The Use of Conventional and Mobile Application in Removable Partial Denture Designing Jan Iryne A. Filoteo

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Author's contribution

The sole author designed, analyzed, interpreted and prepared the manuscript.

Original Research Article

ABSTRACT

Aims: This study was conducted to compare the level of performance of the dental students following the principles of Removable Partial Denture with the use of conventional paper-based method and mobile software application.

Study Design: A descriptive research design was utilized in this study. Assessment of performance of students using conventional paper-based methods in RPD designing was measured and compared with using the mobile application.

Place and Duration of Study: This research study is a pilot study in Prosthodontics using mobile software application as a supplemental teaching aid in the design of a removable partial denture for the dental students enrolled in a private University in the Philippines for the academic year 2018-2019.

Methodology: A descriptive research design was utilized in this study. Assessment of performance of students using conventional paper-based methods in RPD designing was measured and compared with using the mobile application. The level of performance of dental students using both methods was also measured following the RPD principles. An exercise was given to the students to design RPD using the conventional method and with RPD mobile application. Output of their given tasks was evaluated using rubrics.

Results: Based on the data gathered and results obtained, the respondents agreed that

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conventional method in RPD designing is easy to use, yield accurate results and they are satisfied on its use. The mobile application software was considered as a practical supplement for RPD designing. When the two methods were compared, the results show that there is no significant difference in the use of conventional paper based method and mobile application with regards to its ease of use, accuracy of results as well as with the satisfaction of students When the level of performance of dental students were grouped according to the two methods used following the principles of RPD designing, significant difference were noted in terms of major connector, minor connector, rest, denture base, and overall design. The dental students performed better using conventional method in designing the major connector, minor connector, rest and denture base compared to supplemental mobile applications.

Conclusion: Dental students perform well in the conventional RPD designing using conventional methods under the supervision of their Clinical Instructors compared to their level of performance using mobile application software.

1. INTRODUCTION

Dental caries and periodontal diseases are major causes of tooth loss. Severe tooth loss and edentulism (no natural teeth remaining) are widespread and particularly seen among older people [1]. In the Philippines, the state of oral health of older Filipinos is poor. However, with several oral health programs being promoted by the local government units, people are losing fewer teeth, resulting in an increased need for treatment of partial rather than complete edentulism. But due to the socio-economic status of most Filipinos, many patients prefer removable partial dentures (RPD) instead of implants to overcome financial limitations. RPD is a component of prosthodontics which denotes the branch of dentistry pertaining to the restoration and maintenance of oral function, comfort, appearance, and health of patient by restoration of natural teeth and replacement of missing teeth and craniofacial structures with artificial substitutes [2]. Prosthodontics is one of the courses in the Dental curriculum offered for second year proper in which the students are trained to develop a functional prosthesis. During this period, traditionally the students are taught how to make the design using conventional paper-based method. RPD is a versatile, cost effective and reversible treatment method for partially edentulous patients at any age [3]. In creating a removable partial denture, the dental students must understand the basic principles of doing the partial denture design. With conventional paper-based drawing, the students are required to draw using paper and pencil while with the mobile application, the students use an application to visualize the design for the removable partial denture. Digitalization offers great potential to revolutionize dental education

to help prepare future dentists for their daily practice. More interactive and intuitive e-learning possibilities will arise to stimulate an enjoyable and meaningful educational experience with 24/7 facilities. Augmented and virtual reality technology will likely play a dominant role in the future of dental education [4]. The design of RPD will dictate the success of the treatment being done to the patient. Providing a useful and comfortable RPD requires careful diagnosis, planning, and hence, this study aimed to assess the dental students in the RPD design using the conventional paper-based method and with the use of mobile software design application and explore the use of mobile application as a viable supplemental method in teaching RPD designing.

