The Use of Tele-dentistry to Improve Learning the Modified Complete Denture Technique: A Qualitative Study

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Abstract

Complete edentulism adversely affects the health and quality of life in older adults. Simplified treatment procedures may encourage general dentists to treat edentulism with success. Tele-dentistry also offers a solution to coaching general dentists in remote areas. Thus, the aim of this study was to evaluate the learning outcomes of non-interactive and interactive self-study using videoconferences and text for general dentists to practice the modified complete denture technique. Participants were general dentists with less than five years of experience. All participants attended a 3-hour self-study session and were assigned to interactive or non-interactive groups while treating edentulism using the modified complete denture technique. The *participants' perspectives on* the *value of learning, self-confidence, satisfaction, and ability to complete the tasks were collected using focus group*s. *The findings showed that* the *self-study sessions were adequate for understanding the treatment procedures*. Both interactive and non-interactive groups *similarly accomplish*ed the treatment with complete dentures. *A crucial factor* in comprehension *and confidence*-building is the use of a video in the self-study d*emonstrating clinical procedures*. The satisfaction in learning outcomes of both groups were similar, except that the interactive group showed more confidence because they could discuss their cases with an expert. Videoconferences in group, private chat, or group chat are v*iable options for consultation, depending on individual preference*s. *However, most participants mentioned that a private videoconference may cause unpleasant pressure*. *Self-study* is *sufficient for learners to achieve desirable outcomes, but online interaction increased self*-confidence in learners and might be embraced for future improvement.

Keywords: *Online Learning, Tele-education, Complete Denture, Modified Complete Denture Technique*

1. Introduction

Based on the Thailand National Oral Health Survey (2017), tooth loss is a growing problem among older Thai adults, which significantly impacts their quality of life (8th Thai National Oral Health Survey, 2017). Edentulous patients have decreased masticatory function, malnutrition, social impairment, and a shorter lifetime (Emami, de Souza, Kabawat, & Feine, 2013; 8th Thai National Oral Health Survey, 2017). There is a possible relationship between complete edentulism and the risk of developing other comorbid conditions (Felton, 2009). Therefore, fully edentulous patients require oral rehabilitation. However, many patients are on a waiting list for complete dentures (CDs) in community hospitals. Most dental schools in Thailand include treating edentulous patients in the undergraduate curriculum. However, the recent graduates might feel a lack of confidence and experience in treating complete edentulism. Furthermore, conventional clinical procedures for complete dentures require considerable chair time and multiple dental visits. The simplified technique only requires four clinical steps, eliminating the need for a second impression, a face-bow transfer, and a separate appointment for the try-in of the anterior teeth (Cunha et al., 2013; Kawai et al.,

2005; Regis et al., 2013). We modified the technique to reduce clinical procedures while maintaining conventional complete denture principles. The modified complete denture technique requires approximately three dental visits. The first visit is to create preliminary models using alginate impressions and stock trays. These preliminary models are for the preparation of maxillary and mandibular occlusal rims for bite registration and final impressions in the second visit. In the third visit, complete dentures will be inserted and delivered. Systematic reviews demonstrated that general dentists may use the simplified method and achieve similar results with significantly fewer dental visits (Paulino, Alves, Gurgel, & Calderon, 2015; Ye & Sun, 2016). If general dentists in community hospitals are trained to use the modified complete denture technique, this could markedly reduce the time that patients spend waiting for edentulism treatment.

Tele-dentistry is an alternative strategy for improving dental education in remote areas due to a shortage of manpower to teach in the community. There is growing support for the efficacy of tele-dentistry as it has been shown that tele-dentistry is equally effective or better than non-tele-dentistry approaches in many ways (Estai, Kanagasingam, Tennant, & Bunt, 2017). However, most tele-dentistry studies are limited to tele-diagnosis and tele-consultation (Mariño & Ghanim, 2013).

