

Description of Partial Edentulism among Patients Visiting the Prosthodontic Department at a Tertiary Care Center in the Eastern part of Nepal

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Abstract

Introduction: Various classifications of partially edentulous conditions are in the dental literature. But, in the last decades a new attitude of expectancy has appeared, consisting of following up the parameters of oral health in a partially edentulous patient. So, the objective of this study was to determine the frequencies of various classes of partial edentulism according to an index developed by the American College of Prosthodontists.

Materials and Methods: This cross-sectional descriptive study was conducted from April 2017 to September 2017 after taking ethical clearance from the Institutional Review Committee. All partially edentulous patients reporting to the clinic were included (Purposive sampling). Informed consent was taken for participation in the study, comprehensive examination was done, entered in case-record form and marked on the Prosthodontic Diagnostic Index -check list (as developed by the American College of Prosthodontists) for each patient by the principal investigator. Kennedy's class was also noted for each patient. Collected data were entered in Microsoft excel 2013 and statistical analysis was done by SPSS 20 version. Chi-square test was applied to see associations of Prosthodontic Diagnostic Index Classes with age, gender and Kennedy's Classes.

Results: Out of total patients examined, 10.70% (n=35) were categorized as Prosthodontic Diagnostic Index Class- I; 30.50% (n=100) as Class-II; 32.90% (n=108) as Class-III and 25.90% (n=85) as Class IV. Significant associations of these classes with age groups and Kennedy's Classes were seen.

Conclusions: Most common Prosthodontic Diagnostic Index Class found was class III (Substantially compromised) which was significantly associated with >45 years of age and Kennedy's Class III. Second most common was class II (Moderately compromised) which was significantly associated with ≤45 years of age and Kennedy's Class-III.

Keywords: Kennedy's Classification; Oral Health Epidemiology; Partial Edentulism; Prosthodontic Diagnostic Index

Introduction

Partial edentulism is the condition resulting from loss of one or more but not all natural teeth. According to World Health Organization, partial edentulism is an indicator of oral health of a population. Oral health is one of the major issues concerning the quality of life [1]. Poor oral health and loss of teeth adversely affect the dietary intake, nutritional status, phonetics, psychology and the general health of a patient [1]. Collection of updated information on

the prevalence of various patterns of partial edentulism in a given population will help in proper planning of dental services to the population.

Various classifications of partially edentulous conditions are in the dental literature, the most commonly being used is Kennedy's classification [2-11]. An ideal classification should include information regarding all the clinical aspects of the case. In the last

decades a new attitude of expectancy has appeared, consisting of following up the parameters of oral health in a partially edentulous patient [1]. Though, Kennedy's classification system has many advantages it does not give information about many clinical factors like abutment condition, existing occlusion, which are necessary for proper treatment planning [12]. These limitations have been rectified in the American College of Prosthodontists Prosthodontic Diagnostic Index (ACP PDI) classification system [13]. ACP PDI classification system categorizes patients according to complexity of the edentulous condition and helps the clinician to make a diagnostically driven treatment plan. The analysis of diagnostic factors is facilitated with the use of a worksheet and guidelines have been given for the use of this index [13].

As said by the ACP, use of this classification system for partially edentulous patients will lead to improved intraoperator consistency and professional communication, enhanced diagnostic consistency, and simplified aid in the decision to refer a patient. So, the purpose of this study was to determine various classes of partially edentulous patients visiting the Department, according to ACP PDI Classification System and thus to establish a trend of using this standard system in the Clinic.

Materials and Methods

This cross-sectional descriptive study was conducted from April 2017 to September 2017 in the Department of Prosthodontics, B.P Koirala Institute of Health Sciences after taking ethical clearance from Institutional Review Committee (IRC). All the partially edentulous patients reporting to the clinic were included (Purposive sampling). Written informed consent was taken from each patient for participation in the study. A comprehensive clinical assessment of each patient as recommended and mentioned in "Parameters of Care for the Specialty of Prosthodontics" by the ACP [14], was done by the principal investigator (Prosthodontist). It included chief complaint, identification of dental and medical health care providers, relevant medical and dental history, psychosocial factors, and a thorough clinical examination of extraoral findings including TMJ examinations, intraoral findings and records. Kennedy's Class was also noted for each patient.

