Pattern of partial edentulism among Najranian subpopulation and its association with related factors

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Abstract:
Objective: This study aims to determine the prevalence and pattern of partial edentulism among dental patients attending the Najran Specialist Dental Center, Najran, Saudi Arabia. Materials and Methods: Data was collected from 640 subjects who reported to the Najran Specialist Dental Center, Najran, Saudi Arabia and were prescribed with removable dental prostheses (RDP). Intraoral clinical and radiographic examinations were performed. The subjects were categorized into four age groups: 30–40, 41–50, 51–60, and > 60 years. Levels of educational and monthly income status were recorded, encoded into a SPSS program, and analyzed using Chi-square test. Results: Among all the dental patterns, Kennedy class II obtained the highest number of occurrence in the maxillary arch, whereas class I obtained the highest number of occurrence in the mandibular arch in both genders and all age groups. Kennedy class II obtained the highest number of occurrence, followed by class III in both arches in the monthly income groups. Class IV obtained the lowest number of occurrence in all age, gender, educational level, and monthly income groups in both arches. Conclusions: Among the selected subjects, Kennedy class I and II were the most prevalent patterns in both arches, all age groups, and both genders. Class IV was the least dominant pattern in all groups. The levels of educational and monthly income status played a role in the edentulism pattern of patients. Dental caries was the most common reason for tooth loss.

Key words: edentulism, Kennedy, gender, education, tooth loss

Introduction:

Dental caries, periodontitis (disease surrounding the soft tissue of the tooth), trauma, and/or a combination of these disorders are the common causes of tooth loss.1-3 On the basis of potential combinations of teeth to ridges, various methods of partial edentulism classification have been reported in different dental studies and surveys. At present, Kennedy classification is the most accurate and widely used and accepted because of its simplicity, ease of application to all partial edentulous situations, immediate visualization of the type of partially edentulous arch being considered, and differentiation between tooth-borne and tooth-tissue-borne removable partial dentures.4 The use of this classification has reduced the tremendous number of possible semi-edentulous combinations into four main basic and simple classes, namely, classes I, II, III and IV.5 Published epidemiological dental surveys and studies focused on investigating the relationship of Kennedy classification with various factors among the Saudi Arabian subpopulation. According to previous local studies in Jeddah, Jazan, Aljouf, Dammam, and Qassim2,6,7,8,9,10, age is strongly associated with Kennedy classifications; class I and II occur with increasing age. Similar studies in Jeddah, Jazan, Aljouf, Dammam, Qassim and Riyadh2,6,7,8,9,10,11, concluded that class III was the most common in both gender and arches among their subpopulation, whereas other studies mentioned that Kennedy class I and class II were the most frequent in both arches and genders.8,12 Class IV was the least frequent in both genders and arches among all the
screened samples in previous studies.\textsuperscript{2,6,7,8,9,10,11,12}

Local studies in Jeddah, Riyadh, Qassim, and Dammam\textsuperscript{6,10,11,12,13} and international studies\textsuperscript{14,15,16,17,18} revealed that the Kennedy classification among patients seeking removable partial denture treatments highly depends on their socio-economic parameters such as monthly income and educational level.

In the Najran region, dental treatment services are provided by the main specialist dental center in the region. This center has several clinics of specialists and consultants. Two of these clinics provide treatments for partially edentulous patients. Therefore, this study aims to determine the incidence of Kennedy classification in both dental arches and its relationship to age and gender among the Najran population. The association of partial edentulism with the socio-economic and educational status of the examined subjects who attended the Najran Specialist Dental Center was also investigated.

**Materials and Methods**

This retrospective cross-sectional study was conducted among patients who attended the Najran Specialist Dental Center, Najran region, Saudi Arabia, to replace their missing teeth. Approval from the director of the health affairs in the region was obtained for this study. Data were collected from patient files at the removable prosthodontics clinics from May 2014 to August 2017. The treated patients were referred from the screening and diagnostic clinic in the center and from the governmental dental clinics in the whole region.

Inclusive criteria were both genders, more than 30 years old and partially edentulous in the maxillary or mandibular areas or both arches. Completely edentulous subjects and those with missing third molars in both arches were excluded from this study. The Kennedy modification areas were not incorporated to circumvent the complexity. Only one investigator collected the data. Screening data included personal information data, gender, radiographic result and online contact. Panoramic digital radiograph machine (PaX-Flex 3D tomography X-ray system) was used in this study. The respondents consisted of 640 subjects [males: 328 (52.0%); females: 312 (42.0%)].

