

Appraisal of removable partial denture service in a dental faculty for (2005-2010). A retrospective study

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Abstract— One of the parameters that may be used to evaluate the clinical teaching appraisal and the competency of undergraduate students is their clinical training outcome yearly or within certain time; individually or collectively. The time required for managing one patient, facilities provided, the quality of offered service, the major types of Kennedy classes treated, all of these can provide the teaching authority with an overview of clinical teaching problems encountered by the learners and weak areas in training program that need further development. The aim was to analyze the clinical service of undergraduate students offered during their clinical learning program in prosthetic dentistry at the faculty of dentistry from 2005-2010. The data were collected from prosthetic dentistry archive of the patients visiting the clinics from 2005-2010. Results revealed that men seek treatment more than women. Patient's age was related to increase in removable partial denture demand. Chinese attended the prosthetic clinics more than other ethnic groups. Hypertension and diabetes mellitus represented the highest general diseases among patients. Kennedy Class III patients were the most group seeking prosthetic replacement. Acrylic resin material was mostly used for fabrication of partial denture. The average time needed by the student to treat one partially edentulous patient was 4 months. Recall for successfully issued partial dentures was 84.2%. For maxillary arch, 1% of the lab forms were filled properly before sending to the technician. However, in mandibular arch, the problem was worse. One of the important feedback of this study indicated that gingival uncover was used systematically in less than 20% of the treated cases. Therefore, more academic clinical efforts are required to develop and update the clinical skill, knowledge and training methods for undergraduate dental students.

Keywords— *Clinical teaching outcome; removable partial denture; dental education*

I. INTRODUCTION

Removable partial denture (RPD) is the most popular prosthetic option used for replacing partially missing teeth. Its benefits include improvement of the appearance, masticatory efficiency, speech and increasing quality of life [1]. Ambiguity regarding the RPD survival rate in 10 years observation is continuing compared to fixed partial denture (FPD)[2,3]. RPDs are non-invasive, affordable for partially edentulous patient and mostly are indicated in Kennedy class III with multiple edentulous areas. In Class IV, RPDs are

recommended particularly in case of too long edentulous space for fixed prosthesis or when alveolar bone loss has been sustained. The importance of RPD depends on treatment availability, acceptability, and accessibility [1]. In United States, the adults are retaining more of their natural teeth so that larger proportion of patients will be partially edentulous and require fixed and/or removable partial dentures [4]. The majority of the patients who were treated in the school of dental medicine/ University of Zagreb were lost more than 10 natural teeth for both upper and lower jaws [5]. In Pomerania (SHIP), the patient demands for complete dentures were more than RPDs. The demand for RPDs decreased with age progress. In addition, wearing RPDs were higher among 65-74 years old people and the lower anterior teeth were the last teeth to remain in elderly [6]. The gender difference regarding the RPD demand was also studied in Kirikkale University/ Turkey, whereas males tend to wear complete dentures more than females who requested mainly partial dentures [7]. After reviewing the designs of 528 frameworks of dental laboratory/faculty of Dentistry/Hacettepe University in 1999, Keyf found that Kennedy class I formed (43.37%) followed by class II (38.44%), class III (18.18%), and absence of class IV [8]. In South Nigeria, within 4 years, the hospital received 188 (53.6%) males and 163 (46.4%) females mostly with Kennedy's class III (57.3%) followed by class IV (26.2%), while class I and II were very low (0.9%). If the modifications were considered; class I formed 1.7%, class II was 1.4%, and class III was 5.7% [9]. Same finding regarding Kennedy class III was reported in Pakistani armed forces. In addition, RPDs were prescribed for 2.2% in 15-20 year old patients, 36.6% (for 21-30 year old), 33.3% (for 31-40 years), 23.6% (for 41-50 years) and 4.3% in people over 50 years [10]. However, In Eastern Wisconsin, researchers found that the most fabricated RPD was Class I (38.4%) followed by Class III (31.2%), Class II (25.0%) and finally Class IV (5.4%) in 903 patients. A lower incidence of Class IV demonstrated that removable prostheses may be declined in favor of fixed prostheses [11]. Acrylic resin and metallic RPDs are routinely used in clinical practice. In some countries acrylic resin RPDs are used more than metallic. For example; in Singapore and Eastbourne, UK, the number of acrylic and cobalt chromium (Co-Cr) partial dentures

