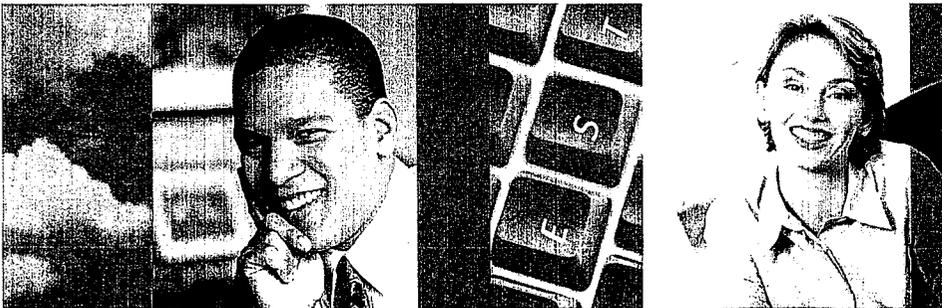


# ALTERNATIVE PATHWAYS FOR INITIAL LICENSURE FOR GENERAL DENTISTS

SUBMITTED TO

Office of Professional Examination Services  
California Department of Consumer Affairs  
2420 Del Paso Road, Suite 265  
Sacramento, CA 95834



FINAL REPORT



PREPARED BY

Comira

Psychometric Services Division

110 Blue Ravine Road, Suite 160

Folsom, California 95630

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## SECTION 1: INTRODUCTION

### BACKGROUND

The Dental Bureau of California is considering alternative pathways to initial licensure, and, in 2008, the Bureau contracted with Comira to explore the feasibility of those pathways. There have been many concerns about existing clinical examinations, particularly in terms of validity of the content tested and reliability of the judgments made about candidate performance. Chambers (2004a) cites the difficulties of "one-shot" clinical examinations in terms of cost effectiveness, fairness, reliability and validity despite efforts to improve them. He states that "one-shot" examinations have unknown validity, expose the public to an unnecessary level of risk, and fail to sample the full range of competencies. The California Dental Association has adopted a policy in 2005 that "supports elimination of human subjects/patients in the clinical licensure process with the exception of the alternative methods of licensure examinations that are carried out within the dental schools' curricula."

Based on interviews, observations, and documentation, four alternatives to initial licensure were identified. They were Curriculum Integrated Format (CIF), Objective Standardized Clinical Examination (OSCE), traditional portfolio, and a hybrid portfolio examination. The hybrid portfolio examination is an alternative based upon the synthesis of the traditional portfolio and test cases (or competency cases) used in the dental schools for competency evaluations.

Two formats in particular, portfolio and the OSCE have been used successfully in Canada and the United Kingdom for credentialing medical and dental professionals. Chambers (2004a, 2004b) and others advocate the use of clinical portfolios because portfolios provide a more fair, less costly method for assessment. Moreover, portfolios use more data, more diverse data, and data of a higher quality than is currently used. Chambers (2004b) states that "because attempts to improve initial licensure examinations have not been founded in measurement theory, partial and inadequate remedies have led to a cycle of refutations, defenses and political polarization (p. 173)." The OSCE is becoming more widely used in dentistry, particularly for summative assessments in coursework at institutions such as the Royal London School of Medicine and Dentistry and Leeds Dental Institute. The National Dental Examining Board of Canada (NDEB) began to include OCSE as part of the certification process in 1994. To this day, the NDEB uses the OSCE in lieu of actual patients for clinical assessments.

## PURPOSE OF THE STUDY

The purpose of the study is to explore alternative pathways to initial licensure and make recommendations as to their merits.

## CRITERIA FOR SUCCESS

The following criteria, some of which have been identified by the California Dental Association (CDA, 2008) and Webb, Endacott, Gray, Jasper, McMullan & Scholes (2003) are critical elements for implementing an alternative pathway for initial licensure:

1. Oversight maintained by the Dental Bureau/Board of California
2. Built-in system for auditing the process
3. Does not require additional resources from the students, schools, or the Dental Bureau/Board of California
4. Must be instituted within the current systems of student evaluation
5. Must be considered an examination that meets all professional testing standards
6. Meets psychometric standards, relevant to current practice, and designed for minimum competence
7. Is designed to cover the full continuum of competence
8. Evaluation of competence is within the course of treatment plan for patients of record
9. Evaluators are regularly calibrated for consistent implementation of the alternative examination
10. Has policies and procedures that treat licensure candidates fairly and professionally, with timely and complete communication of examination logistics and results

## PSYCHOMETRIC STANDARDS

The Standards for Educational and Psychological Testing (1999) set forth by the American Educational Research Association, the American Psychological Association, and the National Council on Measurement in Education serve as the standards for evaluating all aspects of credentialing, including professional and occupational credentialing. The Standards are used by the measurement profession as the psychometric standards for validating all examinations, including licensing and certification examinations.



## **SECTION 2: RESEARCH STRATEGY**

### **GENERAL APPROACH**

In order for the study to be thorough and objective, it was necessary to contact deans, associate deans, and key faculty at the five Bureau-approved dental schools to gain an understanding of their predoctoral programs for general dentists. Comira conducted interviews with the deans and key faculty in charge of competency examinations by telephone and/or met with them at their schools. Comira also extensively reviewed written documentation regarding the examinations to gain insights into the procedures used in competency examinations and associated scoring systems.

### **ASSUMPTIONS**

The occupational analysis conducted by the Office of Examination Resources at the California Department of Consumer Affairs identified the competencies of general dentists and served as the basis for the Board's examination program. The Board requires individuals seeking licensure to pass written and clinical examinations in order to become licensed in California.

Discussion of existing pathways, such as PGY-1, Western Regional Examining Board (WREB), programs for internationally-trained practitioners, or the Dental Bureau's clinical examination were not included as part of this report.

### **TERMINOLOGY**

A "competency examination" differs from a laboratory practical exercise or a clinical examination conducted as part of coursework, in that the competency examination is performed without intervention by faculty. The job of faculty is to determine the student's competence through a procedure and stop the examination only if the patient would be harmed.

A "test case" or "evaluation case" refers to the patients used within each school's competency examinations. The student dentist is required to follow strict guidelines in selecting patients for competency examinations, and cannot proceed with any treatment without faculty approval.

## APPLICABLE PSYCHOMETRIC STANDARDS

The Standards for Educational and Psychological Testing (1999) use the term "test" broadly and include credentialing procedures as well as actual examinations.

Standard 14.8 states:

"Evidence of validity based on test content requires a thorough and explicit definition of the content domain of interest. For selection, classification, and promotion, the characterization of the domain should be based on a job analysis (p. 160)."

Standard 14.9 states:

"When evidence of validity based on test content is a primary source of validity evidence in support of the use of a test in selection or promotion, a close link between test content and job content should be demonstrated (p. 160)."

Standard 14.10 states:

"When evidence of validity based on test content is presented, the rationale for defining and describing a specific job content domain in a particular way (e.g., in terms of tasks to be performed or knowledge, skills, abilities or other personal characteristics) should be stated clearly (p. 160)."

Standard 14.13 states:

"When decision makers integrate information from multiple tests or integrate test and nontest information, the role played by each test in the decision process should be clearly explicated, and the use of each test or test composition should be supported by validity evidence (p. 161)."

Standard 14.14 states:

"The content domain to be covered by a credentialing test should be defined clearly and justified in terms of the importance of the content for credential-worthy performance in an occupation or profession. A rationale should be provided to support the claim that the knowledge or skills being assessed are required for credential-worthy performance in an occupation and are consistent with the purpose for which the licensing or certification program was instituted (p. 161)."

## TASKS ACCOMPLISHED

There were four tasks performed as part of the present study:

- (a) Perform background research and literature review of material related to alternative pathways and their psychometric characteristics;
- (b) Interview SMEs, observe school practices and examinations at Bureau-approved dental schools;
- (c) Identify competency statements in Bureau-approved dental schools; and,
- (d) Identify underlying constructs and compare clinical competencies tested in Bureau-approved dental schools according to those constructs.

## SECTION 3: ALTERNATIVE PATHWAYS

### CURRICULUM INTEGRATED FORMAT

Definition. The curriculum integrated format (CIF) is described on page 5 of "Information for the New Graduate" (American Dental Association, 2008) as:

"...clinical examinations that use simulated patients (manikins). The CIF examinations are administered to senior dental students of record beginning with the simulated examinations early in the senior year and the restorative and periodontal examinations early in the second semester of the senior year. It allows dental students to take the examination in sections spread out across their last year of dental school, instead of taking all four parts at the very end of senior year. Candidate scores are reported to their dental school administration for the purpose of student remediation. Students can be eligible for licensure by the time of graduation, which means that they can begin planning their transition out of dental school several weeks earlier than those whose exams are near graduation and have to wait eight weeks for scores. As of fall 2006, all schools in the Central Regional Dental Testing Services (CRDTS), Northeast Regional Board of Dental Examiners (NERB), and Council of Interstate Testing Agencies (CITA) utilize CIF in their clinical licensure examination....Students often have three opportunities to pass the CIF before graduation."

