

Technical Report
The National Board Dental Examinations

Joint Commission on National Dental Examinations

2008

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Executive Summary
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The 2008 edition of the Technical Report for the National Board Dental Examinations is the main source of validity evidence available to state licensing boards and other users of the dental examination scores. Validity is the most important consideration for any examination program. For the dental examinations, validity refers to the degree to which logic and evidence support the use and interpretation of scores for making pass/fail decisions affecting candidates for licensure to practice dentistry. The technical report contains both direct evidence and references to other documents and sources of information that contribute to this body of validity evidence. This report also provides background and historical information that allow the user of the scores the opportunity to understand the developments that have led this program to its current status.

The content of the Technical Report is presented in such a way as to address a series of standards regarding the validity of credentialing examinations (American Educational Research Association, American Psychological Association, and the National Council on Measurement in Education, 1999). Successful completion of a credentialing examination by individuals indicates that they have achieved some acceptable level of performance in an area of knowledge. Some of the principal information presented in the Technical Report is summarized below.

- **Purpose:** The purpose of the National Board Dental Examinations is to assist state boards in determining the qualifications of dentists who seek licensure to practice dentistry. These qualifications include the ability to understand important information from the basic biomedical, dental, and clinical dental sciences and also the ability to apply such information in a problem-solving context.
- **Content:** Content specifications are based on the findings of validity studies involving practice analyses conducted every five years. Test construction committees are responsible for recommending minor modifications during the interim period. The Joint Commission through its Committee on Examination Development approves all changes to the content specifications.
- **Item and Examination Development:** Test construction committees are responsible for the development of items and editions of the examinations using guidelines for writing high-quality multiple-choice items. Items are pretested on published editions to confirm their acceptability.
- **Standard Setting and Scoring:** Part I and Part II are criterion-referenced and not norm-referenced. Specifically, the scores and the pass/fail points are determined by specific criteria not by the process sometimes known as “grading on a curve.” Expert educators and practitioners establish the criteria. The standards are maintained across editions through the use of equating processes. Essentially, the equating process allows for adjustments to the Part I and Part II standards to control for subtle differences in the difficulty of items that appear on the different editions.
- **Administration:** A high level of security is maintained on all examination materials. Strict precautions are in place at the Joint Commission’s offices and the testing centers to ensure that the content is not compromised. The Joint Commission offers Part I and Part II on computer at Prometric Testing Centers throughout the United States. Once eligible, candidates can schedule examination on any business day.

The report provides detailed information related to the items above along with information related to history, examination administration, the rights and responsibilities of candidates, and failure rates of candidates, to name but some. A copy of the Technical Report is available for downloading on the American Dental Association’s website (www.ada.org).

American Educational Research Association, American Psychological Association, National Council on Measurement in Education. (1999). *Standards for Educational and Psychological Testing*. Washington, DC: Author.

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1. Introduction

High-stakes examination programs, such as those of the Joint Commission on National Dental Examinations (Joint Commission), should be concerned with validity, because validity relates to the degree to which logic and evidence support the use of examination scores in making pass/fail decisions affecting candidates for licensure or certification. The Joint Commission also has an obligation to inform its constituency, i.e., state boards of dentistry, that it is doing its best to provide the highest quality examination programs possible. National examination standards provide useful guidance to testing organizations that can help them improve upon their validation efforts. It is important that examination organizations adhere to these standards and provide evidence that their policies and procedures conform to these standards.

This technical report provides a comprehensive summary of information about the current validation efforts for the National Board Dental Examinations (NBDE) administered by the Joint Commission. Both direct evidence, presented in this technical report and references to other documents and sources of information contribute to this body of validity evidence. Additionally, this report provides background information that allows each reader the opportunity to understand the history and processes that have led this examination program to its present status.

Technical reports continue to be a main source of validity evidence. The *Standards for Educational and Psychological Testing* (American Educational Research Association [AERA], American Psychological Association [APA], and the National Council on Measurement in Education [NCME], 1999) provide national standards for testing organizations. In chapter 6, the provision of supporting documentation of validity evidence is considered important. The objective of a technical report is to provide examination users with information to help them evaluate the validity of examination scores they interpret and use. Six standards from that chapter seem relevant to this technical report and appear in Table 1.1. This report shows that the Joint Commission endeavors to provide the highest quality examination programs possible.

Table 1.1
Standards Pertaining to Supporting Documentation Found in a Technical Report

6.1 Test documents should be made available to prospective test users and other qualified persons at the time a test is published or released for use.

6.2 Test documents should be complete, accurate, and clearly written so that the intended reader can readily understand the content.

