Six years'results of partially edentulous patients treatment in academic institute

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***Abstract*—With the growth and development of new knowledge and skill every day, the evaluation of dental program and teaching outcome in prosthetic dentistry become crucial to compete with the advances in other disciplines concerning human well-being and health service provider of the community. The purpose of this study was first; to explore the clinical service presented by undergraduate students during their formal training in prosthetic dentistry clinics at faculty of dentistry from 2005-2010. The second objective was to evaluate and assess the designing concept of metallic frame work as offered for the patients for the same period. The data were collected from patient's archive of prosthetic dentistry department according to certain inclusion criteria. 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. Increased general conditions were correlated to reduced number of remaining teeth. Repeated service was included 20.4 % of the total treatment outcome. The designing rules for metal partial dentures should be revised according to new updates of oral immunity and preventive measures during treatment offering like minimum coverage, protection of the normal cleansing action and load distribution. As a conclusion, assessing the clinical activity of undergraduates should be done regularly as one of the important parameters for clinical proficiency evaluation of the students as well as the instructors and the clinical program. More 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

Clinical training and learning outcome of undergraduate students in dental school may be assessed annually, biannually or at regular interval by analyzing the patient management appraisal plus formal methods like formative summative tests, competency test, and objective structured clinical test. Additional parameters may be included in the evaluation of the student clinical performance like the time required for managing one patient, the quality of offered service, patient flow, patient general health status, mostly encountered general conditions, the major types of Kennedy classes treated, and more factors that influence directly on the performance of learners as well as the teaching and learning process. The analysis of gathered information offers the stakeholders an overview of the training problems encountered by the learners and the required emphasis on weak areas in the clinical training program and facilities for further development.

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 patients 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. Finally, the designs of RPDs were analyzed according to updated criteria.

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 $\rho<0.001$, and 0.05.

III. RESULTS

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

933 (50.1%) of the people attending for RDs service were men, while the rest were females (Table 1). The difference between men and women was significant ($t = 3.39$, $df = 1861$, $\rho<0.001$, 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 ($\chi^2 = 5.61$, $df = 5$, $\rho=0.346$) (Table 2).

TABLE 1. Age and 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 $\rho<0.001$)*

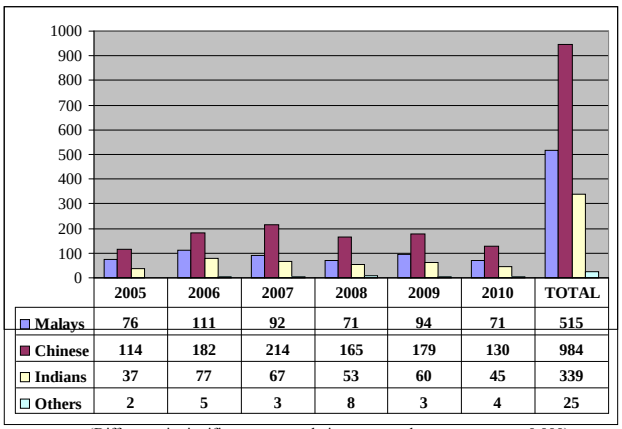
TABLE 2. Gender composition in years

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, throughout the six years 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 (χ^2= 1035.9, df= 3, ρ =0.000 and χ^2= 63.38, df = 5, ρ =0.000) (*Fig.* 1).



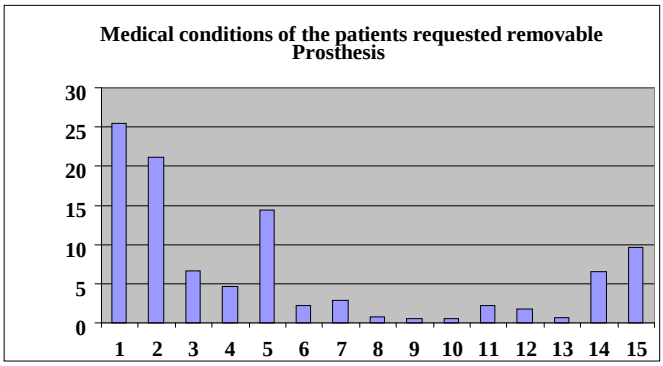
	2005	2006	2007	2008	2009	2010	TOTAL
Malays	76	111	92	71	94	71	515
Chinese	114	182	214	165	179	130	984
Indians	37	77	67	53	60	45	339
Others	2	5	3	8	3	4	25