provided by National Health Service over 9 years was 5:1 in favor of acrylic resin. On the other hand, in Eastern Wisconsin/ USA, 73% of RPDs had metal framework, while the rest (27%) were made of acrylic resin. Finally, high incidence of metallic RPDs was reported in Marquette University/ School of Dentistry, Milwaukee except in rare instances [11]. One of the parameters that may be used to evaluate the clinical teaching appraisal and the competency of undergraduate students in dentistry is their clinical training outcome yearly or over certain time; individually or collectively. The time spent in managing patients, facilities provided, the quantity of failures or repeated cases, the quality of offered treatment, the major types of Kennedy classes treated, all of these can provide the supervising teaching authority a primary overview for

performing additional detailed investigations and analysis to get feedback regarding the pitfalls, weak areas in the clinical training program that need further development.

The aim of this study was to analyze some of the information regarding RPDs service offered by undergraduate students of dental program degree (3rd, 4th and 5th year) from 2005-2010 in first faculty of dentistry, Malaysia.

II. MATERIALS AND METHODS

This is a descriptive retrospective study integrated 3308 patients' folders of prosthetic dentistry clinics' archive from January 2005 to December 2010. 2395 (72.4%) patients were received RPDs service while, 918 (27.8%) patients were treated by complete dentures. Data of 1863 folders were only considered due to incomplete records, missing or poor quality radiographs in the excluded files. The acquired information included patient demographics, medical status and detailed dental information. In addition, Kennedy's classification occurrence, materials used for fabrication of RPDs, starting and finishing dates of the received treatment, duration of treatment, and the RPD designs were recorded for each patient.

The data were analyzed by statistical software SPSS version 17.0. (SPSS Inc.). Descriptive tests, chi-square, and t-test were used and the level of statistical significance was set at $p < 0.001$, and 0.05.

III. RESULTS

A. The Gender and Ethnic Composition of Patients Attending from 2005-2010

933 (50.1%) of the people attending for RPDs service were men, while the rest were females (Table 1). The difference between men and women was significant ($t = 3.39$, $df = 1861$, $p < 0.001$, 2-tailed, CI; 95%). The men and

women average age attending the clinic for RPD were statistically different (Table 1). Patients' requests for RPD service in 2006 were higher than other years. The women attendance was higher in 2006, while men presence was more in 2007. However, no statistical difference was found between men and women attendance over 6 years ($\chi^2 = 5.61$, $df = 5$, $p = 0.346$) (Table 2).

TABLE 1. Gender composition

Gender	Age Average In Year	SD	No.	%
Men	58.2 *	±12.796	933	50.1*
Women	56.3	±11.324	930	49.9
Total	57.3	±12.13	1863	100.0

(* Significant difference at $p < 0.001$)

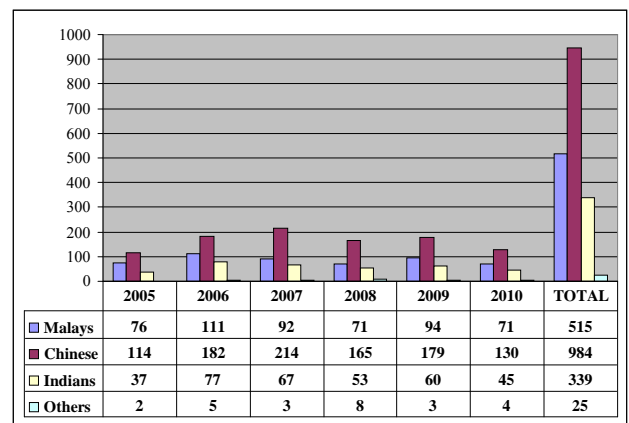
TABLE 2. Gender composition in years

Year/ Gender	2005 ^a		2006 ^a		2007 ^a		2008 ^a		2009 ^a		2010 ^a		Total
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
Men	114	12.2	178	19.1	204	21.9	138	14.8	171	18.3	128	13.7	933
Women	115	12.4	197	21.2	172	18.5	160	17.2	165	17.7	121	13.0	930
Total	229	12.3	375	21.1	376	20.2	298	16.0	336	18.0	249	13.4	1863