6.5 *When statistical descriptions and analyses that provide evidence of the reliability of scores and the validity of their recommended interpretations are available, the information should be included in the test's documentation. When relevant for test interpretation, test documents ordinarily should include item level information, cut scores and configural rules, information about raw scores and derived scores, normative data, the standard errors of measurement, and a description of the procedures used to equate multiple forms.*

6.9 *Test documents should cite a representative set of available studies pertaining to general and specific uses of the test.*

6.14 *Every test form and supporting document should carry a copyright date.*

6.15 *Test developers, publishers, and distributors should provide general information for test users and researchers who may be required to determine the appropriateness of an intended use in a specific context. When a particular test use cannot be justified, the response to an inquiry from a prospective test user should indicate this fact clearly. General information also should be provided for test takers and legal guardians who must provide consent prior to a test's administration.*

2. Purpose of the National Board Dental Examinations

The first and most fundamental step in the development of any examination program is to establish a purpose. The purpose of the National Board Dental Examination program is to measure whether a candidate possesses entry-level knowledge adequate for the competent practice of dentistry. This knowledge includes the ability to recall important information from the basic biomedical, dental, and clinical dental sciences as well as patient management and apply such information in a problem-solving context.

The *Joint Commission Bylaws* (Joint Commission on National Dental Examinations, September 2002) state the purposes of the examinations under Article I. Among these purposes is one that is central to this examination program:

To provide and conduct written examinations, exclusive of clinical demonstrations, for the purpose of assisting state boards in determining qualifications of dentists who seek licensure to practice in any state, district or dependency of the United States, which recognizes the National Board Examinations, here and after referred to as National Board Dental Examinations.

These purposes are also stated in *Examination Regulations* (Joint Commission on National Dental Examinations, March 2007).

The Joint Commission is the body that oversees the design, administration, scoring, and reporting of examination scores to its constituents. The Department of Testing Services of the American Dental Association provides the technical support for many steps in the examination development, administration, scoring, and reporting processes. The Joint Commission's *Standing Rules* (Joint Commission on National Dental Examinations, March 2007) provide descriptions of its membership and committees and their roles.

Four committees serve the Joint Commission. Each committee is assigned a portion of the materials to be considered by the Joint Commission, and each committee is responsible for making specific recommendations to the Joint Commission. The Committee on Administration deals with operations for both the National Board Dental and Dental Hygiene Examinations. This includes security, examination regulations, bylaws and standing rules, and finance. The Committee on Dental Hygiene deals with the National Board Dental Hygiene Examination (NBDHE) and is responsible for content and examination specifications, test construction procedures, scoring procedures, dissemination of information related to the examination process, validity, and matters affecting finance. The Committee on Examination Development deals with the dental examination, its content and specifications, examination construction procedures, scoring procedures and reporting processes. It also concerns itself with the dissemination of information about the examination process and validity. The Committee on Research and Development relates to both the dental hygiene and the dental examinations. This committee concerns itself with any research or development activity related to the examination programs.

3. Historical Perspective

The National Board of Dental Examiners was established in 1928 as a standing committee of the American Dental Association for the purpose of providing and conducting written examinations for use at the discretion of state boards of dentistry in licensing dentists. These examinations were to provide a national standard for the knowledge of basic biomedical and clinical dental sciences necessary for the competent practice of dentistry. The practical demonstrations of clinical skills were reserved for individual states to administer. The National Board responsibilities included not only developing and administering National Board examinations, but also formulating rules and regulations pertaining to examinations.

Current National Board examinations bear little similarity to the first editions, which were administered in 1933 and 1934. Advances in examination methodology caused the most dramatic changes. Examination format was changed in the early 1950's from essay to multiple-choice. This led to the adoption of norm-referenced scoring procedures and

delegation of examination construction to committees of dentists and dental hygienists who were subject-matter specialists. In the 1960's, the Council on National Board Examinations, which succeeded the National Board of Dental Examiners, was among the first testing agency to employ computer scoring and to use statistical techniques to identify candidates who did not select answers independently.

In the early 1980's, the Joint Commission on National Dental Examinations, which succeeded the Council on National Board Examinations, instituted the procedure of equating examinations by means of common anchor items. This was done to ensure a consistent standard for minimally acceptable performance among editions of the examinations and ended the era of norm-referenced scoring. The pass rate on the examinations thereafter fluctuated to the degree that the abilities of the candidates changed. In 1992, a comprehensive case-based Part II Examination replaced the Part II battery of seven individual examinations. Also, at that time, a criterion-referenced method of setting the performance standard based on Rasch psychometric theory was instituted for Part II. In 2007, a comprehensive Part I examination replaced the traditional battery of four individual examinations. The comprehensive Part I examination consists of 400 items, of which 80 are testlet based. Part I has been criterion-referenced since the early 1990s.