(Difference is significant among ethnic groups and among years, ρ =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 but under medical control (*Fig. 2.*)

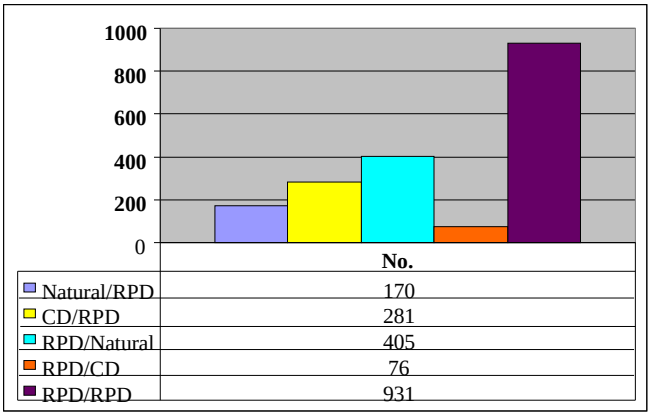


1 : Normal subjects, 2 : Hypertension, 3 : CVS Diseases, 4: Musculoskeletal & CNS diseases, 5 : Diabetes, 6 : Other endocrine, 7 : Respiratory diseases, 8: Liver diseases, 9: Renal diseases, 10 : Blood Diseases, 11: Gastrointestinal Diseases, 12: Neoplasm, 13: Mental and Physical Handicap, 14: Allergies,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

Fig. 2. Medical conditions of the population

D. *Types of Removable Prostheses 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 ρ<0.05, CI: 95%) (*Fig. 3.).*



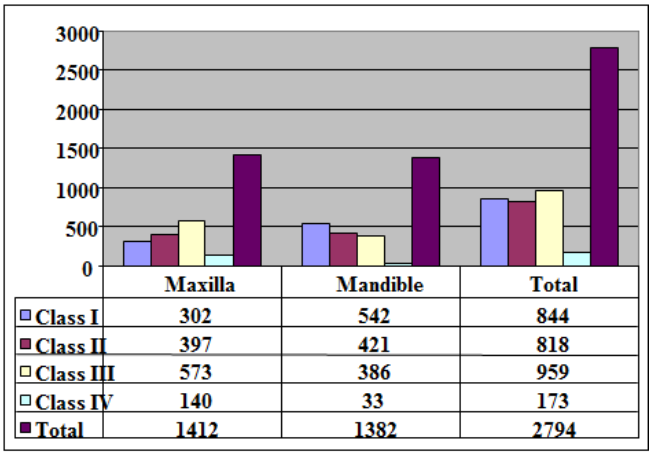
	No.
Natural/RPD	170
CD/RPD	281
RPD/Natural	405
RPD/CD	76
RPD/RPD	931

(The difference is significant at ρ< 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 without modifications: 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. Amazing findings in this study showed that Class IV occurrence was 4 times more in the upper arch compared to lower. The difference between Kennedy groups was significant (χ^2 =173, df =3,ρ =0.00) (*Fig. 4.*).



	Maxilla	Mandible	Total
Class I	302	542	844
Class II	397	421	818
Class III	573	386	959
Class IV	140	33	173
Total	1412	1382	2794

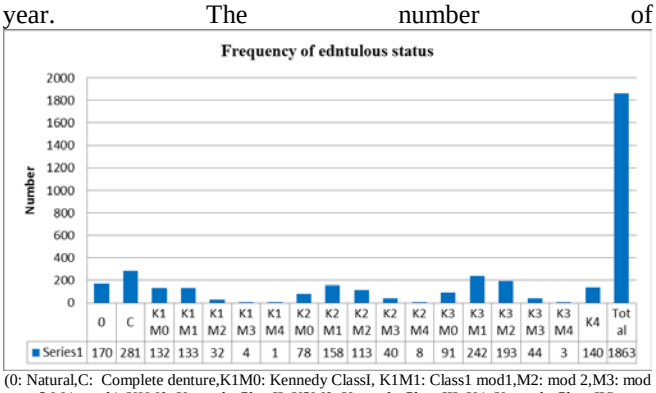
(The difference is significant between Kennedy classes according to arch location)

