

## THE QUALITY OF REMOVABLE PARTIAL DENTURES DESIGN FOR SIXTH YEAR DENTAL STUDENTS AT UMM AL-QURA UNIVERSITY, MAKKAH, SAUDI ARABIA

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### **ABSTRACT**

**Aim of the study:** This study was conducted to assess the ability of sixth year dental students at Umm Al-Qura University (UQU dent) to provide an appropriate design suitable for various cases of removable partial denture.

**Materials and Methods:** Designs of six partially edentulous cases (three maxillary and three mandibular) were drawn by two hundred forty eight of sixth year UQU dental students. All participants were provided with prepared RPD design sheets and allowed to draw the design. The design components were also written in the space provided in the table of the design sheet. This study was conducted over four consecutive years from 2018 to 2021. The maxillary study cases were: Two cases of Kennedy Class III modification 1 and Kennedy Class I modification 1. While the mandibular study cases were: Kennedy Class I and two cases of Kennedy Class I modification 1.

**Results:** The excellent and good scores of RPD designs for the UQU sixth-year dental students were higher than the satisfactory and unsatisfactory scores. The excellent score was gradually increased in successive academic years from 2018 to 2021.

**Conclusion:** Most of the dental students at Umm Al-Qura University were able to provide the appropriate design for the various cases of removable partial dentures. This reflects the students' understanding of the basic principles of RPD design and thus is an evidence to the quality of the removable prosthodontics course.

**KEYWORDS:** Removable Partial Denture, Denture Design, Dental Students, UQU.

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## INTRODUCTION

Up till now, removable partial denture (RPD) have been recommended as a conservative, simple, economic, convertible and effective method for esthetic and functional rehabilitation of partially edentulous cases.<sup>(1,2,3,4)</sup> To insure an efficient prosthetic rehabilitation without or with minimal damaging of the associated structures, meticulous attention must be paid to every step in the manufacture of the prosthesis.<sup>(5,6)</sup>

One of the most important steps in proper fabrication of RPDs is planning the design based on careful clinical and radiographic examinations of the oral and dental tissues. This step is very essential to provide RPD that work efficiently and in harmony with the surrounding oral and dental tissues without harmful effect.<sup>(7,8)</sup>

Out of importance of planning the design, the journal of Prosthetic Dentistry in 1996 insisted on the role and responsibility of the dentist regarding design.<sup>(9)</sup>

But Several researches proved that designing of removable partial denture facing many problem that resulted in ineffective, esthetically poor, harmful and damaging to surrounding tissues.<sup>(10,11,12,13)</sup>

This problem seems to be worldwide in developing and developed countries.<sup>(14,15,16,17)</sup> It was estimated that only one-third of the RPDs worn by the adult population were considered adequate.<sup>(18)</sup>

Accordingly many attempts were carried out to clarify the causes of improper RPD design.<sup>(19,20)</sup> Some of these researches claimed that this improper design may be attributed to educational factors while another studies related this problem to improper communication with lab.<sup>(7,21)</sup> Thus this study was emerged to explore if the education program of prosthetic division of Umm Al Qura University faculty of Dentistry (UQU Dent) regarding RPD design is adequate to graduate students having ability to provide proper RPD design or not. The

purpose of the current investigation was to assess the ability of senior dental students to draw and describe proper RPD design.

## MATERIAL AND METHODS

Two hundred forty eight of six year dental students of UQU Dent were asked to draw the RPD design of six different RPD cases. An ethical approval for the study was obtained from the research bioethics and medical committee of Umm AlQura University. This study was conducted over four consecutive academic years from 2018 to 2021.

For 2018 academic year students, a prepared two sheets of two RPD cases (one maxillary and one mandibular) were distributed to all participants (50 students) in the classroom. The maxillary case was Kennedy Class III, modification 1 (appendix.1A). The mandibular case was Kennedy Class I, modification 1 and all maxillary teeth are present except tooth #17 and 16 were missed (appendix.1B).

For 2019 academic years, another two RPD cases (one maxillary and one mandibular) were distributed to all participants (70 students) in the classroom. The maxillary case was Kennedy Class III, modification 1 with tooth #26 has been restored with a crown restoration (appendix. 2A). The mandibular case was Kennedy Class I, modification 1 (appendix. 2B).

