

## **Evaluation of Location and Extent According To ACP Classification for Patients Undergoing Fixed Partial Denture Treatment - A Retrospective Study**

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## ABSTRACT

The aim of this study was to retrospectively evaluate the location and extent according to ACP classification. A total of 786 data entries were taken after reviewing 86000 patient data, duplicate and missing entries were omitted. So a total of 447 entries were evaluated. The data was collected from patient records in Saveetha Dental College, over a period of one year. The evaluation was based on the technique used by the dental students, to measure . The results of the study were subjected to statistical analysis. Data analysis was done using SPSS software version 23.0. Chi-square test and frequency evaluation was done to evaluate correlation of classes with age and gender of the selected samples shows higher male patients seeking prosthodontic treatment than the female patients. Association between the location of the teeth, age and gender was found to be statistically significant. ( $p < 0.05$ ).

**Keywords:** partial edentulism; ACP classification; partially edentulous; age; gender

## INTRODUCTION

One of the most important oral health indicators is the ability to retain more teeth throughout life. Edentulism or complete tooth loss is prevalent worldwide among older people. Earlier studies have shown that edentulism affects the health and the overall quality of life of the elderly. (Shamdol *et al.*, 2008) Tooth loss in adults and elderly individuals continues to be an oral health hazard that has negative impacts on quality of life and interferes with work activities (Gerritsen *et al.*, 2010). Missing teeth can interfere with chewing ability, diction, and esthetics. Low self-esteem related to tooth loss can hinder an individual's ability to socialize, hamper the performance of work and daily activities, and lead to absence from work (Petersen, 2003).

Partial edentulousness is a dental arch in which one or more natural teeth are missing, but not all. Generally, it occurs by caries, periodontal problems, traumatic injuries, impactions, supernumerary teeth, neoplastic and cystic lesions. (Website, no date), (Abdel-Rahman, Tahir and Saleh, 2013) Some studies have reported caries as the main causative agent for tooth loss. 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. Caries and periodontal disease are the main reasons for tooth loss in adults. In addition to clinical causes, other factors have been associated with tooth loss, such as the dental service used, time since the last visit to the dentist, reason for seeking treatment, and lifestyle, demographic and socioeconomic factors.

Clinically, partial edentulism results in tilting and drifting of adjacent teeth, supra eruption of opposing teeth, altered speech, changes in facial appearance and temporomandibular disorders (Abdurahiman, Abdul Khader and Jolly, 2013). It is anticipated that both the edentulous

and partially edentulous classification systems will be incorporated into existing electronic diagnostic and procedural databases (SNODENT, ICD, CPT, and CDT).

The classification system is intended to offer the following benefits: Improved intraoperator consistency, Improved professional communication, Insurance reimbursement commensurate with complexity of care, An objective method for patient screening in dental education, Standardized criteria for outcomes assessment and research, Improved diagnostic consistency and a simplified, organized aid in the decision making process relating to referral.

An ideal classification should include information regarding all the clinical aspects of the particular case. Various classifications of partially edentulous conditions are in the dental literature, the most commonly being used is Kennedy's classification.(Jeyapalan, 2015), (Moaleem and Al Moaleem, 2017), (Fayad, Baig and Alrawaili, 2016), (Kumar *et al.*, 2017), (Pellizzer *et al.*, 2012), (AL-Dwairi, 2006), (Madhankumar *et al.*, 2015), (Curtis *et al.*, 1992)