Fig. 4. Pure kennedy classes in the sample

2) Kennedy classes with modifications (maxillary and mandibular arches): Overall, there were 916 RPDs

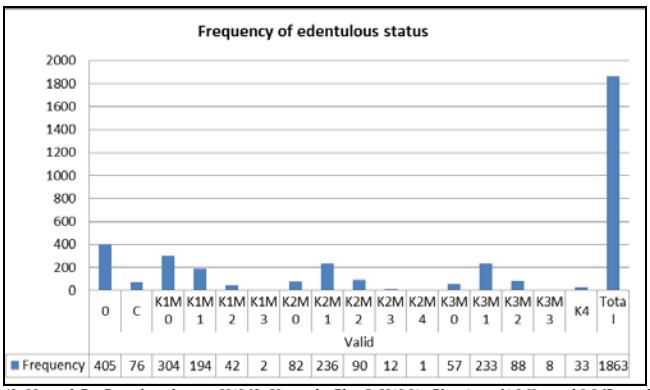
fabricated without any modification while 1197 RPDs incorporated at least one modification area. Among the RPDs without modifications, Class I was the most common (51.7%). RPDs with combined anterior and posterior modification areas as well as extensive modifications were frequently found in Kennedy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

3) Patients treated each year according to Kennedy classification: The total number of patients who seek removable prosthodontics service was 1863 to whom 2794 RPDs were constructed (1412 maxillary and 1382 mandibular RPDs). The sum of partially edentulous patients was increasing each year to reach its peak in 2006 with 570 RPDs (20.4%). However, the number was decreased in 2008 by 4.2% from 2007 and increased again in the following year. The number of patients was inconsistent each year and the lowest was marked in 2005, representing 11.5% of the total sample. These variations were statistically evident among Kennedy classes throughout the study ($\chi^2 = 38.1$, df = 15, $\rho = 0.001$) (*Fig. 7).*



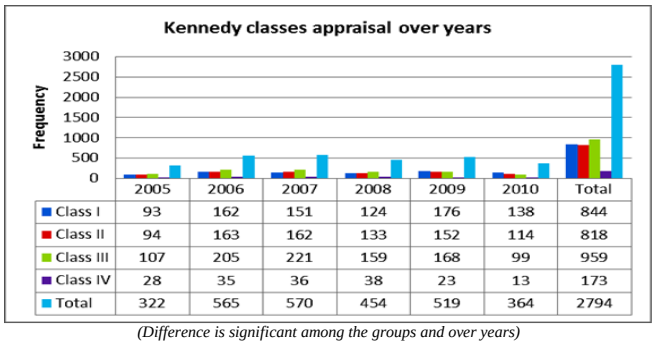
(0: Natural,C: Complete denture,K1M0: Kennedy ClassI, K1M1: Class1 mod1,M2: mod 2,M3: mod 3,M4: mod4, K2M0: Kennedy ClassII, K3M0: Kennedy Class III, K4: Kennedy Class IV)

Fig. 5. Frequency of maxillary kennedy classification with modifications



(0: Natural,C: Complete denture,K1M0: Kennedy ClassI, K1M1: Class1 mod1,M2: mod 2,M3: mod 3,M4: mod4, K2M0: Kennedy ClassII, K3M0: Kennedy Class III, K4: Kennedy Class IV)

