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The Satisfaction of Copy Denture Box for Replica Denture Procedures

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Abstract— Replica denture procedure is one of the technique for replacement of the old complete. The objective of this study was to assess the satisfaction of copy Denture Box in the mode of easy-handling, cost effectiveness and time saving. Seven prototypes of Denture Box were constructed using 3D printer using ABS materials. 30 dental technicians had been randomly selected from three public universities and private dental laboratory. The respondents were given a chance to try the Denture Box using alginate to produce a mould for making the replica. A pre-tested questionnaire consisted of few questions pertaining knowledge, background and satisfaction towards the copy Denture Box were distributed. 15 (n) respondents had tried the Denture box. Most of the respondent has 10-15 years of working experience. 87% (n=13) respondents were agreed that the copy denture box was easy to handle with a mean score of 4.13(± 0.25) and able to save cost, 93% (n=14) with a mean score of 3.93 (±0.18). Even though all the respondents were satisfied with the box, there was no statistical relationship between subjects preference technique and their willingness to use the newly invented box in the future (p>0.05). Respondents gave an encouraging feedback in the manner of easy-handling, cost effectiveness and time saving of the copy Denture Box. Further study to assess the accuracy of the replica is recommended.

Keywords— Copy denture; denture replica; duplicating process.

I. INTRODUCTION

In 1960's, copy denture techniques were initially introduced to make a spare denture [1]-[2]. However, it has undergone several modifications and used as an alternative to replace primary impression [3]. With the aid digital technology, scanning and 3D printing had been introduced to improve the conventional copy denture procedure [4].

The copy denture technique modifies any discrepancies in fitting surface and the occlusal surface of the previous denture. The denture reproduces favourable aspect of polished surface and tooth position [5]. It also can improve the aesthetic from previous dentures. It would help to reduce problems in newly made denture, especially in term of neuromuscular adaptation [6]. The usual problem aroused from replacement of complete denture in elderly population was they have difficulty in muscle adaptation of their new denture [7]. The frustration that aroused from complaint was due to problem in neuromuscular coordination, patient's motivation in learning new skills and adaptation of health supporting tissue [8]. Currently, the copy denture technique introduced was varied and do not have standard procedures [9]-[16].

Due to this current condition, a team of researcher has invented a box for copy denture procedure. The prototype box was constructed using 3D printer Acrylonitrile Butadiene Styrene (ABS) materials and designed for suitable use of alginate impression materials and silicone. The denture replica can be made from cold cure acrylic and wax to reduce cost in the laboratory procedure. The aim of this study was to

assess the knowledge of the dental technician on copy denture and assess the satisfaction of the newly invented copy denture box.

II. THE MATERIAL AND METHOD

A. Materials

Seven newly invented copy denture boxes were constructed using 3D printer material. All respondents were asked to try the invented copy denture box. The respondents needed to give feedback after the replica denture procedure.

B. Sampling

The respondents were chosen through randomized sampling. A total of thirty technicians from three (3) public universities and private dental laboratory, and clinicians who had experience with copy denture procedure during their practice (N=30).

C. Questionnaire

A bilingual questionnaire was developed and validated by two prosthodontics who did not involve in this study. It consists of three parts, which were demographic, knowledge and assessment on Denture Box. The assessment included easy-handling, cost saving and time saving criteria. Each of the criteria was assessed using Likert-scale. Score 1 representing the least favourable response and 5 the most favourable response.

D. Data analysis

Data were analysed to determine satisfaction levels of respondents towards copy denture box. Score for Likert Scale was set before the data were analysed. For easy-handling, if the score was more than 12, the respondent was considered to be satisfied with the copy denture box. For cost effectiveness, the score was set to be at more than 6 and lastly, for time saving, the score was set at more than 4. The score for total level of satisfaction was more than 22. The Chi Square test was used to find the relationship between clinician/technician preference techniques with their willingness to use the copy denture box in the future.