(^a Difference is not significant)

B. The Ethnic Groups' Composition of the Sample

Generally, over the five year of study, the Chinese request for RPD service was the highest among other ethnicity (Malays and Indians). On the other hand, Malays and Indians showed highest attendance in 2006 while the number of Chinese patients was higher in 2007. Number of patients requested RPD treatment in 2006 was high compared to the other years of study. The difference was significant among the different ethnic groups and over different years ($\chi^2 = 1035.9$, $df = 3$, $p = 0.000$ and $\chi^2 = 63.38$, $df = 5$, $p = 0.000$) (Fig. 1).

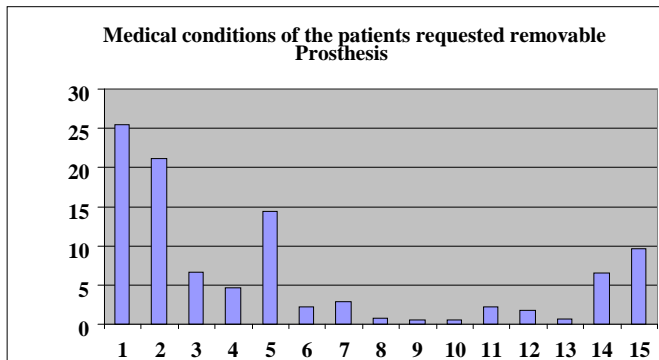


(Difference is significant among ethnic groups and among years, $p = 0.000$)

Fig.1. The distribution of different ethnic composition of the sample over years of the study

C. The Medical Status of Patients Attending the Clinics from 2005-2010

25.5% of the patients attended the prosthetic clinics claimed they were healthy. The rest were suffered from different medical conditions under control (Fig. 2.)

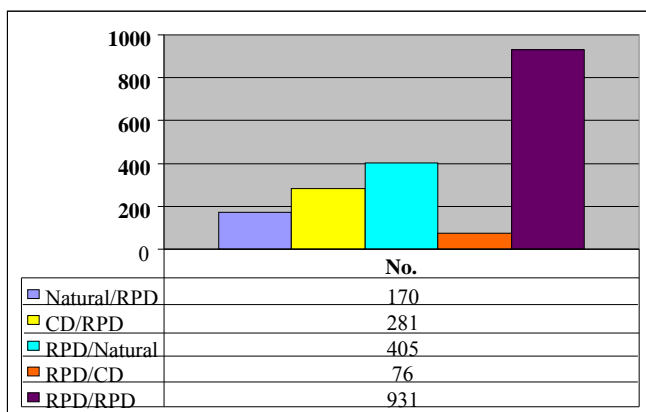


1 : Normal subjects, 2 : Hypertension, 3 : CVS Diseases, 4 : Musculoskeletal & CNS diseases, 5 : Diabetes, 6 : Other endocrine, 7 : Respiratory diseases, 8 : Liver diseases, 9 : Renal diseases, 10 : Blood Diseases, 11 : Gastrointestinal Diseases, 12 : Neoplasm, 13 : Mental and Physical Handicap, 14 : Allergies, 15: Other diseases

Fig. 2. Medical conditions of the population

D. Types of Removable Prosthesis Provided by Undergraduate Students

Maxillary RPD opposed by mandibular RPD represented the most prosthetic treatment prescribed. It formed nearly (50%) of the total. It was followed by a single maxillary RPD against natural teeth (21.7%), and maxillary RPD against mandibular complete denture (4.1%). While, 9.1% of RPDs were opposed by maxillary natural dentition (significant difference at $p < 0.05$, CI: 95%) (Fig. 3.).