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. These limitations have been rectified in the American College of Prosthodontists Prosthodontic Diagnostic Index (ACP PDI) classification system (McGarry *et al.*, 2002). ACP PDI (American College of Prosthodontists Prosthodontic Diagnostic Index) allows patients to be classified based on diagnostic findings and specific objective criteria, presented at their initial examination. In 2005, the PDI was incorporated in the glossary of prosthodontic terms.(Felton, 2005) This system uses questionnaires that were formatted according to physical findings, prosthetic history, pharmaceutical history and systemic disease evaluation of each patient. In this way four categories are defined, ranging from class I to class IV, with the class I representing an uncomplicated clinical situation and a class IV patient representing the most complex and higher- risk situation. This 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]. Our team has rich experience in research and we have collaborated with numerous authors over various topics in the past decade (Subramanyam *et al.*, 2018)('Fluoride, fluoridated toothpaste efficacy and its safety in children - review', 2018; Ezhilarasan, 2018; Felicita, 2018; Kavarthapu and Thamaraiselvan, 2018; Krishnan *et al.*, 2018; Marimuthu *et al.*, 2018; Nair *et al.*, 2018; Padavala and Sukumaran, 2018; Pandian, Krishnan and Kumar, 2018; Rajeshkumar *et al.*, 2018; Rao and Kumar, 2018; Vijayashree Priyadharsini, Smiline Girija and Paramasivam, 2018; Abhinav *et al.*, 2019; Ke *et al.*, 2019; Mehta *et al.*, 2019; Panchal, Jeevanandan and Subramanian, 2019; Ponnulakshmi *et al.*, 2019; Ramesh *et al.*, 2019; Sridharan *et al.*, 2019; Sweta, Abhinav and Ramesh, 2019; Wu *et al.*, 2019; Palati *et al.*, 2020; Paramasivam, Vijayashree Priyadharsini and Raghunandhakumar, 2020).

The objective of this retrospective study was to evaluate the frequency and correlation of various ACP classes of ridges with age and gender.

<b>Class I</b>  <b>Ideal or minimally compromised tooth condition</b>	<ul style="list-style-type: none"> <li>• The edentulous area is confined to a single arch.</li> <li>• The edentulous area does not compromise the physiologic support of the abutments.</li> <li>• The edentulous area may include any anterior maxillary span that does not exceed 2 incisors, any anterior mandibular span that does not exceed 4 missing incisors, or any posterior span that does not exceed 2 premolars or 1 premolar and 1 molar.</li> </ul>
<b>Class II</b>  <b>Moderately compromised tooth condition</b>	<ul style="list-style-type: none"> <li>• Edentulous areas may exist in 1 or both arches.</li> <li>• The edentulous areas do not compromise the physiologic support of the abutments.</li> <li>• Edentulous areas may include any anterior maxillary span that does not exceed 2 incisors, any anterior mandibular span that does not exceed 4 incisors, any posterior span (maxillary or mandibular) that does not exceed 2 premolars, or 1 premolar and 1 molar or any missing canine (maxillary or mandibular).</li> </ul>
<b>Class III</b>  <b>Substantially compromised tooth condition</b>	<ul style="list-style-type: none"> <li>• Edentulous areas may be present in 1 or both arches.</li> <li>• Edentulous areas compromise the physiologic support of the abutments.</li> <li>• Edentulous areas may include any posterior maxillary or mandibular edentulous area greater than 3 teeth or 2 molars, or anterior and posterior edentulous areas of 3 or more teeth.</li> </ul>
<b>Class IV</b>  <b>Severely compromised tooth condition</b>	<ul style="list-style-type: none"> <li>• Edentulous areas may be extensive and may occur in both arches.</li> <li>• Edentulous areas compromise the physiologic support of the abutment teeth to create a guarded prognosis.</li> <li>• Edentulous areas include acquired or congenital maxillofacial defects.</li> <li>• At least 1 edentulous area has a guarded prognosis.</li> </ul>

**Table 1-** Table represents the ACP classification of location and extent. The individual specifications of categorization have been mentioned in the table.

## **MATERIALS AND METHODS**

### **Sampling**

This retrospective study has been conducted in an institutional setup at Saveetha dental college, Southern part of India. A total of 786 patient data were taken from 86000 of patient data after reviewing, duplicate and missing entries were omitted. So a total of 447 entries were evaluated. The data was collected from Saveetha Dental College over a period of 10 months (June 2019 to March 2020). Data was collected between 01 June 2019 and 31 March 2020, Samples with improper data and repetitions were excluded from the study and ethical approval was done by the institutional review board (SDC/SIHEC/2020/DIASDATA/0619-0320). The objective of this study is to determine the patterns and frequencies of partial edentulism for patients who attending the prosthodontic department at college of dentistry, Saveetha University to establish databases for trend comparison of frequencies and regarding the relation with age and gender of partially edentulism population in Chennai.

