An Evaluation of a Novel Decision Aid - Mobile App in a Shared Decision Making for Patients in Dentistry

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ABSTRACT

The idea of Shared Decision Making (SDM) is well known in medical field but not well acknowledged in dental practices. It is an educational model for actively involving patients in clinical decision making process by providing patients with the best currently available clinical evidences regarding treatment outcomes, allowing for the clarification of patient and practitioner preferences. SDM need to be implemented effectively with the use of decision aids that provide evidence-based answers for patient questions and integrate the patient preferences. This study aimed to develop a novel Decision Aid – Mobile App (MA) for chairside used in the SDM process and to compare patients' dental knowledge, satisfaction and anxiety level by using MA and Standard Care (SC). The MA was developed by mobile app designer and researchers. The MA provides an evidence-based prognoses, benefits, risks and costs for various treatment options based on review by a group of prosthodontists. Thirty-four (34) participants were selected to participate in this study. Subjects were randomly assigned into two groups which were SC (n=17) and MA (n=17). Questionnaire regarding knowledge, satisfaction and anxiety was answered by the subjects after the treatment

options discussion in the students' clinic. From the results of this study, 26 questionnaires (76.5%) were completely answered and included in the study. Subjects in the MA group (n=13) demonstrated a statistically significant increase in knowledge (chi-square test; p<0.05) compared to the SC group (n=13). However, there was no significant difference between two groups with regards to their anxiety and satisfaction level (Mann-Whitney U-test; p>0.05). This study reported that the use of novel mobile app as a decision aid play an important role to facilitate SDM process in clinical dentistry. The result has reported a significant improvement in patient knowledge of prosthodontic treatment options.

Keywords: *Decision aid, Treatment options, Mobile app, Shared decision making, Fixed prosthodontics*

INTRODUCTION

The idea of Shared Decision Making (SDM) is well known in medical field but not well acknowledged in the dental practices. It is a model for actively involving the patients in the clinical decision-making process by providing patients with the best currently available clinical evidence regarding expected treatment outcomes, and allowing for the clarification of patient and practitioner preferences (Johnson et al., 2006). Besides, SDM does not only covers the inclusion of the ethical diversities involve in patient-centered care, but also the quality improvements in the decision-making process (Gyu et al., 2012). Therefore, it has been suggested that SDM is imperative for a routine dental patient care (Ng et al., 2013).

In the SDM concept, the patient and clinician will consider outcomes probabilities and patient preferences of a certain treatment where they will then come up with mutual agreement on appropriate healthcare decision. Few earlier studies have reported that most patients would want to be involved in making decision for their treatment plan (Barrat 2008; Frosch& Kaplan, 1999). It is an option to the paternalistic care model which was widely practiced for many years, where SDM can now help patients and clinicians to get afinal decision that satisfy for both patients and clinicians (Frosch& Kaplan, 1999; Towle& Godolphin, 1999). However, there are possible interferences or limitations for an effective SDM implementation

that requires further address including lack of communication skills from the clinicians, task complexity, lack of time and missing information (Barry 2002; Elwyn et al., 1999; Gravel et al., 2006). In Malaysia situation, an overview reported by Ng et al., 2013 revealed that very few clinicians implement SDM approach which was partly due toinadequate training, research and teaching of SDM in local undergraduate and postgraduate curricula and the lack of accurate and accessible health information.

A good and well-designed Decision Aid (DA) used by clinicians and patients may increase the effectiveness of SDM implementation (Barrat, 2008). The DA is an important tool in SDM as it facilitates patient and clinician to choose a suitable treatment option that can satisfy the patient's expectation (Charles et al., 1997) and share relevant and accurate information to patient with different needs of information (Johnson et al., 2006). It was reported that the usage of DA increases satisfaction with decision making, reduce anxiety, and improve knowledge and realistic expectations. The increase active participation in decision making by patients did reduce decisional conflict and the number of patients remaining undecided for their treatment options, and improve agreement between values and choice (O'Connor et al., 2003). DA also provides patients with personal and cultural utilities in understanding treatments, relevant alternatives, diagnosis, prognosis, and in reducing uncertainty as well as assist dentists in determining treatment options, cost effectiveness, and efficient patient care for improving oral health, successful outcomes, and personal self-care (Bauer et al., 2005).