Details were entered in case record form (including the above mentioned diagnostic criteria) and marked on the ACP PDI Classification -Check list for partially edentulous patients [13]. ACP

PDI-Partially edentulous- check-list consists of brief description of five-diagnostic criteria. Those criteria are: 1. Location and extent of edentulous areas, 2. Abutment condition (a. need of localized adjunctive treatment; b. insufficient tooth structure) 3. Occlusion, 4. Residual ridge and 5. Conditions creating a guarded prognosis (each criterion has been described as below) [13].

Criterion 1: Location and extent of edentulous area or areas

This criterion was visually examined during intraoral examination and on diagnostic casts. The edentulous span confined to a single arch and not exceeding 2 missing incisors in maxillary arch or 4 incisors in mandibular arch or 2 premolars, or 1 premolar and 1 molar in posterior region was categorized as ideal or minimally compromised. Edentulous areas in both arches and not exceeding 2 missing incisors in maxillary arch or 4 incisors in mandibular arch or 2 premolars, or 1 premolar and 1 molar in posterior region or a missing maxillary or mandibular canine was categorized as moderately compromised. Any posterior maxillary or mandibular edentulous area greater than 3 teeth or 2 molars or any edentulous area including anterior and posterior areas of 3 or more teeth was categorized as substantially compromised. Any edentulous area or combination of edentulous areas requiring a high level of patient compliance was categorized as severely compromised.

Criterion 2: Abutment condition

This criterion was visually examined during intraoral examination using diagnostic instruments like mouth mirror, periodontal probe, explorer, and on intraoral radiographs and diagnostic casts. When in doubt, periodontal, orthodontic and endodontic consultations were taken. Need of Localized adjunctive treatment (Criterion 2a): When periodontal, endodontic, or orthodontic procedure was not indicated for any abutment tooth the condition was categorized as ideal or minimally compromised, indicated in 1 or 2 sextants as moderately compromised, indicated in 3 sextants as substantially compromised and in ≥ 4 sextants as severely compromised. Insufficient tooth structure (Criterion 2b): When all abutment teeth had sufficient structure the condition was categorized as ideal or minimally compromised, insufficient in 1 or 2 sextants as moderately compromised, in 3 sextants as substantially compromised and in ≥ 4 sextants as severely compromised. An abutment tooth having any of the vertical walls $< 4\text{mm}$ in height and $< 1\text{mm}$ in width was considered as having insufficient tooth structure for adequate retention and resistance of prosthesis.

Criterion 3: Occlusion

Comprehensive extraoral and intraoral assessments were done before considering an increase in the Occlusal Vertical Dimension (OVD) [14,15]. The magnitude of OVD loss (if any), facial profile and aesthetics, and status of the TMJ were assessed on extra oral examination. The difference in vertical dimension between the rest position of mandible and at occlusion was examined to determine the magnitude of OVD loss (if any). This measurement was made 3-4 times in a patient and when the readings varied, mean was taken. More than one method (extraoral measurements, phonetics, esthetics) were used in a patient to determine the loss of OVD. Consultations with senior prosthodontists in the department were taken whenever in doubt. When no preprosthetic occlusal therapy was required and Class I molar and jaw relationships were seen the occlusion was categorized as ideal or minimally compromised. When required localized adjunctive therapy like enameloplasty on premature occlusal contacts in a patient with Class I molar and jaw relationships were categorized as moderately compromised. When required reestablishment of entire occlusion without any change in the OVD or presence of Class II molar and jaw relationships as substantially compromised. When required reestablishment of entire occlusion with change in the OVD or presence of Class II division 2 or Class III molar and jaw relationships as severely compromised.

Criterion 4: Residual ridge

This criterion was examined during intraoral examination, on diagnostic casts and on an orthopantomogram (OPG). Residual bone height of ≥ 21 mm measured at the least vertical height of the mandible on a panoramic radiograph and residual ridge morphology resistant to horizontal and vertical movement of the denture base (type A maxilla) were placed under ideal or minimally compromised. Residual bone height of 16 to 20 mm measured at the least vertical height of the mandible on a panoramic radiograph and residual ridge morphology resistant to horizontal and vertical movement of the denture base (type B maxilla) were placed under moderately compromised. Residual alveolar bone height of 11 to 15 mm measured at the least vertical height of the mandible on a panoramic radiograph and residual ridge morphology with minimum influence to resist horizontal or vertical movement of the denture base (type C maxilla) were placed under substantially compromised. Residual vertical bone height of ≤ 10 mm measured at the least vertical height of the mandible on a panoramic radiograph and residual ridge offering no resistance to horizontal

or vertical movement (type D maxilla) were placed under severely compromised.

