Assessment of Partial Edentulism Based on Kennedy’s Classification System

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ABSTRACT
Edentulism is the state of being edentulous without natural teeth in the oral cavity. Edentulism leads to impairment of normal function, aesthetics, comfort and speech which is followed by sequelae of undesirable events which includes occlusal discrepancies, migration and spacing of surrounding teeth, loss of space, supra eruption of teeth and temporomandibular disorders. The Variation in the number and location of the edentulous spaces and its complex relation to the remaining tooth structure or the natural teeth constrains the need to classify the partial edentulous arches. The aim of the current study was to assess the frequency of partial edentulism according to Kennedy’s classification system. The retrospective study was conducted among the outpatient department of Saveetha Dental College and Hospital from June 2019-August 2019. The patient data was assessed. The data were tabulated using MS-Excel. The data was then analysed using IBM SPSS software (version 20). Pearson's chi-square test was done. Male predilection (62%) was identified in relation to partial edentulism. The most frequently observed edentulism in maxillary and mandibular arch was Kennedy’s class III (23% and 21% respectively), whereas Kennedy’s class IV was majorly observed among patients aged between 20-30 years (5%) (p<0.05). There was an increased frequency of Kennedy’s class I and II pattern and a decline in Kennedy’s class III and IV with increase in age.

INTRODUCTION
Edentulism is the state of being edentulous without natural teeth in the oral cavity. Edentulism leads to impairment of normal function, aesthetics, comfort and speech which is followed by sequelae of undesirable events which includes occlusal discrepancies, migration and spacing of surrounding teeth, loss of space, supra eruption of teeth and temporomandibular disorders (Carr and Brown, 2011a; Ariga et al., 2018). These parameters invariably make teeth as the main functional component of the oral cavity, the absence of which results in decreased chewing efficiency, poor nourishment and greatly affects the quality of life (Stratton and Wiebelt, 1988; Jeyapalan, 2015).
According to WHO (World Health Organization, 2013), guidelines, the mere presence of 21 functional teeth is required for adults to provide a good dietary intake and play a pivotal role in maintaining nourishment. Prevention of tooth loss improves the diet and nutritional status (Sapkota et al., 2015; Basha et al., 2018).

The tooth loss occurs in the oral cavity due to a variety of reasons including dental caries, Periodontal diseases, trauma, pulp and periradicular diseases (Abdel-Rahman et al., 2013; Jyothi et al., 2017). Tooth loss creates spaces called edentulous spaces. The health of a particular population can be assessed by observing the presence of partial edentulous spaces than completely edentulous arches (LaVere and Krol, 2005; Doğan and Gökalp, 2012).

The Variation in the number and location of the edentulous spaces and its complex relation to the remaining tooth structure or the natural teeth constrains the need to classify the partial edentulous arches (Gad, 2017; Sadig and Idowu, 2002).

The purpose of classification has numerous reasons which include communication between dental college students, colleagues, technicians, as planning a good design and treatment plan is important in predicting the prognosis of the treatment and welfare of the patient. This classification can also predict the difficulties associated with a particular removable partial denture and helps in selection of suitable components and serves as a guide (Carr and Brown, 2011b).

There are a diversely large number of classifications for partially edentulous arches which includes cummer’s classification, Kennedy’s classification, Apple gate’s classification, Neurohr classification, Bailey’s classification, Wild’s classification, Skinners classification and Avant classification (Prabhu et al., 2009; Fayad et al., 2016). Amongst all the classification Kennedy’s classification is the most commonly used and widely accepted classification because of the ease of immediate visualisation, which helps to differentiate between tooth borne and tissue borne dentures (Oginni, 2005; Charyeva et al., 2012).

**Kennedy’s Classification**

CLASS I: Bilaterally edentulous area presents posterior to the remaining natural teeth.

CLASS II: Unilaterally edentulous area present posterior to the remaining natural teeth.

CLASS III: Unilaterally edentulous area bound anteriorly and posteriorly by the natural teeth.

CLASS IV: Single bilaterally edentulous area anterior to remaining posterior teeth.

