〔Original〕

The correlation among practical training components in preclinical training of complete denture prosthodontics

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Abstract

In a program for preclinical training of complete denture prosthodontics for dental students, only a limited number of topics including the clinical procedures can be taught within the insufficient practice hours available. It is necessary for those planning such programs to analyze each topic and training component in detail, yet there are few reports relevant to this process. We designed a questionnaire to assess student achievement to utilize the responses for improvements to our program. Seventy-nine fourth-year students who had finished the pre-clinical training in complete denture prosthodontics were asked whether they thought they would be able to conduct the following 6 training components by themselves without help from the instructor : "preliminary impression taking", "precise impression taking", "maxillomandibular registration", "gothic arch tracing", "wax denture trials", and "denture insertion". Answers were scored on a Visual Analogue Scale. The results showed strong positive correlations, indicated by correlation coefficients greater than 0.70, [were observed] between "preliminary impression taking" and "precise impression taking", "maxillomandibular registration" and "gothic arch tracing", "wax denture trials" and "denture insertion", as well as between "maxillomandibular registration" and "denture insertion". It is worth noting that each of these pairs display similarities in procedures or theory. The results will be useful in improving the efficiency of our training programs.

Key words：preclinical practice, undergraduated prosthodontic education, simulation

Introduction

With advances in dental medicine, the quantity and diversity of the knowledge and skills that dental students are required to acquire are increasing rapidly ; accordingly, an extensive assortment of dental school courses is now offered, ranging from the Structure of Dental Materials to Molecular Biology. Upon graduation from dental school, dentists are expected to possess all of the knowledge and skills that are necessary to provide dental care. Therefore a thorough and intense undergraduate education is needed. There remain several unresolved questions regarding how to teach prosthodontics, including how to secure sufficient faculty to take change of the instruction (Nimmo et al., 2007 ; Nimmo et al., 2008) and the provision of suitable self-instructional materials for on-demand video-based demonstrations (Ingebrigtsen et al., 2008) and suggestions for decreasing the duration of training in specific components (Graser, 1990). The complete denture prosthodontics curriculum is traditionally taught during the lower grades of dental education, and a strong emphasis is placed on the laboratory component (Petropolous & Rashedi, 2005 ; Rashedi & Petropolous, 2003 ; Weintraub & Weintraub, 1997 ; Haug et al., 1993). The practical nature of the undergraduate clinical training pro-

受付：平成23年9月30日　受理：平成25年1月9日

gram is considered important in Japan because it allows students to actively participate in dental care after completing the preclinical practice programs. Preclinical practice programs in prosthodontics education have been improved through the education system using the manikin simulation ; accordingly, the goal of pre-clinical training in complete denture prosthodontics has changed from the mere fabrication of dentures to the acquisition of basic clinical skills through the complete denture fabrication.

The typical curriculum for removable denture prosthetics education in a Japanese dental school is as follows. Fourth-year students attend lectures and receive basic training in complete denture prosthetics for half the year and partial denture prosthetics for the remaining half. In the fifth year, students go through clinical training in an outpatient department for about one year, to give students extensive practical experience through the treatment of outpatients. This makes it essential that students acquire the basic knowledge and skills in the fourth year to be able to participate in treatment with a practicing dentist in the fifth year ; here there is a steady increase in the amount of information they must absorb in the fourth year, making it necessary to explore methods of educating students efficiently in the limited time period available.

A basic requirement here is that students must learn the preclinical practice course material thoroughly before beginning clinical practice. In planning a program for basic training including clinical practice in removable denture prosthetics, educators must analyze all training components in detail to establish the optimal number of topics and hours to invest in the training. Few reports have analyzed the education practice in removable denture prosthetics (Ueno et al., 2007). In this report we have analyzed responses to a questionnaire to assess student achievement and investigated the correlations among various practical training components taught in preclinical complete denture prosthodontics training, in order to be able to conduct the program more effectively.

Materials and Methods

The complete denture prosthodontics curriculum includes a simulated case which the students follow from diagnosis to the installation of a complete set of dentures. The case is simulated using a mannequin with a double-hinge axis allowing a range of mandibular border movements similar to the biomechanical range depicted in Posselt's figure. A complete series of denture treatments is performed on the mannequin, starting with a medical exam and continuing with preliminary impression taking, precise impression taking, maxillomandibular registration, gothic arch tracing, wax denture trials, and finally the installation of the new complete denture fabricated by the student.

The curriculum includes one lecture and three practice sessions per week for 14 weeks, i.e., 14 lectures and 42 practice sessions in a year. Each lecture and practice session is 80 minutes long. At the beginning of a practice session, the teaching staff demonstrates the procedures to be studied that day. The staff-to-student ratio is 1 : 13.