The study included data of patients with informed consent, Partial edentulous cases and Patients undergoing fixed partial denture treatment, whereas the exclusion Criteria had patients with incomplete data and complete edentulous patients. Cross verification of data for errors and measures are taken to minimise sampling bias while double blinding the Analyser and Reviewer. Dependable variables included age, sex and the location of the teeth. Independent variables include edentulous span. The internal and external validity of the sample selected and all the samples are selected based on a simple random sample. The data was collected and entered in the MS Excel spreadsheet and tabulated. Descriptive statistics was used to frequency of different classes of location and extent and the correlation of age and gender with it. Statistics were carried out using SPSS Software version 23.0 by IBM. Statistical test used is ChiSquare and Crosstabs data is evaluated.

## **RESULTS**

From the retrospective study, the total number of patients who require fixed partial denture treatment were examined among them. The gender distribution of the sample (Figure 1) showed that; males were most prevalent (55.03%) and females were the least prevalent (44.97%). 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. In doing so, Out of total patients examined, 74.94% (n=335) were categorized as ACP PDI: Class- I; 10.07% (n=45) as Class-II; 14.77% (n=66) as Class-III and 0.22% (n=1) as Class IV. (FIGURE 2) Class- I is the least complex condition and Class IV is the most complex condition.

Association between the age distribution and location, extent of the missing tooth was done and it shows that in the 20 - 30 years age group, 19.9% (n=88) were Class- I; 2.9% (n=13) were Class-II; 0.895 (n=4) were Class-III. in the 31 - 41 years age group, 26% (n=117) were Class- I; 2.6% (n=12) were Class-II; 2.2% (n=10) were Class-III and 0.22% (n=1) were Class IV. In the 41 -50 years age group, 15.8% (n=71) were Class- I; 1.79% (n=8) were Class-II; 6.4% (n=29) were Class-III. In the 51 -60 years age group, 9.6% (n=43) were Class- I; 2.6% (n=12) were Class-II; 3.5% (n=16) were Class-III. In the 61 -70 years age group, 3.5% (n=16) were Class- I; 1.5% (n=7) were Class-III. Regarding the correlation of the age with the location and extent , it is found to be statistically significant differences between them. (Chi-Square Value - 46.649 and  $p$ -value - .001), ( $p<0.05$ ). (Table 2) (Figure 3)

Association between the gender distribution and location, extent of the missing tooth was done and it shows that among males, 44.07% (n=197) were Class- I; 4.70% (n=21) were Class-II; 6.26% (n=28) were Class-III and among females, 30.87% (n=138) were Class- I; 5.37% (n=24) were Class-II; 8.50% (n=38) were Class-III and 0.22% (n=1) were Class IV. Regarding the correlation of location and extent with the gender there was a statistically significant difference between them. (Chi-Square Value - 8.664 and  $p$ -value - .005), ( $p<0.05$ ). (Table 3) (Figure 4)

Regarding the relation of the partial edentulism pattern to the age (Table 3 & Figure 1) there was a high statistical significance difference between different age groups. It was found that with an increase in age, there is an increase in the tendency to Class- I & Class- II and a decrease in Class- III. Class- III is the most prevalent class in the younger three age groups (21-30), (31-40) and (41-50 years old) while Class- I is the most prevalent in the 2 older age groups ( 51-60) and (> 60 years old).

The results indicate a high difference between male and female patients, where the males showed the higher frequent examined cases in this study than the female patients. The results also indicated a high percentage of partial edentulous cases and the higher frequency of Class I is seen at age ranging from 31 - 40 years. On the other hand, the distribution of the removable partial edentulous cases were the least in frequency at age 61 - 70 years.