All states and jurisdictions that use the CRDTS or NERB examinations use CIF examinations.

Disadvantages of CIF. Elliot (2008) states that the use of manikins, as in the CIF, provides standardization of the level of treatment difficulty. However, manikins present the same dilemma as actual patients in traditional clinical examinations because only a narrow range of examination procedures are performed.

### OBJECTIVE STRUCTURED CLINICAL EXAMINATION

Definition. The Objective Structured Clinical Examination (OSCE) requires candidates to rotate through a series of stations in which they must perform specific tasks such as review information supplied in a specified period of time, e.g., case history, photographs, radiographs, casts, models) and answer extended matching type questions. Each extended matching type question involves up to 15 questions and one or more correct answers. Some stations require the candidate to write a prescription for a patient, based on information about a specific case. There are no actual patients used at any of the stations. One organization (Accreditation Council for Graduate Medical Education, 2000) describes the OSCE as very useful to measure specific

clinical skills and abilities, but difficult to create and administer and cost effective only when many candidates are to be examined in one administration.

Disadvantages of OSCE. Zartman, McWhorter, Seale, and Boone (2002) use the OSCE format to assess the effectiveness of their pediatric dentistry program at the Baylor College of Dentistry. They indicated that during their transition into the OSCE format, there were several changes that were necessary for format to work.

First, the logistics of developing and administering the examination were time consuming. There were considerations that had to be made for the size of group to be assessed, the amount of space available, and the time limits for administration. Second, there were modifications that had to be made to the curriculum based on the feedback they received from students regarding what were considered basic concepts. Third, there was a great deal of student anxiety about the impending changes in curriculum format. Faculty responded to the students' anxiety by creating modules similar to the OSCE format within the curriculum. Fourth, the candidate data from the OSCE stations were scored by a number of scorers. In a number of cases, the faculty had to develop a standardized methodology to score the examinations.

Nonetheless, there have been studies exploring psychometric qualities of the OSCE. Gerrow, Murphy, Boyd, and Scott (2003) explored the reliability of the written and OSCE components of the certification process for 2,317 graduating dental students in Canada. Candidate data from the examinations were entered into a database along with their year of graduation, school, and performance in the final year. They found statistically significant correlation coefficients between the written and OSCE examinations, but the correlations only explained 20% of the variation in class rankings.

## TRADITIONAL PORTFOLIO

Definition. Portfolios in the arts or humanities-based education often include evidence of self-assessment; however, when used for regulatory purposes, the definition is much narrower. For example, Reckase (1995, p. 12) defines a portfolio as a "purposeful collection of student work that exhibits to the student and/or others the student's efforts, progress, or achievement in (a) given area(s). This collection must include student participation in selection of portfolio content, criteria for selection, criteria for judging merit, and, evidence of student self-reflection." He notes that this definition is intended to develop a hypothetical application of portfolio assessment.

By contrast, a clinical portfolio assesses performance in contexts that simulate clinical settings. Challis (2001) points out that "if portfolio is to be used for assessment; there should be total clarity on the part of the learner and assessor as to the purpose of the portfolio, why this method is being used, and what criteria the assessors will be using to make judgments about the portfolio. Achieving this clarity will require a climate of trust and partnership between learners and assessors, whilst still accepting that judgments will need to be made about learner progress and achievement (p. 438-439)."

The portfolio is often organized by competencies, unlike the portfolios used in non-clinical settings, e.g., undergraduate education in the arts or humanities. The Accreditation Council on Graduate Medical Education describes portfolios as tools to measure competence according to six outcomes: patient care, medical knowledge, practice-based learning and improvement, interpersonal and communication skills, professionalism, and systems-based practice (Jarvis, O'Sullivan, McClain, & Clardy, 2004).

Letts, Mosessner, and Dooley (2001) define a portfolio as a collection of work or materials that demonstrates growth over time and a file or collection of original work or documents that support the work. Its strength is its ability to capture learning over time, to allow for a genuine link to clinical situations, and to provide a framework for students to assess their strengths and weaknesses. These authors acknowledge that the development of some standard portfolio requirements for registered nurses with well-trained reviewers can alleviate the challenges posed by the need to evaluate student work within the educational setting.

Another definition of a portfolio was recently proposed by the Dental Bureau of California (2007) as a collection of verified clinical experiences based on results of competency examinations in diagnosis and treatment planning, periodontics, direct and indirect restorative, prosthodontics, and endodontics. Each candidate who wishes to obtain initial licensure by competency would be required to have performed a specific number of clinical experiences prior to submitting a portfolio. Each portfolio would be evaluated by a team of examiner-auditors from the Bureau and a team of clinical competency evaluators/instructors from the schools.

Elliott (2008) describes portfolios as "the use of live patients in a third-party evaluation developed during the educational process. In a portfolio, students provide examples of evidence (patient experiences) to support and document their claims of clinical competency, based on their institutional program's competencies.

Psychometric issues relating to the use of portfolios. If used for summative rather than formative purposes, the portfolio must meet stringent psychometric requirements that include standardization, rater training with structured guidelines for making decisions, and large numbers of examiners to average out rater effects (Driessen, van der Vleuten, Schuwirth, Tartwijk & Vermunt, 2005, p. 215; Davis & Ponnampereuma, 2005, Friedman Ben-David, Davis, Harden, Howie, Ker, & Pippard, 2001). Friedman Ben-David et al. note that the validity of the inferences made about the portfolio depend on the reliability of the test. If the test scores or ratings suffer from low inter-rater agreement or poor sampling, inferences cannot be made. Moreover, there should be a clear definition of the purpose of the portfolio and identification of the competencies to be assessed. Webb, et al (2003) and McMullan (2003) cite several criteria that should be used to evaluate portfolio assessments, namely, explicit grading criteria, evidence from a variety of sources, internal quality assurance processes, and external quality assurance processes.

Content validity is also important in developing an examination for initial licensure (Chambers, 2004a) such that there should be a validation process that inquires whether tasks being evaluated should be representative of tasks critical to safe and effective practice. A recent paper by Patterson, Ferguson, and Thomas (2008) in Medical Education also calls for validation of the process in terms of using a job analysis to identify core and specific competencies.

A recent paper entitled "Point/Counterpoint: Do portfolio assessments have a place in dental licensure?" addresses many of these issues specifically as they pertain to the purpose of licensure rather than education in general (Hammond & Buckendahl, 2006; Ranney & Hambleton, 2006).

Hammond and Buckendahl do not support the use of portfolios for dental licensure. Two issues are important in considering portfolio assessments. First, standardizing the training and evaluation across a broad range of locations would be difficult. Second, demonstrations of abilities in past records would need to be verified so that there is an evaluation of the current range of competencies. These authors contend that the portfolio does not provide an assessment of minimum skills that is administered *independent* of the training program to support licensure decisions; and therefore, provides no external validation and verification of the students' competence. Moreover, there may be measurement error, or low reliability, within the system as a result of errors in content sampling, number of observations of performance, number of examiners rating the candidate's performance, assumptions of unidimensional relationships between items, lack of inter-rater agreement, and reliance on pairs rather than triads of examiners for all candidates.

On the other hand, Ranney and Hambleton (2006) support the use of portfolios for dental licensure. According to these authors, testing agencies have published little or no data to allow an assessment of reliability of validity of their examinations. Variability in the reliability of clinical licensure examinations and pass rates among testing agencies may reflect lack of reliability or validity in the examination process, and, omission of skills necessary to practice safely at the entry level, not just changes in candidate populations. Furthermore, there is great dissatisfaction amongst dental school deans connected with the use of patients. The authors recognize that several criteria would need to be met before portfolio assessment could be implemented. The most important of these criteria are: administration by independent parties, inclusion of a full continuum of candidate competencies for comprehensive evaluation, and, evaluating competence within the context of a treatment plan designed to meet the patient's oral health care needs. In their discussion, the authors believe that portfolio assessments could work if the developers considered which tasks to measure, how the tasks would be scored, calibration protocols for examiners, and how performance expectations would be set.

Faculty concerns regarding portfolio process. Lettus et al. (2001) cite several faculty concerns regarding the portfolio process. First, was the structure and process of the portfolio. Second, was the students' ability to develop written portfolios that met

expected professional standards. Third, was the accuracy and legitimacy of the documentation. Fourth, was the inter-rater reliability of the examiners. These concerns are addressed by providing a structure and framework for the portfolio, a means to verify the authenticity of the information presented, and a well-defined rating system for use by examiners.

Student perceptions of portfolio process. Davis, Ponnampuruma and Ker (2009) identified and analyzed medical student attitudes in the United Kingdom to the portfolio process over time. They administered a questionnaire to Scottish medical students over a five-year period. They found that students perceived the portfolio heightened their understanding of learning outcomes and allowed them to reflect on their work. They concluded that the downside of portfolios was the excessive amount of paper evidence required. Davis, et al.'s findings concur with those of previous research (e.g., Spicuzza, 1996) that cite portfolio assessments as excellent tools to assess professional growth and instructional goals; however, they are difficult to score, not readily comparable, problematic in terms of reliability and validity, and time consuming.

