Complete Denture Education in U.S. Dental Schools

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Purpose: **In 2001, a survey of U.S. dental schools was conducted to determine curricular content, teaching philosophies, and techniques used in clinical complete denture programs.**

Materials and Methods: **The questionnaire was mailed to the chairperson of the prosthodontic/restorative department of 54 U.S. dental schools. Of these, 44 schools returned the completed survey, resulting in a response rate of 82%. The mean, median, and range of responses were computed where applicable.**

Results: **Results from this survey show that a large majority of schools are using similar materials in clinical complete denture treatment: irreversible hydrocolloid for preliminary impression (87%); light-cured composite resin for record base fabrication (70%); a semiadjustable articulator (98%); and semianatomic posterior tooth form used exclusively or in combination with other tooth forms (75%). In addition, a large majority of schools are using similar techniques in clinical complete denture treatment: use of a protrusive record (80%); use of extra-oral measurements, speech, and esthetics for establishing the occlusal vertical dimension (59%); use of the conventional compression molding method for processing complete dentures (82%); occlusal equilibration and face-bow preservation (75%); and the clinical remount procedure (91%). A quality control program is present for cases sent to and returned from the laboratory in 73% and 84% of responding schools, respectively.**

Conclusions: **Clinical complete denture predoctoral programs vary from school to school, yet a large percentage of schools agree on many topics. Only 55% of schools reported incorporating new educational materials such as the use of dental implants and treatment of patients with implant-retained overdentures at the predoctoral level. Sixteen percent are allowing students to graduate without a set number of required complete dentures as has traditionally been the case. Sixteen percent are using newer techniques such as injection molding and microwave processing technique in addition to the conventional processing technique.**

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IN 1995 the Institute of Medicine (IOM) published a report emphasizing the need for dental educators to reassess the predoctoral prosthodontic curriculum to make it more relevant to clinical practice for the general practitioner.[1] Such a curriculum will be important considering that millions of individuals without complete dentitions will require prosthodontic treatment well into the 21st century.[2]

With the introduction of preventive dentistry in the middle of the 20th century, most people now realize that natural teeth can be retained for life. In the past two decades there has been a steady decline in the prevalence of tooth loss and edentulism in the United States, and the number of people who are retaining their natural teeth is growing rapidly.[3] The absolute number of persons over 65 years is expected to double by the year 2030, and the actual number of those needing treatment with complete dentures will remain almost constant.[4] This means that knowledge and skills in treating patients with edentulism will be important as the century progresses.[5] Therefore, dental schools must continually evaluate the removable prosthodontic curriculum to ensure that

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the dental health needs of society and the goals and objectives of the Commission on Dental Accreditation are being met.[6] Prosthodontic curriculum and laboratory delegation surveys are useful tools in assessing prosthodontic education.[6]

The aims of this survey were to determine the current trends in predoctoral complete denture treatment and to determine which educational techniques and materials are being used by U.S. dental schools.

Materials and Methods

In November 2001, a questionnaire (see Appendix) was mailed to the chairpersons of the prosthodontic/restorative departments of 54 U.S. dental schools, requesting information on their predoctoral clinical complete denture curricular content. Following a second mailing to schools that had not returned the questionnaire within 3 months, 44 of the 54 schools responded, yielding a response rate of 82%.

The survey consisted of 20 multiple choice questions and asked the respondents to circle all responses that applied to their programs. The option of providing a specific answer other than the listed choices was available for some questions. The questions were pilot-tested on site by faculty members who approved of the questionnaire before it was mailed to other schools.

Results

Materials Used for Making Preliminary Impressions (Question 1)

Thirty-eight schools (87%) reported using irreversible hydrocolloid as the preliminary impression material, and 6 schools (14%) reported using both irreversible hydrocolloid and impression compound.

Articulator Used (Question 2)

Forty-three schools (98%) reported using a semi-adjustable articulator in their clinical complete denture program and one school (2%) indicated "other," specifically, "it depends on the occlusal scheme chosen."