Many studies which involved case reports (Ashok *et al.*, 2014), surveys (Ashok and Suvitha, 2016), systematic reviews (Ganapathy, Kannan and Venugopalan, 2017),(Ganapathy, Kannan and Venugopalan, 2017; Ariga *et al.*, 2018), (Kannan and Venugopalan, 2018), literature reviews (Venugopalan *et al.*, 2014),(Vijayalakshmi and Ganapathy, 2016),(Subasree, Murthykumar and Dhanraj, 2016; Vijayalakshmi and Ganapathy, 2016),(Selvan and Ganapathy, 2016), In Vivo studies,(Jyothi *et al.*, 2017),(Jain, Ranganathan and Ganapathy, 2017),(Duraisamy *et al.*, 2019), In vitro studies (Ganapathy *et al.*, 2016),(Ajay *et al.*, 2017) and retrospective studies (Basha, Ganapathy and Venugopalan, 2018) were carried out by our team previously. We are currently focusing on epidemiological studies.

## DISCUSSION

The primary purpose in using a classification for RPDs is to simplify the description of potential combinations of teeth to ridges.(Sadig and Idowu, 2002) The pattern of tooth loss has been evaluated in many selected populations in different countries. (Curtis *et al.*, 1992),(Esan *et al.*, 2004),(AL-Dwairi, 2006).

Several methods of classification of partially edentulous arches are proposed and are in use. It has been estimated over 65,000 possible combinations of teeth and edentulous spaces in opposing arches are there.(McCracken *et al.*, 1985) The foremost familiar classifications are those originally proposed by Kennedy, Cummer, Bailyn and Costa (Costa, 1974) in 1974 summarized most of the classification systems for partially edentulous arches and the rationale of the classification. These included: the number and position of direct retainers, the relation of edentulous spaces to abutment teeth, the type of denture support, that is, tooth- supported, tissue- supported, or a combination,(Beckett, 1953) the quality and degree of support a removable partial denture receives from the abutment teeth and residual ridge,(Skinner, 1959) the number, length, and position of edentulous spaces and the number and position of remaining teeth,(Mauk, 1942) the location and extent of edentulous spaces,(Şakar, 2016) the boundaries of the spaces,(Friedman, 1953) and combinations of these principles.(Applegate, 1960), Classifications have also been proposed by Neurohr, Austin and Lidge, Avant,(Avant, 1966) and others.(Miller, 1970),(Costa, 1974).

Gender has been one of the key factors analyzed by various authors. There is no significant correlation with gender and occurrence of partial edentulism was concluded by most of the authors. However, few studies have observed that there has been a significant relationship between gender and various Classes of partial edentulism.(Jeyapalan, 2015). In the present study, it was observed that the number of males who underwent fixed partial denture procedures were higher than that of females.

Some studies have observed that women show a higher proportion of edentulousness than males.(Sapkota, Adhikari and Upadhaya, 2015) however many previous studies show a higher proportion of edentulousness in males than females.(Hoover and McDermott, 1989) Our institution is passionate about high quality evidence based research and has excelled in various fields ( (Pc, Marimuthu and Devadoss, 2018; Ramesh *et al.*, 2018; Vijayashree Priyadharsini, Smiline Girija and Paramasivam, 2018; Ezhilarasan, Apoorva and Ashok Vardhan, 2019; Ramadurai *et al.*, 2019; Sridharan *et al.*, 2019; Vijayashree Priyadharsini, 2019; Chandrasekar *et al.*, 2020; Mathew *et al.*, 2020; R *et al.*, 2020; Samuel, 2021)

A positive relationship between tooth loss and age has been documented(Carr and Brown, 2015). The correlation between the pattern of tooth loss and socio-economic status has also been established.(Esan *et al.*, 2004).



## CONCLUSION

The results of the present study indicated that the greater frequency of removable partial edentulous cases is the class I partially edentulous cases which are the most frequent cases, while the class IV partially edentulous cases were these least frequent cases it also shows higher male patient seeking for prosthodontic treatment than the female patients. It was found that with an increase in age, there is an decrease in the tendency to Class- I and an increase in Class- II. Class- I is the most prevalent class in the studied groups.