Kennedy’s classification of edentulous arches into four categories based on the descending frequency of occurrence during the time of proposal. Henceforth the current study aims to assess the frequency of partial edentulism according to Kennedy’s classification during a time period of 6 months in Saveetha Dental College and Hospitals. Saveetha dental hospitals have been a research center which conducted surveys (Ashok et al., 2014; Venugopalan et al., 2014), clinical trials (Ashok and Svitha, 2016; Ganapathy et al., 2016), cross sectional studies (Selvan and Ganapathy, 2016; Subasree et al., 2016), case reports (Vijayalakshmi and Ganapathy, 2016; Ajay et al., 2017), Reviews (Ganapathy et al., 2017; Jain et al., 2017) and other scientific studies (Kannan and Venugopalan, 2018; Duraisamy et al., 2019).

**MATERIALS AND METHODS**

This study was conducted among the patients of Saveetha dental college and Hospitals who attended the outpatient department during a time frame of 3 months from June 2019 to August 2019. Patient data were assessed for the number of people who had attended the outpatient department of saveetha dental college and hospitals with edentulous arches during the time period of 3 months. Among 86000 patients who attended the outpatient department of Saveetha Dental College and Hospitals, 300 samples were assessed which fulfilled the inclusion criteria of the current study. Institutional ethical committee clearance was obtained for data retrieval and usage as needed for the study (SDC/SIHEC/2020/DIASDATA/0619-0320)

The verification of the details was done with the presence of two reviewers to eliminate observers bias. The verification process was done with the help of photographs and diagnosis data. Incomplete data without diagnostic notes and photographs were excluded from the study. The data obtained were tabulated in MS-Excel and the parameters which were considered for assessment includes age, gender, site of edentulism and Kennedy’s classification. The data was entered in IBM SPSS software (Version 20), chi-square test was performed and the results were interpreted and tabulated.

**RESULTS AND DISCUSSION**

A total of 300 edentulous arches were assessed out of which 62% were males and 37% were females (Figure 1)

Majority of the patients participated in the study were aged above 60 years of age (27%), followed by patients aged between 41-60 years (50%), 31-40
years (13%), and 21-30 years (10%) (Figure 2).

The most frequently recorded Kennedy’s classification was Kennedy’s class III (44%), followed by Kennedy’s class IV (21%), Kennedy’s class II (20%) and Kennedy’s class I (14%) (Figure 3).

When compared with maxillary and mandibular arches, both arches exhibited high frequency of Kennedy’s class III while mandible exhibited increased frequency of Kennedy’s class II (24%) and IV (23%). Maxilla exhibited increased frequency of Kennedy’s class III (46%). There was no statistical significance (p>0.05) (Figure 4).

When compared with age, patients between 21-30 years of age exhibited an increased frequency of Kennedy’s class IV (57%), while patients of age 31-40, 41-50, 51-60 years exhibited an increased frequency of Kennedy’s class III (45%, 57%, 46%), while patients of age above 60 years exhibited an increased frequency of Kennedy’s class II (35%). There was a positive association between age of the patient and Kennedy’s classification. It was statistically significant (p<0.05) (Figure 5).

Males exhibited higher frequency of Kennedy’s class I, III and IV while females exhibited increased frequency of Kennedy’s class II. There was a positive association between gender of the patient and Kennedy’s classification. It was statistically significant (p<0.05). (Figure 6).

In our present study the frequency of Kennedy’s class I was more in maxilla when compared with mandible while males had more frequency of Kennedy’s class I (61%) when compared to females (39%). The results are in contradiction to that of the study done by Mohammed(Mohammad Arif Lone, 2019) where mandible has more frequency of Kennedy’s class I (52%) when compared to maxilla. Studies done by Javid(Patel Jy, 2014)suggest that Kennedy’s class I is most observed in males (52%) in the mandibular arch. This study contradicts our current study in relation to the arches involved but favours the result of male predilection. Studies done by Manal also yield a similar comparison as of that of Javid’s study. (Patel Jy, 2014)(Figure 3).

The present study analysed the frequency of Kennedy’s class II to be more prevalent in the mandibular arch with a female predilection (54%) when compared to females (46%). The results are in agreement with the study done by Lone (2019) which agrees that mandibular arch exhibits increased frequency of Kennedy’s Class II (54%). This contradicts the study done by Patel et al. (2014) where Kennedy’s Class II shows male predilection, but favours the current study in relation to the increased frequency in the lower arch(72%). Studies were done by Shubita (2015) also favours high frequency in lower arch (52%), but contradicts with an male predilection (Figure 3).