There has been only one report to instruct general dentists about prosthodontic procedures. Keeppanasserril, Matthew, and Muddappa (2011) evaluated whether recently graduated dentists with remote supervision from specialists could provide good overdentures and promote patients' oral health-related quality of life. One group received instruction remotely via video conferencing, mobile devices, and emails, whereas the second group received instruction in-person at the dental school. The study found that recently graduated dentists from both groups provided similarly good overdentures regardless of whether they received remote supervision or direct teaching. Thus, remote supervision with the aid of tele-dentistry, such as online self-study sessions, may be considered for clinical training. The online self-study sessions are beneficial as learners can customize their learning pace and review the material as needed (Chen et al., 2003). Nonetheless, the perspectives of the trainees towards self-study and/or remote supervision have never been reported.

In response to the need to train general dentists to perform the modified complete denture technique, an online module has been designed for self-study and professional development. However, it is not known whether these self-study sessions, with or without remote supervision, are sufficient for learners to achieve the required clinical skills. To investigate the usefulness of the module, all participants had access to self-study sessions, but only the interactive group joined videoconferences and private chats while treating edentulism using the modified complete denture technique. Then, the learning outcomes in the learners' perspective of non-interactive self-study and interactive self-study were described and evaluated. The scope of this research is limited to the study of learning outcomes from the learners' perspective and does not cover treatment results or treatment quality.

2. Objectives

To describe and evaluate the learning outcomes in the learners' perspective of non-interactive self-study and interactive self-study groups.

3. Materials and Methods

3.1 Population and sample

3.1.1 Population

Dentists who have worked in community hospitals of Thailand are the population due to these dentists being the target group to receive online training for treatment of edentulous patients.

3.1.2 Sample population

The case complexity and dentistry experience could be confounding factors that affect the learning outcomes of the self-study module. The experience of dentists is likely to depend on the number of years post-graduation. Therefore, the inclusion and exclusion criteria are as follows.

Inclusion criteria for subject enrollment

1) Dentists with less than 5 years' experience

2) Dentists who had at least one complete denture case according to case selection criteria below and were willing to fabricate complete dentures with the modified technique.

Case selection criteria for complete denture fabrication in this study

- Patients with stable general health
- Patients with normal jaw movements
- Patients with completely edentulous maxillary and mandibular ridges

Exclusion criteria for subject enrollment

1) Dentists who have had at least one year of prosthodontic training.

2) Dentist who could not provide time for self-study and discussion in a focus group

3) Dentists who have inappropriate conditions of complete denture cases, including:

- Patients with unstable general health: unstable angina or heart attack during the last six months, undergoing cancer therapy, Alzheimer's disease, or dementia
- Patients with Parkinson's disease
- Patients with xerostomia
- Patients with psychiatric conditions that could influence their response to treatment: anxiety disorders, severe mental illness (SMI), including bipolar disorder, psychotic disorders (i.e., schizophrenia), post-traumatic stress disorder, and major depressive disorder.
- Patients with severely resorbed alveolar ridge

3.1.3 Sample size

Twenty-four participants were recruited, however, three participants dropped out based on the exclusion criteria. There were 5–6 participants in each focus group of interactive and non-interactive self-study. According to AMEE Guide No. 91 (Stalmeijer, McNaughton, & Van Mook, 2014), a focus group may consist of 6 to 10 participants. Sample size justifications in qualitative research are generally not limited to the number of focus groups members, but to data adequacy. In this study, discussion in focus groups was allowed until no new data emerged to ensure that data saturation was achieved, both in code saturation and meaning saturation.

3.1.4 Sampling method

The purposive sampling method was used in this study. The participants were assigned to the two groups in order to maximize the generalizability of the participant characteristics (Table 1). Participants in both focus groups were equally distributed in terms of number of years after graduation, graduation university, or the regional hospital where they have been working.