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## AUTHOR CONTRIBUTIONS

First author, Dr. Sai Teja Reddy collected the raw data, performed the analysis, intercepted and wrote the manuscript. Second author, Dr Nabeel Ahmed contributed to conception, data design, analysis interpretation and critically revised manuscripts. The third author, Dr. Keerthi Sasanka Participated in the study revised the manuscript as per guideline, alignments and formatting. All the authors have discussed the results and contributed to the final manuscript.

## CONFLICT OF INTEREST

None Declared

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## CHARTS AND TABLES

Table 1- Table represents the ACP classification of location and extent.

Figure 1 -The Pie diagram shows the frequency of gender in the study.

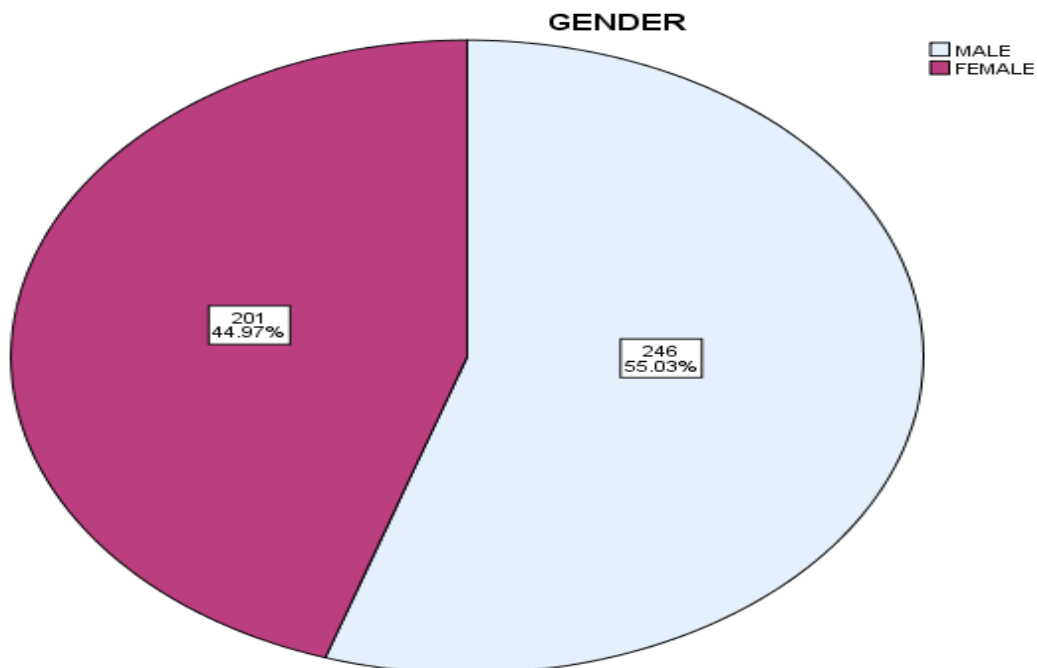
Figure 2 -The Bar Graph showing the frequency distribution of ACP classification according to location and extent.

Table 2 -This table shows the association between the age of the patient to the various classes of ACP according to location and extent

