

Partial Edentulism and its Correlation to Age, Gender, Socio-economic Status and Incidence of Various Kennedy's Classes– A Literature Review

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ABSTRACT

Partial edentulism, one or more teeth missing is an indication of healthy behaviour of dental practices in the society and attitude towards dental and oral care. The pattern of partial edentulism has been evaluated in many selected populations in different countries by different methods. Most of the studies have evaluated partial edentulism by surveying of Removable Partial Dentures (RPDs), patients visiting clinics, clinical records and population in particular locality.

The objective of the study is to review the prevalence of partial edentulousness and its correlation to age, gender, arch predominance, socio economic factors and incidence of various Kennedy's Classes. Key observations drawn from the review are as below.

- There is no gender correlation for partial edentulism.
- Prevalence of partial edentulism is more common in mandibular arch than maxillary arch.
- Younger adults have more Class III and IV RPDs. Elders have more distal extension RPDs Class I and II.

Keywords: Edentulousness, Removable partial denture, Survey

INTRODUCTION

Partial edentulousness is a dental arch in which one or more but not all natural teeth are missing. Generally, it occurs by caries, periodontal problems, traumatic injuries, impactions, supernumerary teeth, neoplastic and cystic lesions [1-4]. Some studies have reported caries as the main causative agent for tooth loss [5-7]. According to Zaigham et al., and Abdel Rahman et al., dental caries and periodontal disease were the major causes of tooth loss in early childhood and adolescence [2,4]. Also, studies have documented that age correlates positively with partial edentulism [1,3,4].

Partial edentulism leads to several drawbacks to the subjects including clinical challenges and lifestyle compromises. Clinically, partial edentulism results in drifting and tilting of adjacent teeth, supra eruption of opposing teeth, altered speech, changes in facial appearance and temporo-mandibular disorders [1,2,8]. Also, the loss and continuing degradation of the alveolar bone, the adjacent teeth and also the supporting structures will influence the difficulty to achieve an adequate restoration in a partially edentulous patient [9]. On the lifestyle compromises, partial edentulism restricts dietary options, which leads to weight loss. Further, it leads to lack of confidence and confined social activities, which may adversely affect the quality of life and lead to psychological dissatisfaction [1].

Partially edentulous arches have been Classified by various methods. The possible combinations of partial edentulism are more than 65,000 depending on their incidence in maxillary and mandibular arches [2,10]. The primary objective of the classification is to facilitate the communication about the combination of missing teeth to edentulous ridges among students, dental practitioners and laboratory technicians [1,4,10-15]. Among the various methods of classification like Kennedy, Applegates, Avant, Neurohar, Eichner, ACP (American College of Prosthodontics) etc, Kennedy's classification is widely studied and clinically accepted by Dental Community [2,3,9,14]. As per Kennedy's classification, there are four main types of partially edentulous arches as Class I, Class II, Class III and Class IV. Kennedy's classification is widely accepted

due to its advantages of immediate visualization and recognition of prosthesis support [2,3,10]. The patterns in the incidence of the various Classes of removable partial dentures should be reviewed periodically to serve as teaching guidelines [2,16].

Partial edentulism is one of the widely studied topics in dentistry. The pattern of partial edentulism has been evaluated in many selected populations in different countries. Several studies have analysed the correlation between partial edentulism and its influencing factors like socio-economic parameters, age, gender, etc, [1,2,4-6,8,12,15,17-20]. Few studies also have analysed the awareness among the subjects to replace the missing teeth [1,5,7,8,16-20]. Surveying of RPDs, patients visiting clinics, clinical records and population in a particular locality have been the common method of evaluation of partial edentulism. Most commonly, studies have been done by recording patient details through questionnaire and then by clinical examination. The aim of this literature review was to analyse the prevalence of partial edentulousness and its correlation with gender, age, socio-economic factors, arch predominance and incidence of various Kennedy's Classes by reviewing various surveys to identify the factors of significant influences.

Selection of studies

There are numerous scholarly articles available on partial edentulism in various journals of international and national publishers. For this study, articles were selected by web searching pubmed indexed and non-indexed journals with key words like "Partial Edentulism", "Survey of Partial edentulism", "incidence of Kennedy's Classes", etc. Studies with surveys on partial edentulism and its various impacting factors like age, gender, socio-economic status and incidence Kennedy's Classes were selected from 1990 till 2014.

List of studies reviewed are as below [Table/Fig-1]:

- In 1992, Curtis D et al., surveyed 327 RPD frameworks in a regional dental laboratory in Northern California and compared with results from previous studies [13].