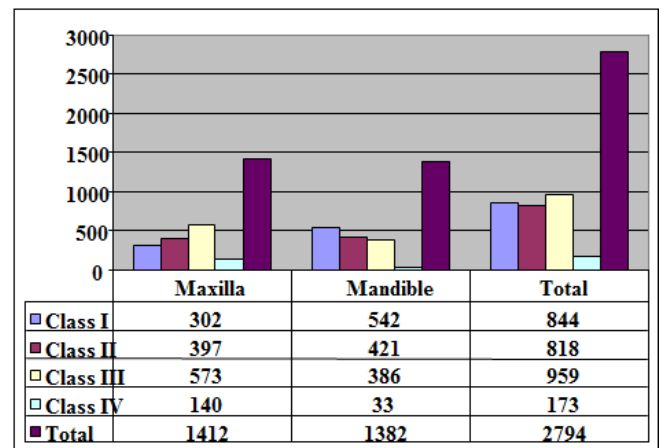
(The difference is significant at $p < 0.05$, CI 95%)

Fig 3. Types of Removable dentures from 2005-2010

E. Kennedy Classes Treated During the Period (2005-2010)

1) Kennedy classes received without modifications:

2) 932 cases (with opposing natural teeth or unimaxillary complete denture) in the two arches were excluded from the results regarding the RPDs. The total cases were 1863 patients (2794 arches). Class III (34.3%) was most frequently restored followed by Class I (30.2%), Class II (29.3%) and finally Class IV (6.2%). Maxillary Class III was more common (40.6%) than mandibular. Mandibular Class I (39.2%) and Class II were more compared to maxillary. A mazing findings revealed that Class IV occurrence was 4 times more in the upper arch compared to lower. The difference between the different groups were significant ($\chi^2 = 173$, $df = 3$, $p = 0.00$) (Fig. 4.).



(The difference is significant between Kennedy classes and between arches)

Fig. 4. Pure Kennedy classes in the sample

3) *Kennedy classes with modifications (maxillary and mandibular arches):* Overall, there were 916 RPDs fabricated without any modification while 1197 R PDs incorporated at least one modification area. Among the RPDs without modifications, Class I was the most common (51.7%). RPDs with combined anterior and posterior modification areas as well as extensive modifications were frequently found in Kennedy Class III followed by Class II maxillary arches and Class I. However, maxillary RPDs class I with modification 1 were the most commonly fabricated. In contrast, in the mandible, class III with modification 1 partial dentures were the most frequently constructed followed by Class II modification 1 partial denture. 1878 R PDs (approximately two-thirds of total RPDs) exhibited one or more modification areas were fabricated from 2005 to 2010, (Fig. 5, 6).

4) *Patients treated each year according to Kennedy classification:* The total number of patients who came for removable prosthodontics service was 1863 to whom 2794 RPDs were constructed (1412 maxillary and 1382 mandibular RPDs). The number of partially edentulous patients was increasing each year to reach its peak in 2006 with 570 R PDs (20.4%). However, the number was decreased in 2008 by 4.2% from 2007 and increased again