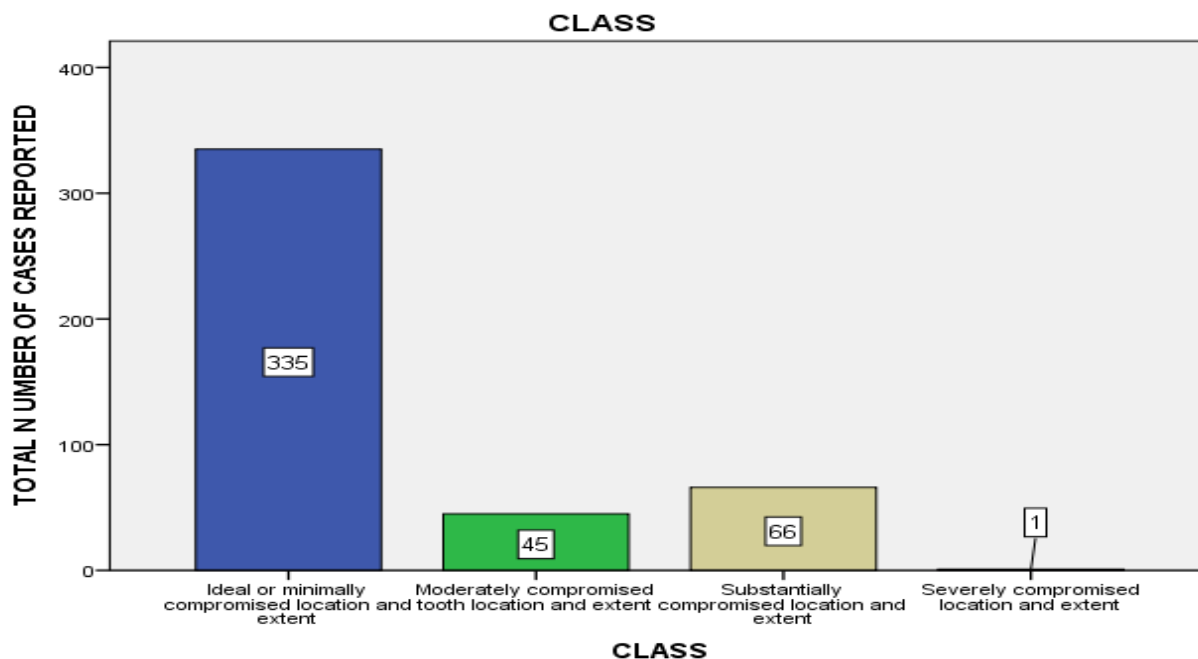
Figure 3 -The bar diagram shows association between the age of the patient to the total number of cases reported when classifying according to location and extent

Table 3 -This table shows the association between the Gender of the patient to the various classes of ACP according to location and extent

Figure 4 -The bar diagram shows association between the Gender of the patient to the total number of cases reported when classifying according to location and extent



**Figure 1 - The Pie diagram shows the frequency of gender in the study. 44.97% of females and 55.03% of male participated in the study. Pink colour represents female and White represents male participation in the study.**