Criterion 5: Conditions creating a guarded prognosis

This finding (if present) was elicited mostly during history taking. Patients with severe oral manifestations of systemic disease, maxillomandibular dyskinesia and/or ataxia or refractory patient.

Any single criterion of a more complex category placed the patient into the more complex class. Presence of esthetic concern or challenge (if any) and TMD symptoms increased the complexity of the classification by one or more levels.

Statistical analysis

Collected data were entered in Microsoft excel 2013 and statistical analysis was done by SPSS 20 version. Chi-square test was applied to see the associations with age, gender and Kennedy's classes.

Results

A total of 328 patients were examined among whom 121 (36.9%) were males and 207 (63.1%) were females. Mean age was 45.51 ± 14.668 (minimum age=15; maximum age=75). Out of total patients examined, 10.70% (n=35) were categorized as ACP PDI: Class- I; 30.50% (n=100) as Class-II; 32.90% (n=108) as Class-III and 25.90% (n=85) as Class IV. Significant associations with age and Kennedy's Classes were seen (Table 1 and Table 2). Class-I and Class-II were significantly associated with ≤ 45 years (Table 1). Class-III and Class-IV were significantly associated with > 45 years (Table 1). PDI Class-I, Class-II and Class-III were significantly associated with Kennedy's Class-III (Table 2). PDI-Class-IV was significantly associated with combination of Kennedy's classes including Class-I or Class-II or both (Table 2).

Out of 328 patients, only 35(10.70%) had all the criteria minimally compromised and had no TMD and/or esthetic concern (Figure 1).

Among those classified as PDI Class-II (Figure 2), 52 (15.85% of total) had moderately compromised location and extent of edentulous areas and needed periodontal, orthodontic or endodontic treatment in 1-2 sextants. Among those 52 patients, 20 patients also needed localized adjunctive occlusal therapy and 1 patient had moderately compromised edentulous ridge. Twenty patients (6.1% of total) categorized as class-II were otherwise classified as class I, but had moderately compromised abutment condition and needed

periodontal, endodontic or orthodontic treatment in 1-2 sextants. Similarly, 4(1.21% of total) patients having TMD and 3(0.91% of total) patients having high esthetic concern were otherwise classified as class-I but, kept under class-II. Twelve (3.65% of total)

patients had all other criteria minimally compromised but, needed localized occlusal therapy. Nine (2.74% of total) patients had all other criteria minimally compromised but had insufficient abutment tooth structure.

PDI-Classes	Age			Gender		
	≤45yrs n (%)	>45yrs n (%)	P-value	Male n (%)	Female n (%)	P-value
Class-I	33 (19.9)	2 (1.2)	<0.001	12 (9.9)	23 (11.1)	0.989
Class-II	83 (50.0)	17 (10.5)		37 (30.6)	63 (30.4)	
Class-III	31 (18.7)	77 (47.5)		40 (33.1)	68 (32.9)	
Class-IV	19 (11.4)	66 (40.7)		32 (26.4)	53 (25.6)	

Table 1: Association of ACP PDI Classes with age and Gender.

PDI-Classes	Kennedy's Classes						P-value	Total
	Class I n (%)	Class II n (%)	Class III n (%)	Class IV n (%)	Com1* n (%)	Com2** n (%)		n (%)
Class-I	0(0)	0(0)	34(10.4)	1(0.3)	0(0)	0(0)	<0.001	35 (10.7)
Class-II	0(0)	4(1.2)	83(25.3)	11(3.4)	1(0.3)	1(0.3)		100 (30.5)
Class-III	2(0.6)	21(6.4)	57(17.4)	11(3.4)	13(4)	4(1.2)		108 (32.9)
Class-IV	12(3.6)	13(3.9)	21(6.4)	3(0.9)	33(10)	3(0.9)		85 (25.9)
Total:	14(4.3)	38(11.6)	195(59.4)	26(7.9)	47(14.3)	8(2.4)		328(100)

Table 2: Association of ACP PDI Classes with Kennedy's Classes:

* Including Class I or Class II or both. **Excluding both Class I and Class II. Here; Kennedy's class-I, class-II, class-III and class-IV represent the class in one arch or both arches of the patient.