2. MATERIALS AND METHODS

Prior to designing performance of the respondents, an orientation on the specific exercise in RPD was done. DentALL RPD software designer was uploaded in the student's I-Phone or I-Pad and gave them a tutorial on how to use it. They were instructed on how to do the illustration of RPD and labelling its different components. Afterwards, an exercise designed for the study as an outcomes measure of instruction was administered in the students of Prosthodontics II at the final period of first semester of Academic Year 2018-2019. The students were given enough time to complete the exercises which were proctored by the researcher. The exercise required students to design RPD using the conventional paper-based method and using DentALL RPD mobile application software. Output of their given tasks was evaluated using rubrics by the assigned faculty handling Prosthodontics II to avoid bias.

Questionnaires with specific evaluation questions with modified Likert rating scales were used in terms of the preference of the dental students between the two methods being compared in designing RPD such as the conventional paper-based method or use of DentAll RPD design software. Data collection includes the parameters mentioned; ease of use; accuracy of results, and student's satisfaction in the use of the mobile application. The level of performance of dental students was also assessed following the RPD principles.

3. RESULTS AND DISCUSSION

Overall, a general average of 4.20 indicated that the respondents "Agree" that the conventional paper-based method in RPD designing is easy to use, yield accurate results and they are satisfied on its use

Table 2 presents the weighted mean for the indicators in each of the three criteria along with their verbal interpretation using mobile application. Each overall mean showed that the students agree that the mobile application is easy to use, shows accuracy of results and is satisfactory in using as viable supplement for the conventional paper-based drawing.

The test on significant differences in on the level of performance of dental students in designing RPD using the conventional method and the mobile application was analysed and presented in Table 3. As shown in the table, a *p-value* of 0.29 was obtained for the ease of use. The p-value which is greater than the 0.05 level denotes that there is no significant difference on the variables being considered. Thus, there is a strong evidence to accept the null hypothesis. This means that there is no significant difference in the performance of the students using the conventional method compared to the use of software mobile application because the students were mostly adapted to the use of mobile application. For the accuracy of results, a *p-value* of 0.055 which is still greater than 0.05 level shows that there is no significant difference in the accuracy of results of the two methods. Same as with the satisfaction of students, the *p- value* of 0.24 which is greater than the 0.05 level denotes that there is no significant difference. Thus, the null hypothesis must be accepted. This also shows that there is no significant difference in the use of conventional method and mobile software

application with regards to the satisfaction of students. Considering the three parameters, such as ease of use, accuracy of results and satisfaction of students, all the results show that the level of performance of dental students have no significant difference when grouped using the conventional method and mobile application in designing RPD. Although the student's demographics were not considered, it can be presumed that almost all students enrolled in Prosthodontics II were born into the millennial generation, 1982 onwards, in which they have an information technology mindset. Millennials have a digital lifestyle, and this has a high impact on students' attitudes on digital literacy [5]. Many teachers from elementary to post-secondary school were found using some form of mobile learning; thus, students showed positive outcomes for mobile technology both in their attitude and achievements [6].

Following the principles of RPD designing, dental students were proficient using the conventional method in major connector, minor connector, direct retainer, indirect retainer rest, denture base, and in overall design. Summing up, the overall mean of 2.89 revealed that the dental students were all proficient in RPD designing using the conventional method. The findings of the study supported the study of Abdulhadi and Mohammed [7] that generally, the dental students prefer more to be supervised and some of them like conventional teaching techniques than digital designing.

Most of the dental students have acceptable performance in RPD principles such as major connector, indirect retainer, rest, denture base, and overall design. Following the RPD principles, after all the components are placed and the design is established, it is only then were the minor connector will be placed, minor connectors attach all the components of the RPD to the major connector, which can be the reason why the result of the performance of the students are mostly acceptable [6].. Only in direct retainer that the respondents showed proficient performance. Most retention of RPDs is provided by direct retainers which are clasp assemblies or attachments applied to an abutment tooth to retain RPD in position [8]. This implies that students are more conscious in doing designing through conventional methods with the direct retainers.