III. RESULT AND DISCUSSION

TABLE I
ASSESSMENT ON KNOWLEDGE OF RESPONDENTS ON COPY DENTURE TECHNIQUE

Characteristics	Frequency (%)
Occupation	
Private dental technologist	7 (46.7)
Public universities dental technologist	5 (33.7)
Clinician	3 (20)
Years of experience	
<5 year	1 (6.7)
5-10 year	4 (26.7)
10-15 year	5 (33.3)
>15 year	2 (13.3)

TABLE II
ASSESSMENT ON KNOWLEDGE ON COPY DENTURE TECHNIQUE

Variables	Frequency (%)
Do you know that copy denture can be done using these materials?	Answer Yes
Soapbox and alginate	14 (93.3)
Impression tray and silicone	12 (80.0)
Other material	4 (26.6)
Not sure	1 (6.7)
I prefer this technique for copy denture	Answer YES
Soapbox and alginate	10 (66.7)
Impression tray and silicone	4 (26.6)
Others	1 (6.7)
Do you know the advantages of copy denture?	Answer YES
Easy to handle	4 (6.7)
Save time	12 (80.0)
Elderly can adapt new denture easily	9 (36.6)
Number of denture constructed using copy denture	
1-5	8 (53.3)
More than 10	7 (46.7)
Copy denture technique is convenience than conventional technique	
Yes	14 (93.3)
Not sure	1 (6.7)
I will use this box in the future	
Yes	13 (86.7)
Not sure	2 (13.3)

Out of 30, only 15 individuals agreed to take part in this research. All of them completed the questionnaires after they have used the new copy denture box. 47% were private dental technologist, 33% were dental technologist from public universities and 20% were dental clinician. The majority of the technicians which are 33.3% had working experience up

to ten years and only 6.7% had worked less than five years as shown in Table I.

TABLE III
CHI-SQUARE TESTS ON THE PREFERENCES AND THE WILLINGNESS TO USE THE BOX IN THE FUTURE

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	7.212 ^a	4	.125
Likelihood Ratio	5.279	4	.260
N of Valid Cases	15		

a. 9 cells (90.0%) have expected count less than 5. The minimum expected count is .13.

TABLE IV
ASSESSMENT OF COPY DENTURE BOX:

Variable	Frequency (%)			Mean score (SD)
	Disagree	Not sure	Agree	
Easy-handling				
Copy denture box is easy to use	2 (13.3)	0 (0.0)	13 (86.7)	4.13 (0.25)
Copy denture box make your work easier	1 (6.7)	0 (0.0)	14 (93.3)	4.27 (0.21)
Copy denture box is suitable for alginate.	1 (6.7)	0 (0.0)	14 (93.3)	4.27 (0.21)
Copy denture box is suitable for silicone.	5 (33.4)	7 (46.7)	3 (20.0)	2.80 (0.22)
Cost saving				
Small amount of materials (alginate/silicone) needed to make copy denture replica by using this box.	2 (13.4)	5 (33.3)	8 (63.3)	3.47 (0.27)
The cost of copy denture box worth its usage	0	4 (26.7)	11 (73.3)	3.93 (0.18)
Time saving				
Copy denture box can reduce laboratory work process.	0	0	15 (100.0)	4.53 (0.13)

Table II exhibits the assessment on knowledge of respondents on copy denture technique. 100% of the subjects claimed that they have knowledge on copy denture procedure. 66% of them preferred to use soapbox with alginate when they have a chance to do copy denture procedure. It was followed by the use impression tray with silicone (13%) and others. Concerning their experience with copy denture, most of them has constructed at least once piece of denture using copy denture technique. In addition, 93% respondent agreed that copy denture were more convenient than conventional techniques. Even though most of respondent were dental technologist, they were aware that the copy denture would help to reduce the adaptation time for the elderly. The finding reflected that sample preferred copy denture technique before trying the new invented copy denture box. However, after using the newly invented copy denture box, there is no statistical relationship between subjects preference technique and their willingness to use the newly invented box in the future ($p>0.05$) as shown in Table III. Apart from that, 86.7% and 80% of them are willing to use and promote the use of newly invented copy denture box to others respectively.

