Dental interns’ perception toward online learning of complete denture rehabilitation: a questionnaire survey

Feng Luo
Sichuan University

Jiapei Jiang
Sichuan Electrical Power Hospital

Linxin Yang
Sichuan University

Yan Liang
Sichuan University

Yuan Cao
Sichuan University

Xue Xiao Zhou
Sichuan University

Qianbing Wan (wanqianbing@126.com)
Sichuan University

Research Article

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Abstract

**Background:** Students' internship year is critical for dental interns to develop the skills and knowledge to perform complete denture rehabilitation (CDR). Online learning is recommended because students can't go to the clinic with the outbreak of COVID-19. This study aims to assess students' intentions toward online learning to improve teaching quality and ensure students master the CDR.

**Methods:** A questionnaire-based online survey was conducted to evaluate internship students’ background and attitudes to online learning of CDR. The questionnaire consists of three parts and 20 structured questions regarding students' experience with online learning, students' knowledge background about CDR, and students' attitude about online learning CDR. 63 dental interns, including 19 male and 44 female undergraduate dental students, participated in this survey.

**Results:** 93.65% of the 63 students have participated in online learning, 76.19% believe it is necessary to provide online instruction, and 80.95 % plan to join in the future. 71.42% of the students think they are ready for online learning on CDR. Then, we evaluated students’ knowledge background about CDR. Survey results indicate most students believe they are unprepared to perform CDR in the clinic and only a small percentage of students are familiar with the diagnosis, treatment process, and operation of CDR. Fortunately, interns are incredibly optimistic about the prospect of learning complete dentures online. According to our survey, 60.90% of students enjoy learning online, 71.43% are motivated to continue online learning, and 82.54% believe online learning of CDR is helpful.

**Conclusion:** According to the survey results, adopting online learning may be a practical solution to guarantee students' quality of oral clinical placements and address the growing shortage of clinical placement opportunities worldwide. Furthermore, the effectiveness and efficiency of online learning need to be further evaluated to ensure they can enhance dental interns’ knowledge level and practical ability of CDR.

**Background**

The complete denture is an essential part of dental prosthodontics. Complete denture rehabilitation (CDR) is a traditional prosthodontic treatment option for edentulous patients suffering from systemic, anatomic, or financial limitations [1]. There are mainly elderly and middle-aged edentulous patients that need CDR. The number of follow-up visits, the treatment cycle, and the restoration steps of CDR are duplicated. Moreover, CDR is challenging to treat oral rehabilitation due to its physiological and psychological challenges [2]. Thus, the final year of undergraduate dental education is crucial for dental internships, in which students are expected to develop the skills and knowledge needed to perform CDR [3]. Nevertheless, since 2020, a particular situation has prevented students who are supposed to participate in clinical practice from doing so [4]. The lack of internship opportunities will severely hamper students' ability to combine theoretical knowledge with clinical practice. In this regard, implementing the suspension of classes while not ending teaching and learning and ensuring the quality and progress of
education during this period is an urgent issue to be solved on the front line of prosthodontics teaching [5].

Online learning refers to applying information and communication technologies to support and enhance learning and teaching between students and teachers [6]. Online learning is the leading force in the education industry since it is non-district based, time and space inflexible, and can avoid unnecessarily aggregating people and associated infectious diseases. Also, online learning has the advantage of being able to be recorded, broadcast, and replayed. Thus, online learning can play an essential role at certain times in supplementing face-to-face classes. Many dental schools have shifted to online learning over the past two years [7]. The students from the School of Stomatology, Wuhan University, China, started online learning on February 17, 2020, to ensure the student's health and to continue educational activities in dentistry [4]. Chang et al. assessed the effectiveness of online learning during the pandemic of COVID-19 in 13 dental schools in 7 Asia countries and regions through a questionnaire survey [7]. According to the results, online courses have been offered at all participating dental schools. No matter whether shutdowns occurred, dental school students had sufficient computer skills to support online learning, be well prepared for the online course, and actively ask questions online. Similarly, other dental schools switched to online learning in spring 2020 by transferring established “face-to-face” learning. As reported, most students and lecturers favor the use of online learning, suggesting that the use of online learning in the future curriculum will extend beyond COVID-19 [8].