Material Used for Record Base Fabrication (Question 3)

Thirty-one schools (70%) reported using a light-cured composite resin (Triad, Denstply, York, PA); 6 schools (14%) acrylic resin; and 2 schools (5%) shellac. Five schools (11%) reported that they use a combination of the choices. These 5 included 3 schools (7%) using both the light-cured composite resin and the acrylic resin; 1 school (2%) using the VLC Triad and the shellac; and 1 school (2%) reporting "other," specifically, processed record bases.

Eccentric Interocclusal Records Used (Question 4)

Thirty-five schools (80%) reported that they teach their students to use a protrusive record; 5 schools (11%) reported not teaching the use of any eccentric interocclusal records; and 2 schools (5%) reported protrusive record and right and left lateral excursive records.

Artificial Teeth Used (Question 5)

Table 1 summarizes the type of artificial teeth used in clinical complete dentures.

Posterior Tooth Form Used (Question 6)

Table 2 summarizes the type of posterior tooth form used in clinical complete dentures.

Mandibular Positioning in Centric Relation (Question 7)

Table 3 summarizes the techniques taught for positioning the mandible in centric relation.

Table 1. Type of Artificial Teeth Used for Clinical Complete Dentures

Type of Artificial Teeth	*Number of Schools Responding (%)*
Bioblend only	3 (7)
Bioform only	9 (21)
Portrait only	10 (23)
Ivoclar only	0 (0)
Myerson only	0 (0)
Bioblend and Bioform	8 (18)
Bioblend, Bioform, and Portrait	1 (2)
Bioblend and Portrait	1 (2)
Bioblend, Bioform, Portrait, and Ivoclar	1 (2)
Portrait, Ivoclar, and other*	1 (2)
Portrait and other*	1 (2)
Other*	3 (7)
Bioform and other*	2 (5)
Myerson and other*	1 (2)
Bioblend, Bioform, and Ivoclar	1 (2)
Portrait and Ivoclar	2 (5)

*Other included Vitapan, Justi, Technic, Classic, and Biotone.

Table 2. Posterior Tooth Form Used in Clinical Complete Dentures

Posterior Tooth Form	*Number of Schools Responding (%)**
Anatomic only	3 (7)
Semianatomic only	7 (16)
Nonanatomic only	2 (5)
All three choices	15 (34)
Anatomic and semianatomic	3 (7)
Anatomic and nonanatomic	5 (11)
Semianatomic and nonanatomic	8 (18)

*Rounding error; does not equal 100%.

Establishing Occlusal Vertical Dimension (OVD) (Question 8)

Twenty-six schools (59%) reported teaching extra-oral measurements, speech, and esthetics for establishing the OVD. Eight schools (18%) reported teaching extra-oral measurements and speech; 7 schools (16%) extra-oral measurements; 2 schools (5%) speech; and 1 school (2%) reported a combination of extra-oral measurements, speech, and "other." For "other" this school wrote "swallowing water."

Flasking the Complete Dentures (Question 9)

Thirty-five schools (80%) indicated that their students do not flask their clinical complete dentures; 1 school (2%) indicated that its students do; and 7 schools (16%) indicated sometimes. The schools that indicated "sometimes" commented: "if they choose to," "first case only," "very rarely," "if rushed," "juniors yes and seniors no," and "relines occasionally."

Treatment of Patients Requiring Tooth-Supported Overdentures (Question 10)

Thirty-nine schools (88%) indicated that their students are treating patients requiring tooth-supported overdentures, and 3 schools (7%) indicated they are not. Two schools (5%) did not respond to this question.

Attachments Used for Tooth-Supported Overdentures (Question 11)

Twenty-two schools (50%) indicated that attachments are not being used, and 16 schools (36%) indicated that attachments are being used. The attachments used are ERA (Sterngold, Attleboro, MA), Zest Anchor (Zest Anchors Inc., Escondido, CA), Rothermann (Sterngold), Flexipost (Essential Dental Systems, South Hackensack, NJ), Zest Anchor Advanced Generation (Zest Anchors, Inc.), Hader Bar (Attachments International Inc., San Mateo, CA), Preci-Ball (Preat Corporation, Santa Ynez, CA), and O-SO (3i Implants Innovations, Inc., Palm Beach Gardens, FL). One school (2%) that had indicated that it was treating tooth-supported overdentures, did not respond to this question.