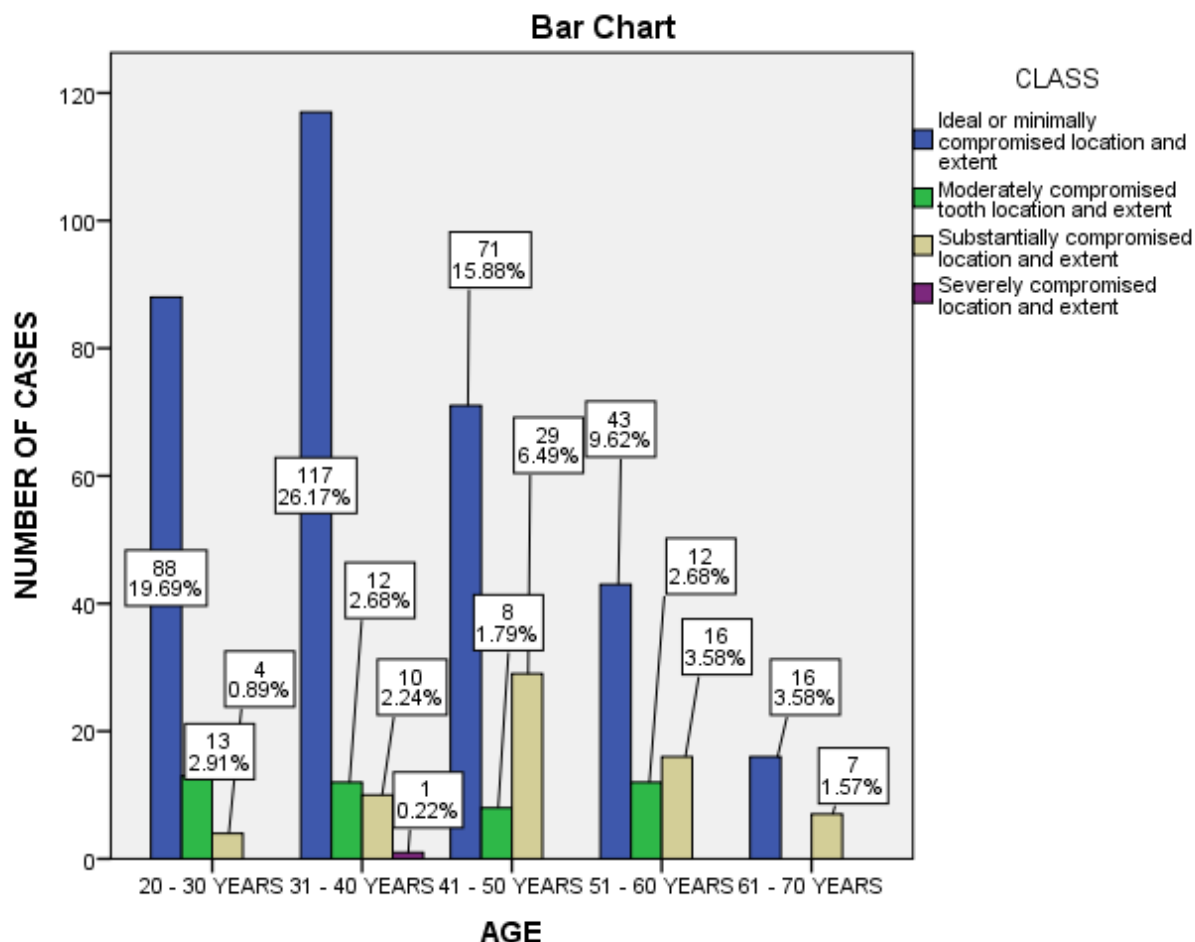


**Figure 2 - The Bar Graph showing the frequency distribution of ACP classification according to location and extent. X-axis represents the class and Y axis represents the total number of cases reported. The results showed the occurrence of 74.94% (n=335) as Class-I; 10.07% (n=45) as Class-II; 14.77% (n=66) as Class-III and 0.22% (n=1) as Class IV.**



AGE	CLASS				Total	Pearson Chi-Square Value - 46.649  P value - .001
	Ideal or minima lly compro mised	Modera tely compro mised	Substan tially compro mised	Severel y compro mised		
20 - 30 YEARS	88 19.9%	13 2.9%	4 0.89%	0 0%	105 23.7%	
31 - 40 YEARS	117 26%	12 2.6%	10 2.2%	1 0.22%	140 31.3%	
41 - 50 YEARS	71 15.8%	8 1.79%	29 6.4%	0 0%	108 24.1%	
51 - 60 YEARS	43 9.6%	12 2.6%	16 3.5%	0 0%	71 15.8%	
61 - 70 YEARS	16 3.5%	0 0%	7 1.5%	0 0%	23 5.1%	
TOTAL	335 75.1%	45 10.0%	66 14.7%	1 0.22%	447 100%	