In prosthodontics, particularly CDR, it isn't easy to visualize and correlate theory with practice. Therefore, exceptional knowledge and training are necessary for the students to master the skill of CDR. Gilmour et al. showed that dental students were most confident in more straightforward procedures and procedures in which they had had the most clinical experience [9]. Lack of clinical experience and traditional teaching methods can lead to students lacking the confidence to complete CDR. During the particular period, students and staff proposed to use online learning as a supplement to face-to-face teaching to help students master the skills and knowledge necessary for CDR. As reported, the attitude and understanding of interns towards online learning are crucial to its development and effectiveness [10]. Therefore, this study assesses students' intentions toward online learning to improve teaching quality and ensure students master the CDR.

**Methods**

**2.1 Participants and questionnaire**

A questionnaire-based online survey (www.wjx.cn) was conducted on a research platform created and managed by the Universal Questionnaire Designer to evaluate internship students’ background and attitudes to online learning of Complete Denture Rehabilitation (CDR). The questionnaire consists of three parts and 20 structured questions regarding students’ experience with online learning, students’ knowledge background about CDR, and students’ attitude about online learning CDR. Elements of the questionnaire are illustrated in Table 1. This study was approved by the Academic Affairs Office of West
China School of Stomatology, Sichuan University. 63 dental interns, including 19 male and 44 female undergraduate dental students, participated in this survey. Names and other personally identifiable information of the participants were protected. Participants were obligated to answer all questions on the questionnaire to ensure the electronic forms were completed.
<table>
<thead>
<tr>
<th>Questions</th>
<th>Options</th>
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<tbody>
<tr>
<td><strong>Part 1: About online learning</strong></td>
<td></td>
</tr>
<tr>
<td>1. Do you prefer face-to-face teaching or online learning?</td>
<td>A. Online learning</td>
</tr>
<tr>
<td></td>
<td>B. Face-to-face teaching</td>
</tr>
<tr>
<td></td>
<td>C. No sense</td>
</tr>
<tr>
<td>2. Have you ever participated in an online learning before?</td>
<td>A. Yes</td>
</tr>
<tr>
<td></td>
<td>B. No</td>
</tr>
<tr>
<td></td>
<td>C. Not sure</td>
</tr>
<tr>
<td>3. Do you think it is necessary to carry out online learning?</td>
<td>A. Yes</td>
</tr>
<tr>
<td></td>
<td>B. No</td>
</tr>
<tr>
<td></td>
<td>C. Not sure</td>
</tr>
<tr>
<td>4. Would you like to participate in the online learning?</td>
<td>A. Willing</td>
</tr>
<tr>
<td></td>
<td>B. Unwilling</td>
</tr>
<tr>
<td></td>
<td>C. No sense</td>
</tr>
<tr>
<td>5. Do you think you are ready for an online learning on complete denture</td>
<td>A. Yes</td>
</tr>
<tr>
<td>restoration?</td>
<td>B. No</td>
</tr>
<tr>
<td></td>
<td>C. Not sure</td>
</tr>
<tr>
<td><strong>Part 2: About complete denture restoration</strong></td>
<td></td>
</tr>
<tr>
<td>1. Can you access your level of knowledge of complete denture</td>
<td>A. Good</td>
</tr>
<tr>
<td>restoration?</td>
<td>B. Average</td>
</tr>
<tr>
<td></td>
<td>C. Poor</td>
</tr>
<tr>
<td>2. Do you have the confidence to perform complete denture restoration in</td>
<td>A. Yes</td>
</tr>
<tr>
<td>clinic?</td>
<td>B. No</td>
</tr>
<tr>
<td></td>
<td>C. Not sure</td>
</tr>
<tr>
<td>3. Are you ready to participate in the treatment process of complete</td>
<td>A. Yes</td>
</tr>
<tr>
<td>denture restoration?</td>
<td>B. No</td>
</tr>
<tr>
<td></td>
<td>C. Not sure</td>
</tr>
<tr>
<td>4. Do you know the treatment plan for complete denture restoration?</td>
<td>A. So much</td>
</tr>
<tr>
<td></td>
<td>B. A little</td>
</tr>
<tr>
<td></td>
<td>C. Not sure</td>
</tr>
<tr>
<td>5. Do you know the appointment management for patients with complete</td>
<td>A. So much</td>
</tr>
<tr>
<td>denture restoration?</td>
<td>B. A little</td>
</tr>
<tr>
<td></td>
<td>C. Not sure</td>
</tr>
<tr>
<td>6. Do you have the confidence to communicate effectively with patients</td>
<td>A. Yes</td>
</tr>
<tr>
<td>with complete denture restorations?</td>
<td>B. No</td>
</tr>
<tr>
<td></td>
<td>C. Not sure</td>
</tr>
<tr>
<td>7. Can you independently perform impression taking for complete denture</td>
<td>A. Yes</td>
</tr>
<tr>
<td>restorations?</td>
<td>B. No</td>
</tr>
<tr>
<td></td>
<td>C. Not sure</td>
</tr>
<tr>
<td>8. Can you operate independently to obtain the occlusal relationship for</td>
<td>A. Yes</td>
</tr>
<tr>
<td>the patient?</td>
<td>B. No</td>
</tr>
<tr>
<td></td>
<td>C. Not sure</td>
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### Questions