Organizational research regarding portfolio. Pavlova, Tsiachristas, Vermaeten, and Groot (2008) conducted a pilot study of portfolios at a public hospital in the Netherlands and found potential barriers to the adoption of portfolio. First, the relative nature of the portfolio matrix should be interpreted such that there was a clear rationale for including or not including specific services in the portfolio and defined cut-off points for each service. Second, the strategic importance of information systems, which can affect an effective benchmarking process and improve the reliability of the information derived. Third, there needs to be a balance between simplicity and validity of the data collection. Fourth, the organizational culture may prevent immediate acceptance of the methodology and the overall adoption of portfolio. The authors cite that organizations may take a long time to understand portfolio and recognize its value.

Disadvantages. The portfolio may not address a student's current competence as an unsupervised practitioner, unless the competencies can be demonstrated independently at about the time the student wishes to enter practice.

## HYBRID PORTFOLIO EXAMINATION MODEL

Definition. What are the distinguishing characteristics of the hybrid portfolio examination? First, it is considered a performance examination which assesses candidates' skills in commonly encountered clinical situations. Second, it includes components of clinical examination administered by the Bureau/Board or regional examining entity. Third, candidates' performance is measured according to the information provided in competency evaluations conducted in the schools by clinical faculty within the predoctoral program of education. Thus, the hybrid portfolio examination involves hands-on performance evaluations of clinical skills as evaluated within the candidates' program of dental education.

The hybrid portfolio model is designed to use the structure for student evaluation that currently exists within the schools to assess minimum competence. The faculty would observe the treatment provided and evaluate candidates according to consistent criteria developed by a consensus of key faculty from all of the dental schools. Each candidate would prepare a portfolio of documentation that provides proof of completion of competency evaluations for specific procedures such as amalgam/composite restoration, endodontics, fixed prosthetics, oral diagnosis and treatment planning, periodontics, radiography, and removable prosthodontics.

The hybrid model captures the strength of the traditional portfolio process but with the advantage of being integrated within the current educational process. During visits to the dental school clinics and interviews with faculty, it was clear that the dental schools were consistent in their methodology for assessing students' clinical skills. The faculty were calibrated and re-calibrated to ensure consistency in their evaluation of the student competencies and the processes used by the dental schools for assessing competencies was very similar. In every case, minimum competency was built into the rating scales used to evaluate students in their competency examinations.

Instead of developing a portfolio and having the portfolio evaluated, the hybrid portfolio model requires documentation of the test cases (or competency cases) which are competency evaluations assembled in either a paper or electronic format. The faculty examiners would have to attest to the ratings achieved by the students. The hybrid portfolio is built and evaluated in real time. The documentation for the portfolio is submitted in paper or electronic format. Each procedure is documented by type of procedure (e.g., periodontics, endodontics, prosthodontics, restorative).

The Dental Bureau would have access to the completed hybrid portfolios in order to complete audits of the documentation. The hybrid portfolio examination could serve as an alternative pathway based upon implementation of the issues described below in the next section (Section 5: Key Findings).

Specific features. The hybrid portfolio examination model addresses the criteria for success described in Section 1.

1. Oversight maintained by the Dental Bureau/Board of California

The Dental Board/Bureau has the lawful responsibility to ensure that dentists who are licensed possess the competencies to practice safely and that responsibility cannot be delegated.

2. Built-in system for auditing the process

Upon implementation, a system must be in place to audit the alternative pathway examination. The auditing system must be part of the design requirement of the alternative pathway examination. The auditing system must be designed such that

the Bureau/Board and the evaluators have defined responsibilities to ensure that the candidates who are successful are competent.

3. Does not require additional resources from the students, schools, or the Bureau/Board of California

There are systems and procedures already in place in the dental schools. The structure of the systems and procedures are quite suitable for evaluating candidates' competence. The systems and procedures are very similar among the dental schools and, with collaboration among the schools, could create a common system.

4. Must be instituted within the current systems of student evaluation

The standards and criteria for successful performance must be fully established by the schools and consistent application of the standards and criteria would take into account the tremendous amount of work undertaken to comprehensively evaluate the candidates' clinical skills in a variety of clinical situations.

5. Must be considered an examination and meet all professional testing standards

Any method or system that evaluates performance and classifies candidates within a licensing context is considered an examination by professional testing standards and case law.

6. Meets psychometric standards, relevant to current practice, and designed for minimum competence

Because the alternative pathway is an examination, it must meet legal standards as explicated in Sections 12944, Section 139, guidelines promulgated by the California Department of Consumers Affairs, and psychometric standards for examinations set forth by the Standards for Educational and Psychological Testing (1999).

7. Is designed to cover the full continuum of competence

The alternative pathway examination must assess competencies throughout the course of treatment including oral diagnosis and treatment planning, follow-up and ongoing care, restorative (amalgam and composite restoration, fixed prosthetics), endodontics, periodontics, radiography, and removable prosthodontics.

8. Evaluation of competence is within the course of treatment plan for patients of record

The competency of the candidates must be evaluated in the course of treatment of a client. The evaluation of competence should not be in an artificial or contrived situation as may be true when the services are solely for the purpose of training.

9. Evaluators are regularly calibrated for consistent implementation of the examination

The evaluators who participate in the alternative pathway examination must be trained and calibrated to ensure that the standards and criteria do not vary across candidates. Each candidate must have a standardized examination experience.

10. Has policies and procedures that treat licensure candidates fairly and professionally, with timely and complete communication of examination logistics and results

The alternative pathway examination must be designed such that candidates are knowledgeable of standards to which they are being held accountable and the procedures that they should follow in order to maximize success.

## **SECTION 4: CLINICAL COMPETENCIES ASSESSED**

### **CLINICAL COMPETENCY STATEMENTS OF EACH SCHOOL**

Key faculty from relevant departments at each of the schools were interviewed regarding the clinical dimensions of practice assessed in competency examinations within their predoctoral programs. All of the schools provided copies of their competency statements that were part of the documentation submitted to evaluators from the Commission on Dental Accreditation at the time of their accreditation site visits. As expected, all of the schools included competencies which met minimum standards set forth by the Commission on Dental Accreditation for predoctoral dental education programs (2007, p. 15): "At a minimum graduates must be competent in providing oral health care with the scope of general dentistry, as defined by the school, for the child, adolescent, adult, and geriatric patient, including:

- a) Patient assessment and diagnosis;
- b) Comprehensive treatment planning;
- c) Health promotion and disease prevention;
- d) Informed consent;
- e) Anesthesia, and pain and anxiety control;
- f) Restoration of teeth;
- g) Replacement of teeth;
- h) Periodontal therapy;
- i) Pulpal therapy;
- j) Oral mucosal disorders;
- k) Hard and soft tissue surgery;
- l) Dental emergencies;
- m) Malocclusion and space management; and,
- n) Evaluation of the outcomes of treatment.

Competency statements for each school are presented in Tables 1-5 organized in according to common themes:

- a) Ethical and professional behavior;
- b) Comprehensive assessment
- c) Diagnosis, treatment planning, comprehensive treatment
- d) Medical and dental emergencies
- e) Pain and/or anxiety control
- f) Communication; and,
- g) Infection control.

Table 1 – Competency statements in California dental schools: UCSF

Dimension	Competency statement
1. Ethical and professional behavior	<ul style="list-style-type: none"> <li>• Demonstrate ethical and professional behavior in interactions with patients and colleagues</li> </ul>
2. Comprehensive assessment	<ul style="list-style-type: none"> <li>• Determine need for, order, obtain, and interpret radiographs and apply oral and maxillofacial radiology safely and effectively</li> <li>• Evaluate medical status of patients and determine their ability to tolerate treatment</li> </ul>
3. Diagnosis, treatment planning, comprehensive treatment	<ul style="list-style-type: none"> <li>• Assess outcomes of comprehensive dental care in student dental practice</li> <li>• Develop appropriate differential diagnoses and diagnostic plans for management of oral diseases of dentition, jaw, oral mucosa, and salivary glands and treat and refer as necessary</li> <li>• Diagnose complete and partial edentulism and provide fixed or removable prostheses and referral as necessary</li> <li>• Diagnose dental disease of child and adolescent patients and provide prevention, monitoring, treatment, and referral as necessary</li> <li>• Diagnose endodontic disease and provide systematic evaluation, case selection, non-surgical treatment, and referral as necessary</li> <li>• Diagnose indications for dentoalveolar surgery and provide treatment and referral as necessary</li> <li>• Diagnose malocclusions and provide monitoring, treatment, and referral as necessary</li> <li>• Evaluate, diagnose, and develop treatment and/or referral plans appropriate to the unique characteristics of each patient</li> <li>• Provide adult caries management including prevention and appropriate intracoronal and extracoronal restoration</li> </ul>
4. Medical and dental emergencies	<ul style="list-style-type: none"> <li>• (addressed in monitoring and treatment in "Diagnosis, treatment planning, comprehensive treatment"; also addressed in coursework that covers medical emergencies, local anesthesia difficulties, etc.)</li> </ul>
5. Pain and/or anxiety control	<ul style="list-style-type: none"> <li>• Provide appropriate level of pain and anxiety control in comprehensive dental care</li> </ul>
6. Communication	<ul style="list-style-type: none"> <li>• Communicate with and educate patients in ways that are both knowledgeable and effective</li> </ul>
7. Infection control	<ul style="list-style-type: none"> <li>• Follow universal infection control guidelines in clinical procedures</li> </ul>