Data was analyzed to determine the pattern of partial edentulism in relation to gender, age, area of missing teeth in each dental arch, monthly income and educational level. The selected subjects were categorized into four groups according to age: 30–40, 41–50, 51–60, and > 60 years old. Monthly income data was collected by contacting the subjects and gathering the information and were categorized into < 3,000 SR, 3,000–10,000 SR, and > 10,000 SR. The educational levels were categorized into illiterate, primary level, secondary level and university level. The reasons for tooth loss were categorized into dental caries, periodontal problems, dental trauma and/or a combination of these. All the relevant data of partial edentulism were collected and recorded in a format design. All the obtained clinical, radiographic, and personal data were summarized as frequencies and percentages and subsequently analyzed using SPSS program version 20.1 for Windows (SPSS Inc., Chicago, Illinois, USA). Associations with age, gender, educational level and monthly income were tested using Chi-square. Statistical significance was considered at p < 0.05.

**Results**

A total of 640 subjects were included in this study, among which 328 patients (52.0%) were males, and 312 (42.0%) were females. The largest number of subjects was in the > 60 group (55.5%), whereas the lowest was in the 30–40 age groups (17.0%). The ages
Figure I: Percentage (%) distribution of gender and age groups

Table I: Number (n) and percentage (%) distribution of Kennedy's class of maxillary and mandibular arch in relation to age groups (Chi-square test)

| Arch / Age Group | Non edentulous n / % | Class I n / % | Class II n / % | Class III n / % | Class IV n / % | Total n / 100% | P-value |
|------------------|----------------------|---------------|---------------|-----------------|----------------|----------------|---------|
| Maxillary        |                      |               |               |                 |                |                |         |
| 30-40            | 1 1.5                | 5 7.4         | 30 44.1       | 5 7.4           | 68 100         | 0.000          |         |
| 41-50            | 19 19.8              | 5 5.2         | 21 21.9       | 36 37.5         | 96 100         | 134 100        |         |
| 51-60            | 21 15.7              | 28 20.9       | 43 32.1       | 40 29.9         | 134 100        | 100 100        |         |
| > 60             | 15 4.4               | 113 33.0      | 134 39.2      | 70 20.5         | 342 100        | 100 100        |         |
| Total N /%       | 56 8.8               | 151 23.6      | 228 35.6      | 173 27.0        | 640 100        | 100 100        |         |
| Mandibular       |                      |               |               |                 |                |                |         |
| 30-40            | 5 7.4                | 27 39.7       | 18 26.5       | 18 26.5         | 68 100         | 0.000          |         |
| 41-50            | 29 29.2              | 27 28.1       | 22 22.9       | 15 15.8         | 96 100         | 134 100        |         |
| 51-60            | 10 7.5               | 37 27.6       | 43 32.1       | 44 32.8         | 134 100        | 100 100        |         |
| > 60             | 9 2.6                | 172 50.3      | 104 30.4      | 57 16.7         | 342 100        | 100 100        |         |
| Total N /%       | 52 8.1               | 263 41.1      | 187 29.2      | 134 20.9        | 640 100        | 100 100        |         |
ranged from 30 years to 88 years with a mean of 60.11 and standard deviation of 13.29 (Figure I).

Table I shows that in the maxillary arch, class II obtained the highest number of occurrence at 134 (39.2%) followed by class I at 113 (33.0%), whereas in the mandibular arch, class I obtained the highest number of occurrence at 172 (50.3%), followed by class II at 104 (30.4%) among the > 60 age group. Class IV obtained the lowest number of occurrence at 32 (5%) in the maxilla and at 4 (0.5%) in mandible in all age groups. The results were statistically significant in all age groups at p < 0.001.

Table II shows that in males, class II obtained the highest percentage, followed by class III (35.7% and 28.0%, respectively) in the maxillary arch, whereas class I obtained the highest percentage, followed by class II (40.2% and 31.7%, respectively) in the mandibular arch. In females, class II obtained the highest percentage, followed by class III (35.6% and 26.0%, respectively) in the maxillary arch, whereas class I obtained the highest percentage, followed by class III (42.0% and 26.6%, respectively) in the mandibular arch. Class IV was the lowest in both arches (maxillary: 5%; mandibular: 0.8%) in both genders. The results in different genders were not statistically significant at p < 0.001.

Regarding the monthly income, Table III shows that in the < 3,000 SR income group, class II obtained the highest percentage, followed by class I in both maxillary (34.5% and 32.9%, respectively) and mandibular arches (51.2% and 29.2%, respectively). In the 3,000–10,000 SR income group, class II obtained the highest percentage, followed by class III in the maxillary (40.3% and 39.6%, respectively) and mandibular arches (29.9% and 27.8%, respectively). In the > 10,000 SR income group, class III obtained the highest percentage in both maxillary and mandibular arches (35.9 and 39.1%, respectively). Class IV obtained the lowest percentage in both arches (maxillary: 5%; mandibular: 0.6%) in all income groups. The results were statistically significant in all age groups at p < 0.001.