<table>
<thead>
<tr>
<th>Questions</th>
<th>Options</th>
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</table>
| 9. Can you independently choose the right artificial teeth for your patients? | A. Yes  
B. No  
C. Not sure       |
| 10. Can you perform the try-in stage of complete denture prosthesis for patients independently? | A. Yes  
B. No  
C. Not sure       |
| 11. Do you know how to instruct patients to properly wear full removable dentures? | A. Yes  
B. No  
C. Not sure       |
| 12. Do you know how to give postoperative guidance to patients after complete denture restoration? | A. Yes  
B. No  
C. Not sure       |

### Part 3 Evaluation of online learning

<table>
<thead>
<tr>
<th>Questions</th>
<th>Options</th>
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</table>
| 1. Do you like to participate in the online learning of complete denture restoration? | A. Like it  
B. Not like it  
C. Not sure       |
| 2. Do you want to continue the online learning of complete denture restoration? | A. Yes  
B. No  
C. Not sure       |
| 3. Do you think online learning are helpful to you? | A. Yes  
B. No  
C. Not sure       |

### 2.2 Data Analysis

Descriptive analysis of all study variables was conducted as a percentage. The percentage of responses was calculated according to the number of respondents per response concerning the total answers to a question. And descriptive statistics were performed in this study. Response percentage is calculated based on the number of respondents per response compared to the total responses for a question.

### Results

#### 3.1 Students’ experience with online learning

In this survey, 63 undergraduate dental students participated. Of those, 19 are male (30.2%), and 44 are female (69.8%). Results showed that 22.22% of students prefer online learning, 60.32% prefer traditional face-to-face teaching, and 17.46% have no idea (Fig. 1a). The survey found that 93.65% of students participated in online learning (Fig. 1b). In comparison, only 6.35% did not. 76.19% of students believe online learning is necessary, and 6.35% think otherwise (Fig. 1c). 80.95% of students express a
willingness to participate. In comparison, 4.76% strongly indicated an unwillingness to do so (Fig. 1d). Moreover, 71.42% of students consider themselves ready for online learning with CDR, whereas 12.70% don't believe they are prepared (Fig. 1e).

3.2 Students’ Knowledge Background About CDR

Interestingly, only 7.94% of students rated their knowledge of CDR as good, 63.49% rated their level as average, and 28.57% rated their level as poor in this questionnaire (Fig. 2a). As shown in Fig. 2b, only 11.1% of students indicated they had the confidence to perform the CDR in the clinic, 65.08% didn't have any, and 23.81% said they were unsure. Additionally, 44.4% of the students responded that they were ready to participate in the CDR process, 28.57% said they weren't, and 26.98% were unsure (Fig. 2c). In this survey, 26.98% of students say they are familiar with the CDR treatment plan, while the same number say they don't know (26.98%), and 46.03% are unsure (Fig. 2d). Student perceptions of appointment management for patients with CDR differ significantly, with 22.22% believing they understand it well and 46.03% believing they do not. Meanwhile, 31.75% say they have no idea about it (Fig. 2e). Students say 34.92% are confident in communicating effectively with patients with CDR, 28.57% lack confidence, and 36.51% are unsure (Fig. 2f).