Table 2 – Competency statements in California dental schools: UOP

Dimension	Competency statement
1. Ethical and professional behavior	<ul style="list-style-type: none"> <li>• Assume active responsibility for one's lifelong learning</li> <li>• Determine and consider patient's dental, medical, and personal situations in evaluating the range of dental theories appropriate for that individual</li> <li>• Develop philosophy of practice</li> <li>• Diagnose and treat only within one's competence</li> <li>• Direct services of dental auxiliaries</li> <li>• Evaluate oral health care delivery and payment systems in terms of impact on patients, dental practices, and profession</li> <li>• Evaluate scientific, lay, and trade information and claims about new products and procedures</li> <li>• Function as patient's primary and comprehensive oral health care provider</li> <li>• Participate in activities designed to improve health of communities</li> <li>• Participate in organized dentistry</li> <li>• Practice four-handed dentistry</li> <li>• Practice with sound business principles and legal requirements and regulations</li> <li>• Prepare and use accurate records</li> <li>• Recognize moral weakness, uncertainty, and dilemmas in dental practice in accordance with normative ethical principles</li> <li>• Recognize signs of abuse and neglect, and take appropriate action</li> <li>• Think critically, solve problems, and base dental decisions on evidence and theory</li> <li>• Use information technology for dental practice</li> </ul>
2. Comprehensive assessment	<ul style="list-style-type: none"> <li>• Interpret findings from complete patient work-up and present them in a standardized format</li> <li>• Perform a complete patient work-up, to include history and physical, laboratory, and radiographic examinations</li> </ul>
3. Diagnosis, treatment planning, comprehensive treatment	<ul style="list-style-type: none"> <li>• Address simple cosmetic concerns</li> <li>• Assess results of periodontal treatment</li> <li>• Combine diagnostic and prognostic data with science base and patient's values to form an individualized, comprehensive, sequenced treatment plan</li> <li>• Determine differential, provisional, and definitive diagnoses</li> <li>• Develop a plan incorporating dental practice management principles</li> <li>• Fabricate nightguard applicants to protect dentition</li> <li>• Involve caregivers, guardians, and other health and social service professionals in managing oral health of patients</li> <li>• Make referrals to dental and medical colleagues, and, in conjunction with them, manage patients' care</li> <li>• Modify ongoing treatment plans based on changed circumstances</li> <li>• Oversee long term care for patients with dental prostheses</li> <li>• Participate in quality assurance systems</li> <li>• Perform simple and surgical tooth and root extractions</li> <li>• Perform treatment for children in a manner that incorporates consideration of expected growth and development</li> <li>• Perform uncomplicated endodontic therapy on permanent teeth</li> <li>• Prevent and treat pulpal inflammations using direct and indirect procedures</li> <li>• Recognize and refer dental malocclusions and disturbances in development of dentition</li> </ul>

Dimension	Competency statement
	<ul style="list-style-type: none"> <li>• Recognize and treat or refer moderate to severe chronic periodontitis, aggressive periodontitis, and other conditions requiring complicated periodontal therapy</li> <li>• Recognize oral health care needs, refer, and ensure follow-up treatment for patients with complex disabilities and medical conditions</li> <li>• Restore single teeth for therapeutic reasons</li> <li>• Treat patients who have missing teeth with simple, fixed, removable, and implant-supported prostheses</li> <li>• Treat patients with special needs who do not require hospital adjunctive care as part of treatment</li> <li>• Treat plaque-induced gingivitis, mild chronic periodontitis, and other conditions requiring uncomplicated periodontal therapy</li> <li>• Treat simple, and recognize and refer complex complications related to intraoral surgical procedures</li> <li>• Treat simple, and refer complex oral bony abnormalities</li> <li>• Treat simple, and refer complex oral mucosal abnormalities</li> <li>• Use preventive strategies to help patients maintain and improve their oral health</li> <li>• Work with commercial laboratory support associated with restorative treatment</li> </ul>
4. Medical and dental emergencies	<ul style="list-style-type: none"> <li>• Perform CPR</li> <li>• Recognize and respond to medical emergencies occurring in the dental office</li> <li>• Recognize and respond to intraoral emergencies</li> </ul>
5. Pain and/or anxiety control	<ul style="list-style-type: none"> <li>• Administer and prescribe medications commonly used in dentistry, including local anesthesia, and manage their complications</li> </ul>
6. Communication	<ul style="list-style-type: none"> <li>• Communicate with patients, staff, and others in an empathetic and culturally competent manner</li> <li>• Counsel patients on lifestyle habits that affect oral health</li> <li>• Discuss treatment plans with patients and caregivers, including presentation of findings, alternatives, risks and benefits, and obtain informed consent from them</li> <li>• Establish and maintain patient rapport</li> </ul>
7. Infection control	<ul style="list-style-type: none"> <li>• Use current infection and hazard control measures</li> </ul>

Table 3 – Competency statements in California dental schools: UCLA

Dimension	Competency statement
1. Ethical and professional behavior	<ul style="list-style-type: none"> <li>• Apply ethical principles to professional practice</li> <li>• Evaluate scientific literature and other sources of information to make decisions about dental treatment</li> <li>• Understand principles necessary for developing, managing, and evaluating a general practice</li> </ul>
2. Comprehensive assessment	<ul style="list-style-type: none"> <li>• Interpret and correlated findings from history, clinical and radiographic examination and other diagnostic tests, and develop problem list</li> <li>• Perform comprehensive examination that collects patient history; chief complain; biological, psychological, behavioral, and social information; and acquire all appropriate records needed to evaluate medical and oral condition for patients of all ages</li> </ul>
3. Diagnosis, treatment planning, comprehensive treatment	<ul style="list-style-type: none"> <li>• Develop comprehensive, properly sequenced treatment plan based on all diagnostic data, and develop alternative treatment plans as appropriate to achieve patient satisfaction</li> <li>• Diagnose developmental or acquired occlusal and/or skeletal abnormalities</li> <li>• Direct laboratory fabrication of restorations and prostheses and modify them, if necessary</li> <li>• Modify treatment plans, when indicated, based on regular evaluation, unexpected circumstances, or special patient needs</li> <li>• Perform preventive and restorative procedures that preserve tooth structure, prevent hard tissue disease, and promote soft tissue health</li> <li>• Prescribe and monitor effects of pharmacotherapeutic agents used to prevent oral diseases</li> <li>• Restore single defective teeth</li> <li>• Treat an manage patients with oral esthetic needs</li> <li>• Treat and manage caries</li> <li>• Treat and manage conditions requiring reparative surgical procedures on hard and soft tissues</li> <li>• Treat and manage diseases of pulpal and periadciular origin</li> <li>• Treat and manage partial or complete edentualism</li> <li>• Treat and manage periodontal disease</li> <li>• Treat and manage temporomandibular disease and chronic orofacial pain</li> <li>• Treat or manage non-odontogenic oral diseases or disorders</li> </ul>
4. Medical and dental emergencies	<ul style="list-style-type: none"> <li>• Prevent, treat, and manage dental and medical emergency situations encountered in the practice of general dentistry</li> </ul>
5. Pain and/or anxiety control	<ul style="list-style-type: none"> <li>• Treat and manage acute orofacial discomfort and psychological distress</li> </ul>
6. Communication	<ul style="list-style-type: none"> <li>• Demonstrate ability to communicate professional knowledge verbally and in writing</li> <li>• Discuss findings, diagnosis, and treatment options with the patient or parent/guardian and obtain informed consent for delivery of mutually accepted treatment</li> <li>• Educate patients concerning etiology and prevention of oral disease and encourage them to assume responsibility for their oral health</li> </ul>
7. Infection control	<ul style="list-style-type: none"> <li>• Understand what is necessary to protect, promote and restore oral health in his/her community</li> </ul>