Table 1. Assessment of Dental students on the use of conventional paper based method in RPD designing

	Mean	Standard Deviation	Verbal Interpretation
1. Ease of Use			
1.1 The conventional is user-friendly or easy to understand and use.	4.30	0.51	Agree
1.2 It allows faster case evaluation than mobile application	4.08	0.78	Agree
1.3 It allows for an organized and sequential manner of case evaluation.	4.22	0.51	Agree
Overall	4.20	0.56	Agree
2. Accuracy of Results			
2.1 The conventional method allows accurately reflecting the clinical condition of the case.	4.06	0.62	Agree
2.2 All affectations manifested by the case can be recorded using theconventional.	4.08	0.78	Agree
2.3 It contains all pertinent evaluation tools needed for proper caseassessment.	4.22	0.51	Agree
2.4 It allows shorter working time during designing of the removable partialdenture.	3.96	0.801	Agree
Overall	4.05	0.62	Agree
3. Satisfaction of students			
3.1 The conventional method allows thorough case evaluation.	4.10	0.62	Agree
3.2 The conventional method is enough in teaching RPD designing	4.02	0.79	Agree
3.3 The conventional method is still my first choice in doing RPD designing	3.94	0.84	Agree
Overall	4.20	0.72	Agree

**Table 2. Assessment of dental students on the use of mobile software application
in RPD designing**

	Mean	Standard Deviation	Verbal Interpretation
1. Ease of Use			
1.1 The mobile application is user-friendly or easy to understand and use.	4.10	0.93	Agree
1.2 It allows faster case evaluation than conventional manual paper-based evaluation.	4.02	0.94	Agree
1.3 It allows for an organized and sequential manner of case evaluation.	4.00	0.95	Agree
Overall	4.04	0.93	Agree
2. Accuracy of Results			
2.1 The mobile application allows accurately reflecting the clinical condition of the case.	3.66	1.00	Agree
2.2 All affectations manifested by the case can be recorded using the mobile application.	3.72	1.01	Agree
2.3 It contains all pertinent evaluation tools needed for proper case assessment.	3.68	1.04	Agree
2.4 It allows shorter working time during designing of the removable partial denture.	3.84	1.037	Agree
Overall	3.72	1.01	Agree
3. Satisfaction of students			
3.1 The mobile application allows thorough case evaluation.	3.88	1.00	Agree
3.2 The mobile application is a viable replacement for conventional paper-based manual drawing.	3.80	0.99	Agree
3.3 I would recommend the use of the mobile application to other students.	3.76	1.09	Agree
Overall	3.81	1.01	Agree

Table 3. Comparative results of conventional method and mobile application in RPD designing

	Groupings	Mean	Standard Deviation	t-value	p-value 0.05	Significance
Ease of Use	Conventional	4.20	0.56	1.05	P = 0.298	Not Significant
	Mobile Application	4.04	0.93			
Accuracy of Results	Conventional	4.05	0.62	1.94	P = 0.055	Not Significant
	Mobile Application	3.73	1.01			
Satisfaction of Students	Conventional	4.02	0.72	1.18	P = 0.243	Not Significant
	Mobile Application	3.81	1.01			

Table 4. Level of performance of dental students using conventional paper-based method following RPD principles

RPD Principles	3	%	2	%	1	%	Mean	Std. Deviation	V.I.
Major Connector	49	98.0	1	2.0			2.98	0.14	Proficient
Minor Connector	49	98.0	1	2.0			2.98	0.14	Proficient
Direct Retainer	49	98.0	1	2.0			2.98	0.14	Proficient
Indirect Retainer	49	98.0	1	2.0			2.98	0.14	Proficient
Rest	49	98.0	1	2.0			2.98	0.14	Proficient
Denture Base	43	86.0	6	12.0	1	2.0	2.84	0.42	Proficient
Overall Design	28	56.0	20	40.0	2	4.0	2.52	0.58	Proficient
Overall							2.89	1.21	Proficient

Table 5. Level of performance of dental students using mobile software application in RPD designing