Table 1 Demographic data of sample population

	Non-interactive self-study (N=12)	Interactive self-study (N=12)
Gender		
Male	1	3
Female	11	9
Number of years after graduation		
< 1	2	2
1	1	1
2	2	3

3	4	4
4	3	2
Graduation university		
Mahidol University	9	6
Chulalongkorn University	0	1
Thammasat University	2	3
Prince of Songkla University	1	1
Chiang Mai University	0	1

	Non-interactive self-study (N=12)	Interactive self-study (N=12)
Region of the workplace		
South	2	4
Central	1	1
Western	0	3
Northeastern	7	4
Eastern	2	0

3.2 Research methodology: Qualitative study - Focus group method (Figure 1)

General dentists from community hospitals were recruited based on the inclusion and exclusion criteria and informed consent was collected through the Line application. Then, demographic information including age, gender, number of years after graduation, graduation university, and the region of their workplace were collected through Google Forms. Twenty-four participants were then assigned into either the interactive or the non-interactive self-study groups, with 12 participants in each. All participants received instructions and a link to attend a 3-hour self-study session about the modified complete denture technique for treating edentulism. The self-study was prepared by an expert (PS) and could be repeatedly accessed with no limitation until the study was complete.

Only the interactive group could join the prescheduled, 1-hour, question-and-answer session through a Zoom videoconference. Participants had opportunities to ask questions for clarification of any confusing points in the online lectures and get suggestions before the treatment began. Afterwards, the participants in the interactive self-study group also had an option to discuss their case via the Line application while treating edentulism. The interactive self-study participants were instructed that they could send intraoral photographs of any clinical procedures during the fabrication of complete dentures, and the expert would advise them how to complete the task or re-step when necessary.

For the non-interactive group, participants did not receive any interactive online instructions through videoconferences or text during the treatment. The clinical judgements to solve problems or to proceed in treatment completion were self-made by the participants. However, participants could submit intraoral photographs of their clinical steps and join video consultations for a question-and-answer session after the data collection in the focus groups was completed.

There were 21 out of 24 participants who continued in this study until the treatment was completed. Three participants (one from the non-interactive self-study group and two from the interactive self-study group) dropped out because they could not find an appropriate case to conduct according to the criteria and complete it within the specified time period.

After case completion, a focus group including 5–6 participants from either the interactive or non-interactive group was conducted through a Zoom conference. In this study, the two focus groups of interactive participants and the two focus groups of non-interactive participants were used for the data collection.

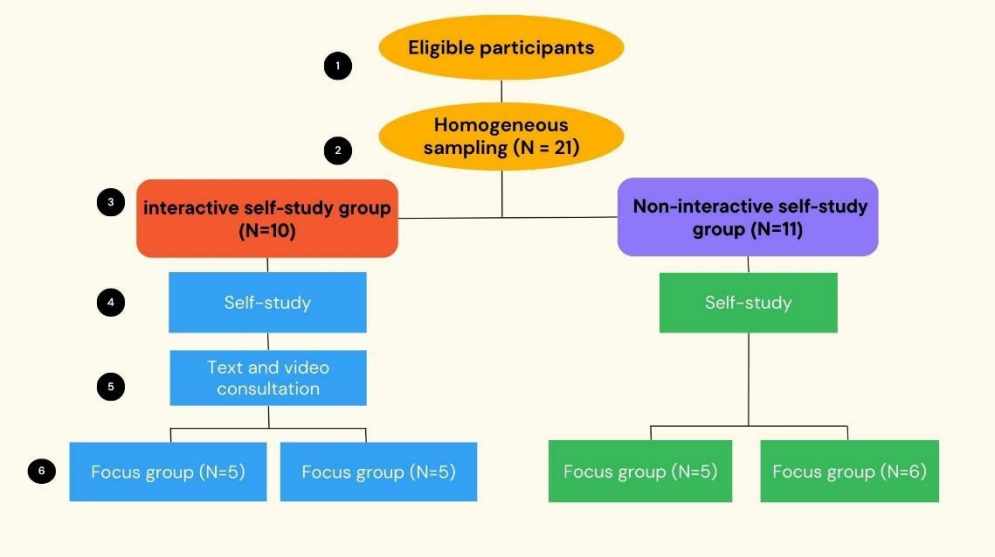

Figure 1 Flow chart of the study design

3.3 Data collection

3.3.1 Online survey

The survey was conducted through Google Forms, which requested demographic information, including name, age, sex, number of years since graduation, university of graduation, and workplace.