Table II: Number (n) and percentage (%) distribution of Kennedy’s classes of maxillary and mandibular arch in relation to gender groups (Chi-square test)
Table III: Number (n) and percentage (%) distribution of Kennedy’s class of maxillary and mandibular arch in relation to monthly incomes (Chi-square test)

| Arch / Income | Non-edentulous n / % | Class I n / % | Class II n / % | Class III n / % | Class IV n / % | Total n / 100% | P-value |
|---------------|----------------------|--------------|---------------|----------------|---------------|----------------|---------|
| Maxillary     |                      |              |               |                |               |                |         |
| 3000          | 40 9.3               | 142 32.9     | 149 34.5      | 93 21.5        | 8 1.9         | 432 100        | 0.000   |
| > 3000-10000  | 12 8.3               | 5 3.5        | 58 40.3       | 57 39.6        | 12 8.3        | 144 100        |         |
| > 10000       | 4 6.3                | 4 6.3        | 21 32.8       | 23 35.9        | 12 18.8       | 64 100         |         |
| Total N       | 56 8.8               | 151 23.6     | 228 35.6      | 173 7.0        | 32 5.0        | 640 100        |         |
| Mandibular    |                      |              |               |                |               |                |         |
| 0             | 16 3.7               | 221 51.2     | 126 29.2      | 69 16.0        | 0 0.0         | 432 100        | 0.000   |
| > 3000-10000  | 20 13.9              | 37 25.7      | 43 29.9       | 40 27.8        | 4 2.8         | 144 100        |         |
| > 10000       | 16 25.0              | 5 7.8        | 18 28.1       | 25 39.1        | 0 0.0         | 64 100         |         |
| Total N       | 52 8.1               | 263 41.1     | 187 29.2      | 134 0.9        | 4 0.6         | 640 100        |         |

Table IV: Number (n) and percentage (%) distribution of Kennedy’s classes of maxillary and mandibular arch in relation to level of education (Chi-square test)

| Arch / Education | Non-edentulous n / % | Class I n / % | Class II n / % | Class III n / % | Class IV n / % | Total n / 100% | P-value |
|------------------|----------------------|--------------|---------------|----------------|---------------|----------------|---------|
| Maxillary        |                      |              |               |                |               |                |         |
| Illiterate       | 20 11.0              | 95 52.2      | 55 30.2       | 8 4.4          | 4 2.2         | 182 100        |         |
| Primary          | 24 8.5               | 44 15.6      | 123 3.6       | 87 30.9        | 4 1.4         | 282 100        |         |
| Secondary        | 8 6.5                | 12 9.7       | 45 36.3       | 55 44.4        | 4 1.4         | 124 100        |         |
| University       | 4 7.7                | 0 0.0        | 5 9.6         | 23 44.2        | 20 38.5       | 52 100         |         |
| Total N          | 56 8.8               | 151 23.6     | 228 35.6      | 173 27.0       | 32 5.0        | 640 100        |         |
| Mandibular       |                      |              |               |                |               |                |         |
| Illiterate       | 0 0.0                | 118 64.8     | 48 26.4       | 16 8.8         | 0 0.0         | 182 100        | 0.000   |
| Primary          | 12 4.3               | 121 42.9     | 94 33.3       | 51 18.1        | 4 1.4         | 282 100        |         |
| Secondary        | 12 9.7               | 19 15.3      | 37 29.8       | 56 45.2        | 0 0.0         | 124 100        |         |
| University       | 28 53.8              | 5 9.8        | 8 15.4        | 11 21.2        | 0 0.0         | 52 100         |         |
| Total N          | 52 8.1               | 263 41.1     | 187 29.2      | 134 20.9       | 4 0.5         | 640 100        |         |
Table IV shows the distribution of the Kennedy classes in relation to educational level. Among the illiterate patients, class I obtained the highest percentage in both arches (maxilla: 52.2%; mandible: 64.8%). In the primary level group, class II obtained the highest percentage in the maxillary arch (43.6%), whereas class I obtained the highest percentage in the mandibular arch (42.9%). Class III obtained the highest percentage in the secondary level group in both maxillary (44.4%) and mandibular arches (45.2%). Class IV obtained the lowest in both arches (maxillary: 5%; mandibular: 0.5%) in all educational groups. The results were statistically significant in all age groups at p < 0.001.

Figure II shows that dental caries was the most common reason for tooth loss of 370 patients (57.8%), followed by the periodontal diseases for 142 cases (22.2%), whereas the least common was the combined reasons at 56 (8.8%). The results were statistically significant in all age groups at p < 0.001.

