ORIGINAL ARTICLE

Various classes of removable partial dentures: A study of prevalence among patients attending a dental and educational institute in Riyadh, Saudi Arabia

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Abstract *Purpose:* Knowledge about the most prevalent types of Kennedy classifications is of great value and will enlighten dental students, dental technicians, and practitioners regarding the treatment needs of their patients, ultimately leading to better treatment outcomes. The aim was to determine the prevalence of various Kennedy classifications among patients attending clinics at the College of Dentistry at King Saud bin Abdulaziz University for Health Sciences and King Abdulaziz Dental Center, National Guard Health Affairs, who were seeking treatment for partial edentulism.

Methods: An observational cross-sectional study was conducted by visualizing cast models for partially edentulous patients. Kennedy classification, age, gender, and treatment design were recorded from the lab request sheets that were attached to the casts in the labs at both the College of Dentistry at King Saud bin Abdulaziz University for Health Sciences and King Abdulaziz Dental Center, National Guard Health Affairs. The statistical analyses were performed with SPSS version 20.0 utilizing frequency and Pearson's and Spearman's correlation tests.

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Results: Kennedy Class I (45.0%) was the most prevalent pattern in both dental arches, followed by Class III (26.2%). Next was Class II (23.3%), while Class IV was the least prevalent (5.4%).

Conclusion: Kennedy Class I was the most noted classification in our patient population. As age increases, there is an increased tendency toward Class I and II.

1. Introduction

The need for prosthetic rehabilitation of completely or partially edentulous arches still exists. Partial edentulism can be attributed to many factors, some of which are inevitable, such as caries, periodontal conditions, trauma, impacted teeth, and neoplastic or cystic lesions (Jeyapalan and Krishnan, 2015). The consequences of untreated edentulous areas can range from the malalignment of adjacent and opposing teeth to impaired esthetics, speech, and chewing, and sometimes temporomandibular disorders (Abdurahiman et al., 2013). Rehabilitating partially edentulous arches can be managed with removable or fixed approaches utilizing teeth, implants, or even oral structures.

Partial edentulism is one of the most widely tackled topics in dentistry. Many studies have investigated the patterns of partial edentulism in different countries and populations (Abdel-Rahman et al., 2013; Araby et al., 2017; Bharathi et al., 2015; Butt et al., 2015; Carr et al., 2011; Curtis et al., 1992; Fayad et al., 2016; HamaAM et al., 2016; Javid Yunus Patel, Mohyuddin Y Vohra and Department, 2016; Keyf, 2001; Madhankumar et al., 2015; NAVEED et al., 2011; Prabhu et al., 2009; Sapkota et al., 2013; Shinawi, 2012; Vadavadagi et al., 2015). In 1925, Edward Kennedy proposed that patterns of partial edentulism fell within four categories: Class I: edentulous areas bilaterally present posterior to remaining natural teeth; Class II: edentulous area unilaterally present posterior to remaining natural teeth; Class III: edentulous area unilaterally present with natural teeth both anterior and posterior to it; and Class IV: single edentulous area bilaterally present anterior to remaining natural teeth (Carr et al., 2011).

As there are no previous data at the College of Dentistry at King Saud bin Abdulaziz University for Health Sciences (KSAU-HS) and King Abdulaziz Dental Center (KADC) regarding this research topic, the information obtained from this article will be valuable. Knowing the most prevalent type of removable partial denture (RPD) classification will familiarize dental students, practitioners, and dental technicians with the treatment needs of the patients, eventually leading to better treatment outcomes.

Several studies showed that Kennedy Class III is the most common pattern of partial edentulism (Abdel-Rahman et al., 2013; Araby et al., 2017; Bharathi et al., 2015; Butt et al., 2015; Carr et al., 2011; Curtis et al., 1992; Fayad et al., 2016; HamaAM et al., 2016; Javid Yunus Patel, Mohyuddin Y Vohra and Department, 2016; Keyf, 2001; Madhankumar et al., 2015; NAVEED et al., 2011; Prabhu et al., 2009; Sapkota et al., 2013; Shinawi, 2012; Vadavadagi et al., 2015). Most of these articles performed clinical examinations on the patients to determine the classification. On the other hand, Kennedy Class I is more prevalent in some studies when measured in terms of the types of RPDs being fabricated and provided to the patients (Curtis et al., 1992; Keyf, 2001). A limited number of studies on this topic have been conducted in Saudi Arabia. For instance, a study at King Saud University (KSU) found that Class III RPDs were the most fabricated, with gender showing no potential effect in the results. They found that the lingual bar was the most commonly used major connector, while in maxilla it was the anterior-posterior palatal strap (Sadig and Idowu, 2002). Another study, conducted at Al Jouf University, supported the results of the KSU study, finding that Class III was more frequent in partially edentulous patients, except among patients aged 41–50 years old, among whom Class I was the most frequent (Fayad et al., 2016). Similarly, in Al Madinah city, specifically at King Fahad Hospital, a study performed via visual examination of patients showed that Class III was more frequent among younger patients, and Class I and II were more frequent in older subjects (Keyf, 2001). Thus, given the results of previous studies, it is anticipated that Kennedy Class III will be the most common form of partial edentulism, while Class I will be the most fabricated type of partial denture.