3.3.2 Focus groups

3.3.2.1 Focus group members: In this study, there were a total of four focus group discussions with two focus groups of participants from the interactive and two focus groups of participants from the non-interactive group, having six participants each. The discussion was facilitated by NP, a master's degree student of the geriatric dentistry and special care program, Chulalongkorn University, and AV was an observer and note taker during the discussions. Participants were appointed to the focus group discussions based on availability.

3.3.2.2 Method of approach: The focus group discussions occurred and were recorded through Zoom videoconferencing. Each focus group discussion lasted 1.5 to 2 hours. The focus group protocol was as follows: The facilitator (1) welcomed and thanked all the participants for joining the discussion in order to establish a permissive atmosphere to speak freely, (2) introduced the facilitator and the note taker, (3) clarified the focus group discussion objectives and rules during the session, and (3) discussed their opinions and provided feedback on learning as listed below.

1) How many CDs have you made in the past? Is there anyone who has rarely made CDs?
2) Does anyone know about or have experience with the modified complete technique?
3) Can you produce complete dentures with the modified complete denture technique on your own using just an online lecture as a guide?)
4) Has this course improved your understanding of the modified complete denture process? Why?)
5) After attending this course, do you feel more confident using the modified complete denture method? Why?
6) Do you have any problems when fabricating complete dentures with the modified technique, and if so, why?

7) Are there any other problems during the rechecking when fabricating complete dentures using the modified procedure as compared with the conventional method?
8) Will you use the modified complete denture procedure again in the future? Why?
9) How can you apply the knowledge gained from this training to your next case?
10) Do you think the session can help to improve your skills to fabricate complete dentures? How?
11) Is this training worthwhile and beneficial in your opinion?
12) Do you think this type of training is convenient? Or would you rather have onsite training?
13) Do you have any recommendations or ideas regarding how to make this session better?
14) Finally, do you think there is anything that should be improved or that you would like to suggest to develop the modified complete denture training even further?
15) This question below was only asked in the interactive self-study focus group.
16) Have you consulted the instructor using the Line app?
17) If there are no more comments, we will end the discussion.

3.4 Measurement

Using the data collection method for thematic analysis, the learners' perspectives were collected in the focus groups. The process began with a familiarization on the data regarding (1) the value of the learning sessions, (2) participant satisfaction, (3) confidence building, and (4) ability to successfully complete the task by focus group discussion and the online questionnaire. Then, the codes and themes were generated accordingly. All codes and themes were reviewed again by two researchers (AV and NP).

3.5 Ethical considerations

The study was approved by the Human Research Ethics Committee of the Faculty of Dentistry, Chulalongkorn University (Approval #2023-087). Participants were informed of the aims and methods of this study by phone before giving written inform consent. All the information of the enrolled subjects remained confidential throughout this study and was not used in other studies.

4. Results and Discussion

Learning outcomes from the learners' perspective were measured in the areas of the value of the learning sessions, confidence building, participants' satisfaction, and the ability to complete tasks successfully. The results are described and discussed as follows:

4.1 Value of learning sessions

4.1.1 Understanding of the modified complete denture technique

All participants reported that they could comprehend the treatment concept after attending the self-study session. They mentioned that the video clips accompanying the self-study sessions facilitated their understanding of clinical procedures. They could clearly understand the methods and process explained in the self-study sessions. Several mentioned that they used the new knowledge to modify their clinical techniques in some cases. Although the techniques mentioned in the video were not new for some participants, they still felt that they learned new things from the tips and problem solving/troubleshooting.