Level of Performance using RPD Principles	3	%	2	%	1	%	Mean	Std. Deviation	V.I.
Major Connector			48	96.0	2	4.0	1.96	0.20	Acceptable
Minor Connector			3	6.0	47	94	1.06	0.24	Acceptable
Direct Retainer	37	74.0	11	22.0	2	4.0	2.70	0.54	Proficient
Indirect Retainer			48	96.0	2	4.0	1.96	0.20	Acceptable
Rest			48	96.0	2	4.0	1.96	0.20	Acceptable
Denture Base			48	96.0	2	4.0	1.96	0.20	Acceptable
Overall Design			48	96.0	2	4.0	1.96		Acceptable
Overall							1.94	1.40	Acceptable

Table 6. Level of performance of dental students using conventional method and mobile software application design following RPD principles

	Groupings	Mean	Standard Deviation	t-value	p-value 0.01	Significance
Major Connector	Conventional	2.98	0.14	29.65	P = 0.00	Very Significant
	Mobile Application	1.96	0.20			
Minor Connector	Conventional	2.98	0.14	48.75	P = 0.00	Very Significant
	Mobile Application	1.06	0.24			
Direct	Conventional	2.98	0.14	3.52	P = 0.00	Very Significant
	Mobile Application	2.70	0.54			
Indirect	Conventional	2.98	0.14	29.65	P = 0.00	Very Significant
	Mobile Application	1.96	0.20			
Rest	Conventional	2.98	0.14	29.65	P = 0.00	Very Significant
	Mobile Application	1.96	0.20			
Denture Base	Conventional	2.84	0.42	13.35	P = 0.00	Very Significant
	Mobile Application	1.96	0.20			
Overall Design	Conventional	2.52	0.58	6.46	P = 0.00	Very Significant
	Mobile Application	1.96	0.20			
Total	Conventional	20.26	1.21	25.60	P = 0.00	Very Significant
	Mobile Application	13.56	1.40			

The test on significant difference on the level of performance of dental students in designing RPD using the conventional method and the supplemental mobile application following the RPD principles was analyzed and presented in Table 6. When the level of performance of dental students were grouped according to the two methods used following the principles of RPD designing, significant difference was noted in terms of major connector, minor connector, rest, denture base, and overall design as evidenced by all the p-values of 0.000 which were all lower than the test of significance at 0.01. This resulted in the rejection of the null hypothesis. This shows that the dental students perform better using conventional methods in designing the major connector, minor connector, rest and denture base compared to supplemental mobile application. This may imply that the dental students are more comfortable in using the conventional method that leads to a more proficient performance in terms of those principles in designing RPD. Based on the total mean with p value = 0.000 which is less than the test of significance at 0.01, this shows that there is significant difference in the overall level of performance of dental students. This means that there is a significant difference in the performance of the students using the conventional method compared to the use of software mobile application because the students were already exposed to the use of mobile application. This was argued by the study of Lechner [8], where he developed a computer-aided learning software to help students learn to design RPD and found that there was no significant difference in student's performance using the conventional teaching of the subject and software assisted methodology. The results of the study reveal that RPD design can be taught as effectively with conventional methods and through mobile software application. Summative assessment showed that students could attain the desired outcomes using either the conventional method or through mobile application. However, significant difference between the two methods in terms of level of performance of dental students implies that the school needs to review its syllabus and consider offering enrichment programs on computer aided teaching and learning and use of various design software and application in RPD.

4. CONCLUSION

Based on the findings of the study, it can be implied that there is no significant difference at the outcomes of the students when using the conventional paper-based method or the mobile application. It can be stated that the use of the mobile application software can be a viable supplement for conventional paper-based manual drawing in removable partial denture designing. Online learning has advantages to enhance undergraduates' knowldedge and skills, therefore, can be considered as a potential method in undergraduate medical teaching [9] The use of mobile devices in dentistry courses was useful and their attitudes towards m-learning were high [10].

CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

To ensure appropriate ethical standards in the conduct of scientific research involving human beings, this study was subjected for evaluation by the Institutional Ethics Review Committee of Centro Escolar University. This warrants that the study adhered to ethical principles to protect the dignity, rights, and welfare of the subjects of this research study.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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