in the following year. The number of

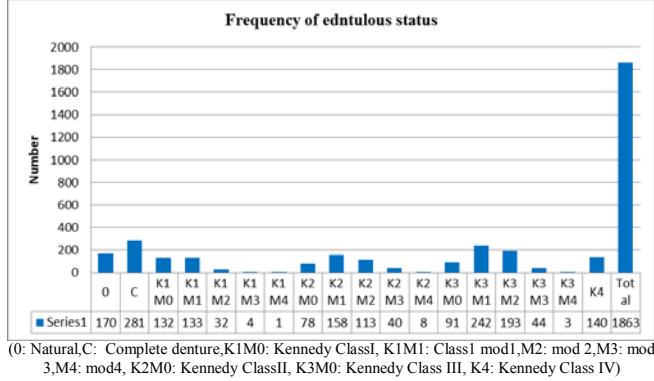


Fig. 5. Frequency of maxillary Kennedy classification with modifications

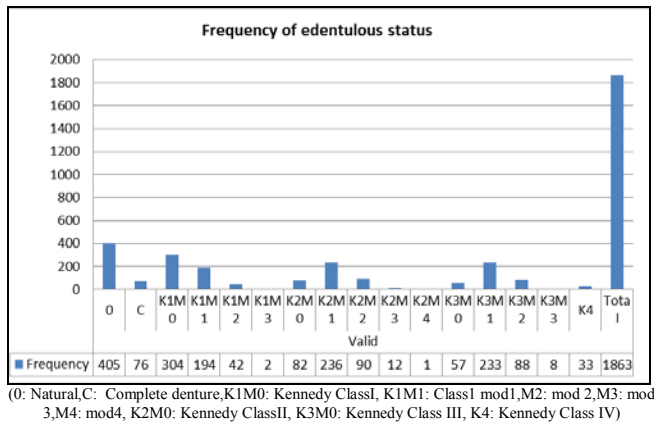


Fig. 6. Frequency of mandibular Kennedy classification with modifications

patients was inconsistent each year and the lowest was marked in 2005, representing 11.5% of the total sample. The variation was statistically evident among Kennedy classes over years of study ($\chi^2 = 38.1, df = 15, \rho = 0.001$) (Fig. 7).

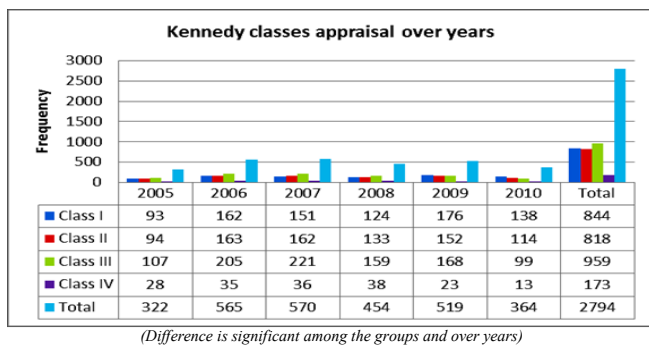


Fig. 7. Distribution of Kennedy classification over years

5) *Distribution of patient's gender according to Kennedy classification within 2005-2010:* The distribution of Kennedy classification in relation to gender is shown in Fig. 8. Both men and women showed similar distribution pattern over the years of the study. Kennedy class III was the most frequently found in both genders followed by Class

I, Class II and finally Class IV. The difference was not significant for the Kennedy classification occurrence in men and women ($\chi^2 = 2.06, df = 3, \rho = 0.560$) (Fig. 8)

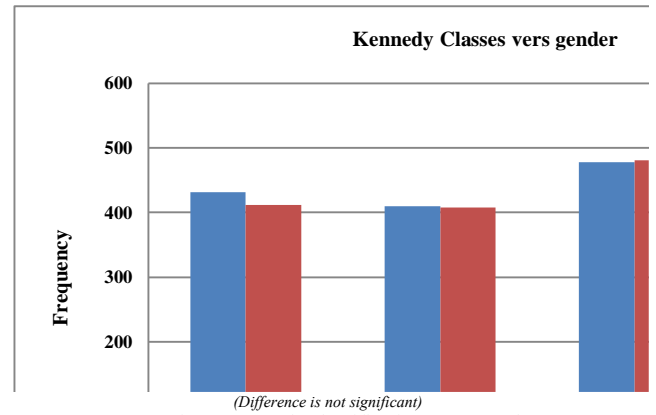


Fig. 8. Kennedy classification verse gender

F. *Type of Materials Used for RPDs Fabrication*

Generally, 56.9% of the RPDs were fabricated using acrylic resin while the rest (43.1%) were made of Co-Cr alloy. Class I RPDs were mostly made of acrylic resin (34.9%), followed by Class II RPDs (29.7%), Class III (28%) and finally Class IV (7.4%). Class III RPDs were frequently fabricated with metal alloys (42.6%) followed by Class II (28.8%), Class I (24%) and Class IV (4.6%). In the maxillary arch, Class III edentulous areas were frequently restored with both acrylic (33.5%) and metal (50.7%) RPDs. Similarly in the mandible; Class III RPDs were commonly made of metal alloy (35.1%). However, for acrylic resin RPDs, Class I was superior (44%). The difference is significant between acrylic and metal use among the Kennedy classes in upper and lower arches ($\chi^2 = 52.46, df = 3, \rho = 0.001$) and ($\chi^2 = 37, df = 3, \rho = 0.001$) (Fig. 9 and Fig. 10).