Figure 1: Number of Class-I patients showing the level of each diagnostic criteria.

Figure 2: Number of Class-II patients showing various levels of each diagnostic criteria.

Among those classified as PDI Class-III (Figure 3), 60 (18.29% of total) patients had substantially compromised location and extent of edentulous areas. Among those 60 patients, 23 also needed periodontal, orthodontic and/or endodontic treatment in 3-sextants; 7 had insufficient abutment tooth structure in 3-sextants; 8 also needed re-establishment of entire occlusion without change in OVD and 1 had class III edentulous ridge. Forty-eight (14.63% of total) patients otherwise classified as class I or class II, needed re-establishment of entire occlusion without change in OVD.

Figure 3: Number of Class-III patients showing various levels of each diagnostic criteria.

Among those classified as PDI Class-IV (Figure 4), Forty-one (12.5% of total) patients had severely compromised location and extent of edentulous areas. Among those 41 patients, 18 needed periodontal, endodontic and/or orthodontic treatment in ≥ 4 sextants; 18 had insufficient abutment tooth structure in ≥ 4 sextants and 8 needed re-establishment of occlusal scheme with change in OVD. Six (1.83% of total) patients because of TMD and 2(0.61% of total) patients because of high esthetic concern (otherwise classified as class III) were placed under class IV. Six (1.83% of total) patients were categorized as class IV because of need of periodontal, endodontic and/or orthodontic treatment in ≥ 4 sextants, other criteria being of a lower class. Similarly, ten (3.04% of total) had other criteria of a lower class but, had insufficient abutment tooth structure in ≥ 4 sextants. Twenty (6.1% of total) patients needed re-establishment of entire occlusal scheme with change in OVD (other criteria were of a lower class).

Figure 4: Number of Class-IV patients showing various levels of each diagnostic criteria.

Discussion

In this study, of the total patients who reported to the department of Prosthodontics during the study period, there was a predominance of females (63.1%), but no significant association between any class of partial edentulism and the gender (Table 2). A literature review has mentioned that many studies have concluded no significant gender correlation with occurrence of partial edentulism and only few studies have observed significant relationship [2]. The literature review has also mentioned that women are more conscious about their appearance and have a better health seeking behavior than men [2]. Youngest patients were 15years old and oldest 75years. The mean age was 45.51 ± 14.66 . Patients younger than 15years were treated in the Department of Pedodontics and not included in this study.

ACP PDI-classes of partial edentulism were allocated to patients based on the diagnostic criteria set by the ACP, following the guidelines established for the use of the index [13]. In doing so, of 328 patients, 35(10.70%) were categorized as PDI class-I (least complex condition), 100 (30.50%) as class II, 108 (32.90%) as class III and 85 (25.90%) as class IV (most complex condition). The most common class found was ACP PDI class III. Kennedy's class was also noted for each patient and the most common was Kennedy's class-III (59.45%) (Table 2). As Kennedy's class-III is considered most easy to rehabilitate, it gives a false impression that the edentulous condition is simple. PDI Class-I, Class-II and Class-III were found to be significantly associated with Kennedy's Class-III. PDI-Class-IV

was significantly associated with combination of Kennedy's classes including Class-I or Class-II or both. Many studies have shown that Kennedy's Class-III is the most common class found [2-11].

In a similar study done in Pakistan, of 534 patients 92 (17.2%) were class I, 212 (39.7%) class II, 146 (27.3%) class III and 84 (15.7%) class IV, the most common class being class II [12]. In another study done at the Dental School of Athens, out of 71 partially edentulous patients, two were Class I, 17 were Class II, 29 were Class III and 23 were Class IV, the most common class being class III [16].

In another study conducted in India, which used only radiographs to classify patients under ACP PDI Classes (not grouped into partially edentulous and completely edentulous), found that most of the patients belonged to the age group of 31 to 45 years: 39.4% patients were class I; 20.0% were class II; 33.7% were class III; and 6.9% were class IV [17].