Technique Used to Process Complete Dentures (Question 12)

Thirty-six schools (82%) indicated using the conventional compression molding method; 4 schools (9%) indicated using both the conventional

Table 3. Technique Taught for Positioning the Mandible in Centric Relation

Technique	*Number of schools Responding (%)**
Bimanual manipulation	5 (11)
Tongue placed in posterior aspect of palate	9 (21)
Thumb and finger manipulation	7 (16)
Tongue placed in posterior aspect of palate, and thumb and finger manipulation	11 (25)
Bimanual manipulation, and tongue placed in posterior aspect of palate	4(9)
Bimanual manipulation, and thumb and finger manipulation	1 (2)
All three choices	5 (11)
Bimanual manipulation, tongue placed in posterior aspect of palate, other**	1 (2)
Tongue placed in posterior aspect of palate and other**	1 (2)

*Rounding error; does not equal 100%.
**Other included "gothic arch trace" and "swallow."

Table 4. Attachments Used with Implant-Retained Overdentures

Attachments	*Number of Schools Responding (%)**
Bar	5 (11)
Stud	9 (21)
Other**	3 (7)
Bar and stud	15 (34)
Bar, stud, and other**	4 (9)
No response	8 (18)

*Rounding error; does not equal 100%.
**Other included "case dependent," "o-rings," and "magnets."

compression molding method and the injection molding method; 2 schools (5%) indicated using both the conventional compression molding method and the microwave processing technique; and 1 school (2%) indicated using the conventional compression molding method, the injection molding technique, and the microwave processing technique.

Treatment of Patients Using Implants (Implant-Retained Overdentures) (Question 13)

Twenty-four schools (55%) reported that their students treat edentulous patients with implants and implant-retained overdenture prostheses. Twenty schools (45%) reported that they do not.

Implant Overdenture Attachments used Clinically (Question 14)

Table 4 summarizes the answers to this question.

Occlusal Equilibration and Face-Bow Preservation of Complete Dentures (Question 15)

Thirty-three schools (75%) indicated that the complete dentures are returned to the students for occlusal equilibration and face-bow preservation, and 11 schools (25%) indicated that they are not returned to the students to complete these procedures.

Clinical Remount Procedure (Question 16)

Forty schools (91%) reported that their students are taught the clinical remount procedure at the time of denture delivery, and 4 schools (9%) reported that they are not.

Protocol for Postinsertion Adjustments (Question 17)

All responding schools (100%) indicated that there is a set postinsertion adjustment protocol for complete denture patients in the clinics.

Minimum Complete Denture Requirements for Graduation (Question 18)

Thirty-seven schools (84%) indicated that there is a minimum number of complete denture arches a student must complete in order to graduate, and 7 schools (16%) indicated that there is no such number.

Immediate Denture Requirements for Graduation (Question 19)

Forty-one schools (93%) indicated that immediate dentures fulfill partial graduation requirements, and 3 schools (7%) indicated that they do not count toward graduation requirements. Of the 41 schools indicating that these prostheses count toward graduation, some of their write-in responses included: "worth the same as a complete denture," "varies," and "no specified amount."

A Quality Control Program for Clinical Cases Sent to the Laboratory (Question 20)

Thirty-seven schools (84%) indicated that there is a quality control program that evaluates laboratory work sent by students to either a commercial laboratory or an in-house laboratory. Seven schools (16%) indicated that there is no such program.

A Quality Control Program for Clinical Cases Returned from Commercial or In-House Laboratory (Question 21)

Thirty-two schools (73%) indicated that there is a quality control program that evaluates the laboratory work returned by the dental laboratory to the students. Eleven schools (25%) indicated there is no such program.