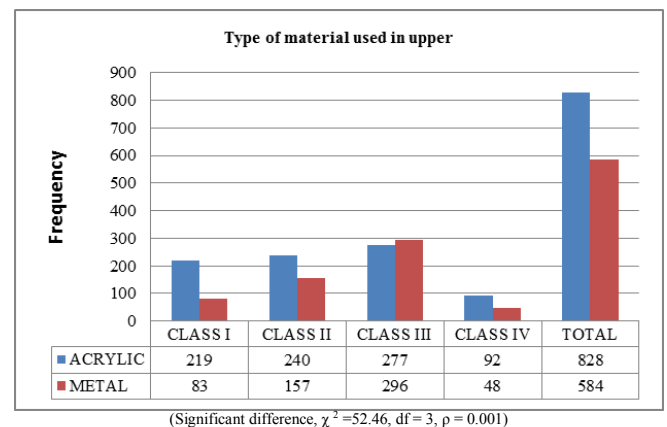
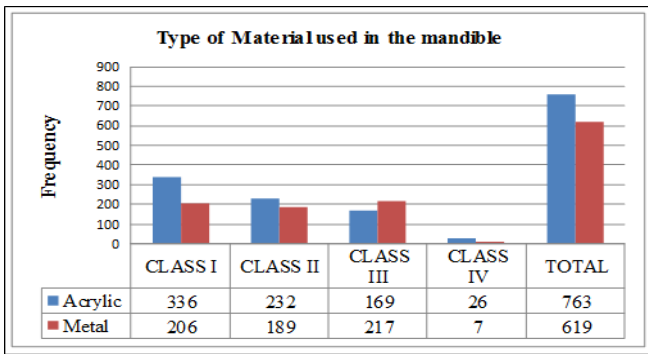


Fig. 9. Materials used for maxillary RPDs



(Difference is significant for the use in different classes)
 Fig. 10. Materials used for mandibular RPDs

G. The Demand for RPD According to Patient's Age Group

With age increase, the people demand for (RPD) rises to reach its peak at 55-64 years and then the request for RPDs declines as the age of patients continues to increase more. The mean age of patients that came for RPD treatment was 57.28±12.13 years. In addition, the age group (16-24) years requested the least RPD service (2.2%) compared to other groups in the sample, while 55-64 years of age people requested more RPD (33.0%) than other components forming the population (Fig 11).

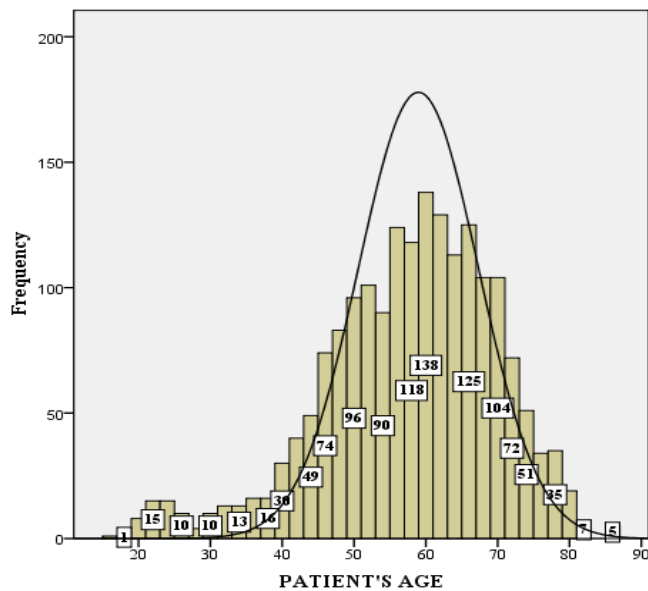


Fig. 11. RPD requesting age groups

H. Numbers of Remaining Teeth in Patients Requesting RPD Treatment From 2005-2010

The majority of patients seek RPDs treatment had average 10-15 abutment teeth left (22.1%) as illustrated in figure 12. Patients have less than 5 abutment teeth left (8.2%) represented the least group of patients who requested RPDs. On the other hand, patients have more than 25 teeth

left signified the second less common group in the sample (9.4%).