For 2020 academic years due to the pandemic covid-19, the evaluation was performed electronically. One mandibular RPD case (Kennedy class I) was send to all students (76 students) (appendix. 3).

For 2021 academic years, one RPD maxillary case (Kennedy class I modification 1) was distributed to all participants (52 students) in the classroom (appendix. 4).

All participants were asked to inspect the allowed partially edentulous cases and suggest the best design for each case. The design components

were also written in the space provided in the table. Each design form was provided with a blank space to write any additional comments regarding the RPD design.

All RPD designs were assessed by the same assessor and categorized as Excellent: 10-9, Good: 8-7, Satisfactory: 6-5 or Unsatisfactory (needs improvement): <5.

The design assessment followed the principles of removable partial denture design described by Prosthodontics.<sup>(6,22,23)</sup>As it is well known, there are more than one acceptable design for the same RPD case, the design was considered correct if it provided proper support, stability, and retention with no damage to the remaining teeth and periodontal tissues.

Each design was scored with one point for each correctly planned components (major connector, denture base type, direct retainer, indirect retainer, proximal plate, supporting elements and reciprocation) and proper classification. The quality of the design was assessed by the total score as shown in tables (1, 2 and 3).

**RESULTS**

The descriptive analysis of the design scores of (172) maxillary, (196) mandibular RPD and 368 maxillary and mandibular cases were presented in table (1) and figure (1). Table (2) and figure (2)

revealed the design score of RPD cases for four consecutive year students. While the descriptive analysis of design scores of the assessed three maxillary and three mandibular partially edentulous cases for sixth year students for four consecutive years (2018, 2019, 2020 and 2021) are shown in table (3) and figure (3).

The design score of 39% of the assessed maxillary partially edentulous cases was Excellent, 36.05% was Good, 19.2% was Satisfactory while 5.81% was Unsatisfactory and need improvements. For the lower RPD cases, the results revealed that the design score of 36.73% of the assessed cases was Excellent, 42.86% was Good, 16.85% was Satisfactory and 3.57 % was Unsatisfactory and need improvements. For both maxillary and mandibular cases, the total design score of 37.77% was excellent and 4.62% was unsatisfactory. These outcomes revealed an amazing result that is the excellent and good scores of RPD designs for the UQU students were higher than the satisfactory and unsatisfactory scores.

Table (2) and Figure (2) revealed a gradual increase in the excellent score for the design of RPD cases for sixth-year students in successive academic years from 2018 to 2021. It was 26% in 2018 and 51.9% in the 2021 academic year. While the unsatisfactory scores decreased from 7% in 2018 to 1.9% in 2021.

TABLE (1) Design score of (172) maxillary and (196) mandibular RPD cases.

Design Score of RPD cases Score Scale	Design Score					
	Maxillary cases (172)	%	Mandibular cases (196)	%	Maxillary & Mandibular cases (368)	%
Excellent (10-9)	67	39%	72	36.73%	139	37.77%
Good (8-7)	62	36.05%	84	42.86%	146	39.67%
Satisfactory (6-5)	33	19.2%	33	16.85%	66	17.93%
Unsatisfactory (<5)	10	5.81%	7	3.57%	17	4.62%

TABLE (2) Design score of RPD cases for four consecutive Years.

Design Score of RPD cases Years & students number	Excellent (10-9)	Good (8-7)	Satisfactory (6-5)	Unsatisfactory (<5)
2018(50) students	13 (26%)	16.5 (33%)	17 (34%)	3.5 (7%)
2019(70) students	24 (34.3%)	30 (42.9%)	11.5 (16.4%)	4.5 (6.43%)
2020(76) students	38 (50%)	36 (47.4%)	2 (2.6%)	
2021(52) students	27 (51.9%)	17 (32.7%)	7 (13.5%)	1 (1.9%)

Table (3) The descriptive analysis of design score of the assessed maxillary and mandibular partially edentulous cases for sixth year students for four consecutive years.