2. Materials and methods

This is an observational cross-sectional study conducted by visualizing cast models for the partially edentulous patients, recording their Kennedy classification, age, gender, and treatment design from the lab request sheets that were attached to the casts. The inclusion criteria were patients from both genders, above the age of 15 years, having partially edentulous areas in either or both jaws who were attending the clinics at the College of Dentistry at KSAU-HS and KADC between January 2017 and January 2019 and who were treated by either conventional or transitional removable partial prostheses. Exclusion criteria excluded all dental casts for patients who would not be treated with a removable partial denture, completely edentulous patients, and those only missing maxillary and mandibular third molars.

Dentists and dental students at the College of Dentistry at KSAU-HS and KADC treated their partially edentulous patients by making dental impressions and then sending the impressions to the dental lab with the treatment design instructions. At that stage, we collected the information needed (e.g., age, gender, arch, and major connector design) from the lab request sheets. All data were transferred to SPSS version 20.0 for statistical analysis. Regarding the statistical analyses, frequency tests were predominantly used for prevalence and percentages. Besides, Pearson's and Spearman's correlation tests were used to look for correlations between Kennedy classifications and the other variables. A P value of < 0.05 was considered statistically significant.

3. Results

The data were collected from 202 casts of patients from 17 to 85 years old of both genders who were attending clinics at the College of Dentistry at KSAU-HS and KADC and under active treatment for their partially edentulous jaws. Among those patients, 41.3% were males and 58.7% females. In terms of age distribution, the age range of 41–50 was the most prevalent (37.2%), followed by 51–60 (25.5%). Of the cast samples, 84 (41.6%) were maxillary arches, and 118 (58.4%) were mandibular arches. Regarding the pattern of partial edentulism: Class I (45.0%) was the most prevalent pattern in both dental arches, followed by Class III (26.2%) and then Class II

(23.3%), while Class IV was the least common (5.4%). Spearman's correlation test implied that there were no statistically significant differences between different Kennedy classifications and gender (P = 0.98), but it was found to be statistically significant results between Kennedy classification and the arch (P < 0.03). The latter correlation was negative meaning that maxillary arches have more Class III and IV, and mandibular arches have more Class I and II patterns of partial edentulism. Pearson correlation test revealed the presence of a negative significant correlation between Kennedy classification and age groups (P < 0.01), which means that the older the patient the more prevalent Class I and II are. Regarding the pattern of modification among patients with Class I, those with no
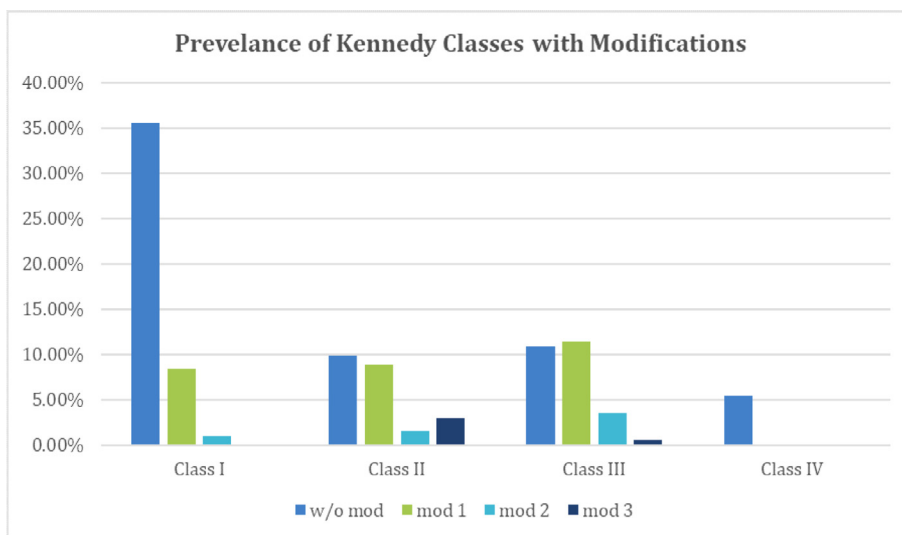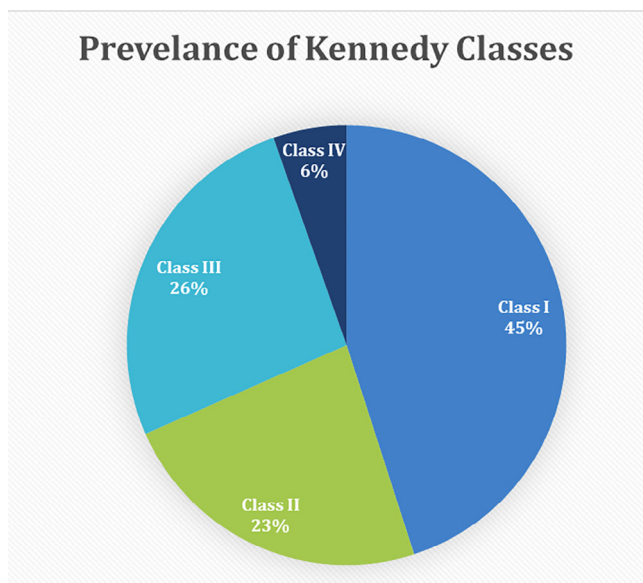