Table 4 – Competency statements in California dental schools: USC

Dimension	Competency statement
1. Ethical and professional behavior	<ul style="list-style-type: none"> <li>• Apply ethical, legal, and regulatory concepts and principles to the provision and/or support of oral health care services</li> <li>• Improve oral health of individuals from diverse, disadvantaged, and “at risk” populations through diagnosis, treatment, and education in a variety of practice settings</li> <li>• Provide empathic care for all patients without discrimination</li> <li>• Regularly assess one’s knowledge and skills, and seek additional information to correct deficiencies and enhance performance</li> <li>• Understand principles, regulations and procedures necessary to manage and lead a contemporary dental practice</li> </ul>
2. Comprehensive assessment	<ul style="list-style-type: none"> <li>• Assess patient goals, values and concerns to establish rapport, guide patient care, maintain oral health, and monitor therapeutic outcomes</li> <li>• Perform comprehensive diagnostic evaluation based on application of scientific principles and current literature, with consultations as appropriate</li> <li>• Recognize normal range of clinical findings and significant deviations that reflect oral pathology and require monitoring, treatment, or management</li> <li>• Recognize oral manifestations of systemic disorders, as well as systematic complications of oral disease, and seeking consultations as needed</li> </ul>
3. Diagnosis, treatment planning, comprehensive treatment	<ul style="list-style-type: none"> <li>• Combine clinical and supporting data, with individual patient’s goals and values, and integrate multiple disciplines into individual, comprehensive, sequenced treatment plans with appropriate diagnoses, prognoses, and treatment alternatives</li> <li>• Recognize indications for oral surgical procedures, treating uncomplicated conditions, and referring complicated surgical procedures</li> <li>• Recognize needs for orthodontic treatment, performing uncomplicated procedures and referring complicated ones</li> <li>• Recognize patients with chronic orofacial pain and dysfunction (including temporomandibular joint disorders), treating uncomplicated conditions, and referring complicated surgical procedures</li> <li>• Recognize periodontal disease, treating uncomplicated conditions, and referring complicated periodontal procedures</li> <li>• Recognize pulpal and periapical disease, treating uncomplicated conditions, and referring complicated endodontic procedures</li> <li>• Restore edentulous spaces to optimal form, function, and esthetics using fixed partial dentures, removable partial dentures, complete dentures, or implant supported restorations</li> <li>• Restore single defective teeth to optimal form, function, and esthetics using direct and indirect restorations</li> <li>• Understand differences between various models of oral health care delivery</li> </ul>
4. Medical and dental emergencies	<ul style="list-style-type: none"> <li>• Anticipate, detect, and provide initial treatment and follow-up management for complications and medical emergencies that may occur during or as a result of dental treatment</li> <li>• Select and administer or prescribe pharmacological agents in the treatment of dental patients</li> </ul>
5. Pain and/or anxiety control	<ul style="list-style-type: none"> <li>• Manage patients with pain or anxiety using non-pharmacological methods</li> <li>• Recognize and manage pain, hemorrhage, trauma, and infection of the orofacial complex</li> </ul>
6. Communication	<ul style="list-style-type: none"> <li>• Communicate effectively, both orally and in writing, with colleagues, practitioners, staff, patients, and the public</li> <li>• Provide patient education and preventive procedures to maximize oral health</li> </ul>
7. Infection control	<ul style="list-style-type: none"> <li>• Implement and monitor infection control and environmental</li> </ul>

Table 5 – Competency statements in California dental schools: LLU

Dimension	Competency statement
1. Ethical and professional behavior	<ul style="list-style-type: none"> <li>• Apply ethical principles to professional practice and personal life</li> <li>• Function as a leader in a multicultural work environment and manage a diverse patient population</li> <li>• Perform clinical decision making that is supported by foundational knowledge and evidence-based rationales</li> <li>• Understand basic principles important in developing, managing and evaluating a general dental practice</li> <li>• Understand importance of maintaining physical, emotional, financial, and spiritual health in one's personal life</li> </ul>
2. Comprehensive assessment	<ul style="list-style-type: none"> <li>• Conduct comprehensive examination to evaluate general and oral health of patients of all ages within the scope of general dentistry</li> </ul>
3. Diagnosis, treatment planning, comprehensive treatment	<ul style="list-style-type: none"> <li>• Analyze continuously the outcomes of patient treatment to improve treatment</li> <li>• Assess and manage maxillary and mandibular skeletal dental discrepancies, including space maintenance, as represented in early, mixed and permanent dentitions</li> <li>• Determine diagnosis by interpreting and correlating findings from examination</li> <li>• Develop a comprehensive treatment plan and alternatives</li> <li>• Evaluate and manage diseases of pulpal origin and subsequent periradicular disease</li> <li>• Evaluate and manage treatment of periodontal diseases</li> <li>• Manage restoration of individual teeth and replacement of missing teeth for proper form, function, and esthetics</li> <li>• Promote, improve, and maintain oral health in patient-centered and community settings</li> <li>• Provide basic surgical care</li> <li>• Recognize and manage pathologic changes in tissues of the oral cavity and head and neck area</li> <li>• Recognize and manage problems related to occlusal stability</li> </ul>
4. Medical and dental emergencies	<ul style="list-style-type: none"> <li>• Manage dental emergencies and medical emergencies that may be encountered in dental practice</li> </ul>
5. Pain and/or anxiety control	<ul style="list-style-type: none"> <li>• Manage pain and anxiety with pharmacologic and non-pharmacologic methods</li> </ul>
6. Communication	<ul style="list-style-type: none"> <li>• Apply behavioral and communication skills in the provision of patient care</li> </ul>
7. Infection control	<ul style="list-style-type: none"> <li>• Provide appropriate preventive and/or treatment regimens for patients with various dental carious states using appropriate medical and surgical treatments</li> </ul>

## CLINICAL COMPETENCIES TESTED

Rating scales. All of the schools had slightly different formats, but similar rating criteria for their competency examinations. Below are examples of competencies tested in periodontics, indirect restoration, composite restoration, and endodontics (Tables 6-9). While the exact wording of the criteria and the structure of each school's rating system is not identical, the minimum criteria address the same concepts.

Table 6 – Examples of rating scales for periodontic scaling/root planing

	Examples of minimum criteria	Rating system
UCSF	<ul style="list-style-type: none"> <li>Distances from CEJ to gingival margin within 1 mm</li> <li>Furcation measurements accurate</li> <li>Mobility measurements accurate</li> </ul>	<ul style="list-style-type: none"> <li>P/F grading</li> </ul>
UOP	<ul style="list-style-type: none"> <li>Complete periodontal charting (pocket depths)</li> <li>Pocket probing depths satisfactory</li> <li>Mobility and furcations satisfactory</li> </ul>	<ul style="list-style-type: none"> <li>Grade of 5-7 is passing (scale of 1-9)</li> </ul>
UCLA	<ul style="list-style-type: none"> <li>Assess and record pocket depths</li> <li>Assess and record furcation invasions</li> <li>Assess and record tooth mobility</li> </ul>	<ul style="list-style-type: none"> <li>P/F grading</li> </ul>
USC	<ul style="list-style-type: none"> <li>Charting measurements do not vary more than 1 mm from faculty's measurements</li> <li>Recession, furcation involvement, mobility, plaque and calculus indices recorded</li> </ul>	<ul style="list-style-type: none"> <li>≥ 75% out of 100</li> </ul>
LLU	<ul style="list-style-type: none"> <li>Subgingival calculus correctly identified and properly removed</li> <li>Charting is accurate and complete</li> </ul>	<ul style="list-style-type: none"> <li>≥ 70 points and above is passing (100 points possible)</li> </ul>

Table 7 – Examples of rating scales for indirect restoration

	Examples of minimum criteria	Rating system
UCSF	<ul style="list-style-type: none"> <li>Caries removed</li> <li>Occlusal reduction sufficient</li> <li>Gingival depth/margin position sufficient</li> <li>Axial contours adequate (no over contours)</li> <li>Soft tissue has slight laceration or no laceration</li> </ul>	<ul style="list-style-type: none"> <li>Satisfactory grade (8) (scale of 1-10)</li> </ul>
UOP	<ul style="list-style-type: none"> <li>Occlusal reduction uniform (1.5 to 1.5 mm)</li> <li>Supragingival chamfer finish line .5-1 mm</li> <li>Supragingival shoulder finish line 0.5 – 1 mm</li> <li>Slight soft tissue damage or no damage (untouched)</li> </ul>	<ul style="list-style-type: none"> <li>Minor, slight, or moderate is passing, no deductions for uncorrectable or significant errors</li> </ul>
UCLA	<ul style="list-style-type: none"> <li>Occlusal reduction with minor, slight, or moderate deviations</li> <li>Axial reduction with with minor, slight, or moderate deviations</li> <li>Draw and taper with minor, slight, or moderate deviations</li> <li>Contours with minor, slight, or moderate deviations</li> </ul>	<ul style="list-style-type: none"> <li>Minor, slight, or moderate quality is passing</li> </ul>
USC	<ul style="list-style-type: none"> <li>Caries removed</li> <li>Axial walls are tapered for maximum retention</li> <li>Finish lines are smooth and free of irregularities</li> </ul>	<ul style="list-style-type: none"> <li>Grade of S is passing</li> </ul>
LLU	<ul style="list-style-type: none"> <li>Caries completely removed</li> <li>Margins/finish line of prep are appropriately placed, smooth, well defined and uniform or have slight/moderate deviations</li> <li>Slight or moderate soft tissue trauma or no trauma</li> </ul>	<ul style="list-style-type: none"> <li>Grade of Satisfactory is passing</li> </ul>