Discussion

The results of this clinical complete denture curriculum survey of U.S. dental schools show that prosthodontic education varies among schools, although many trends in materials and procedures used are evident.

A large majority of schools are using similar materials for complete denture treatment. Irreversible hydrocolloid as preliminary impression material is the primary material of choice for many programs (87%). Light-cured composite resin for record base fabrication is used by 70% of dental schools. A large majority of programs (98%) reported using a semiadjustable articulator for the clinical program. This finding correlates well with a previous survey[7] of preclinical complete denture programs, which showed that 95% used the semiadjustable articulator exclusively.

There was wide variability in the type of artificial teeth used in the clinical complete denture program. The artificial teeth currently in widest use appear to be the Portrait teeth (23%), followed by the Bioform teeth (21%). Other reported artificial teeth include Bioblend, Ivoclar, Myerson, Vitapan, Justi, Biotone, and Classic. These results vary from the previous study[7] that found that the artificial teeth in widest use preclinically appear to be the Bioform teeth (28%), followed by the Portrait teeth (19%). In the current study, the posterior tooth form in widest use exclusively or in combination with other tooth forms appears to be the semianatomic tooth form (75%).

Similarly, a large majority of schools are using the same techniques in clinical complete dentures. Eighty-five percent of schools teach the use of a protrusive record exclusively or in combination with right and left lateral excursive records. This is a larger percentage compared with the preclinical finding of 67%.[7]

The technique currently taught most widely (68%) for positioning the mandible in centric relation position appears to be placing the tongue in posterior aspect of the palate in combination with other techniques, such as thumb and finger manipulation and bimanual manipulation. Fifty-nine percent of schools are teaching the use of extra-oral measurements, speech, and esthetics for establishing the OVD.

The majority of schools are not requiring students to flask their clinical complete denture cases (80%). This finding is consistent with a previous study[8] that looked at the amount of clinical laboratory work delegated by dental students to the laboratory technicians. This study showed there is a trend toward the increased use of in-house and commercial laboratory technicians for denture flasking through deflasking of processed dentures. These results are also consistent with results obtained from a preclinical survey of predoctoral complete denture programs,[7] indicating that 63% of schools are not requiring students to process their complete denture setups made during the preclinical course.

The use of the conventional compression molding method for processing complete dentures appears to be the most popular method (82%); however, 16% of schools are using newer techniques such as injection molding and the microwave processing technique, in addition to the more traditional processing technique. Most dental schools (75%) require students to perform denture occlusal equilibration and face-bow preservation. This finding is similarly consistent with what is being taught preclinically throughout the United States. Eighty-four percent of schools are teaching the use of the face-bow preservation record preclinically.[7] The clinical remount procedure performed at the time of denture delivery is taught by most dental schools (91%).

It appears that most schools (84%) have a minimum number of complete denture arches that students must complete toward graduation; however, 16% reported not having any minimum requirements for graduation. In addition, most programs (93%) indicated that immediate dentures count toward graduation requirements.

Most dental schools have incorporated a quality control program that evaluates cases sent to (84%) and returned from (73%) the laboratory. All responding schools are in agreement that a set postinsertion adjustment protocol is necessary for complete denture patients in the clinics.

Eighty-eight percent of schools indicated that their students are treating patients requiring tooth-supported overdentures; however, only 55% reported that their students treat edentulous patients with implants and implant-retained overdenture prostheses. One reason for this difference in percentages could be due to the complexity and cost of treatment involving dental implants.

Among the schools that encourage the treatment of patients with implant-retained

overdenture prostheses, the type of attachments used varies.

