than 40 years, Class III predominated, while from the age of 50 years onwards, the frequency of Classes I and II increased, which is associated with greater posterior tooth loss with age. Similarly, FAYAD et al. (2016) found in Saudi Arabia a prevalence of Class III in young adults (more than 75 % in the 21-40 age groups), with a marked decrease in older groups. ZAIGHAM &MUNEER (2010) concluded that with increasing age, there was an increase in the tendency for partial edentulism. This value was higher than 55% in the 30-39 years age group.

This study presents some limitations that should be considered when interpreting the results. The cross-sectional design was performed with convenience sampling**,** which restricts the generalizability of the findings, since the sample is composed exclusively of patients who attended the Imaging Service and had complete radiographs. This may introduce a selection bias, since these patients could present different clinical characteristics from the general population.

The analysis was based on radiographic records only, which precludes consideration of other relevant clinical factors such as reasons for extraction, history of previous prosthetic treatment, periodontal status or other systemic conditions that might influence the pattern of tooth loss. Furthermore, although an interexaminer calibration protocol was applied with a good level of agreement (Kappa $\geq$ 0.80), radiographic interpretation remains susceptible to interobserver variability, especially in cases with suboptimal quality records. It is important to note that this study did not include modifications to the Kennedy classification (only classes I to IV), which could underestimate the real complexity of the edentulism pattern**,** especially in patients with multiple noncontiguous edentulous spaces. However, the results of the study contribute with updated data on the pattern of partial edentulousness in a Chilean adult population, highlighting the usefulness of the Kennedy classification as a tool for characterization and treatment planning in oral health.

The results of this study allow us to conclude that Kennedy Class III was the most frequent partial edentulousness pattern in both

arches, especially in adults between 40 and 64 years of age, with no significant differences by sex. As age increases, a transition to more complex classes, such as I and II, is observed.

These findings highlight the need to focus prevention and prosthetic rehabilitation strategies according to the age profile, favoring early interventions that allow preservation of posterior abutments.

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