Discussion:
The Kennedy classification is the most accepted classification of edentulism and allows immediate visualization of the partially edentulous arch. This technique also enables a systematic approach and application of sound principles of denture design. This study was conducted among patients who attended the dental clinics of removable dental prostheses (RDPs) in Najran Specialist Dental Center. The elderly age group contained the highest number of subjects (57.8%); this result was in agreement with that of one study but dissimilar to those of other studies. The difference can be attributed to the difference in areas of sample collection. In the present study, the samples were selected from treated patients in clinics of RDPs only.

The findings of the present study showed that Kennedy class I obtained the highest frequency, followed by class II in the maxillary arch. This result was in agreement with that of Al Moaleem et al.
These findings also coincided with the results of the prevalence of class I and II in the mandibular arch. However, this finding disagreed with the results of other locally conducted research in Dammam in the east⁹, Jeddah in the west⁶, Aljouf in the north⁸, Jazan in the south²,⁷, and Madinah & Riyadh in the central region¹⁰,¹¹. These results concluded that class III is the most common classification in all age groups and both arches. This difference was possibly due to the difference in the ages of the selected subjects. These studies included young age groups, whereas the present study included middle-aged and elderly patients.

As shown in Table II, the results between genders did not differ significantly. Previous studies ²,⁶,⁷,¹² showed that significant differences in the results are observed between males and females. This inconsistency can be attributed to the number of subjects from both genders and the area of sample collection.

In the present study, class IV was the least common in both arches and genders as compared with the other classes. This result was not in agreement with previous results²,⁶,¹³ because patients in both genders cannot remain without the replacement of frontal teeth by any type of prostheses.

The number of patients (67.5%) was higher in the high-income group than in the < 3,000 SR income group. This result agreed with the finding of a previous study¹³, which indicated that the majority of patients earning < 3,000 SR are living in the south and east regions of the country.

This study found that partial edentulism is caused by various factors, such as educational level and socio-economic status, which play an important role in the Kennedy class of patients. Most of the subjects in this study obtained a primary level of education (282, 44.1%), followed by the illiterate (182, 28.4%) as shown in Table IV. This finding was consistent with that of other studies³,¹³. The need for RDP decreases with the increasing levels of education because people with a high level of education are keen about their health needs and may seek dental treatments earlier than others. These people are more able to afford regular dental care than those with a lower education status. Majority of the subjects in this study population have a low socio-economic status and thus need more dentures than the high socio-economic group. Studies have long established a close relationship of low socio-economic status and monthly income with RDP.

Gossadi et al ¹⁹ investigated the reasons of tooth loss in Jazan and found that the main reason is periodontal disease, followed by dental caries. This finding did not coincide with the findings of the present study. This variation can be attributed to the difference in the age groups examined. In another study conducted in Abha, Al Moaleem et al ² conclude that dental caries is the most common reason for tooth extraction in young age groups, whereas periodontal diseases are the most common causes of tooth extraction in elderly age groups. Almutariy and Mohan ³ conducted a study in Qassim region and concluded that the most frequent cause of tooth loss for all affected cases is dental caries (90.4%), followed by periodontal problem (6.4%).

The strengths of this study are as follows: edentulousness was determined after screening the files and panoramic X-rays of all participants. In addition, the clinical, radiographic and online examinations were performed by the same dentist. The limitations of this study were related to the number of patients. The sample size was not large enough and did not represent the whole area of Najran. In addition, the subjects were selected from patients who attended the RDP clinics (elder age group) in the main dental center. This study recommends further studies with a large and representative sample size that will involve all governmental dental centers and private clinics in the province. Results from the present and futures studies will help in
determining and providing the needs of the population regarding different types of prostheses for missing teeth.

**Conclusion:**

The following conclusions were drawn from this cross-sectional study. The highest number of subjects were in the > 60 age group, whereas the lowest was in the 30–40 age groups. In both genders, class II obtained the highest number of occurrence in the maxillary arch, whereas class I obtained the highest number of occurrence in the mandibular arch. In subjects with < 3,000 and 3,000–10,000 SR income groups, class II obtained the highest number of occurrence in both arches. In the > 10,000 SR income group, class III obtained the highest number of occurrence in both arches. Class I obtained the highest percentage in both arches in the illiterate group, whereas class III obtained the highest percentage in both arches in the secondary level group. In the primary level group, the highest percentage in was obtained by class II in the maxillary arch and class I in the mandibular arch. Class IV obtained the lowest percentage for all age, gender, educational level, and monthly income groups in both arches. These results were statistically significant in all age, educational level, and monthly income groups at p < 0.001.

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