Today, the dental profession is facing the effect of changing epidemiology, demographics transition, and the rapid development of science and technology. Therefore, dentists must be able to bridge the gap between media and the advances in research occurring during their professional plus they need to evaluate systematically the various methods of possible diagnosis and treatments, and apply them in practices to help patients to make a decision in respect to their concerns (McCreery& Truelove, 1991).

The hypothesis of this study is that the usage of newly developed DA in SDM approach will increase patient knowledge, higher patient satisfaction and may reduce anxiety level in comparison to the Standard Care (SC)

which is the standard discussion with informed consent. Therefore, the first objective of this study is to develop a novel chair-side Decision Aid - Mobile App (MA) that explains the treatment choices, benefits, risks, prognosis in single missing tooth replacement. The second objective of this study is to compare the patients' dental knowledge, satisfaction and anxiety level by different approach using MA and SC.

MATERIALS AND METHODS

This study was a Randomized Controlled Clinical Trial (RCT) to evaluate the use of decision aid in SDM process while making the best treatment option for their single missing tooth replacement. It was conducted among patients who were referred to the Centre for Restorative Dentistry Studies, Faculty of Dentistry, UniversitiTeknologi MARA (UiTM). Ethics approval was obtained from the Ethics Committee of the Institute of Research Management and Innovation UniversitiTeknologi MARA (Reference: REC/47/17). The informed consents of the 34 patients were obtained prior to start the study.

Development of the Mobile Apps Decision Aid

A draft of MA with content for SDM process was developed by the researchers. The MA draft was designed bilingually in Malay and English, and it was distributed to three Prosthodontists for their expert opinions and content verification. The contents of the DA included advantages, disadvantages, time, costs, and longevity for each treatment options for a single missing tooth replacement based on the current literature review. With regards to the estimated time and cost of the treatment option section, information was based on the average time taken for an undergraduate dental student to complete the treatment, and the costs were based on the current Faculty of Dentistry UiTM fee schedule. Animations and clinical pictures, consented by the patients,were embedded to provide patients with better understanding and visualization of each treatment procedure. Upon completion and verification of the content, the draft was sent to a mobile app developer for designing and installation in an Android mobile device. The MA was then made accessible to the public as shown in Figure 1 and 2.

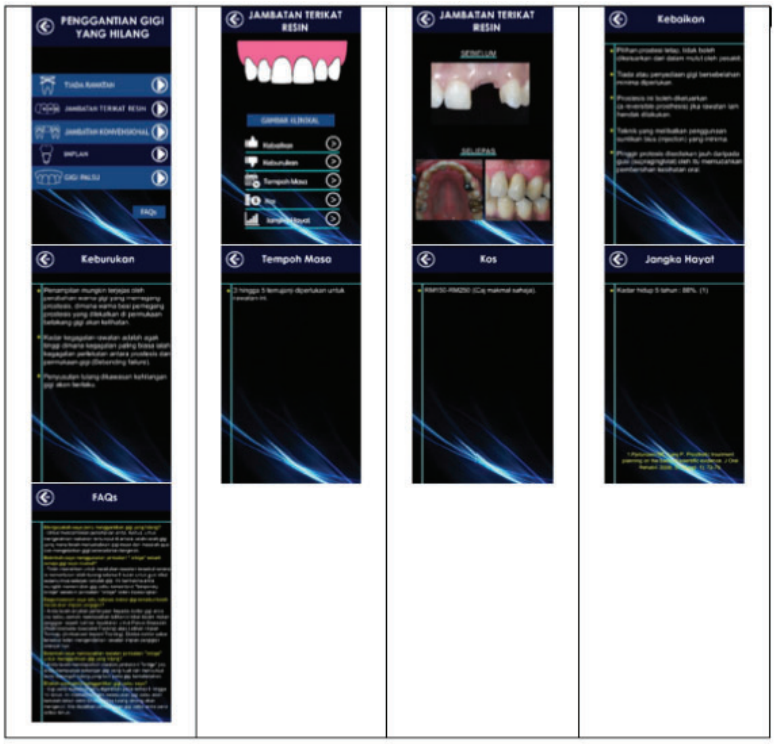

Figure 1: Final Mobile App Decision Aid (Malay version)