Difference between previous studies and this study is that previous authors did not attempt to describe the contributions of each diagnostic criterion in the determination of PDI-classes whereas, this study did.

When considering the contributions of various diagnostic criteria in the determination of PDI-classes of patients (figure 1 - figure 4), out of 100 PDI class-II patients 72% needed periodontal, endodontic, or orthodontic treatment in 1-2 sextants and 52% had the edentulous areas located in both the arches. Which shows that some patients who had minimally compromised extent and location of edentulous area were also classified as PDI class-II because of need of localized adjunctive treatment (Figure 2). Among the patients who were categorized as class III (n=108), 55.55% had ≥ 3 teeth or 2 molars missing in posterior area in one or both arches and 51.85% needed re-establishment of entire occlusion without change in VDO. Localized adjunctive treatment like periodontal, endodontic, and orthodontic had little contribution in determination of this class. Similarly, 48.23% of those classified as class IV had extensive edentulous areas located in one or both arches and 32.94% needed re-establishment of entire occlusion with change in VDO, 28.23% needed periodontal, endodontic or orthodontic treatment in ≥ 4 sextants, 32.94% had insufficient abutment tooth structure in ≥ 4 sextants and none had class IV edentulous residual

ridge. Class I and Class II were significantly associated with age ≤ 45 yrs whereas, Class III and Class IV were significantly associated with age > 45 yrs. This is because of the fact that periodontal diseases, wear of teeth, change in occlusal plane which complicate the condition are seen more in older people.

An immediate significance seen while using this classification system was that some important clinical findings which might otherwise be overlooked were found and many cases which would have been treated by undergraduate students were being considered by the specialists. As felt by the principal investigator, more cases of need of occlusal therapy and correction of malocclusion were found out than before.

Occlusion is a vast subject and to be dealt by a specialist. Evaluation of important aspects such as presence of certain functional or skeletal deficits, orientation of the occlusal plane, free-way space, vertical dimension, type of occlusion, size and location of edentulous areas, number, strategic location and quality of the likely abutment teeth are important when considering rehabilitation of partially edentulous patients [18]. One of the limitations of this study was that more objective diagnosis of those patients who needed increase in OVD and were indicated some type of diagnostic prosthesis fabricated at the increased vertical dimension could not be followed up.

The Japan Prosthodontic Society has also developed a multi-axis assessment protocol (treatment difficulty indices) to evaluate the complex variations in patients who need prosthodontic care, and to classify the level of treatment difficulty [19]. This multi-axis treatment difficulty indices include 4-axes: oral physiological conditions (Axis I), general health and sociological conditions (Axis II), OHRQOL (Axis III) and psychological health conditions (Axis IV). Each axis is graded from 0-3 and on the basis of those criteria, patients are categorized under four categories from CTD1-CTD4 (CTD: Comprehensive level of treatment difficulty) [19]. The difference between the Japanese indices and the ACP PDI indices seems to be in the diagnostic criteria and grading system. Though, ACP has also recommended a comprehensive evaluation of each patient, the diagnostic criteria used to classify patients are more objective and based on clinical findings.

The standards set by the ACP PDI Classification Systems are becoming universal and research articles or case reports which are sent to some of the prosthodontic journals are not being accepted unless the patients are classified according to this classification system [17]. So, the principal investigator feels the need of adopting this classification system in this part of the world also.

Conclusion

Within the limitations of this study, the most common class of ACP PDI partial edentulism was class III (substantially compromised) (n= 108; 32.90%); second most common was class II (moderately compromised) (n=100; 30.5%); third was class IV (severely compromised) (n= 85; 25.9%) and the least common was class I (minimally compromised) (n=35; 10.7%). There existed significant associations of PDI-Partial edentulism classes with age and Kennedy's classes, but no significant association with gender. There is a need of multicenter epidemiological study of this type.

Declarations

Ethics Approval and Consent to Participate

Ethical approval was taken from the IRC of B. P. Koirala Institute of Health Sciences. Written informed consent was taken from each patient to participate in the study.

Consent for Publication

Not Applicable.

Availability of Data and Material

The datasets analyzed during this study will be made available from the corresponding author on reasonable request.

Competing Interests

There is no competing interest.

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