Fig. 6. Frequency of mandibular kennedy classification with modifications

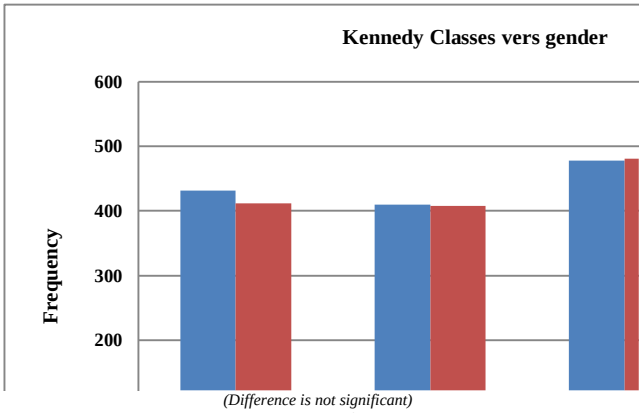


	2005	2006	2007	2008	2009	2010	Total
Class I	93	162	151	124	176	138	844
Class II	94	163	162	133	152	114	818
Class III	107	205	221	159	168	99	959
Class IV	28	35	36	38	23	13	173
Total	322	565	570	454	519	364	2794

(Difference is significant among the groups and over years)

Fig 7. Distribution of Kennedy classification over years

4) 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 during the six years. 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 Kennedy classification occurrence in men and women ($\chi^2 = 2.06$, df = 3, $\rho = 0.560$) *(Fig. 8)*



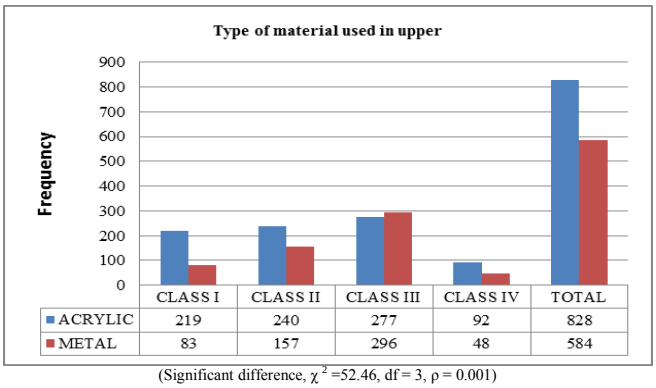
(Difference is not significant)

Fig. 8. Kennedy classification verse gender

E. 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 maxillary arch, Class III Kennedy was frequently restored with either acrylic resin (33.5%) or metal (50.7%) RPDs. Similarly in mandible; Class III RPD was commonly made of metal alloy (35.1%). However, acrylic resin use was superior in Class I (44%). The difference is significant

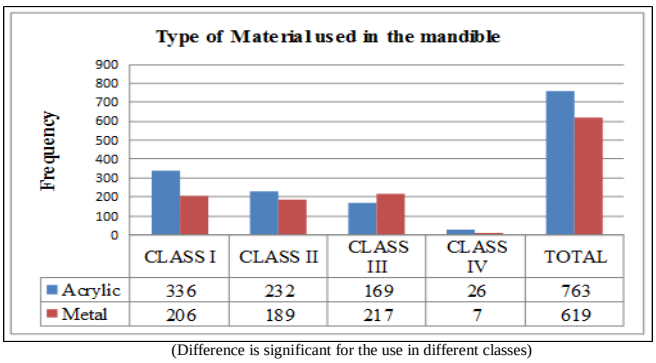
between acrylic resin and metal use among Kennedy classes in upper and lower arches (χ^2 =52.46, df = 3, ρ = 0.001) and (χ^2 =37, df = 3, ρ =0.001) *(Fig. 9 and Fig. 10).*



	CLASS I	CLASS II	CLASS III	CLASS IV	TOTAL
ACRYLIC	219	240	277	92	828
METAL	83	157	296	48	584

(Significant difference, χ^2 =52.46, df = 3, ρ = 0.001)

Fig. 9. Materials used for maxillary RPDs



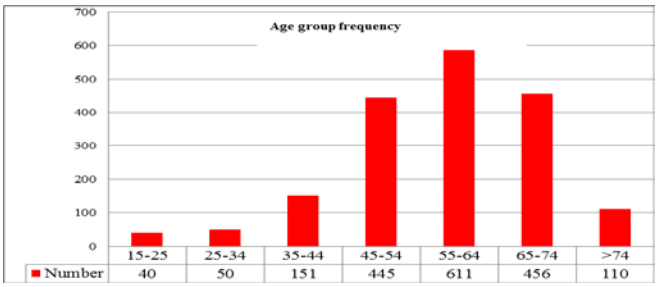
	CLASS I	CLASS II	CLASS III	CLASS IV	TOTAL
Acrylic	336	232	169	26	763
Metal	206	189	217	7	619

(Difference is significant for the use in different classes)

Fig. 10. Materials used for mandibular RPDs

F. 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 who attended prosthetic clinics for RPD service was 57.28±12.13 years. In addition, the age group of (16-24) years request was the least for RPD replacement (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 a,b*).