There was agreement among the interactive group that the questions and answers in the videoconferences helped them understand the self-study contents better. Nonetheless, there were only three out of ten participants who posted questions to the expert in a Line app chat. One of the reasons was because

they could complete the major steps and finish their task without any issues. There may also have been a few questions that were not essential for completing the task. In addition, they hesitated when posting unnecessary questions. The fact that they were unfamiliar with the expert possibly made them feel nervous.

4.1.2 Applying the knowledge and improving skills to fabricate complete dentures

Before the training, some had been aware of a simplified method for treating edentulism. However, most participants of both groups lack the confidence to use this method and therefore, consistently used conventional procedures. However, they gained more confidence after completing the self-study of the techniques. Interestingly, they also mentioned better learning outcomes, such as ability in self-assessment and justification of clinical procedures, or adaptation of the knowledge in different situations. Moreover, after learning as a group in the Zoom videoconferences, several participants have utilized this knowledge in a new situation when patients had partial edentulism with two or three teeth remaining.

Both groups stated that the self-study helped them to reassess their routine procedures, correct mistakes, and improve clinical outcomes. These topics included basic knowledge that they had forgotten, such as the anatomy of the alveolar ridge, how to follow the steps correctly, and how to solve problems when they rechecked. Some information they had never known before but helped them to complete tasks faster. Many of these can be applied to treat edentulism, not just the modified technique.

4.1.3 Will you use the modified complete denture procedure again in the future?

All participants stated they would like to continue the modified complete denture procedure because it reduced the number of hospital visits, and therefore reduced treatment costs. Additionally, the modified technique worked well at the subdistrict health promoting hospitals which serve patients in remote areas. Based on the dentists' perspective, the simplified technique functioned similarly to the conventional CDs. Moreover, the patients were satisfied since their dentures were delivered more quickly and functioned effectively.

These results correspond with the findings of systematic reviews demonstrating that general dentists may use the simplified method and achieve similar results within a substantially lower number of dental visits (Paulino et al., 2015; Ye & Sun, 2016). Moreover, several randomized studies comparing two complete denture fabrication techniques, a conventional technique and a simplified technique, showed comparable results in both patient feedback and physician-based findings (Cunha et al., 2013; De Villa Camargos et al., 2019; Kawai et al., 2005; Regis et al., 2013).

4.2 Confidence building

Both groups reported more confidence due to the step-by-step procedures to be applied in conventional methods. However, some participants still lacked confidence to perform these methods. They believed that their confidence would increase if they gained more experience. Several from the non-interactive group believed that asking questions would give them more confidence when trying the simplified technique because they were unsure if their actions were correct.

One participant from the interactive group had attended a one-time lecture about modified techniques previously but had never considered using this method. She felt confident in the method because of the video demonstrating the steps along with the interactive sessions with the instructor via LINE and Zoom. The interactive session reassured her that if there were any problems along the way, there would be someone to support her. Nonetheless, she posted no questions to a private chat because the Zoom session clarified all the questions she had. One member of the interactive groups also had previous experience using the simplified method. He previously learned the modified technique from his senior colleague, but there was no clear advice for the process or the priority of problem solving. However, he reported increased confidence about the technique because he gained more knowledge and practical techniques from the sessions. The self-

study followed by a question-and-answer session in Zoom assisted him in the areas where he lacked confidence.

4.3 Participant satisfaction

4.3.1 Appropriate content

All participants mentioned that the content of the self-study sessions enhanced their understanding of the procedures. This included a step-by-step procedure in the video with easy explanations. As adult learners, they learned by practicing it in the workplace. Therefore, participants found that the self-study provided guidance for improving their clinical skills and therefore, they could finish the tasks in shorter chair time, which in turn is beneficial for their patients. Nonetheless, there were suggestions that adding topics could be helpful. A demonstration of a variety of border molding and bite registration materials was suggested. Additionally, inclusion of patient management and advanced clinical procedures in severely resorbed alveolar ridges was also recommended.