Fig. 1
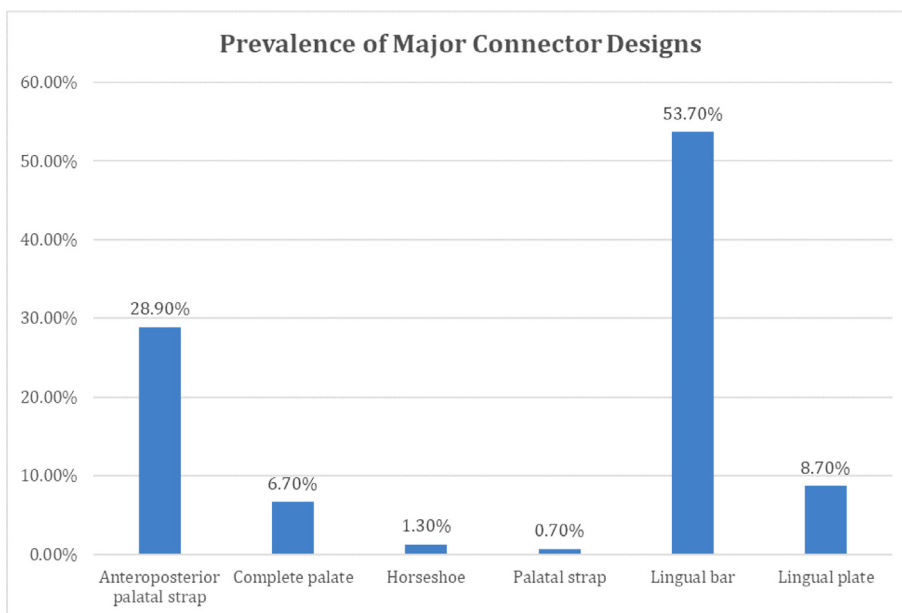
Fig. 2

Fig. 3

modification were most prevalent (79.1%); the same was noted with Class II, where those with no modification were also the most common (42.6%); however, in patients with Class III, patients with modification 1 were more common (40.4%) as shown in Fig. 1. The most commonly used major connector is the lingual bar (86.0%) for mandibular arches and the anteroposterior palatal strap for maxillary arches (76.8%) as illustrated in Fig. 2.

4. Discussion

This research aimed to identify the prevalence of Kennedy classifications in relation to age, gender, modifications and type of major connectors used for patients seeking treatment with RPDs in clinics at the College of Dentistry at King Saud bin Abdulaziz University for Health Sciences and King Abdulaziz Dental Center.