	15-25	25-34	35-44	45-54	55-64	65-74	>74
Number	40	50	151	445	611	456	110

Fig. 11a. Age group demand for RPDs in years

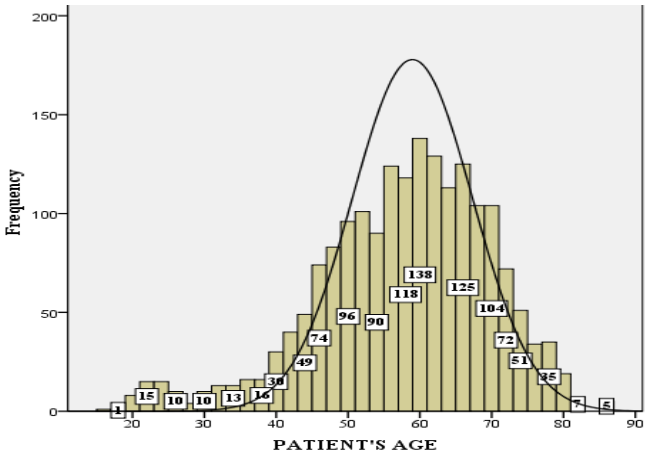


Fig. 11b. Age distribution requesting RPDs

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

The majority of patients seeking 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 whom were treated using RPDs. On the other hand, patients have more than 25 teeth left signified the second less common group in the sample (9.4%).

H. 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 single or pair of RPD. While, some cases (6.7%) took more than 12 months to be fabricated. In second place, 37.9% of the students need 5 - 8 months to finish their prosthesis. 12.0% of the students required 9- 11 months to fabricate RPDs. This duration signified the maximum time encountered in this survey. 6.7 % of the students finished one RPD in more than one year (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

I. 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)

J. 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, ρ =0.0001, one-tail)

Table 7. Gingival protection or uncover 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, ρ = 0.0001, one-tail)

K. The relation between the sum of general disease and the number of remaining teeth

A negative significant correlation had been found between the number of remaining teeth and general disease number. This means that the number of remaining teeth in a patient is statistically related to his general health and to the number of acquired general diseases (Table 8).

Table 8. The relation between the left teeth number and the number of general conditions

	Number of teeth	Significance
Number of disease	R= - 0.119*	ρ =0.001(2-tailed)
Total No. 1883		

*significant value at ρ< 0.001

L. The Number of Refabricated RPDS or Retreated Cases

During clinical training of undergraduate students, some failures in treatment outcome of partially edentulous patients are expected within certain limit. During six years of clinical training of more than 1300 students, 154 prosthetic appliances were repeated two times representing 16.6% (8.3% * 2) of the total service. 18 patients were repeated 3 times representing 3% (1% *3), and 3 patients service were repeated four times 0.8 %(0.2% *4). As a result, the total remade cases were equal to 20.4% of the total number attending the clinic for RPD service.