4.3.2 Convenience of training sessions

The time length of the self-study was reported to be suitable, and the online sessions could be repeated if needed. The contents explaining the simplified methods were easy to comprehend. Therefore, it was convenient for the learners as reported by the non-interactive group. Nonetheless, participants of the non-interactive group would have liked to have had a question session with the instructor. In that way, they would have felt more confident to not make mistakes in the case.

For the consultation sessions, participants mentioned that a group videoconference, a private chat, or a group chat, those can be effectively used depending on personal preference. Some mentioned the benefits of using the Line app chat that allows them to post their questions at any time in need while working on the case. They felt no need to schedule an appointment. However, some preferred a private chat because they did not want to disturb other members in group chats. On the other hand, some liked the group chats because they could learn when other members discussed their cases. Some participants preferred group videoconferencing via the Zoom application because they prefer talking rather than typing to facilitate communication. However, they were aware that it could be challenging to schedule a group appointment and that people might not be able to work simultaneously. Nonetheless, no one chose individual videoconferencing because they did not want to encounter uncomfortable feelings in a private conversation with the expert.

The interactive group was satisfied with the training. Since the topic was familiar to general dentists, the self-study with the demonstration video was adequate. They mentioned that all of the key points were well explained in the self-study sessions and the question-and-answer videoconference. Some participants reported that the Line chat, or interaction, was not necessary afterwards. It was mentioned that a group chat was useless when nobody started a conversation. Yet, no one wanted to be the first to begin a conversation in the group chat.

From their perspective, online learning should be as effective as, or better than, on-site lectures or bedside learning. Direct observation onsite might have limitations such as a far distance or low voice tone, which would make its quality poorer than viewing the video. Moreover, the video could be repeatedly watched as needed. Keeppanasserril, Matthew, & Muddappa (2011) reported that recently graduated general dentists who are remotely supervised can produce overdentures that are comparable to those made by dentists who receive direct teaching. Additionally, this study revealed that participants liked to study online and then practice with online-based supervision. Nevertheless, they believed that a single case is insufficient, and they

might not be able to solve future problems. They thought that they could gain more confidence as they experienced more cases.

4.4 Ability to complete the task successfully

All participants finished the treatment using the modified technique within three to four dental visits. However, they reported that the second appointment went longer than expected. For the newly graduated dentists, the second visit was 3 hours or more. Both patients and dentists became fatigued. Participants mentioned that the first case generally took a considerable amount of clinical time. Nevertheless, the second case could be managed in shorter sessions because they already had experience. Their lack of confidence in the clinical procedures was the primary issue, especially in the first cases. For example, some noticed that the shape of the occlusal rims appeared unusual, but they were doubtful if this was typical.

Most participants reported a need to try-in teeth before insertion. From their experience, insertion without try-in caused problems that required a long chair time to solve. Half of them still made an appointment for a try-in due to a lack of confidence in the laboratory and being unsure of whether the patients were biting correctly. Some experienced small problems with overextension and thick flange edges during denture insertion. However, correction of these problems is feasible. Whether conventional or modified approaches are used for complete dentures, common complaints, such as denture-associated pressure on soft tissue, emerged in recheck visits. Therefore, participants agreed that fabricating a complete set of dentures using the modified procedure provided similar results when compared with the conventional method.

5. Conclusion

According to the findings in this study, self-study is sufficient for learning the modified complete denture technique. Both the interactive self-study group and the non-interactive self-study group could accomplish the modified complete dentures. A crucial tool for comprehension and confidence-building when utilizing the modified technique is the video that demonstrated the steps in action. Nonetheless, the interactive group could clarify their questions with the instructor before and during the case, which might have provided them with enhanced confidence. Thus, interaction between the teacher and learners may improve the self-study module based on their personal preferences. This interaction can be in a group videoconference, a private chat, or a group chat, but a one-on-one videoconference is not preferred.

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