The assessment of new invented copy denture was encouraging. Most respondents said it was easy handling,

86.7% of respondent agreed that the box was easy to use; 93.3% and 93.3% agreed that it makes work easier and suitable for alginate respectively. However, 46.7% were not sure whether the box was suitable for silicone as depicts in Table 4. On the analysis for cost saving shown in Table 5, the majority of the subjects (53.3%) agreed that, by using copy denture box, small amount of impression material was needed. 73.3% agreed cost of box worth its usage. Besides that, in terms of time saving, all of the respondents agreed that the invented copy denture box can reduce laboratory work process with 46.7% agreed and 53.3% strongly agreed as in Table 6. Overall, all of respondent showed positive response on all of the three aspects assessed.

The respondents' dropout rates are 15 out of 30 (50%). Respondents that involved in this study were technicians and clinicians that had experienced constructing new denture using copy denture procedure. In addition, the respondents' knowledge on copy denture procedure was good as they can recognized various copy denture techniques and acknowledged the benefits of each technique especially in term of time saving. However, very few knew that the copy denture can benefit the elderly population in term of denture adaptation need shorter time. This might be due to most of them are not aware of the clinical important rather than the laboratory aspect. Similar finding found in dentist's knowledge on copy denture, they have the knowledge on copy denture but they did not practice the technique [17].

The assessment on the invented copy Denture Box in terms of easy-handling, 46.7% of the respondents were not sure whether silicone is suitable or not to use with the new box. Silicone was not being provided to the respondent to try it with the new box during the procedure. In addition, most of the current copy denture technique box use alginate as impression material such as Murray-Wolland box and soapbox for copy denture technique [14]-[15].

Assessment of cost saving showed the respondents agreed that less amount of alginate or silicone needed as compared to when using soapbox. Alginate was used because it is cheaper, less expensive material and easy to handle [14]-[15]. Furthermore, the majority of the respondent's preferred alginate and soapbox technique prior tested the newly invented box. On the other hand, soapbox will produce more bubble-effect which will affect the accuracy of the replica. Barclay stated a problem that was experienced by clinicians to practice the copy denture is expensive flask for copy denture technique [5]. Thus, the newly invented box was targeted to be cheaper than the other flask. Based on the finding, the majority of the respondents agreed that cost of the box worth its usage. Thus, the newly invented box can save time because it does not need any modification and ready to be used like a Murray-Wolland box [14].

Overall, all respondents showed positive response for the satisfaction assessment. However, even though clinician and technician had used the newly invented copy denture box, they might not use it in the future. Based on a local finding, it showed that the technician or clinician has a positive attitude towards copy denture, but they do not practice copy denture due to lack of training [17]. In addition, some clinicians had never been taught this technique during their undergraduate study [5].

The limitation of this study was the prototype material of the copy denture box was made from 3D printer materials, Acrylonitrile Butadiene Styrene (ABS). ABS is a cheap material and strong. However, when it is exposed to UV light, it becomes brittle. During the procedure, several prototypes were broken after being tested by the respondent. The final material for the copy denture box is polycarbonate material (plastic). Polycarbonate material is more durable and stronger [18].

Further research to compare the newly invented box with other instruments, such as Murray-Wolland box and soapbox is needed. In addition, the accuracy of the replica made from auto-polymerising acrylic resin and wax using the invented box may also be tested.

IV. CONCLUSIONS

In conclusion, it was found that, most of the respondents preferred copy denture technique than conventional technique. The respondents also gave positive and encouraging feedback in terms of easy-handling, cost saving and time saving of the invented copy denture box.