I. The Consumed Time by Student to Fabricate and Issue RPD to Each Patient

43.3% of the students needed about 1 - 4 months to fabricate and issue one or pair of RPD. While, some cases (6.7%) took more than 12 months to be fabricated. In second place (37.9%) of students took 5 to 8 months to finish their prosthesis. 12.0% of students needed 9- 11 months to fabricate RPDs . This duration signified the maximum time encountered in this survey (Table 3.).

Table 3. Duration to finish one RPD patient by student

Duration	Frequency	(%)
1- 4 months	807	43.3
5 -8 months	707	37.9
9 - 12 months	224	12.0
> 12 months	125	6.7
Total	1863	100.0

J. The Review Status for Patients After RPD Issue From 2005-2010

84.2% of successfully treated PEPs were recalled for review. While, the rest (15.8%) of them left without post insertion review. Difference was highly significant (z = 41.808, ρ=0.0001) (Table 4).

Table 4. Review frequency of RPD

Status	Frequency	(%)
Review	1568 ^a	84.2
No Review	295	15.8
Total	1863	100.0

^a(Significant difference, z = 41.808, ρ= 0.0001, one-tail)

K. Student Performance of RPD Design on the Laboratory Form

The order form for lab work is a written message between the laboratory technician and the student to start processing the fabrication of metal framework and acrylic resin RPD. The findings indicated that in maxillary arch, 1% of the forms were filled properly regarding the dimension of the different components before sending to the lab. While for the lower arch the problem of communication was worse. Gingival uncover by partial denture components is applied as a preventive measure to reduce the irritant effect of RPD on free gingiva. This important rule was assessed on the RPD design form. Gingival uncover was used in less than 20% of the indicated cases (Tables 5, 6, 7).

Table 5. Components of maxillary arch lab form filling

Dimension of components	Frequency	Percent
Unfilled	191	99.0
filled	2	1.0
Total	193	100.0

Table 6. Components of mandibular arch lab form filling

Dimension of components in mandibular arch	Frequency	Percent
Unfilled	540 ^a	98.36
filled	9	1.64
Total	549	100.0

^a(significant difference, z =32.05, p =0.0001, one-tail)

Table 7. Gingival protection or uncoverage by major connector

Gingival Protection	Frequency	Percent
Covered gingiva	155 ^a	80.3
Uncovered gingiva	38	19.7
Total	193	100.0

^a(significant difference, z =11.9, p = 0.0001, one-tail)

IV. DISCUSSION

The listed RPD cases that have been treated at Dental Faculty from 2005 until 2010 were 2394. However, only 1939 folders were available for this study due to unavailability of the rest. Consequently, 1863 cases were only included and analyzed after considering the inclusion and exclusion criteria. The RPD services at the Faculty of Dentistry were provided at lower cost compared to private or primary dental care facilities. As a result, the residents from variable socioeconomic levels seek this opportunity. Therefore, broad and in depth information of the RPD status over time can be retrieved for many purposes like clinical education status and medical service planning.

In this study, statistical difference between men and women was not found regarding RPD services. This finding is similar to a study done in Kota Bharu [12] and in contradiction with some researchers [7, 13].

As the age increases, the demand for removable partial denture (RPD) also grows to reach its peak age at 55-64 years before decreases again when patient's age passes 64 years. One study stated that the request for complete denture increases with aging and partial denture request decreases. In addition, the likelihood of wearing RPDs was high in patients aged 65-74 years [14]. However, in this study the mean age was 57.28 years.

Chinese patients contribute to highest proportion of Malaysian population received RPD treatment compared to Malays and Indians for each year of this study. Similar analysis in the literatures was absent for comparison. Many studies have been done to compare the prevalence of RPD treatment in subjects that come from rural area and urban area. The results demonstrated that subjects in rural area requested more RPDs than in urban region. In Pomerania, high level education subjects were more likely look for fixed prosthodontics, whereas lower education group more frequently looked for removable complete or partial prosthesis [6]. However in this study nearly all the subjects came from urban area as the Faculty is located in the same vicinity therefore, no correlation can be done.

Hypertension and Diabetes Mellitus signified the most common pathologic conditions declared by the RPDs' patients. However, there are no direct relationship in this study between certain systemic diseases and partially edentulous status due to the fact that these diseases are commonly found among elderly in Malaysia whether they are edentulous or dentate. This finding was in agreement with a study done on elderly in Pomerania that revealed Diabetes was the most common disease in patients seeking RPD service [6].