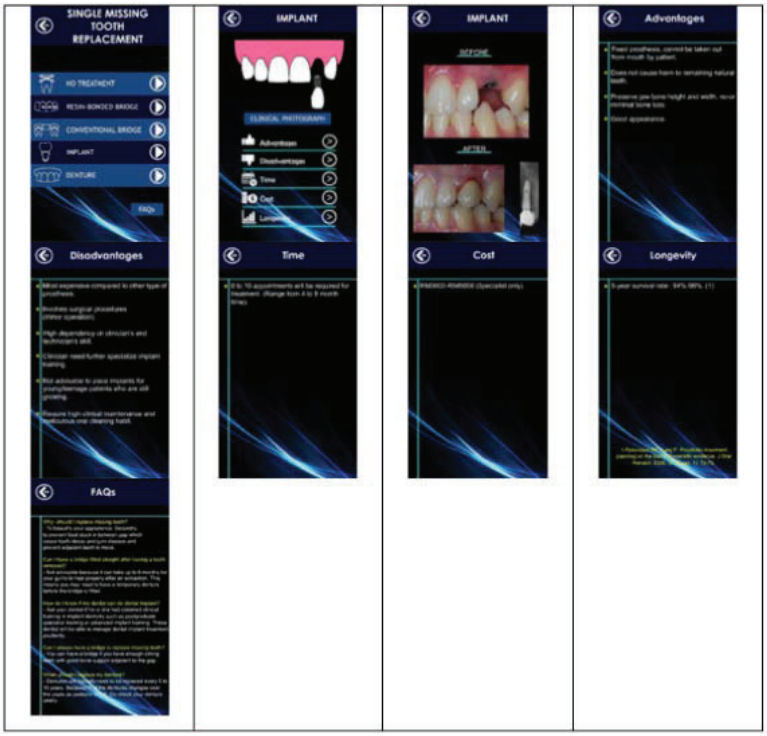

Figure 2: Final Mobile App Decision Aid (English version)

Preparation of Questionnaire

The questionnaire was adopted (Johnson et al., 2006) and modified for an evaluation of patients knowledge, satisfaction and anxiety level for a fixed prosthodontic treatment option of single missing tooth replacement. Five questions were prepared to assess the patient knowledge in the following topic: chance of success, treatment cost, benefits, risks and adequacy of information as shown in Figure 3. The satisfaction and anxiety level were both measured using a seven-point Likert scale as shown in Figure 4.

1. What is the approximate chance of success for your treatment? _____ %
2. About how much will it cost for all treatment associated with this tooth?

   RM_____
3. What do you consider to be the major benefit of your treatment?

   _____
4. What is/are the major risk(s) associated with your treatment?

   _____
5. Do you feel that you were given enough information to make the best treatment choice

   (circle one) ?

   YES NO

Figure 3: Questions to Assess the Knowledge in the Questionnaire

6. How satisfied were you with the explanation of your treatment options?

1 Very dissatisfied	2 Dissatisfied	3 Somewhat dissatisfied	4 neutral	5 Somewhat satisfied	6 satisfied	7 Very satisfied

6. Did the explanation of treatment options make you more or less anxious about the

   treatment?

1 Much less anxious	2 Less anxious	3 Slightly less anxious	4 No difference	5 Slightly more anxious	6 More anxious	7 Much more anxious

Figure 4: Seven-point Likert Scale to Assess Satisfaction and Anxiety Level

Sample Size Determination

The sample size was determined based on the previous similar study carried out by Johnson et al. (2006). They had determined the minimum sample size for the patient knowledge was seventeen subjects per group, while satisfaction and anxiety level was determined to be forty each group.

Inclusion Criteria

The inclusion criteria of the subjects participated in the study were:

1. Clinically presented with a single missing tooth that need replacement.
2. Patients who are not illiterate
3. Age 18 and above
4. Capable to make own decision with no advanced Alzheimer's disease, severe learning difficulties or Down's syndrome.
5. Understand Malay or English well

Study Set-up

As shown in Figure 5, thirty-four (34) consecutive subjects that met all the inclusion criteria were selected to participate in the study. They were recruited by the undergraduate dental students from the waiting list of patients referred to Centre for Restorative Dentistry Studies for missing tooth replacement. Researcher 1 (SNS) and 2 (MF) were well trained to use the mobile app and they were calibrated to perform the study, each of them in-charged of Standard Care (SC) and Mobile App Decision Aid (MA) respectively to avoid bias. Randomization was performed through drawing a labeled envelope from a box and all the subjects were randomly assigned into two groups: Group A (SC) with researcher 1, Group B (MA) with researcher 2. Thirty-four (34) patients were involved in this study after informed consent obtained. However, there were only twenty-six (26) questionnaires were useable due to eight (8) questionnaires were not properly completed and could not be evaluated. Both groups had undergone SDM process to discuss the advantages, disadvantages, time, costs and longevity

for each treatment option to replace missing tooth using standard care (SC) which is a normal discussion between clinician (researcher) and patient (subject); mobile app decision aid (MA), which the subject need to download it from the Google Play Store using their smart phone and subsequently discussed the same information with the researcher. After the discussion, all the subjects need to complete the questionnaires regarding the treatment option that they just chose. Then the researcher placed the questionnaire in a sealed labeled envelope and collected all for data analysis.