Design Score of RPD cases Score Scale	Design Score					
	(2018) Number (50) students		(2019) Number (70) students		(2020) Number (76) students	(2021) Number (52) students
	Maxillary Kennedy class III	Mandibular Kennedy class I mod. 1	Maxillary Kennedy class III mod. 1	Mandibular Kennedy class I mod. 1	Mandibular Kennedy class I	Maxillary Kennedy class I mod. 1
Excellent (10-9)	14 (28%)	12 (24%)	26 (37.14%)	22 (31.4%)	38 (50%)	27 (51.9%)
Good (8-7)	14 (28%)	19 (38%)	31 (44.29%)	29 (41.4%)	36 (47.4%)	17 (32.7%)
Satisfactory (6-5)	19 (38%)	15 (30%)	7 (10%)	16 (22.9%)	2 (2.63%)	7 (13.46%)
Unsatisfactory (<5)	3 (6%)	4 (8%)	6 (8.57%)	3 (4.3%)		1 (1.9%)

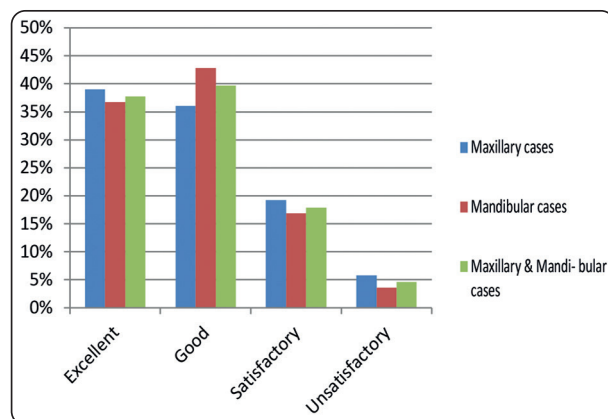


Fig. (1): Diagram represents the design score of the maxillary, mandibular and maxillary and mandibular RPD cases.

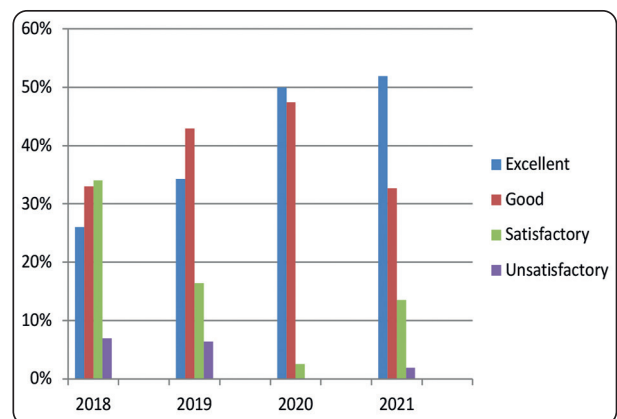


Fig. (2): The graph represents the design score of RPD cases for four consecutive Years.

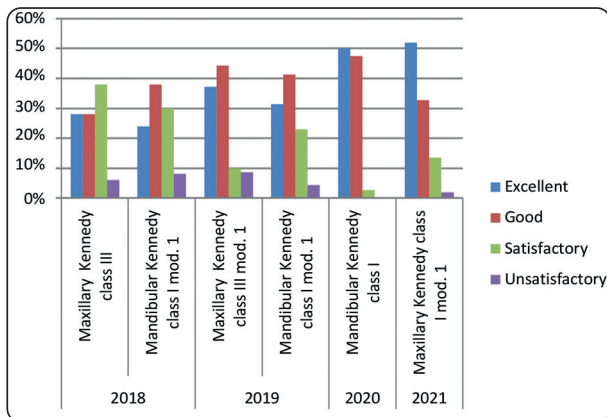


Fig. (3): The graph represents the design score of the assessed maxillary and mandibular partially edentulous cases for sixth year students for four consecutive years.

## DISCUSSION

Many attempts were carried out to clarify the causes of suboptimal RPD design.<sup>(5,7,19,20,21)</sup>

Several documents claimed that most of general practitioners depend mainly on the laboratory technician in providing RPD design. Moreover, they refer the preliminary impression directly to the lab before any abutment preparation.<sup>(24)</sup> others pointed out that more than 90% of metallic RPDs fabricated by technician without any design form description from the dentist.<sup>(25)</sup>

Some studies attributed this issue to lack of essential principles of RPD design by most general practitioners. While others claimed that the financial factors is the cause.<sup>(21,25,26)</sup>

Therefore, this study emerged to evaluate the ability of sixth year dental students at Umm Al-Qura University to provide the appropriate design for different RPD cases which reflects students' understanding of the basic principles of RPD design and will therefore be an evidence to the quality of the removable prosthodontics course.