The majority of undergraduates took about 1 to 4 months to treat one partially edentulous patient. In addition, some cases (6.7%) required more than 12 months to be completed due to many reasons either related to the students, patient or the clinical teaching.

Since the first study on Kennedy classification prevalence was done by Anderson et al. in 1952 and later further researches were completed in 1990s and early 2000s, reported that Kennedy class I and II were most frequently fabricated in contrast with our finding that showed Kennedy Class III patients were the most requesting for RPD and it is in agreement with recent studies on prevalence of RPD treatment from 2002 up to 2011. The established patterns of tooth loss reported in some studies [15, 16] explain the trend of high percentage of Kennedy class III RPD fabrication in this study. The lower cost for RPD service compared to fixed prosthesis may influence the patients' desire to select removable instead of fixed replacement for Kennedy class III.

Class III was most frequently restored with metal framework due to positive health condition of the remaining teeth. In contrast, free- end saddles were commonly restored with acrylic resin especially for mandible because of the negative condition of the remaining teeth and the expectation for complete denture service earlier than with class III.

The majority of RPDs patients have average 10-15 teeth left (22.1%). Patients with less than 5 teeth left (8.2%) represented the least group of patients who requested RPDs.

On the other hand, patients have more than 25 abutment teeth left (9.4%) signified the second less common group in the sample.

Review of the patient after issuing the denture is very important to resolve any complaint or oral problem faced. However, in more than 15% of cases, patient fails to attend review for any reason (personal or technical).

Students under total supervision should list down complete information of the component dimension before sending the lab form to the technician to proceed with the framework fabrication. However, no attention was paid for this important step and the process move depending on the student competency to include such information in the laboratory form.

The Minimum coverage of the oral structures around the abutment teeth like free gingiva, gingival sulcus was rarely used within 2005-2010 (nearly 1 %). This indicates the absence of program updates regarding RPD design teaching even though, this rule is very crucial for the abutment health and its supporting tissues due to the evident destruction of periodontal ligaments[17-20]. The clinical teaching and students' performance should be assessed bi-yearly by the use of variable methods and examinations [21]. The introduction of new utilities to enhance medical teaching like examination and diagnostic softwares and e-learning have increased the practical performance of students in general and their clinical competency as well as their skill, meanwhile, achievement time is reduced for patient management at the level of undergraduate students [22-25]. The outcome analysis can be one of most important indicators for measuring the clinical teaching after changing some of the variables and the facilities of the training to see the positive or negative impact on the performance clearly so that academic stakeholders can upgrade to better facilities and teaching methodology.

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V. CONCLUSION

The analysis of clinical teaching outcome symbolized by the successfully offered service by the undergraduates for more than 5 years revealed that archiving should be monitored and maintained carefully to prevent missing or incomplete information to be used later for further study. Comparing the outcomes of consecutive academic years can reveal the advancement and progress of student and the academic institution performance, service as well as program achievement. We suggest that the clinical appraisal

of the students is assessed every two years to permit enough data to be gathered and analyzed. No significant statistical difference between men and women has been found. As the age increases, the demand for removable partial denture also grows to reach the peak age at 55-64 years. Chinese patient contribute to the highest proportion of ethnic group. The majority of undergraduates took about 1 to 4 months to treat one partially edentulous patient. Hypertension and Diabetes Melitus signified the most common pathologic conditions declared by the RPDs' patients. Patients with Kennedy Class III were the most frequently requested RPD. The majority of RPDs patients' have an average of 10-15 abutment teeth left (22.1%). More than 15% of the patients failed to attend recall visit. Acrylic resin material was mostly used for fabrication of partial denture compared to metal alloy. For maxillary arch, 1% of the lab forms were filled properly before sending to the lab. However, in mandibular arch the problem was worse. Gingival uncover or minimum coverage is rarely applied as a preventive measure to reduce the irritant effect of frame on the free gingiva and periodontal health. The results showed that less than 20% of the indicated cases, gingival uncover was used in the design.

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