Author Name	Maxillary Arch	Mandibular Arch
Curtis D et al., [13]	37%	63%
Keyf F et al., [11]	44%	56%
Prabhu N et al., [5]	41%	59%
Sadiq WM et al., [12]	49%	51%
Naveed H et al., [10]	32.6%	36.8%
Khalil A et al., [15]	43.6%	56.4
Patel JY et al., [14]	63.2%	67.4%
AbdelRahman HK et al., [4]	49.63%	50.36%

[Table/Fig-1]: Prevalence of partial edentulism in maxillary arch and mandibular arch as reported in various studies

- In 2001, Key F surveyed 528 RPD frameworks collected from the clinics of the faculty of dentistry at Hacettepe University and have evaluated the distribution according to the Kennedy's classification, selection of maxillary and mandibular major connectors and direct/indirect retainers, selection of clasp types and have compared the data with the previous studies [11].
- In 2002, Sadiq W M et al., reviewed 422 patients requiring 740 RPDs from the clinic of College of dentistry, King Faud University, Saudi Arabia. He determined the patterns of partial edentulism and design frequency of all the RPD frameworks [12].
- In 2006, Al Dwairi ZN et al. studied the frequency of different Classes of patterns of partial edentulism by reviewing 200 laboratory authorization forms for patients attending a dental teaching hospital in Jordan [19].
- In 2009, Prabhu N et al., carried out a cross-sectional house to house survey at Herga village of Udupi district, Karnataka India. Total, 350 subjects were examined to identify prevalence of partial edentulousness and its relationship with gender, socioeconomic parameters, etc [5].
- In 2009, D'Souza KM et al., conducted a cross sectional study on 423 patients who attended the Outpatient Department of Prosthodontics during September to October, 2009 in the state of Goa, India to establish a relationship between socio-demographic variables, aetiological factors, and partial edentulism and also evaluated the prevalence of different Classes of partial edentulism according to Kennedy's classification [18].
- In 2010, Eikhamenor EE et al., analysed 351 patient's records who presented to the University of Benin Teaching Hospital outpatient clinic and determined the most frequent type of removable prosthesis during the study period January 2004 - October 2008 [3].
- In 2010, Zaigham AM et al., examined 367 patients attending the prosthodontics OPD – Lahore Medical & Dental College, Lahore for partial denture to find the pattern of tooth loss and its relationship with age and gender [2].
- In 2011, Naveed H et al., conducted a study examining 1000 patients to determine the frequency of occurrence of various patterns of partial edentulism in armed forces personnel seen at the Department of Prosthodontics, Armed Forces Institute of Dentistry (AFID), Pakistan [10].
- In 2012, Charyeva OO et al., studied patient records, together with panoramic radiographs to determine the prevalence of various types of partial edentulism [21].
- In 2013, Abdel Rahman HK et al., studied the incidence of various Kennedy's Classes of partial edentulism and its relationship with age and gender [4].
- In 2013, Khalil A et al., conducted a cross-sectional study in the Department of Prosthodontics at Khyber College of dentistry, Peshawar among 115 patients and determined the patterns of partial edentulism along with arch predominance [15].
- In 2013, Abdurahiman VT et al., conducted a cross-sectional study to find out the frequency of partial edentulism, its arch distribution

status, among a student sample aged 18-25 years by means of a questionnaire survey followed by clinical examination of the student community from Tirurtaluk, Malappuram district, Kerala, India [8].

- In 2013, Sapkota B et al., correlated gender predominance, employment status, arch prevalence and awareness for replacement with studied the frequency of occurrence of various Kennedy's Classes. Sample size is 194 patients in dental OPD at Dhulikhel Hospital [20]. In 2014, Bharathi M et al., examined 1420 patients to determine the incidence of different Kennedy's Classes of partial edentulism during 18 months period in the outpatient department (OPD), prosthodontics, G Pulla Reddy Dental College, Kurnool (Andhra Pradesh) [22].
- In 2014, Patel JY et al., conducted study among 100 patients in the outpatient dental department and determined the patterns of Kennedy's Classes of partial edentulism and its relationship with gender [14].

Gender correlation to partial edentulism

Gender has been one of the key factors analysed by various authors. Most of the authors have concluded that there is no significant gender correlation with occurrence of partial edentulism. However, few studies have observed that there has been significant relationship between gender and various Classes of partial edentulism. In addition, studies have reported that women have more awareness to restore the same than men. This may be because of women are more conscious about their appearance and had a better health seeking behaviour [1,5,8,16,20].

Sadiq WM et al., observed no significant gender differences for extension base RPDs with examination of 422 patients with 298 males and 124 females. However, the author has quoted a previous study in Saudi Arabia which reported that females had greater mandibular distal extension, which was reasoned with higher rate of mandibular molar tooth loss. Further, the author has explained that difference in study findings may be due to the fact that the males outnumbered females by more than half in the study population [12].