Conclusions

A survey was conducted for the clinical complete denture predoctoral curriculum in American dental schools. Eighty-two percent of schools responded. Information obtained from the responding schools included materials used, educational techniques used, and requirements toward graduation. The responses were tabulated. There is some variability from school to school on certain aspects of the techniques and materials used; however, agreement was noted by a large percentage of schools on the following topics:

1. Materials used for making preliminary impressions and record base fabrication,
2. The articulator used,
3. Use of a protrusive record,
4. Posterior tooth form used,
5. Techniques used for establishing the VDO,
6. Techniques used for processing complete dentures,
7. Procedures followed for occlusal equilibration and face-bow preservation,
8. Use of a clinical remount procedure,
9. Techniques taught for positioning the mandible in centric relation,
10. Treatment of patients requiring tooth-supported overdentures,
11. Treatment of patients requiring implant-retained overdentures,
12. Use of a postinsertion protocol,
13. Number of complete denture requirements for graduation,
14. Immediate denture requirements for graduation, and
15. Use of a quality control program for cases sent to and returned from the laboratory.

The questions with the most variable responses were:

1. Use of attachments for tooth-supported overdentures, and
2. Artificial teeth used.

Appendix: Questionnaire

Instructions: Please circle all responses that apply to your school's clinical complete denture curriculum. More than one answer may be selected. All data collected will be kept strictly confidential and will not be identified by individual schools in any future publications or presentations. Thank you for your cooperation.

1. What material do you currently teach for use in making a preliminary impression for complete dentures?
   a. irreversible hydrocolloid
   b. impression compound
   c. other (please specify)_____
2. In the fabrication of complete dentures, what type of articulator are students being taught to mount final casts on?
   a. simple hinge type articulator with lateral movement capacity
   b. simple hinge type articulator without lateral movement capacity
   c. a semiadjustable articulator
   d. other (please explain)_____
3. What material are you currently teaching for use in fabrication of record bases?
   a. TRIAD
   b. shellac
   c. acrylic resin
   d. other (please specify)_____
4. Which eccentric interocclusal records are you currently teaching your students in the construction of complete dentures?
   a. only protrusive record
   b. only right and left lateral excursive records
   d. protrusive record and right and left lateral excursive records
   c. none
   d. other (please specify)_____
5. What kind of artificial teeth do you currently have available in your clinical complete denture course for your students?
   a. Bioblend
   b. Bioform
   c. Portrait
   d. Ivoclar
   e. Myerson
   f. other (please specify)_____
6. What do you currently use for posterior tooth form?
   a. anatomic teeth
   b. semianatomic teeth
   c. nonanatomic teeth
7. What technique is taught for positioning the mandible in centric relation position?

a. bimanual manipulation
b. tongue placed in posterior aspect of palate
c. thumb and finger manipulation
d. other (please specify)_____

8. What technique is currently being taught for establishing the vertical dimension of occlusion?
a. extra-oral measurements
b. speech
c. esthetics
d. other (please specify)_____

9. Do students flask their own complete dentures for their clinical cases?
a. yes
b. no
c. sometimes (please specify)_____

10. Are students treating patients who require tooth-supported overdentures?
a. yes
b. no

11. If "yes" for question 10, are attachments being used?
a. yes (please specify)_____
b. no

12. Are students treating patients who require implant-retained overdentures?
a. yes
b. no

13. What kind of overdenture attachments are students exposed to clinically?
a. bar
b. stud
c. other (please specify)_____

14. How are dentures being processed?
a. conventional compression molding method
b. injection molding technique
c. fluid resin technique
d. microwave processing

15. Are complete dentures returned to students after processing for occlusal equilibration and face-bow preservation?
a. yes
b. no

16. Are students being taught to complete the clinical remount procedure at time of denture delivery?
a. yes
b. no

17. Is there a set protocol for post-insertion adjustment visits of complete denture patients in the clinics?
a. yes
b. no

18. Is there a minimum number of complete denture arches that a student must complete in order to graduate?
a. yes
b. no

19. Do immediate dentures count partially towards graduation requirements?
a. yes
b. no

20. Is there a quality control program for evaluation of edentulous patient case materials from students' work submitted to either a commercial laboratory or to your school's in-house laboratory?
a. yes
b. no

21. Is there a quality control program for evaluation of edentulous patient case materials returning from either a commercial laboratory or from your school's in-house laboratory?
a. yes
b. no

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