M. Results of RPD Metallic Frame Analysis

1) Analysis of RPD design on maxillary arch: The applied design principles and the components use in each maxillary RPD design sheet were compared to updated mechanical and bioprotective rules. 193 designs of the maxillary RPD were analyzed. The method was used before by the author. It is based on evaluation of the placement and application of RPD components in different Kennedy classes. Each design was blindly analyzed by the researchers and reported in relation to most acceptable designing rules [12, 13]. The result of analysis showed a significant statistical difference for rest placement (χ^2 =68.523, DF=1, ρ <0.00), direct retainer use (χ^2 = 80.959, DF= 1, ρ<0.00), guiding plane use (χ^2 = 11.446, DF = 1, ρ < 0.001), major connector selection (χ^2 = 61.65, DF= 1, ρ<0.00), the dimension of RPD components (χ2 = 185.083, DF= 1, ρ<0.00). The indirect retainer usage was not statistically different from the updated practice (χ^2 = 2.285, DF= 1, ρ<0.131). If these results are added to the previously investigated criteria regarding the gingival uncover or protection, then the sum of correctly applied criteria for RPD components was low in comparison to the incorrect ones (1/7) (*Fig. 12*). We think that more than 90 % correct application or use of each RPD components during the designing is acceptable ratio to consider successful application of the RPD rules. Therefore, the outcome of design is very critical for proper RPD management and this problem should be corrected throughout updating the knowledge and training of the supervisor plus the students.

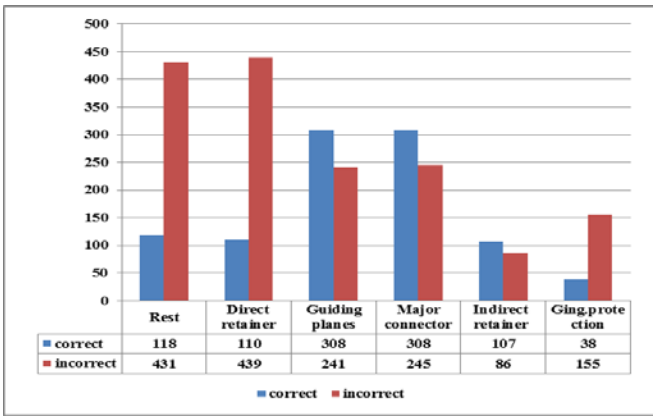


Fig.12 Result of maxillary designs analysis

2) Analysis of RPD design on mandibular arch: The analysis of designs on mandibular arch revealed the presence of significant statistical difference for rest placement (χ^2 =178.450, DF= 1, ρ<0.00), direct retainer type (χ^2 = 197.16, DF= 1, ρ<0.00), guiding planes use (χ^2 = 8.117, DF=1, ρ<0.004), major connecter selection (χ^2 =6.341, DF= 1, ρ<0.012), and indirect retainer indication (χ^2 =21.64, DF=1, ρ<0.00). Comparable to the results of maxillary RPD, the acceptable placement and use of the RPD components in lower arch were low in relation to the incorrect use (*Fig. 13*).

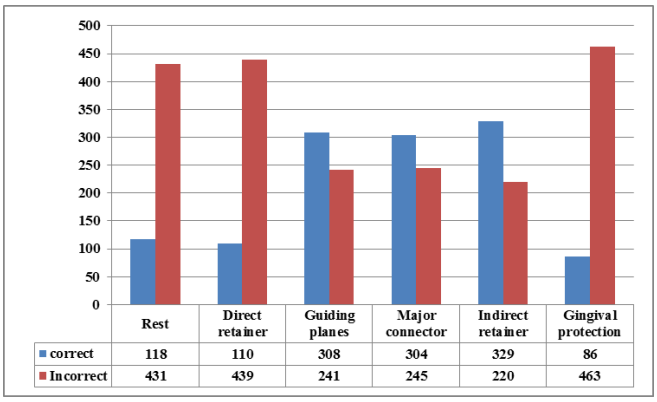


Fig. 13 Results of mandibular RPD analysis

IV. DISCUSSION

The registered 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 [14] and in contradiction with some researchers [7, 15].

As the age increases, the demand for removable partial denture (RPD) also grows up to reach its maximum peak 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 [16]. However, in this study the mean age was 57.28 years. This difference is quite normal due to the sample used for the study, location, ethnicity, and level of health service provided.

Chinese patients contribute to highest proportion of Malaysian population received RPD treatment when 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 and urban areas. 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 edentates 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, patients' level of difficulty and cooperation or the clinical teaching which is affected by the supervisors, teaching facilities and other factors.

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 conversely to 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 pattern of tooth loss that was reported in some studies [17, 18] explains the trend of high percentage of Kennedy class III RPD fabrication found 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 plus the patient desire for conservative approach. This difference from one trend to another may reflect the development in conservative treatment toward saving more posterior teeth in order to promote better effective prosthetic treatment later and it may also indicate the improvement of patient attitude toward teeth preservation by more awareness to oral hygiene.