Al Dwairi ZN et al.. noted that Kennedy's Class II and Class III patterns were more frequent among males than females [19]. Prabhu N et al., observed that there was statistically no significant correlation between gender and partial edentulism on examining 350 patients with 147 males and 203 females [7]. But there is statistically significant correlation between gender and various Classes of partial edentulousness in the upper and lower arch [5].

Zaigham AM et al., found that gender had no correlation with distribution of RPD classification on his study comprising 367 patients with 157 males and 210 females [2]. Abdel Rahman HK et al., studied that gender has no statistically significant relation with prevalence of various Classes of partial edentulism [4].

Abdurahiman VT et al., studied that there was no significant gender difference observed in the frequency of occurrence of partial edentulism. However, the author has observed that men are more prone to partial edentulousness in maxillary posterior region and women in mandibular posterior region [8]. Sapkota B et al., observed that females are more edentulous compared to males but at the same time, opt for a higher level of replacement of missing teeth. This may be due to their dependency upon the males for their dental treatment to save the teeth. However, they are more conscious about their appearance, which explains their preference for replacement of missing teeth [20]. Patel JY et al., observed that women shows greater amount of edentulousness than males [14].

Prevalence of partial edentulism in maxillary and mandibular arch: Several studies have observed that prevalence of partial edentulism is more common in mandibular arch than maxillary arch as follows.

Curtis D et al., explained that greater number of mandibular RPDs

Author	Sample Size	Class I	Class II	Class III	Class IV
Curtis D et al., [13]	327 RPDs	40%	33%	18%	9%
Keyf F et al., [11]	362 patients; 528 RPDs	43%	38%	18%	0%
Naveed H et al., [10]	1000 patients	19%	18%	57%	5%
Sadiq WM et al., [12]	650 Patients; 740 RPDs	25%	28%	41%	6%
Prabhu N et al., [5]	350 patients	12%	15%	72%	1%
D'Souza et al., [18]	423 Patients	19.27%	23.94%	50.3%	6.49%
Ehikhamenor EE et al., [3]	351 Patients	3%	2%	63%	26%
Zaigham A M et al., [2]	367 Patients	12.5%	26.5%	57.5%	3.5%
Bharathi M et al., [22]	112 Patient Records	18%	11%	62%	9%
Abdel Rahman et al., [4]	963 cases	25.75%	22.84%	48.84%	1.55%

[Table/Fig-2]: Distribution of Kennedy's classification as reported by various studies

was observed compared with maxillary RPDs and this is probably related to the general pattern of tooth loss and the many problems related with mandibular complete dentures [13]. Sadiq WM et al., observed that the Classes of RPDs vary between maxillary and mandibular arch. Class I and Class II (distal extension RPDs) were predominant in mandibular arch, while Classes III and IV were common in maxillary arch [12].

Keyf F found that mandibular RPDs were more common than maxillary RPDs. Class I mandibular RPD was the most common type of RPDs used for mandibular arch and Class II maxillary RPD was the most common type for maxillary arch [11]. Prabhu N et al., noted that partial edentulism was more common in the mandibular arch compared to maxillary arch. This is due to the fact that mandibular teeth erupt earlier in the oral cavity which is prone for higher carries rate and higher chance of the tooth to get extracted [5].

Naveed et al., Khalil A et al., and Patel JY et al., noted that frequency of partial edentulism was higher in mandibular arch compared to maxillary arch [10,14,15]. Abdel Rahman HK et al., observed that even though mandibular RPDs are more common than maxillary RPDs, the difference wasn't statistically different [4]. Sapkota B et al., studied that partial edentulousness was common in maxillary arch compared to mandibular arch [20].

Incidence of Various Kennedy's Classes: In treatment planning of partial edentulism, pattern of partial edentulism based on Kennedy's Classes plays a vital role in deciding the type and design of the prosthesis. The incidence of partial edentulism differed in various studies as below.

Curtis D et al., concluded that Class I RPD was the one most commonly constructed with mandibular RPDs more common than maxillary RPDs. The number of Class II RPDs has increased when compared with the previous study by Anderson et al. This shows the trends in prevention of tooth loss [13].

Keyf F observed that Class III RPDs was less than Class I and Class II because of the fixed prosthodontic approach. The incidence of Class I RPDs showed a small rise in comparison with that of Class II. Class IV RPDs was not seen at all [11].

Naveed H et al., observed that among the all Classes, Kennedy's Class III was most common in both the arches maxilla and mandible. The author has explained that as the study population comprised of higher frequency of younger age group, Class III was predominant. Further, Kennedy's Class III modification 1 was the most common in both arches. In combination, maxillary Class III opposing mandibular Class III was the most common pattern observed [10].