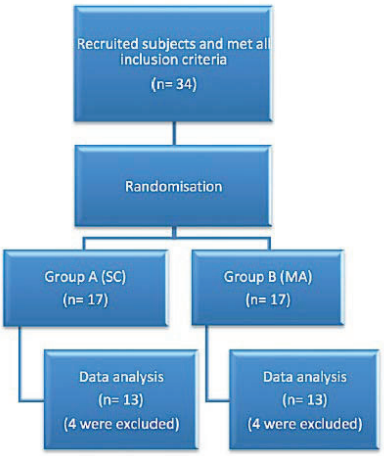

Figure 5: Study Set-up

Statistical Analysis

In this study, the patient knowledge, satisfaction and anxiety level were analyzed accordingly. Chi-Square test was used for group comparison with regards to their knowledge questions, while, the patient satisfaction and anxiety level were both analyzed using Mann-Whitney U-test. Statistical significance level was determined if $p<0.05$. All the statistical analysis was performed using Statistical Software (SPSS Statistics 21, IBM, Chicago, IL, USA).

RESULTS

Knowledge of the fixed prosthodontic treatment options was measured using a percentage showing the total number of correct answers to five questions. MA demonstrated a statistically significant increase in knowledge compared to the SC group (Chi-square; $p<0.05$). In general, all the knowledge questions were correctly scored higher in the MA group compared with SC group. The biggest differences between groups were found with question no 2 (38 percent), question 3 (38 percent) and question 5 (54%) as shown in Figure 6.

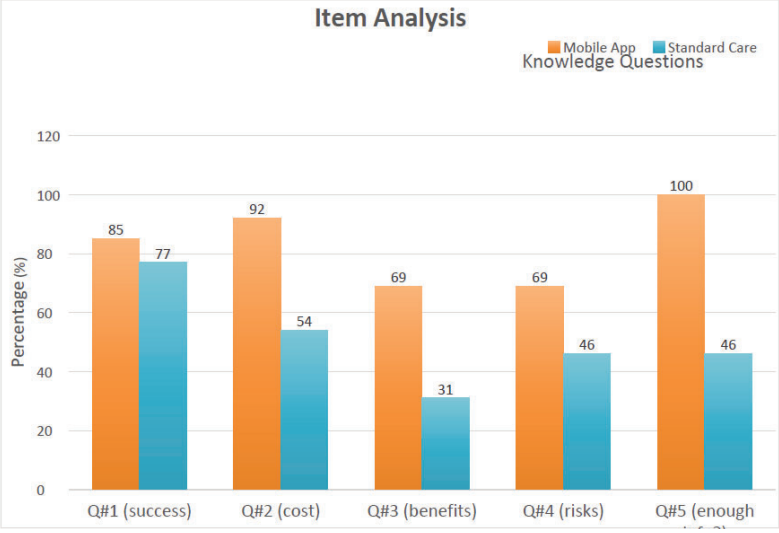

Figure 6: Comparison of the Percentage of the Correct Answer between Groups

With regards to the patient satisfaction, it was assessed by question 6 using a seven-point Likert scale as shown in Table 1. An increased scored of number indicated a higher level of patient satisfaction with the treatment options discussion. However, there was no significant difference between SC and MA using the Mann-Whitney Rank U-test. ($p>0.05$).

Table 1: Comparison of the Satisfaction between Groups

	1 (very dissatisfied)	2 (dissatisfied)	3 (somewhat dissatisfied)	4 (neutral)	5 (somewhat satisfied)	6 (satisfied)	7 (very satisfied)
Mobile Apps	0	0	0	0	4	6	3
Standard Care	0	0	0	0	4	7	2

Pertaining to anxiety level, it was measured by question 7 using a seven-point Likert scale as seen in Table 2. A lower scored of number indicated less anxiety about the treatment choice. Again, there was no significant difference between both groups using the Mann-Whitney Rank U-test ($p>0.05$).