Since RPD was not only constructed by the specialist but also by general practitioners, this study worked on the sixth year students who would graduate early and should have enough knowledge regarding RPD design.

This study revealed an amazing results that is (77.4%) of the six year students sharing in this study has ability to provide proper RPD design (75%) for maxillary and (79.6%)for mandibular arches. Thus we can say that the UQU graduated students have ability to provide adequate RPD design that is the main factor affecting successful treatment of partially edentulous cases. While a very low percentage (4.62%) of the students were unsatisfactory and need improvements (5.81%) for maxillary arch and (3.57%) for the mandibular one.

The increased design score of students of UQU DENT evidenced from the results of this study proved that the theoretical and practical teaching plan implemented in the context of removable prosthodontics course for under graduate students of UQU DENT have enough knowledge and practical skills to provide an appropriate RPD design. The theoretical and practical teaching plan is consistent with the basic principles of RPD construction described by the Prosthodontics Academy,1994 and various prosthodontics textbooks.<sup>(6,23)</sup>

In the UQU DENT, the education of basic principles of RPD design was started from 4th year. Where the students practically trained well about delivering the RPD design of different cases after surveying each case. All students are trained to practice the dental surveyor when designing an RPD. In the fifth year, students allowed to deliver at least one metallic RPD case. The final year students should deliver at least two metallic RPD case. In addition to, easy communication between students and dental technician either directly or phone to identify the described design sheet form add an important factor in successful rehabilitation of RPD cases. As it was proved that the proper communication of the dentist and the dental technician will marked ly participate in providing an excellent RPD.

Another factor may prove these results, unlimited access to partially edentulous cases appropriate for students. This improves the RPD skill acquired

by undergraduate dental students and providing students with adequate clinical experience in the dental school environment that will in turn carry into the practice of dentistry.

This is contrary to some dental schools that may graduate the students without treating at least one partially edentulous patient with a metallic RPD,<sup>(27)</sup> that may be due to the limited access to patients suitable for undergraduate teaching.<sup>(28)</sup>

The gradual increase in the excellent score for the design of RPD cases for sixth-year students in successive academic years from 2018 to 2021 and the decreased unsatisfactory scores from 7% in 2018 to 1.9% in 2021 reflects the continuous interest of faculty members on the development of the curriculum and their keenness to raise the level of students.

## CONCLUSION

Based on the results of this study, it could be concluded that the majority of UQU dental students are able to provide appropriate RPD design. This could be attributed to an appropriate undergraduate curriculum that incorporate theoretical, laboratory and clinical instructions that provide students with the ability to provide planning, designing and maintenance of multiple RPDs in accordance with the prosthodontic principles, concepts, and practices of the Academy of Prosthodontics.

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## APPENDICES



Umm Al-Qura University  
Faculty of dentistry



جامعة أم القرى  
كلية طب الأسنان

**REMOVABLE PARTIAL DENTURE FRAMEWORK DESIGN**

**STUDENT NAME:**..... **ID. NUMBER:**.....


Your patient has the partially edentulous arch shown in the illustration. Teeth #14,#24 have mesio buccal undercuts. A very high frenal attachment is present immediately below the teeth #14,#24. the residual ridges are of good quality and the first premolars and third molars are strong. The patient exhibits high gag reflex.

What would be your RPD design?

**Kennedy class:**..... **mod:**.....


**Major connector:**.....

**Type of denture bases:**.....




Teeth #	Direct retainer	Indirect retainer	Proximal plate	Rest location & form	Reciprocation

Appendix (1A): Represent the maxillary case of Kennedy Class III, modification 1.