Sadiq WM et al., observed that Kennedy's Class III RPDs were most frequently encountered pattern of partial edentulism in both upper and lower arches whereas Class IV was the least commonly encountered pattern. The author has quoted that incidence of various Classes of RPD was not only a reflection of the pattern of tooth loss but also patients demand and affordability of alternative treatment. Since the fixed prosthodontic service was not free of charge, this would have influenced the number of partially edentulous patients with Kennedy's Class III to seek removable partial dentures instead of fixed [12].

Al Dwairi ZN et al. also observed that Class III was the most prevalent type of classification in study population. In the study, Class III occurred 47% in maxilla and 45 % mandible. Similar to Sadiq M et al., the author also has observed that maxillary Kennedy Class III classification opposing mandibular Class III was the most common type of combination occurring 30% of the total [19].

Prabhu N et al., observed that Kennedy's Class III was the most common Class of partial edentulousness followed by Class II, Class I and lastly Class IV in the age group 35-44 years [5]. D'Souza KM et al., studied that Kennedy's Class III was the frequent type of classification encountered [18]. Ehikhamenor EE et al., identified that Kennedy's Class III was the most common RPDs followed by Class IV restored in patients attended University of Benin outpatient clinic [3].

Zaigham AM et al., observed that Class III dental arch was the most dominant pattern in maxillary arch with Class IV being the least in number [2]. Charyeva OO et al., determined that the most commonly prevalent type of classification was Kennedy type III in both maxilla (50%) and mandible (41.1%) and the least prevalent was Kennedy type IV (7.1%) in the maxilla, (5.6%) in the mandible [21]. Abdel Rahman HK et al., and Bharathy et al., determined that Kennedy's Class III was the most frequently encountered classification followed by Kennedy's Class I, Class II, and Class IV, the least encountered [4,22].

Khalil A et al., observed that Kennedy's Class IV was most commonly encountered in maxillary arch and Class I in mandibular arch. In combination type of edentulousness Class I was the most commonly observed classification [15]. Sapkota B et al., studied that Kennedy's Class III is the most frequently observed classification followed by Class II, Class IV and Class I [20]. Patel JY et al., also found that Kennedy's Class III was the most commonly encountered classification in both maxillary and mandibular arches. However, he differed in his observation on the Classes followed Class III as Class II, Class I and Class IV [14].

Age correlation to partial edentulism

Among the various factors studied, age is the key factor found to have significant relationship with occurrence of partial edentulism and various incidences of Kennedy's Classes of partial edentulism [Table/Fig-2].

Sadiq WM et al., found that Younger adults had more Classes III and IV RPDs. Older adults had more distal extension RPDs (Class I and II) [12].

Zaigham AM et al., concluded that with an increase in age, there was an increase in Class I & Class II dental arch tendency and a decrease in Class III & Class IV. In younger age groups, Incidence of Kennedy's Class III was found to be 49% in age group 20-29 years and above 55% in age group 30-39 years, which was relatively higher than that of any other Classes. This is due to the trauma to maxillary central incisors at early childhood stage Early loss of first molar due to caries may be the reason for higher occurrence of Class III in younger age groups. When age increases, due to further loss of teeth, extension of existing saddle leads to Class I and Class II. Kennedy's Class IV was also found to be most common incidence in age group 20-29 years. The author has explained that

at early childhood stage, maxillary central incisors are more prone to trauma, which leads to Class IV in younger age groups [2].

Abdel Rahman HK et al., found that younger age group patients had more Class III and Class IV in both the arches and as age increases due to multiple teeth extraction, there was significant increase in Class I and Class II [4].

Socio-Economic parameters

Partial edentulism depends on socio-economic parameters like family income, education, occupation, etc. Partial edentulism decreases in the employed group and when family monthly income increases. Also, subjects in this group are more aware to replace the missing teeth. The lower income group people could not afford to the treatment procedures that would have saved their questionable tooth, so might have opted for extraction. Less educated people aren't much aware about oral health care. People with better employment status are more concerned about their aesthetics and opted for dental treatment. Socio economic parameters have direct influence on the replacement of missing teeth. Prabu N et al., have found that the lack of motivation was the common reason for not seeking dental treatment [1,5,6,15,18,20].

CONCLUSION

Based on the above review, it's concluded that there is no gender correlation for partial edentulism. Also, prevalence of partial edentulism is more common in mandibular arch than maxillary arch. Younger adults had more Class III and IV RPDs. Older adults had more distal extension RPDs Classes I and II. Interestingly, results in few studies are contrasting. This may be due to fewer sample size of the study, poor oral hygiene status of that particular locality, etc. Further evaluation based on bigger sample size, multi-location studies with details on the oral hygiene status of locality would be helpful. Further, it's observed that categorisation of modification spaces for Kennedy's Classes, prosthetic status, prosthetic need of the subject and their preference of the type of prosthesis are topics less studied. These topics could be prioritised by dental care experts in future studies.

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