It was found that Kennedy Class I was most prevalent as illustrated in Fig. 3. This is in line with Keyf et al. and Curtis et al. (Curtis et al., 1992; Keyf, 2001) but contradicts many other studies, such as Sadig et al., which found that Class III was the most prevalent (Sadig and Idowu, 2002). This might be attributed to different methodological approaches; while our study focused on patients who were seeking treatment, other studies investigated the type of edentulism, regardless

of the treatment provided. Many authors have analyzed gender as a key factor affecting the type of partial edentulism (Abdurahiman et al., 2013; Bharathi et al., 2015; Carlos et al., 2007; Carr et al., 2011; Curtis et al., 1992; Fayad et al., 2016; Javid Yunus Patel, Mohyuddin Y Vohra and Department, 2016; Jeyapalan and Krishnan, 2015; Keyf, 2001; Madhankumar et al., 2015; Prabhu et al., 2009; Sadig and Idowu, 2002; Sapkota et al., 2013; Suominen-Taipale et al., 1999; Udani, 1954; Vadavadagi et al., 2015). Most studies, including the present study, have concluded that there is no significant correlation between gender and type of partial edentulism, whereas a few studies have found a significant relationship between gender and various classes of partial edentulism which was associated with urbanization as a socioeconomic factor rather than the gender itself (Suominen-Taipale et al., 1999; Udani, 1954). It was also found that as age increases, there is an increased tendency toward Class I and II and a decrease in Class III. Class III is the most prevalent class in the two youngest age groups (10–20 and 21–30 years old), while Class I is the most prevalent in the four oldest age groups (41–50, 51–60, 61–70, and 71–80 years old) as shown in Table 1. Araby et al. (Araby et al., 2017) had similar findings. The most commonly fabricated major connector for the maxilla is the anteroposterior palatal strap and for the mandible, it is the lingual bar, as this is in line with Zanco et al. and Curtis et al. respectively, and these are also similar to the findings of Sadig et al (Abdel-Rahman et al., 2013; Curtis et al., 1992; Sadig and Idowu, 2002).

5. Conclusion

In sum, our study aimed to explore various Kennedy classifications among patients attending clinics at the College of Dentistry at KSAU-HS and KADC who were seeking treatment for their partially edentulous jaws and to explore the classifications' relationships with age and gender. Kennedy Class I is the most noted classification in our patients. We also found that with increased age there is an increased tendency toward Class I and II. Gender shows no significant relationship with the type of Kennedy class. Lingual bar and anterior-posterior palatal strap are the most used major connectors for the mandible and maxilla, respectively.

Ethical committee approval

Table 1 Prevalence of Kennedy Classes among Different Age Groups.

Kennedy classification	Age distribution (%)								Total
	10–20	21–30	31–40	41–50	51–60	61–70	71–80	81–90	
Class I			4.8%	18.1%	10.6%	6.9%	2.1%		42.6%
Class II		0.5%	4.8%	9.0%	6.9%	2.7%			23.9%
Class III	0.5%	3.2%	4.3%	8.5%	8.0%	2.7%	0.5%		27.7%
Class IV		1.1%	1.6%	1.6%		1.1%		0.5%	5.0%
Total	0.5%	4.8%	15.4%	37.2%	25.5%	13.3%	2.7%	0.5%	**100**%

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

Abdel-Rahman, H.K., Tahir, C.D., Saleh, M.M., 2013. Incidence of partial edentulism and its relation with age and gender. Zanco J. Med. Sci. 17, 463–470.

Abdurahiman, V.T., Abdul Khader, M., Sanju John Jolly, S.J., 2013. Frequency of partial edentulism and awareness to restore the same: a cross sectional study in the age group of 18–25 years among kerala student population. J. Indian Prosthodont. Soc. 13, 461–465. https://doi.org/10.1007/s13191-012-0246-2.

Araby, Y.A., Almutairy, A.S., Alotaibi, F.M., 2017. Pattern of partial edentulism in correlation to age and gender among a selected Saudi population 5, 1–4. https://doi.org/10.12691/ijdsr-5-1-1.

Bharathi, M., Mahesh Babu, K.R., Reddy, G., Gupta, N., Misuriya, A., Vinod, V., 2015. Partial edentulism based on kennedy's classification: An epidemiological study. J. Contemp. Dent. Pract. 15, 229–231. https://doi.org/10.5005/jp-journals-10024-1520.

Butt, A.M., Rahoojo, A., Punjabi, S.K., Lal, R., 2015. Incidence of Various Kennedy ' S classes in partially edentulous patients visiting Dental Opd Hyderabad / Jamshoro. Paksitan Oral Dent. J. 35, 329–331.