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REFERENCES

- [1] S.G. Manoli and T.P. Griffiths, "Duplicate Denture Technique," *The Journal of Prosthetic Dentistry*, vol. 2, pp. 104-107, Jan. 1969.
- [2] Adam, C.E, "Technique for Duplicating an Acrylic Resin Denture," *The Journal of Prosthetic Dentistry*, vol. 8, pp. 406-410. May. 1958.
- [3] R.M. Basker, J.C. Davenport and J.M. Thomason, *Prosthetic Treatment of the Edentulous Patient*. England: John Wiley & Sons Ltd., 2011.
- [4] K. Kurahashi, T. Matsuda, T. Goto, Y. Ishida, T. Ito, T. and T. Ichikawa. "Duplication of complete dentures using general-purpose handheld optical scanner and 3-dimensional printer: Introduction and clinical considerations." *Journal of Prosthodontic Research*, vol. 61, pp.81-86. March. 2017.
- [5] C. Barclay. *Prosthodontics. Master Dentistry: Volume 2: Restorative Dentistry, Paediatric Dentistry and Orthodontics*, 2nd Ed. Churchill Livingstone: Elsevier Health Sciences, pp.119, 2008.
- [6] S.R. Habib and F.A. Vohra, "Replacing Existing Dentures by Copy-Denture Technique for Geriatric Patients: A Case Report." *JPDA*, vol. 22, pp. 265-270, Oct. 2013.
- [7] J.F. McCord and A. Grant, "Identification of complete denture problems: a summary," *British Dental Journal*, vol.189, pp. 128-134, Aug. 2000.
- [8] C. Stilwell, "Risk management in clinical practice. Part 6b. Identifying and avoiding medico-legal risks in removable dentures," *British Dental Journal*, vol. 209, pp. 339-350, Oct. 2010.
- [9] A. Rajapur, "Duplication of Complete Dentures Using Autopolymerizing Acrylic Resin: A Review of Techniques," *International Journal of Prosthetic Dentistry*, vol. 2, pp. 8-11, Apr. 2011.
- [10] H.C. Karkazis and A. Kossioni, "A Copy-Denture Technique: Laboratory and Clinical Procedures," *Univ. Of Athens, Quintessence of Dental Technology*, vol. 18, pp. 159-164, 1995.
- [11] S. Soo and A.C. Cheng, "Complete Denture Copy Technique-A Practical Application," *Singapore Dental Journal*, vol. 35, pp. 65-70, Dec. 2014.
- [12] C.P. Owen, "New Dentures From Old: A Duplication Method Using "Appropriatech"." *Journal of the Canadian Dental Association*, vol. 72 pp. 393-397, June. 2006.

- [13] T.J. Lindquist, T.O. Narhi, and R.L. Ettinger, "Denture Duplication Technique with Alternative Materials," *The Journal of Prosthetic Dentistry*, vol. 77, pp. 97-98, Jan. 1997.
- [14] I.D. Murray and A.W. Wolland, "Simple Denture Copying Using the Murray-Wolland Duplicating Box System," *Univ. of Newcastle Upon Tyne, The Dental Technician*, vol. 39, pp. 4-8, 1986.
- [15] D. Sendhilnathan and S.V. Nayar. "Fabrication of Duplicate Denture from Existing Complete Dentures", *Journal of Indian Prosthodontic Society*, vol. 7, pp. 188-189, Oct. 2007.
- [16] T.J. Lindquist and R.L. Ettinger. "Patient Management and Decision Making In Complete Denture Fabrication Using a Duplicate Denture Procedure: A Clinical Report", *The Journal of Prosthetic Dentistry*, vol. 82, pp. 499-503, Nov. 1999.
- [17] N. Yacob, W.N.S. Wan Ali, and F. Abdul F., "Copy denture techniques: Why not?" in *Proc. The International Conference on Healthy Ageing*, 2014, p. 61.
- [18] J. Francois. (2012) Review: What Materials can be 3D Printed? 3D Printer Improvements. [Online]. Available : <http://www.tridimake.com/2012/12/3d-printing-plastic-filaments-kinds-and.html>