Table 2: Comparison of the Anxiety between Groups

	1 (much less anxious)	2 (less anxious)	3 (slightly less anxious)	4 (no difference)	5 (slightly more anxious)	6 (more anxious)	7 (much more anxious)
Mobile Apps	6	5	1	0	1	0	0
Standard Care	9	4	0	0	0	0	0

DISCUSSION

Shared Decision Making with Mobile App (MA) as the Decision Aid (DA)

Medical Health care decisions can be grouped either “effective” treatment or “preference sensitive” treatment. “Effective” treatments are referred to when treatment advantages are significantly better compared to the disadvantages, thus improve the quality of life of the patients. On the other hand, the “Preference Sensitive” are treatments relying on patient values with uncertain treatment advantages and disadvantages. It is suggested that with the use of DA during decision making process, it will

give patients more insight information of the diseases and facilitate patients and clinicians to make a sensible decision especially for a preference-sensitive treatment (Levine et al., 1992). In Malaysia, it was reported that clinicians are still being dominant in making healthcare decisions with minimal involvement of the patients. One of the recommended protocol in the study to promote SDM approach among clinicians and patients was to incorporate SDM into research, clinical practices and teaching curriculum (Ng et al., 2013).

Today, generation Y or the millennial generation grew up in culturally diverse schools, are tech-savvy, enthusiastic, confident, well networked and learning oriented individuals. While, the other elder generations have also been exposed to all new technology especially smart phones. Therefore, utilization of MA to further explain the treatment options during the treatment planning stage might be the best methods to communicate with most of the patients. At present, MA currently provided nine thousand software related to medicine and fifteen thousand software for wellness (Marceglia et al., 2012). However, utilization of Apps in the dental clinics for patient education or SDM process in Malaysia is currently lacking (Mustaza et al., 2016). Hence, this newly developed MA is useful for the clinicians and patients during SDM process. It was designed into Malay- English bilingual which would be easily understood by most of the Malaysian and foreign patients. Besides that, incorporation of some dental animations using simple layout, clinical pictures and Frequently Asked Questions (FAQs) to further explain and provide patients with better idea regarding the offered treatment options, subsequently facilitate and improve the effectiveness of SDM process as it has shown in this study.

Increase of Patients' Knowledge and Satisfaction, Reduce of Anxiety Level

Thirty-four (34) patients were recruited in this study, but there were only twenty-six (26) questionnaires were useable. This study found that the differences regarding patient knowledge between the SC and MA groups was statistically significant, with the knowledge of chosen treatment option was scored higher in MA group. The result suggested that MA assisted the SDM approach more effectively regarding the prognosis and cost of the treatment and delivered adequate information to the patients (100%). At

the same time, the remaining two knowledge questions regarding benefits and risks were also scored higher in MA group, which were about 70% of subjects answered correctly. The positive increase might be contributed by the animation and photos embedded in the MA group which facilitate patients' understanding of the diseases and treatment options. Findings from the present study was consistent with one previous study (Johnson et al., 2006). With regards to the patient satisfaction and anxiety level, it has revealed that no statistically significant different between SC and MA groups. The score for satisfaction level question was similarly high for both groups, as 70% of the subjectsreported 'satisfied' and 'very satisfied'. On the other hands, the score for anxiety level question was low where more than 80% of the subjects reported they were 'less anxious' and 'much less anxious' in both groups. In comparison with related studies, this result was reported similar with Johnson et al., 2006 and by O'Connor et al., 2003. It was deemed that these findings might be associated with the well calibrated and informative clinicians conducting the study. Thus all subjects did rate high satisfaction and low anxiety level using MA and SC intervention.

Future Prospect of the Mobile App Decision Aid

From the results of this study, one could propose that further development of this MA to various dental problems would be appreciated. On the other hand, due to the significantly increase penetration of smartphones and tablets amongst the public, the continuous potential growth of this MA in dentistry could be a profitable business developments in the future.

CONCLUSION

This study reported the use of a novel mobile app as a decision aid to facilitate SDM process in clinical dentistry. Significant improvement in patients' knowledge of prosthodontic treatment options were established. On the other hand, high patients' satisfaction and low anxiety level were also achieved using both mobile app and standard care intervention.

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