Carlos, M., Salvador, G., Lins, A., Carvalho, M., Ribeiro, M., Pereira, J.R., 2007. Combination syndrome in patients treated At Bauru. Signs (Chic). 15, 9–13.

Carr, A.B., Brown, D.T. (David T., McCracken, W.L., 2011. McCracken's removable partial prosthodontics. Elsevier Mosby.

Curtis, D.A., Curtis, T.A., Wagnild, G.W., Finzen, F.C., 1992. Incidence of various classes of removable partial dentures. J. Prosthet. Dent. 67, 664–667. https://doi.org/10.1016/0022-3913(92)90167-9.

Fayad, M.I., Baig, M.N., Alrawaili, A.M., 2016. Prevalence and pattern of partial edentulism among dental patients attending College of Dentistry, Aljouf University, Saudi Arabia. J. Int. Soc. Prev. Community Dent. 6, S187–S191. https://doi.org/10.4103/2231-0762.197189.

HamaAM, D., MahmoodDK, D., AO, D.A., 2016. Prevalence and assessment of partially edentulism according to kennedys classification in sulaimani city. Asian J. Sci. Technol. 7, 3367–3370.

Javid Yunus Patel, Mohyuddin Y Vohra, J.M.H., Department, 2016. Assessment of Partially Edentulous Patients Based on Kennedy's Classifi cation and its Relation with Gender Predilection Javid. Int. J. Sci. Study 2, 32–36.

Jeyapalan, V., Krishnan, C.S., 2015. Partial Edentulism and its Correlation to Age, Gender, Socio-economic Status and Incidence of Various Kennedy's Classes- A Literature Review. J. Clin. Diagn. Res. 9, ZE14-7. https://doi.org/10.7860/JCDR/2015/13776.6124.

Keyf, F., 2001. Frequency of the various classes of removable partial dentures and selection of major connectors and direct/indirect retainers. Turkish J. Med. Sci. 31, 445–449. https://doi.org/10.5005/jp-journals-10024-1520.

Madhankumar, S., Mohamed, K., Natarajan, S., Kumar, V.A., Athiban, I., Padmanabhan, T.V., 2015. Prevalence of partial edentulousness among the patients reporting to the Department of Prosthodontics Sri Ramachandra University Chennai, India: An epidemiological study. J. Pharm. Bioallied Sci. 7, S643.

Naveed, H., Aziz, M.S., Hassan, A., Khan, Waheedullah, Azad, Azad Ali, 2011. Patterns of partial edentulism among armed forces personnel reporting at armed forces istitute of dentistry Pakistan. Pakistan Oral Dent. J. 31, 217–221.

Prabhu, N., Kumar, S., D'souza, M., Hegde, V., 2009. Partial edentulousness in a rural population based on Kennedy's classification: An epidemiological study. J. Indian Prosthodont. Soc. 9, 18. https://doi.org/10.4103/0972-4052.52869.

Sadig, W.M., Idowu, A.T., 2002. Removable partial denture design: A study of a selected population inSaudiArabia. J. Contemp. Dent. Pract. 3, 37–47.

Sapkota, B., Adhikari, B., Upadhaya, C., 2013. A Study of assessment of partial edentulous patients based on Kennedy's classification at Dhulikhel Hospital Kathmandu University Hospital. Kathmandu Univ. Med. J. 11, 325–327.

Shinawi, L.A., 2012. Partial edentulism: A five year survey on the prevalence and pattern of tooth loss in a sample of patients attending King AbdulAziz University - Faculty of Dentistry. Life Sci. J. 9, 2665–2671.

Suominen-Taipale, A.-L., Alanen, P., Helenius, H., Nordblad, A., Uutela, A., 1999. Edentulism among Finnish adults of working age, 1978?1997. Commun. Dent. Oral Epidemiol. 27, 353–365. https://doi.org/10.1111/j.1600-0528.1999.tb02032.x.

Udani, T.M., 1954. Age incidence of Indian patients in need of full denture service. J. Ind. Dent. Assoc.

Vadavadagi, S.V., Srinivasa, H., Goutham, G.B., Hajira, N., Lahari, M., Reddy, G.T.P., 2015. Partial edentulism and its association with socio-demographic variables among subjects attending dental teaching institutions, India. J. Int. oral Heal. JIOH 7, 60–63.