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 retained 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, more than 15% of cases, the patients fail 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. This student negligence has consequences on the technician performance in following up the design and casting of the framework which result in missing or incorrectly placed components. Therefore, a workflow regarding the different stages should be considered with a system of checkup and quality insurance to ensure the desired fabrication result.

The Minimum coverage of the oral structures around the abutment teeth like free gingiva, gingival sulcus was rarely used within the period from 2005-2010 (nearly 1 %). This indicates the total absence of academic update strategy regarding RPD design teaching even though, this rule is very crucial for the abutment health, long presence in the oral cavity and the health of supporting tissues due to the evident destruction of periodontal ligaments[19-22].

In this study, a negative association is revealed between the total number of remaining teeth and the sum of general diseases. This relation may be considered cautiously; due to the fact that teeth loss is connected to multiple factors that are variable in their impact on the hard structures of the teeth and their supporting tissue status [6].

In clinical training of undergraduate students, some failures in treatment outcome of patients are expected to happen but with limited consequences [23]. In this study some cases were repeated many times before successful result was anticipated. Many factors may be coherent to this problem; like level of case difficulty, student proficiency and skill, supervision efficiency, and other teaching factors. Repeating patient prosthetic treatment for more than one time may induce frustration and many psychological reactions for the operator and the patient as well, in addition to the time, materials and effort wasting. Therefore, this problem should always be taken seriously and investigated in order to be corrected immediately to prevent the consequences.

The results showed that the application rules in RPD design were belonging to classic school and it was not updated regularly according to the modern sound clinical experiments that are based on new advances in oral immunity and biomechanical laws. New paradigm supporters are always challenging to change or update the curriculum while many teachers with conservative spirit still resist any new ideas that arise quickly [24]. Therefore, changes should be conducted routinely and progressively with the eruption of new evidences. Any new program application should imply new clinical learning and teaching skills. It should begin with clinical training for the academic staffs as well before they go to teach new concepts for their students.

Designing metal RPD frame work is long cognitive procedures that need a lot of training and even PBL solving sessions. However, no extra lessons like tutorials or PBL were organized. The selection of each components of the denture should be based on correct mechanical, biological and preventive measures that are newly established regarding the preservation of the gingival and periodontal tissues by using minimally extended major connector, diminish microorganism population by reducing the surface area of the frame to minimum with the respect of the mechanical imperatives of the frame, and fortifying the normal cleansing action of the oral cavity even with the use of RPD.

Removable partial denture module represents nearly more than 50% of prosthetic dentistry program and its teaching starts from first year until fifth year in dental faculties. It includes all forms of learning skill that is distributed in four consecutive years according to teaching levels and the objectives of learning outcome.

The clinical teaching and students' performance should be assessed bi-yearly by the use of variable methods and examinations [25]. Hence, 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 [26-29].

During the 6 years of this retrospective study, the ratio of RPD patients was nearly two thirds of the total visited the prosthetic clinics. This fact should be considered during planning for developing or establishing new syllabus or curriculum for the basic dental degree as well as the postgraduate credentials. The clinical training can profit of these results through the increase weightage and emphasis of the weak areas as described previously. The clinical training program outcome is an image of the utility and interaction between teaching and learning parameters. Hence, its successful outcome indicates competent learner, efficient teachers, and well planned program plus sufficient facilities for training. The aim of developing a weak teaching process should be done always after an exploratory study to reveal the components that should be assessed and criticized for more enhancements. Student proficiency tests if prepared well may be used as a primary indicator of failure and the need for further assessment of the whole process because learners and teachers are responsible collectively.

Therefore, the analysis of clinical outcome 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. Multiple general conditions may be associated with reduced remaining teeth. Upgrading and updating the teaching program from time to time based on new evidences is important to enhance the clinical proficiency of the students and to reduce repeated management of patients.

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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. The designing of the RPD frames showed inconsistency when compared to the new advances in preventive measures, load distribution and modern rules of frame components selection, use and placement.

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