The subjects of the present questionnaire study were 79 fourth-year students (57 male and 22 female) who had finished the preclinical training in complete denture prosthodontics. Students who participated in the practical training without attending the lectures were excluded from the subjects for analysis of questionnaire responses. There was no statistically significant difference in the attendance rates between any pair of the practical training components. The pre-test associated with the basic parts of the practical training showed no statistically significant differences in the level of understanding of the students before the practical training. The questionnaire asked for a score of confidence in the ability to treat the following 6 training components on their own without direct guidance by a dentist, using a Visual Analogue Scale (VAS) : "preliminary impression taking", "precise impression taking", "maxillomandibular registration", "gothic arch tracing" "wax denture trials" and "denture insertion".

The VAS scale is a horizontal line, 100mm in length, anchored by the word descriptors "treat perfectly" at the right end and "not treat at all" at the left end. The participants marked the line at the point representing the degree of perceived confidence. The VAS score was recorded as the measurement in millimeters from the left-hand end of the line to the point that a subject had

marked.

The average VAS score and standard deviation were calculated for each training component. In addition, the VAS range was divided into quarters, as follows : VAS score≦25, 25<VAS score≦50, 50<VAS score≦75, 75 <VAS score. The proportion of scores in each quarter was calculated for each of the six training components surveyed. The values were analyzed by one-way analysis of variance. Correlation coefficients between the VAS scores of the various training components were also calculated.

Results

Table 1 shows the average VAS scores and standard deviations for all the training components. There were statistically-significant difference between the average VAS scores of "preliminary impression taking" and "gothic arch tracing", "wax denture trials" and "gothic arch tracing", and between "denture insertion" and "gothic arch tracing". There were no statistically significant differences among the 6 training components. The students had the least confidence in performing "gothic arch tracing" on their own. On the other hand, "denture insertion" was relatively easy. The "gothic arch tracing" score was statistically significantly different from the "preliminary impression taking", "wax denture trial", and "denture insertion". The average VAS score for all six training components was 46.0±23.9.

Table 2 shows the proportion of scores that fell into each of the four ranges detailed above. The score distribution for "preliminary impression taking" was not statistically different from that of "precise impression taking", that for "maxillomandibular registration" was not statistically different from that of "gothic arch tracing", and that for "wax denture trials" was not statistically different from that of "denture insertion".

Table 3 shows the correlation coefficients between each pair of training components. Strong positive correlations, indicated by correlation coefficients above 0.70, were observed between "preliminary impression taking" and "precise impression taking", between "maxillomandibular registration" and "gothic arch tracing", between "wax denture trial" and "denture insertion", and between

Table 1. Average VAS scores for practical training components

There were statistically significant difference between average scour of "preliminary impression taking" and "gothic arch tracing", "wax denture trial" and "gothic arch tracing", and "denture insertion" and "gothic arch tracing".

Training components	Average Score
preliminary impression taking	*49.0±24.3
precise impression taking	46.0±24.4
maxillomandibular registration	46.6±23.4
gothic arch tracing	37.5±21.7
wax denture trial	*49.4±23.5
denture insertion	*51.2±23.3

*p<0.05 denotes statistically significant difference to average score for "gothic arch tracing".

Table 2. Distribution of VAS scores among quarter–ranges

The score distribution for "preliminary impression taking" was similar to that of "precise impression taking", that for "maxillomandibular registration" was similar to that of "gothic arch tracing", and that for "wax denture trial" was similar to that of "denture insertion".

	>75	75≧, >50	50≧, >25	25≧
preliminary impression taking	16.5	34.2	31.6	17.7
precise impression taking	13.9	30.4	36.7	19.0
maxillomandibular registration	13.5	24.7	31.5	30.3
gothic arch tracing	6.3	22.8	40.5	30.4
wax denture trial	11.4	39.2	32.9	16.5
denture insertion	16.5	40.5	26.6	16.5

Table 3. Correlation coefficients between practical training components
There were strong positive correlations, indicated by correlation coefficients greater than 0.70, between "Preliminary impression taking" and "precise impression taking", between "maxillomandibular registration" and "gothic arch tracing", between "wax denture trial" and "denture insertion", and between "maxillomandibular registration" and "denture insertion".

	preliminary impression taking	precise impression taking	maxillomandibular registration	gothic arch tracing	wax denture trial	denture insertion
preliminary impression taking	−					
precise impression taking	0. 76	−				
maxillomandibular registration	0. 51	0. 57	−			
gothic arch tracing	0. 48	0. 56	0. 77	−		
wax denture trial	0. 56	0. 57	0. 63	0. 61	−	
denture insertion	0. 57	0. 57	0. 70	0. 63	0. 71	−

"maxillomandibular registration" and "denture insertion". The regression equation for "preliminary impression taking" and "precise impression taking" was y=0.76 x+8.54, that for "maxillomandibular registration" and "gothic arch tracing" [was] y=0.71x+4.23, and that for "wax denture trials" and "denture insertion" y=0.71+ 16.19.