Table 8 – Examples of rating scales for composite restoration

	Examples of minimum criteria	Rating system
UCSF	<ul style="list-style-type: none"> <li>• Caries removed</li> <li>• Enamel surface beveled sufficiently or with slight under- or overextensions</li> <li>• Contours reproduced appropriately or with slight deviations</li> <li>• Slight, reversible soft tissue trauma or no trauma</li> </ul>	<ul style="list-style-type: none"> <li>• Satisfactory grade (8) (scale of 1-10)</li> </ul>
UOP	<ul style="list-style-type: none"> <li>• Caries removed</li> <li>• Existing restorative material removed</li> <li>• Surface is smooth and polished to smoothness of adjacent tooth structure, not rough to explorer</li> <li>• Normal occlusion present</li> <li>• Minor pits or voids can be repaired</li> </ul>	<ul style="list-style-type: none"> <li>• Satisfactory rating is passing</li> </ul>
UCLA	<ul style="list-style-type: none"> <li>• Caries removal</li> <li>• Occlusal anatomy of composite has minor, slight, or moderate deviations</li> <li>• Outline (shape/dimensions) with minor, slight, or moderate deviations</li> <li>• Surface finish with minor, slight, or moderate deviations</li> <li>• Facial contours with minor, slight, or moderate deviations</li> </ul>	<ul style="list-style-type: none"> <li>• Minor, slight, or moderate quality is passing</li> </ul>
USC	<ul style="list-style-type: none"> <li>• Outline includes enamel decalcification contiguous with area of caries, restoration or tooth structure, overextensions less than .5 mm</li> <li>• Sufficient depth to identify and remove caries or existing restorative material or less than .25 mm of health dentin or enamel</li> <li>• Finish on enamel margins optimal or within slight deviation of optimal</li> <li>• Surface is free of pits or voids, or minimal deviations from optimal</li> </ul>	<ul style="list-style-type: none"> <li>• Grade of S is passing</li> </ul>
LLU	<ul style="list-style-type: none"> <li>• Outline and extension appropriate with all decalcification, caries, and fissured grooves removed</li> <li>• Margins appropriate, no excess or deficiency</li> <li>• Finish is smooth with no pits, voids or irregularities or with slight/moderate surface pitting, voids or irregularities</li> <li>• No damage to hard or soft tissue</li> </ul>	<ul style="list-style-type: none"> <li>• Minor, slight, or moderate quality is passing</li> </ul>

Table 9 – Examples of rating scales for endodontic

	Examples of minimum criteria	Rating system
UCSF	<ul style="list-style-type: none"> <li>• Canal shape is appropriate</li> <li>• Pulp chambers and canals visible on radiograph</li> <li>• Canal appropriately obturated (fill, density, shape)</li> </ul>	<ul style="list-style-type: none"> <li>• Grade of 3-4 is passing (scale of 1-8)</li> </ul>
UOP	<ul style="list-style-type: none"> <li>• Access outline/dentin preparation satisfactory</li> <li>• Last apical file goes to full working length</li> <li>• Canal vertically compacted</li> <li>• Canal obturated to working length without voids</li> </ul>	<ul style="list-style-type: none"> <li>• Grade of 5-7 is passing (scale of 1-9)</li> </ul>
UCLA	<ul style="list-style-type: none"> <li>• Access cavity adequate</li> <li>• Canal prep and master apical file adequate</li> <li>• Master cone fit adequate</li> <li>• Initial condensation adequate</li> </ul>	<ul style="list-style-type: none"> <li>• Grade of Adequate is passing (scale is excellent, adequate, inadequate, very poor)</li> </ul>
USC	<ul style="list-style-type: none"> <li>• Caries completely removed</li> <li>• Access acceptable</li> <li>• Canal orifice flared</li> <li>• Gutta percha not overfilled</li> </ul>	<ul style="list-style-type: none"> <li>• Grade of S is passing</li> </ul>
LLU	<ul style="list-style-type: none"> <li>• Caries completely removed</li> <li>• Adequate canal flare</li> <li>• Correct working length</li> <li>• Root canal space completely obturated</li> </ul>	<ul style="list-style-type: none"> <li>• P/F grading on each criteria</li> </ul>

Competencies tested. Table 10 summarizes the competencies assessed in the five dental schools tested. Since each competency examination was timed, practice management was implied through all the schools. Details of the competency examinations are presented in Tables 11-16.

UCSF had separate competency examinations for instrument identification and instrument sharpening, caries risk assessment and caries management, emergency, medical/dental history taking, pediatric, and infection control; however, these competencies were embedded within the competency examinations of in other schools.

UOP did not provide a competency examination for oral diagnosis and treatment planning, oral surgery, or, prosthodontics, however, much of this information was included throughout the students' clinical experiences to medically manage complex patients. LLU did not have a competency examination for oral surgery, although the topic was thoroughly covered in clinical experiences.

Radiography was typically embedded within various competency examinations. At UOP, students' radiographic competence was tested in endodontic and periodontic competency examinations. At UCLA, radiographic competence was tested in preventive, fixed removable, and endodontic competency examinations.

It should be noted that the endodontics department at UCLA has an established system in place that incorporates course examinations and competency examinations into a portfolio.

Table 10 – Summary of competencies assessed

Competency	UCSF	UOP <sup>1</sup>	UCLA <sup>2</sup>	USC	LLU
1. Amalgam and composite restoration	X	X	X	X	X
2. Endodontics	X	X	X	X	X
3. Fixed prosthetics	X	X	X	X	X
4. Oral diagnosis and treatment planning	X	--	X	X	X
5. Oral surgery	X	--	X	X	--
6. Periodontics	X	X	X	X	X
7. Radiography	X	--	--	X	X
8. Removable prosthodontics	X	--	X	X	X

<sup>1</sup> Radiographic technique specifically assessed in as part of endodontic and peridental competencies.

<sup>2</sup> Radiographic technique specifically assessed in preventive dentistry, fixed removable, and endodontic competencies. Endodontic competency examinations were part of an existing portfolio system.

Table 11 – Competency examinations at UCSF

Type	Competency assessed
1. Amalgam and composite restoration	(1) Class I amalgam (2) Class II interproximal posterior amalgam (3) Class I composite or preventive resin restoration (4) Class II interproximal posterior composite (5) Interproximal anterior composite (6) Class V smooth surface composite/glass ionomer, or amalgam
2. Endodontics	(1) Single-rooted case (2) Multi-rooted case
3. Fixed prosthetics	Cast restoration
4. Oral diagnosis and treatment planning	(1) OSCE stations; Slides of clinical findings from charts, radiographs, and or pictures (2) Develop treatment plan on a patient including phasing of care, sequencing, continuity of care (3) Assess patients' risk for caries as measured by bacterial testing, saliva flow rates, risk factors from patient questionnaire (4) Review of chart and health history, radiography, evaluation of soft tissue, occlusion, caries risk assessment, treatment plan, restorative plan (pediatric case) (5) Caries risk management
5. Oral surgery	Perform hard and soft tissue surgery, e.g., extraction, including medical history, diagnostic work-up, anesthetic technique, patient management
6. Periodontics	Periodontal scaling and root planning, calculus detection
7. Radiography	(1) Radiographs evaluated in terms of presence of technical errors, anatomic variations, patient reaction (2) Film layout for mounting
8. Removable prosthodontics	Complete denture procedure including master impression, occlusal records, wax try-in

Table 12 – Competency examinations at UOP

Type	Competency assessed
1. Amalgam and composite restoration	(1) Final impression (2) Direct restorative – case management, preparation, restoration
2. Endodontics	(1) Endodontic radiographic technique - anterior or posterior tooth (2) Coronal access - anterior (3) Coronal access - posterior (4) Cleaning and shaping single canal – anterior or posterior (5) Obturation, single canal – anterior or posterior
3. Fixed prosthetics	(included in coursework and clinical experiences to medically manage complex patients)
4. Oral diagnosis and treatment planning	(Performed within various competency examinations)
5. Oral surgery	(not specifically addressed, students perform simple extractions in their training)
6. Periodontics	(1) Oral diagnosis and treatment planning including radiographic interpretation, periodontal charting, occlusal analysis, plaque index, diagnosis, etiology, prognosis, tentative treatment plan (2) Periodontal re-evaluation (3) Calculus detection, scaling and root planning (4) Periodontal instrument sharpening (5) Root planning and diagnosis
7. Radiography	(Performed within various competency examinations)
8. Removable prosthodontics	(included in the coursework and clinical experiences to manage medically complex patients)