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**REMOVABLE PARTIAL DENTURE FRAMEWORK DESIGN**

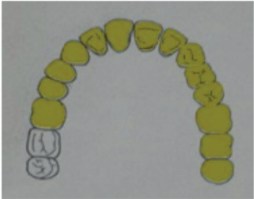

**STUDENT NAME:**..... **ID. NUMBER:**.....

Your patient has a lower partially edentulous arch shown in the illustration. Tooth #46 is tilted mesiolingually and the distance from the free gingival margin to the floor of the mouth is 4 mm. Tooth #35 has midfacial undercut. The undercut on tooth # 43 is on the distofacial surface. All maxillary teeth are present except tooth #17 and 18 were missed. With these factors in mind, could you **SUGGEST** the best lower RPD design?

**Kennedyclass:**.....**mod:**.....


**Major connector:**.....

**Type of denture bases:**.....





Teeth #	Direct retainer	Indirect retainer	Proximal plate	Rest location & form	Reciprocation

Appendix (1B): Represent the mandibular case of Kennedy Class I, modification 1 and the opposing maxillary arch.



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**REMOVABLE PARTIAL DENTURE FRAMEWORK DESIGN**


**STUDENT NAME:**..... **ID. NUMBER:**.....

A partially edentulous patient was presented to your clinic with recently extracted teeth as shown in the illustration. On examination a large torus palatines was noted. The tooth #26 has restored with a crown restoration. Tooth #17 is mesially tilted. What is your RPD design?

**Kennedy class:**..... **mod:**.....

**Major connector:**.....


**Type of denture bases:**.....




Teeth #	Direct retainer	Indirect retainer	Proximal plate	Rest location & form	Reciprocation

Appendix (2A): Represent the maxillary case of Kennedy Class III modification 1.





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**REMOVABLE PARTIAL DENTURE FRAMEWORK DESIGN**

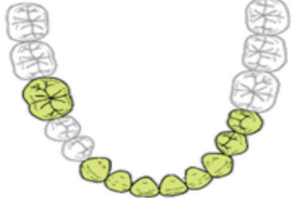
**STUDENT NAME:**..... **ID. NUMBER:**.....

Your patient has a lower partially edentulous arch as shown in the illustration. The anterior teeth have gingival recession. Tooth #35 has midfacial undercut. The undercut on tooth # 43 is on the distofacial surface. Tooth #46 is tilted lingually. With these data in mind, **SUGGEST** the best lower RPD design.

**Kennedy class:**..... **mod:**.....


**Major connector:**.....

**Type of denture bases:**.....




Teeth #	Direct retainer	Indirect retainer	Proximal plate	Rest location & form	Reciprocation

Appendix (2B): Represent the mandibular case of Kennedy Class I, modification 1.



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**REMOVABLE PARTIAL DENTURE FRAMEWORK DESIGN**

**STUDENT NAME:**..... **ID. NUMBER** .....


Your patient has the partially edentulous mandibular arch shown in the illustration. Tooth #35, 45 has mesofacial undercuts. The distance from free gingival margin and floor of the mouth is **10 mm**.

**What would be your RPD design?**

**Kennedy class:**..... **mod:**.....

**Major connector:**.....

**Type of denture bases:**.....



Teeth #	Direct retainer	Indirect retainer	Proximal plate	Rest location & form	Reciprocation

Appendix (3): Represent the mandibular RPD case (Kennedy class I)



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**REMOVABLE PARTIAL DENTURE FRAMEWORK DESIGN**

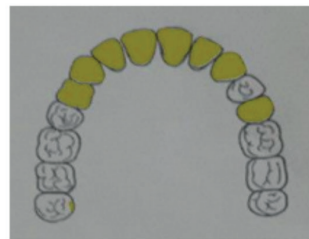
**STUDENT NAME:.....ID. NUMBER.....**

Your patient has an upper partially edentulous arch as shown in the illustration. Tooth #14 has **midfacial** undercut. The undercut on tooth #23 is on the distofacial surface. Tooth #25 is isolated tooth. **What would be your RPD design?**

**Kennedy class.....mod:.....**

**Major connector:.....**

**Type of denture bases.....**



Teeth #	Direct retainer	Indirect retainer	Proximal plate	Rest location & form	Reciprocation

Appendix (4): Represent the maxillary case of Kennedy class I modification 1