Among the students, 30.16% believed they could handle impression taking independently, 38.10% thought they couldn't, and 31.75% thought unsure (Fig. 3a). Similarly, 15.87% of students believe they can achieve occlusal relationships alone, 50.79% think they cannot, and 33.33% are unsure (Fig. 3b). The students said they could choose the correct artificial teeth for patients only 7.94% of the time, 53.97% could not do that, and 38.1% weren't sure (Fig. 3c). In the CDR try-in stage, 31.75% of students believe they can perform the task independently, 46.03% think they cannot, and 22.22% have no idea (Fig. 3d). 39.68% of students believe they know how to properly instruct patients on wearing complete dentures, while 30.16% do not and 30.16% are unsure (Fig. 3e). Finally, approximately 31.75% of students believe they know how to provide patients with postoperative guidance following a complete denture restoration, but 36.51% don't, and 31.75% are unclear (Fig. 3f).

3.3 Students’ Attitude About Online Learning CDR

60.90% of students enjoy participating in the CDR online learning experience, 6.35% dislike it, and 31.7% are unaware of it (Fig. 4a). Accordingly, most students (71.43%) expressed a strong desire to continue learning online with CDR, only 7.94% declined the offer, and 20.63% were undecided (Fig. 4b). Regarding student attitudes towards online learning, 82.54% of students believe online learning is helpful, 6.35% don't think it is beneficial, and 11.11% aren't sure (Fig. 4c).

Discussion
Complete denture prosthodontics is a discipline that requires theoretical knowledge and practical skills. Students' internship year is considered a critical period for transitioning from pre-clinical theoretical study to clinical practice of CDR [11]. However, students were prevented from going to campus with the outbreak of COVID-19 in early 2020 and could not participate in clinical practice. Thus, how guaranteeing the quality of clinical internships is an urgent problem to be solved. Compared with the face-to-face classroom, online learning is not a mainstream teaching mode due to the absence of deeply interactive associations between students and teachers [12]. However, online learning is recommended to avoid unnecessary crowding and associated infections in response to the outbreak. Besides, smart devices and apps allow students to review lessons anytime, anywhere. Hence, online learning may be an appropriate choice in this situation. In fact, some scholars predicted that online learning of dentures will be mainstream by 2025 [13]. Therefore, we must promote and participate in the online learning of CDR.

The original purpose of this questionnaire was to assess students' knowledge and attitudes towards online learning of CDR to use online learning better to improve students' knowledge and clinical practice of CDR. We first collected data on students' attitudes towards online learning and their experience with online learning. According to the questionnaire results, 93.65% of the 63 students have participated in online learning (Fig. 1b), 76.19% believe it is necessary to provide online instruction (Figure c), and 80.95% plan to join in the future (Fig. 1d). This result may benefit from promoting digital education and the vigorous development of science and technology in China [14]. Another crucial reason is that China recommends using online lectures, case studies, and problem-based learning tutorials during the epidemic to avoid unnecessary crowding and related infections [15]. Wang et al. conducted surveys of 42 dental colleges and universities in mainland China between March and April 2020 regarding online undergraduate education [16]. In China, 97% of respondents have opened online courses during the COVID-19 pandemic, with 74% choosing live broadcasts as their primary teaching method. According to their research, a high percentage of students expressed satisfaction with the online learning content, followed by how online teaching was done, the online learning materials, and how they managed their time efficiently. Their findings demonstrated that online teaching represents a valid and reliable measure in most dental colleges and universities during the COVID-19 outbreak in China. Therefore, adopting online learning may be a practical solution that can guarantee students' quality of oral clinical placements and address the growing shortage of clinical placement opportunities worldwide.