The present study observed the frequency of Kennedy’s Class III to be more frequently observed in maxillary arch (53%), with a male predilection (70%). The results are favoured by Javid (Patel Jy, 2014) in relation to higher frequency in mandibular arch but contradicts the current study by yielding a female predilection. While Manal (Shubita, 2015) reported a male predilection with increased frequency in maxillary arch. This variation in results could be due to the limited availability of samples as all the studies had less than 500 samples and the differences in geographic region and race (Figure 3).

The present study has inferred that Kennedy’s class IV was most frequently observed in males (80%) and higher frequency in mandibular arch (60%). Shubita (2015) study is in agreement with our current study with similar results while studies done by Patel et al. (2014) contradicts the results with increased frequency in maxilla among female patients. Meanwhile Lone (2019) is also in agreement with current study showing higher frequency of Kennedy class IV in mandibular arch. It can be due to poor periodontal support of the mandibular incisor (Figure 3).

Figure 1: Bar graph depicts the distribution of edentulism among males and females

The present study has inferred that patients aged between 21-30 years predominantly had higher frequency of Kennedy’s class IV edentulism followed by Kennedy’s class III edentulism similar to previous studies done by Lone (2019); Gupta et al. (2014), with increased frequency of Kennedy’s class III (Figure 5).

The present study inferred that patients of age 31-40 years predominantly had increased frequency of Kennedy class III edentulism similar to previous studies done by Lone (2019); Gupta et al. (2014); Devishree et al. (2018). This variation in results
could be due to the awareness of tooth loss and adequate measures taken to preserve the remaining dentition. (Figure 5).

The present study suggested that patients between the age 41-50 years had increased frequency of class III which was favoured by Gupta et al. (2014) with 43% of prevalence of Kennedy’s class III in 41-50 years old patients. This could be due to the transition period of RPD’s (Figure 5).

The present study suggested that the patients between the age of 50 years had increased frequency of Kennedy’s class III while the results were favoured by Devishree et al. (2018), and Bharathi with similar increase in frequency of class III by more than 50% (Figure 5). Our current study finally suggested that patients above 60 years predominantly had Kennedy’s class II (50%) while Rana et al. (2018); Gupta et al. (2014) contradicts the statement with increased prevalence of Kennedy’s class I edentulism. This could be due to a wide variety of reasons leading to tooth loss including associated diseases and periodontal health (Figure 5).

There was a positive association between age of the patient and Kennedy’s classification as younger adults have increased frequency of Kennedy’s class IV while older adults above 50 years had increased frequency of Kennedy’s class II and I. The results of the current study is favouring the results of previous studies done by Devishree et al. (2018) (Figure 5).

The limitations of our current study include geographically isolated population, availability of minimum number of samples, operator bias, short term study. In Figure 1, Y-axis shows the percentage of edentulous patients and X-axis shows the gender of patients. In Figure 2, Y-axis shows the percentage of patients with partially edentulous arches and X-axis shows the age groups of patients. In Figure 3, Y-axis shows the percentage of patients
with partially edentulous arches and X-axis shows the percentage of Kennedy’s classification. In Figure 4, Y-axis represents the percentage of patients with partially edentulous and X-axis represents the percentage of Kennedy’s classification among male and female. In Figure 5, Y-axis shows the percentage of patients with partially edentulous arches and X-axis shows the percentage of Kennedy’s classification among different age groups. In Figure 6, Y-axis shows the percentage of patients with partially edentulous arches and X-axis shows the percentage of Kennedy’s classification among males and females.

CONCLUSION

Within the limitations of our current study, it can be concluded that Kennedy’s Class III edentulism is the most frequently observed type of edentulism among the South Indian population in both maxillary and mandibular arches. There is a rise in frequency of Kennedy class I and class II edentulism patterns and a decline in Kennedy class III and Kennedy class IV with increase in age.

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Author Contributions

Jembulingam performed the analysis, interpretation and wrote the manuscript. Dr Revathi contributed to conception, data design, analysis, interpretation and critically revised the manuscript. Dr Madhulaxmi helped in coordinating the research and was one of the reviewers. All the authors have discussed the results and contributed to the final manuscript.

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Conflict of Interest

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