Table 13 – Competency examinations at UCLA

Type	Competency assessed
1. Amalgam and composite restoration	(1) Restorative treatment planning (set of radiographs and patient scenarios) (2) Troubleshooting and basic knowledge (radiographs) (3) Diagnosis and treatment (radiographs and tooth on typodont) including full gold crown, mesial decay, occlusal restoration, mesioocclusal restoration, anterior periapical, distoocclusal, PFM crown, root canal (4) Anatomy, contacts, margin integrity and surface finish of restorations
2. Endodontics	Portfolio based competency evaluation including documentation of endodontic diagnosis and treatment planning, radiographic technique, endodontic technique, canal preparation, obturation, provisionalization, infection control
3. Fixed prosthetics	(1) Foundation restoration (2) Full gold veneer restoration including cementation (3) Gold partial veneer or inlay (4) PFM restoration including cementation (5) Bonded ceramic restoration including cementation
4. Oral diagnosis and treatment planning	(1) Fast track treatment planning includes simple to intermediate periodontal needs, operative (2) Advanced treatment planning clinic includes bridges/partials, TMD, significant attrition, more than four fixed units, non-ideal occlusion (3) Oral diagnosis including review of systems, dental history psychosocial history, family medical history (4) Clinical evaluation (5) Head and neck examination
5. Oral surgery	(not specifically addressed)
6. Periodontics	(1) Periodontal diagnosis and treatment plan (2) Periodontal instrumentation (3) Re-evaluation of Phase I therapy (4) Periodontal surgery
7. Radiography	(addressed in various competency examinations)
8. Removable prosthodontics	Reline/rebase treatment/removable partials on approved RPD designs from oral diagnosis and treatment planning

Table 14 – Competency examinations at USC

Type	Competency assessed
1. Amalgam and composite restoration	(1) Amalgam restorations (patient or extracted tooth) (2) Composite restorations including Class II and Class III preparations, impressions, provisionals
2. Endodontics	(1) Endodontic bench examination (one molar access in a typodont) (2) Endodontic bench examination (two teeth in a typodont)
3. Fixed prosthetics	(1) Indirect cast restoration (preparation, impression, provisional) (2) Cementation examination
4. Oral diagnosis and treatment planning	(1) Diagnosis and treatment planning (2) Simulated patient (OSCE) examination (3) Special patients evaluation
5. Oral surgery	Management of medical emergency scenario, clinical patient evaluations and treatment including consultation, exodontia/minor dentoalveolar surgery, post-op management
6. Periodontics	(1) Periodontal diagnosis and treatment planning (2) Periodontic scaling and root planing (3) Use of ultrasonic instrumentation for scaling
7. Radiography	(1) Radiographic technique (2) Radiographic interpretation
8. Removable prosthodontics	Treatment/interim partial dentures including prognostic aids, RPD design

Table 15 – Competency examinations at LLU

Type	Competency assessed
1. Amalgam and composite restoration	(1) Class II amalgam (2) Class II composite (3) Class II and IV composite
2. Endodontics	(1) Diagnosis (2) Pre-treatment (3) Access (4) Canal preparation (5) Fitting master cone (6) Obturation (6) Post-treatment evaluation
3. Fixed prosthetics	(1) All ceramic anterior preparation – manikin (OSCE) (2) Indirect veneer – manikin (OSCE) (3) Ceramic veneer – manikin (OSCE)
4. Oral diagnosis and treatment planning	(1) Comprehensive oral evaluation assessment including professional and general evaluation, documentation data collection, extra-dental examination, dental examination, caries diagnosis and treatment plan, diagnosis, treatment plan and alternatives (2) Oral hygiene instruction with manikin (3) Oral prophylaxis on another student
5. Oral surgery	(not specifically addressed in competency examinations)
6. Periodontics	(1) Three oral health care examinations including periodontal risk and disease assessment (2) Multiple scaling and root planing examinations including pre-treatment calculus, post-treatment calculus (3) Periodontal instrument sharpening (OSCE) (4) Periodontal hand instrumentation on a typodont (OSCE)
7. Radiography	(1) Radiology FMX (2) Radiology interpretation
8. Removable prosthodontics	(1) Full partial denture – manikin (OSCE) (2) Complete denture including casts, vertical dimension of occlusion, occlusion, festooning, neatness

## SECTION 5: KEY FINDINGS FROM INTERVIEWS/SITE VISITS

Importance of difficulty rather than numbers of procedures performed. The deans and faculty at the dental schools addressed the idea of numbers of procedures performed as a prerequisite for any alternative pathway. They indicated that because treatment for each patient is unique, the difficulty of the procedure was the overriding factor in determining competence. There are well-specified criteria, such as the American Association of Endodontics Guidelines, for assigning level of case difficulty (see Appendix A). Thus, the number of procedures performed was not relevant to the quality of services provided.

Challis (2001) addresses this very issue in her research on the use of portfolios for assessment purposes. She states that the trick to resolving the tensions in designing a portfolio is to engage learners in the process of development and only assesses those dimensions which are not better assessed in another way (p. 438). There is no purpose served in insisting on a review of already assessed material, or, on certain items, if skills and knowledge are not necessarily demonstrated.

Concern regarding resources. The deans and faculty at the dental schools also indicated that the focus of the alternative pathway could be thought of in terms of an accreditation model, in which there are requirements that need to be fulfilled prior to an audit, rather than a set of procedures for which schools would be required to expend additional resources and faculty effort to comply with new procedures. There was great concern that considerable effort has already been expended to incorporate existing procedures around the clinical curriculum; consequently, any new procedure cannot take additional resources and create additional demands on the faculty.

Concern about similarity of competencies assessed on simulated vs. real patients. Some deans and faculty expressed a concern regarding the use of simulated (manikin) patients because candidates would be treating real, not simulated, patients in actual practice whose cases span a continuum of care. They were concerned that candidates could learn to achieve competency with simulated patients without being able to perform the same skills competently on an actual patient and manage that patient's condition after the procedure was performed.

Use of designated examiners. One school (LLU) indicated that only full-time faculty who understood the examination process were allowed to function as examiners for competency examinations. They also indicated that it was not uncommon for faculty from nearby schools to familiarize themselves with the rating system and participate in competency examinations as examiners.

Dissimilarity of clinic management software. Most of the patient data is maintained in sophisticated clinic management software to maintain a database of patient records; however, some patient charts are still in paper form. All of the schools are in the process of completing a transition to paperless charting with the idea that records created prior to a specific year would not be converted to electronic media. The type of database software used by each school was not universal for all of the schools. The clinic management software used by UCSF and USC is AxiUm. UOP uses Denticon, LLU used General Systems Design with Chairside Data Entry. UCLA uses Software of Excellence, Int.

Confidentiality of records. Full documentation, which contains confidential patient information from each school's clinic management software, is not readily available in redacted form.

Similarity of content in competency examinations. Since each Bureau-approved school (University of California, San Francisco - UCSF), University of the Pacific - UOP), University of California, Los Angeles - UCLA), University of Southern California - USC), and Loma Linda University - LLU) was accredited by the Commission on Dental Education, coursework and competency examinations were similar in content but implemented in ways that were unique to the school and its patient populations. Two schools, USC and LLU, specifically mentioned in their clinical competency statements the notion of diversity and at risk patient populations.

Scheduling of individual competency examinations. Each school required students to perform numerous examinations on actual patients in their clinical experiences; however, competency examinations were scheduled on demand by students when they felt that they were ready to be examined without intervention or guidance from faculty. In all cases, faculty were given the authority to stop any competency examination from proceeding if there was any procedure that would harm or endanger the subject patient. All competency examinations were performed during the course of treatment for which there was complete documentation of a patient of record, e.g., clinical work-up, diagnosis, treatment plan.

Calibration of examiners. At all schools, faculty who served as examiners for student competency examinations were provided extensive training and calibration prior to performing duties as an examiner. Faculty were required to access hands-on material, detailed slide presentations (PowerPoint), sample cases, and sample documentation each term and participate in calibration sessions to hone their skills. Prior to participating in actual grading of competency examinations, newer faculty were mentored by experienced faculty.

At all the schools, two examiners must concur on failing grades, and if there is disagreement between the two examiners, a third examiner was asked to grade the student. One school specifically mentioned that examiners were designated full-time faculty who were familiar with the grading criteria and the logistics of competency examinations. When faculty were asked if they could remain objective during grading

of students that they knew, they clearly indicated that they understood the difference between being an examiner and being a supportive mentor.

Best practices. The best practice (Albino, et al, 2008, p. 1425; Swanick & Chana, 2005) is to rely on multiple data sources, rather than single sources. These authors describe this practice as “triangulation.” Triangulation involves three elements: *process* (human factors such as communication, organization, ethical behavior), *product* (outcomes of patient care), and *procedure* (technical skills necessary to provide patient care). These data sources can be derived from methods such as longitudinal observations, portfolios, and case-based multiple-choice questions.

## **SECTION 6: OTHER FINDINGS**

### **OCCUPATIONAL ANALYSIS AND EXISTING CLINICAL EXAMINATIONS**

The occupational analysis outlines fifteen content areas of practice which appear to focus on topical content rather than underlying processes such as oral diagnosis and treatment planning. Major content was covered in the occupational analysis; however, some areas were given the same level of importance as others when they were not generally considered major areas of subject matter to be assessed.