We next assessed students' knowledge and attitudes towards CDR. The good news is that 71.43% of the students think they are ready for online learning on CDR (Fig. 1e). Unfortunately, according to this questionnaire, only 7.94% of students rated their knowledge of CDR as good (Fig. 2a), and only 11.11% felt confident performing CDRs in the clinic (Fig. 2b). These results may be attributed to the difficulty of treating oral rehabilitation with a complete denture. Students need to master lots of theoretical and practical knowledge, like the anatomical marks of the edentulous jaw and the retention principle of the complete denture, to perform CDR successfully [17]. That's why most students think they are unprepared to perform CDR in the clinic. However, we believe that students' operational ability and self-confidence will significantly improve during the internship stage. As Wu et al. stated, the final year in dental school is vital for students to practice clinical skills and acquire self-confidence in dealing with patients and oral
Puryer et al. also consider that the student confidence in carrying out prosthetic treatment increased as students progressed through the course, and confidence levels would be increased further with improved clinical experience [19]. Therefore, we need to understand students’ weak points further to enhance their knowledge level and practical ability of CDR through online learning.

Then, we evaluated students’ knowledge background about CDR. 26.98% of students believe they know how to handle CDR treatment plans (Fig. 2d), 22.22% believe they can handle CDR appointment scheduling (Fig. 2e), and 34.92% are confident they can communicate effectively with patients (Fig. 2f). In addition, 30.16% of students think they can handle impression-taking (Fig. 3a), 15.87% believe they can achieve the desired occlusal relationship (Fig. 3b), 7.94% think they can choose the correct artificial teeth (Fig. 3c), and 31.75% of students believe they can perform the try-in stage for patients with CRD independently (Fig. 3d). Moreover, only about 33% of students think they were able to provide patients with postoperative guidance and instructions on using CDR. Survey results indicate only a small percentage of students are familiar with the diagnosis, treatment process, and operation of CDR. It suggests that dental interns' skills in treating patients with complete dentures are insufficient. Despite implantology being widely practiced worldwide, CDR remains necessary due to the elderly's increased life expectancy and poor oral health. We believe that students' lack of clinical experience and technical difficulties with CDR may be the main reasons for interns' low confidence [20]. With these results, we can determine what areas need to be focused on when developing online education for CDR.

In higher education, online learning is well-accepted because of its time efficiency and cost-effectiveness. Physical classrooms and online learning will combine more and more in the future, so dental students must prepare to take part in and adjust to online classes [21]. However, prosthodontics is an extensive subject, and internships are essential for dental graduates to develop clinical competencies, communication, and teamwork skills [22]. The development of attitudes and behaviors toward patient-centeredness can be taught in the internship year, and it can significantly improve students' future clinical performance. Thus, assessment of students’ attitudes and performances are essential factors in measuring success and the value of online learning [23]. Fortunately, our survey results show that interns are incredibly optimistic about the prospect of learning complete dentures online. According to our survey, 61.90% of students enjoy learning online (Fig. 4a), 71.43% are motivated to continue online learning (Fig. 4b), and 82.54% believe online learning of CDR is helpful (Fig. 4c).

Nonetheless, dental students need the training to develop their clinical skills and ample opportunities to apply them in a clinical setting [24]. We recommend early clinical exposure and active teaching-learning methods for learning preclinical prosthodontics. It was worth mentioning that relying solely on the internship year to provide students with procedure skills is inadequate. Therefore, dental students in all fields need a better way to access educational material efficiently and effectively. Currently, many studies have shown that the learning effectiveness of online learning is equal to or better than face-to-face activities [16]. Chang et al. even reported that learning efficiency was improved by 5% – 10% compared to face-to-face activities for students who adopted blended learning [25]. Furthermore, students and lecturers showed a predominantly positive perspective on implementing online learning, providing the
chance to use online learning beyond COVID-19 in the future curriculum [8]. However, stomatology is a subject that focuses on clinical practice, and the lack of clinical practice will affect the improvement of the clinical skills level of dental interns [26]. Therefore, further research is needed to determine whether online learning is still effective in subjects like stomatology, particularly CDR, which emphasize students’ operational level.