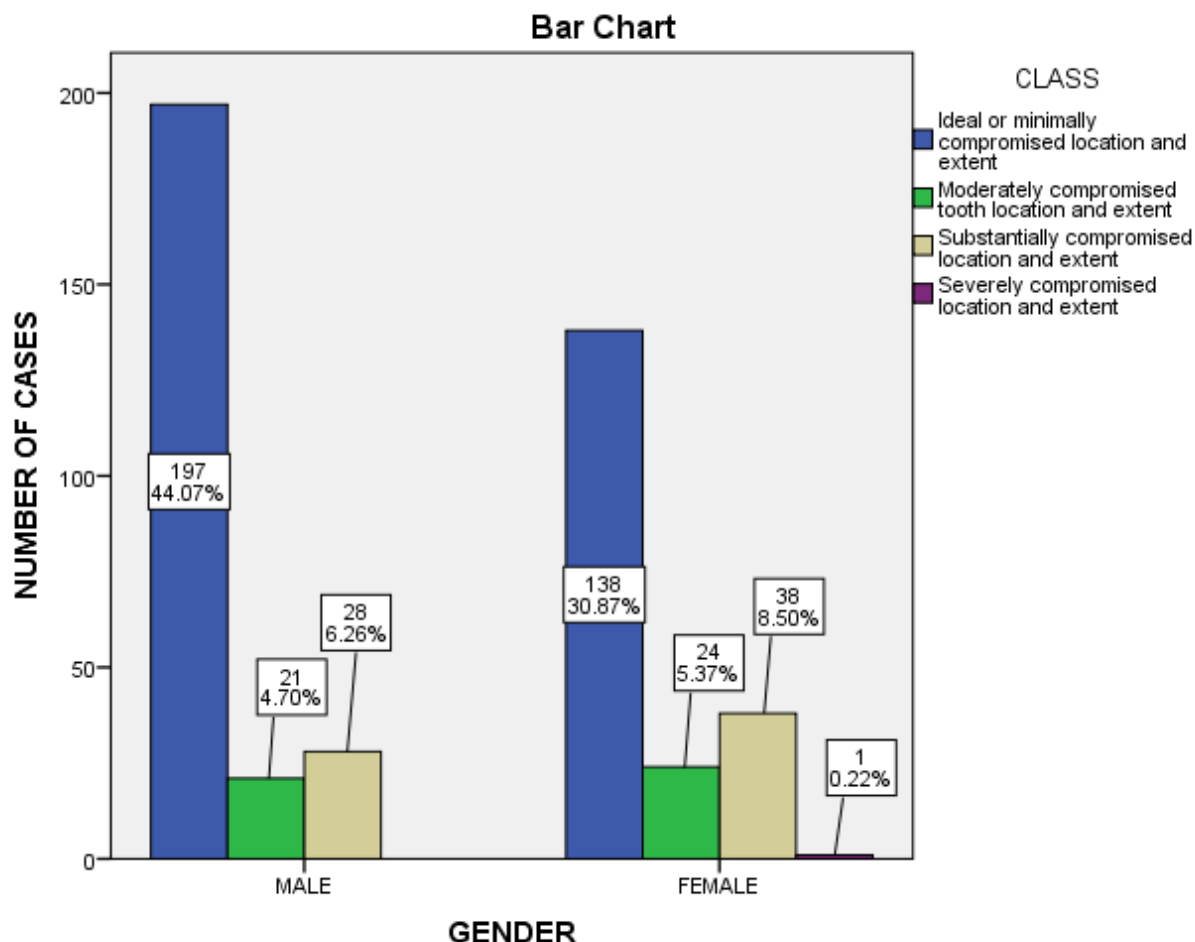
**Table 2 - This table shows the association between the age of the patient to the various classes of ACP according to location and extent in the fixed partial denture treatment patients. Association was done using the Chi square test (Chi-Square Value = 46.649 and *p*-value = .001) and found to be statistically significant.**



**Figure 3 - The bar diagram shows association between the age of the patient to the total number of cases reported when classifying according to location and extent in the fixed partial denture treatment patients according to ACP. X-axis represents the age of the patient and Y axis represents the total number of cases reported. Association between the age of the patient and the total number of cases reported was done using Chi square test (Chi-Square Value = 46.649 and  $p$ -value = .001) and found to be statistically significant.**

GENDER	CLASS				Total	Pearson Chi-Square Value - 8.664  P value - .005
	Ideal or minimal ly compro mised	Modera tely compro mised	Substan tially compro mised	Severely compro mised		
MALE	197	21	28	0	246	
FEMALE	138	24	38	1	201	
TOTAL	335	45	66	1	447	

**Table 3 - This table shows the association between the Gender of the patient to the various classes of ACP according to location and extent in the fixed partial denture treatment patients. Association was done using the Chi square test (Chi-Square Value = 8.664 and  $p$ -value = .005) and found to be statistically significant.**



**Figure 4 - The bar diagram shows association between the Gender of the patient to the total number of cases reported when classifying according to location and extent in the fixed partial denture treatment patients according to ACP. X-axis represents the Gender of the patient and Y axis represents the total number of cases reported. Association between the age of the patient and the total number of cases reported was done using the Chi square test. (Chi-Square Value = 8.664 and  $p$ -value = .005) and found to be statistically significant.**