The 15 content areas cited in the occupational analysis were described as follows:

- I. Evaluation – Conduct medical and dental evaluation to develop comprehensive dental treatment plan.
- II. Endodontics – Diagnose patient's endodontic condition, develop a treatment plan and perform endodontic therapy.
- III. Indirect restoration – Diagnose patient's restorative needs, develop a treatment plan and perform an indirect restoration.
- IV. Direct restoration - Diagnose patient's restorative needs, develop a treatment plan and perform a direct restoration.
- V. Prophylaxis – Perform prophylactic procedures and provide oral hygiene instructions to patients.
- VI. Periodontics - Diagnose patient's periodontal needs, develop a treatment plan and perform periodontal therapy.
- VII. Fixed partial denture - Diagnose patient's restorative needs, develop a treatment plan and perform a fixed partial denture.
- VIII. Removable partial denture - Diagnose patient's restorative needs, develop a treatment plan and fabricate a removable partial denture.
- IX. Complete denture - Diagnose patient's restorative needs, develop a treatment plan and fabricate a complete denture.
- X. Oral surgery - Diagnose patient's oral condition, develop a treatment plan and perform oral surgical procedures.
- XI. Teeth whitening - Perform teeth whitening procedures on a patient.
- XII. Splint therapy – Determine patient's need for splint therapy and perform splint therapy procedures.
- XIII. Safety and sanitation – Prevent injury and spread of diseases in dental services by following Board regulations on safety, sanitation, and sterilization.
- XIV. Ethics – Comply with ethical standards for dentistry, including scope of practice and professional conduct.

XV. Law – Comply with legal obligations, including patient confidentiality, professional conduct, and information management.

Existing clinical examinations used in California did not appear to have a direct relationship to the content areas in the occupational analysis. For example, one area, diagnosis, should have been designated as an area of its own, or included as part of oral diagnosis and treatment planning, which should be a standard part of the comprehensive assessment, diagnosis, and treatment planning process. There are tasks addressing diagnosis included in the analysis, however, the tasks marginalize diagnosis of the patient as a holistic entity who has a medical, dental, pharmacological, and psychosocial history that may impact treatment.

Some areas are not the primary focus of the practice of general dentistry and distort the major areas of subject matter in general dentistry. For example, tooth whitening is a part of cosmetic dentistry. Splint therapy focuses on specific types of removable orthotic appliances. Prophylaxis is limited in this analysis to conventional or ultrasonic scaling, fluoride, sealants and oral hygiene instruction, and could be considered part of periodontics (e.g., scaling).

Other content areas were part of a larger set of procedures. For example, fixed partial denture, removable partial denture, and complete denture are considered prosthodontic procedures; and indirect and direct restoration are considered restorative procedures. Likewise, procedures specified in evaluation are part of comprehensive oral assessment, and, oral diagnosis and treatment planning. Comprehensive assessment and many aspects of diagnosis, treatment planning, or aftercare are embedded within multiple areas such as evaluation, endodontics, indirect restoration, direct restoration, periodontics, fixed partial denture, removable partial denture, complete denture, oral surgery, and splint therapy.

#### REQUIREMENTS FOR LICENSURE IN THE U.S. AND CANADA

In their 2001 review of dental education and licensure, the Council on Dental Education of the American Dental Association (ADA) compared practices for initial dental licensure in the United States and Canada. Their findings indicate that initial licensure in the United States and Canada are very similar; however, Canada relies on the use of the OSCE, which requires candidates to answer multiple-choice questions about radiographs, case histories, and/or models in a series of stations. In the OSCE, simulated patients (manikins) rather than actual patients are used as subjects for examination procedures.

Table 16 – Comparison of practices in U. S. and Canada for initial licensure

Requirement	United States	Canada
Graduation from an accredited program	Yes; program is accredited by the ADA Commission on Dental accreditation	Yes; program is accredited by the Commission on Dental Accreditation of Canada
Written examination	Yes: National Dental Board Examinations (NDBE) Parts I and II	Yes; National Dental Examining Board of Canada Written Examination (NDEB)
Clinical examination	<ul style="list-style-type: none"> <li>• Regionally administered clinical examinations (Central Regional Testing Services; Northeast Regional Examining Board, Southern Regional Testing Agency, Western Regional Examining Board) offered once to multiple times, depending on the testing agency</li> <li>• 10 states (CA, DE, FL, HI, IN, LA, MS, NC, NV plus Puerto Rico and the Virgin Islands) offer state administered examinations</li> <li>• Each state determines which clinical examination results are accepted for the purpose of licensure</li> <li>• All states require completion of both written and clinical examinations before being eligible for licensure</li> <li>• Some states also require additional criteria such as proof of malpractice insurance, certification in Basic Life Support, or a jurisprudence examination</li> </ul>	<ul style="list-style-type: none"> <li>• OSCE offered three times a year</li> <li>• Quebec requires an NDEB certificate or a provincial examination.</li> <li>• Some provinces require completion of an ethics examination</li> </ul>

**NUMBER OF GRADUATES PER YEAR**

Each of the five schools graduates 100-140 students each year. Thus, there may be as many as 700 students graduating from the five Bureau-approved schools, and, more students would be graduating every year once the newly formed sixth dental school is underway. The number of graduates would have a great impact on the feasibility of any alternative pathway to initial licensure.

## SECTION 7: CONCLUSIONS

Several conclusions can be drawn from the observations and information provided in interviews and documentation obtained from the five Bureau-approved dental schools.

1. The hybrid portfolio examination model satisfies the criteria identified by the California Dental Association, the Dental Bureau of California, and the psychometric consultants. Minimum competence would be built into standardized rating scales and extensive calibration and re-calibration of the examiners would address psychometric issues such as reliability and validity.
2. The traditional portfolio is not feasible as originally described by the Bureau. However, if there were no specific numbers of procedures and the portfolio process is integrated into the predoctoral curriculum, it would be feasible. The process should incorporate sensitivities to confidentiality of patient records, diversity of clinic management software used, and difficulty of cases used for competency examinations. The actual logistics would need to be vetted by all the schools in terms of what documents should be provided and how faculty were designated as examiners.
3. Psychometric issues of validity and reliability can still be addressed through careful specification of standards, criteria and scoring guides, and thorough calibration and training of designated examiners. The Bureau could have the responsibility for making final approval of portfolio information, conducting site visits, and performing periodic audits of detailed portfolio documentation.
4. The OSCE and the CIF are not the best venues for licensure examinations because there are more authentic means available for assessing candidates' competence (actual patients). Therefore, the OSCE or the CIF are well suited for preclinical training but not as a licensure examination.
5. The most noticeable strength of the five predoctoral training programs was the thoroughness of their clinical training and the commitment of their faculty to the students. The faculty understood the distinction between their role as a mentor and as an examiner in that there was no intervention during any competency examination unless the patient was in danger of being harmed.
6. All five predoctoral training programs had extensive training programs to calibrate their examiners. Training included detailed PowerPoint presentations, trial grading sessions, and training and mentorship of new examiners with experienced examiners.

7. There are rating systems in place at each of the five schools which evaluate the same competencies; however, the rating systems for key competencies would require standardization across schools in order to interpret the scores derived from the competency examinations on a common metric. Calibration to these rating systems would need to be implemented as well.
8. The involvement of independent parties to make decisions about minimum competence could ensure fairness of ratings if faculty from other departments within the school and/or faculty from other schools are used in the rating process.
9. There are important advantages of using actual patients of record within the schools instead of simulated (manikin) patients. First, procedures are performed as part of treatment thereby eliminating circumstances fostering commercial procurement of patients, particularly the cost of such patients. Second, the safety and protection of patients is ensured because procedures are performed in the course of treatment. Third, candidates would be treated similarly at all of the dental schools in a manner that allows communication of examination logistics and results.

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**APPENDIX A – AAE LEVELS OF DIFFICULTY**

The American Association of Endodontics designed the Endodontic Case Difficulty Assessment Form for use in endodontic curricula. Conditions listed below should be considered potential risk factors that may complicate treatment and adversely affect the outcome.

Levels of difficulty are sets of conditions that may not be controllable by the dentist. There are risk factors that can influence the dentist's ability to provide care at a consistently predictable level and impact the appropriate provision of care and quality assurance.

<p><b>MINIMAL DIFFICULTY</b></p>	<p>Preoperative condition indicates routine complexity (uncomplicated). These types of cases would exhibit only those factors listed in the MINIMAL DIFFICULTY category. Achieving a predictable treatment outcome should be attainable by a competent practitioner with limited experience.</p>
<p><b>MODERATE DIFFICULTY</b></p>	<p>Preoperative condition is complicated, exhibiting one or more patient or treatment factors listed in the MODERATE DIFFICULTY category. Achieving a predictable treatment outcome will be challenging for a competent, experienced practitioner.</p>
<p><b>HIGH DIFFICULTY</b></p>	<p>Preoperative condition is exceptionally complicated, exhibiting several factors listed in the MODERATE DIFFICULTY category or at least one in the HIGH DIFFICULTY category. Achieving a predictable treatment outcome will be challenging for even the most experienced practitioner with an extensive history of favorable outcomes.</p>