In all areas of dentistry, it is necessary to find more efficient and effective ways of delivering educational materials to students. It is imperative that this new learning and teaching model combines solid theoretical principles and uses new technologies and concepts to enhance students’ clinical skills. Virtual reality (VR) offers a promising future in dental education [27]. It is attracting global attention as it provides an exceptional training environment and instant feedback facility, thus creating tremendous opportunities for students to acquire standardized skills. The evolution of technology in the modern world has made VR simulation-based teaching an integral part of learning for both undergraduate and postgraduate students [28]. In dental education, VR is mainly used to assist or replace traditional methods of teaching clinical skills in preclinical training for several subjects, such as endodontics, prosthodontics, periodontics, implantology, and dental surgery [29]. Although dental simulators cannot rival traditional training modalities for skills training in some disciplines, they still have some advantages over conventional methods, and their effectiveness has been validated in some cases. Dental simulators will give students individualized learning assistance combined with big data, cloud computing, 5G, and deep learning technology. Their functions will be more diverse and suitable for preclinical training.

Considering the potential learning enhancement through VR use, many dental colleges and universities offer VR experiment teaching online using the public platform or intra-school network system [30–33]. Educational researchers are challenged to test the effectiveness and efficiency of these new online learning methods or VR teaching online to ensure they can be as effective as traditional teaching methods.

Conclusion

According to the survey results, many students have participated in online learning and plan to join in the future. Even most dental interns think they are ready for online learning on CDR, however, only a few students believe their knowledge background is good enough to perform CDR in the dental clinic. Fortunately, our survey results show interns have a positive attitude toward learning CDR online. Therefore, adopting online learning may be a practical solution that can guarantee students’ quality of oral clinical placements and address the growing shortage of clinical placement opportunities worldwide. However, since CDR requires a relatively high level of clinical skills, the lack of clinical practice will affect dental interns to complete denture restorations in the future. Finding more efficient and effective ways of delivering educational materials to students is necessary. Virtual reality provides an exceptional training environment and instant feedback facility and offers a promising future in dental education. Nonetheless, the effectiveness and efficiency of online learning or VR teaching online need to be further evaluated to ensure they can enhance dental interns’ knowledge level and practical ability of CDR.
Abbreviations

CDR: Complete denture rehabilitation; VR: Virtual reality

Declarations

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Authors’ contributions

Luo Feng drafted the manuscript and participated in the design and coordination of this study. Jiapei Jiang, Linxin Yang, Yan Liang, Cao Yuan, and Xuexiao Zhou participated in the design and coordination of this study. Qianbing Wan participated in the conception and design. All authors read and approved the final manuscript.

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Availability of data and materials

The datasets analyzed during this study can be obtained through the corresponding author on reasonable request.

Ethics approval and consent to participate

This study was exempted from requirements for written informed consent and was approved by the Academic Affairs Office of West China School of Stomatology, Sichuan University. Ethical approval included a process of consent to participate, and participants wrote consent to use data to inform publications. All the steps/ methods were performed in accordance with the relevant guidelines and regulations.

Consent for publication

Not applicable.

Competing interests

The authors declare no potential conflicts of interest with respect to the research, authorship, and publication of this article.
References


**Figures**
Figure 1

Students’ experience with online learning. (a) Do you prefer face-to-face teaching or online learning? (b) Have you ever participated in an online learning before? (c) Do you think it is necessary to carry out online learning? (d) Would you like to participate in the online learning? (e) Do you think you are ready for an online learning on complete denture restoration?
Figure 2

Students' knowledge background and attitude about complete denture restorations. (a) Can you access your level of knowledge of complete denture restoration? (b) Do you have the confidence to perform complete denture restoration in clinic? (c) Are you ready to participate in the treatment process of complete denture restoration? (d) Do you know the treatment plan for complete denture restoration? (e) Do you know the appointment management for patients with complete denture restoration? (f) Do you have the confidence to communicate effectively with patients with complete denture restorations?
Figure 3

Students’ knowledge background and practical ability about complete denture restorations. (a) Can you independently perform impression taking for complete denture restorations? (b) Can you operate independently to obtain the occlusal relationship for the patient? (c) Can you independently choose the right artificial teeth for your patients? (d) Can you perform the try-in stage of complete denture prosthesis for patients independently? (e) Do you know how to instruct patients to properly wear full removable dentures? (f) Do you know how to give postoperative guidance to patients after complete denture restoration?
Figure 4

Students’ attitude about online learning complete denture restorations. (a) Do you like to participate in the online learning of complete denture restoration? (b) Do you want to continue the online learning of complete denture restoration? (c) Do you think online learning are helpful to you?