Discussion

Some studies have reported on materials or methods that are useful in preclinical prosthodontics training (Demirjian & David, 1995 ; LaVere et al., 1996 ; Kawai et al., 2007), but we were unable to locate report of relative difficulty of preclinical complete prosthodontics training components or on correlations between these training components. The results of the VAS questionnaire responses show that students consider gothic arch tracing to be the most difficult training component and installing the fabricated dentures to be the easiest. Gothic arch tracing involves complicated mandibular movement and is considered to depict the path of actual mandibular movement in a comprehensive manner, so performing this training component is difficult for students who do not yet completely understand the underlying principles and mechanisms for analysis of mandibular movement with gothic arch tracing equipment. Installing fabricated dentures, on the other hand, is easy to understand and accomplish because denture installation is similar to the wax denture trials conducted during the point-of-fit check and occlusal adjustment following the denture fitting.

In this study, the data were obtained from student self -assessments. Related to this, it has been reported that there is no statistically significant differences between assessments of instructors and student self-assessments about clinical training (Ono, 2010), and in this study that results are reliable. The correlation analysis clearly showed strong statistical correlations between "preliminary impression taking" and "precise impression taking", between "maxillomandibular registration" and "gothic arch tracing", and between "wax denture trials" and "denture insertion", though these correlations. It is worth noting that, in each of these three pairs, the paired training components involve similar elements in procedures and theory. Both "preliminary impression taking" and "precise impression taking" are required to understand the relationship between intraoral movement and the shape of the borders, and both involve the use of an impression tray, though one is custom made and the other is ready-made. Maxillomandibular registration and gothic arch tracing both require dental students to understand the mechanism of mandibular movement and specifically that of the temporomandibular joint. The wax denture trials and denture insertion both involve checking for proper shape and function, including proper denture flange shapes and occlusal relationships. If instructors were to stress these similarities and differences when planning lectures and training, student perceived abilities in the practice component could improve considerably. Once the similarities and differences of each pair of elements are thoroughly understood, students who have learned and performed one training component in a pair would be able to better understand and perform the related training component that follows in that pair shortly afterward. As the amount of time available for instruction is limited, as is the amount of

effort that instructors can expend, a teaching method based on similarities and differences could also benefit instructors.

In complete denture prosthodontics education, making time available in the curriculum would be particularly helpful because it would free up time for dental students to view procedures as they are actually performed, on video. As it has been reported that humans take in most input information visually (Zimmerman, 1989), watching videos of dental procedures would be effectively equivalent to engaging in practice. Multimedia teaching materials on the practice of complete denture prosthodontics are used at our institution, and the questionnaire respondens had access to these materials. Multimedia instructional materials should be updated to emphasize the similarities established in this study between the various training components that make up the complete denture prosthodontics skill set.

Simplified technical procedures, such as the abbreviated impression technique that has been developed for use in complete denture prosthodontics, represent one solution to the problem of limited practice time (Duncan & Taylor, 2001), though of course simplifying all training components is not possible and may not always result in the best possible educational experience. Before introducing a simplified version of any procedure, the instructor must consider the nature of the procedure. Structuring the curriculum for greater efficiency by emphasizing similarities in theory and technique is also an effective means of simplifying instruction.

This study reports dental student perceptions of their ability to practice complete denture prosthodontics as a means of gathering information that will help in the curriculum design of complete denture prosthodontics education to convey the maximum impact in the limited available time. If a significant correlation is found, it may be useful as an index to decide the volume of training required for students. That is, students who are well-acquainted with a preceding component can more simply understand the following component in the practical training. Meanwhile, students with poor knowledge of a preceding component will need extensive follow up training in both components. But, at present there is no agreed standard for when to conduct the intervention follow-up study to investigate whether the strategy to focus clearly on the analogy of the strongly correlated components is effective for our training programs. However, this study may give particular attention to the results of simulated clinical practice.

Conclusions

Dental students asked how well they believe they would be able to perform 6 aspects of complete denture prosthodontics, and statistically positive correlations were established between the VAS responses for "preliminary impression taking" and "precise impression taking", between "maxillomandibular registration" and "gothic arch tracing", between "wax denture trials" and "denture insertion", and between "maxillomandibular registration" and "denture insertion". These results will be useful in improving the efficiency of training programs that we conduct.

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