Changes in content to reflect growth in knowledge of the basic biomedical and clinical dental sciences have been gradual and frequent. The content has been regularly updated to reflect this growth to keep the examinations current with the practice of dentistry.

The National Board Dental Examinations grew slowly both in acceptances by state boards of dentistry and in participation by candidates. The first candidates completed National Board examinations in 1934. For the five-year period from 1934 through 1938, an average of only 70 candidates per year received National Board certificates. By 1938, eleven states accepted National Board results. Although recognition grew steadily, participation remained at a low level until the mid 1950's. By 1960, National Board results were accepted by 33 states and the District of Columbia. In 1976, results were accepted by 48 states, the District of Columbia, Puerto Rico, and the Virgin Islands. By 1990, all U.S. licensing jurisdictions accepted the National Board examinations as fulfillment of the written examination requirement for licensure.

4. Current Examination Program

The *Examination Regulations* (Joint Commission on National Dental Examinations, March 2007) provides a description of the current examination program. There are currently two separate National Board Dental Examinations. Part I and Part II provide complementary information to state licensing boards.

The Part I examination consists of four disciplines: (1) anatomic sciences (gross

anatomy, histology, and oral embryology), (2) biochemistry-physiology, (3) microbiology-pathology, and (4) dental anatomy and occlusion. Beginning in 2007, Part I consists of one comprehensive examination covering the same disciplines, with items addressing the various disciplines intermingled throughout the examination.

Part II consists of one comprehensive examination covering the following disciplines: (1) operative dentistry, (2) pharmacology, (3) prosthodontics, (4) oral and maxillofacial surgery-pain control, (5) orthodontics-pediatric dentistry, (6) oral diagnosis (oral pathology and dental radiology), (7) endodontics, (8) periodontics, and (9) patient management (behavioral science and dental public health and occupational safety).

A comparison of current subjects tested with those subjects covered on the first National Board examinations would only partially reveal the degree to which coverage has been modified. To a large degree, changes have been made in emphasis within individual examinations in response to changes occurring in the sciences being tested.

Examination Dates

The computer-based Part I is offered on any business day at Prometric Testing Centers, and is administered on one day. Part II is also available as a computer-based examination. The computer-based Part II requires one and one-half days, and is administered on consecutive business days at Prometric Testing Centers.

Examination Centers

At the present time, Part I and Part II are offered only in the United States, its territories, and Canada. These examinations are administered at approximately 400 Prometric Testing Centers.

5. Validity, Validation, and Validity Evidence

Validity is “the degree to which accumulated evidence and theory support specific interpretations of scores entailed by proposed uses” (AERA, APA, & NCME, 1999, p. 84). For every examination program, there is a purpose. To fulfill this purpose, a test score has a desired interpretation and an intended use. The sponsor of the testing program creates a logical argument and assembles validity evidence supporting that argument. Validity is the degree of support suggested by the logical argument and validity evidence upholding this argument. In some instances, the validity evidence works against the argument and lessens validity. In these instances, the testing organization should seek and take remedies to reverse the gravity of this negative kind of evidence. Essentially, validation is the investigative process of creating this argument and collecting evidence that evaluates it.

In the licensing of dentists in the United States, all candidates for licensure must meet a number of criteria before they are licensed to practice in a state. Each state has the authority to issue the license, although in dentistry, as in many other professions, national standards exist.

With the Part I examination, the intended interpretation is the knowledge of basic biomedical and dental sciences that dentists should have. The use of the Part I scores is to recommend passing or failing the candidate. With the Part II examination, the intended interpretation is the professional knowledge of clinical dental sciences including professional responsibility and patient management abilities that dentists should possess. The use of the Part II scores is also to recommend passing or failing the candidate. This technical report contains validity evidence and references to validity evidence that support both interpretations and uses of scores.

6. Professional Test Standards

Large testing organizations responsible for developing, administering, and scoring examinations need criteria or standards upon which to judge their effectiveness. Three professional organizations have joined forces and resources to create the latest version of these standards (AERA, APA, NCME, 1999). These standards provide useful information to guide testing organizations in the validation of their test score interpretations and uses. Throughout this technical report, validity evidence will be identified and connected to testing standards. Many sections of this technical report correspond to chapters in the standards (AERA, APA, NCME, 1999).

AERA (2000) has also issued a set of guidelines that are intended for use with high-stakes, high school graduation examination programs. Some of these guidelines apply to the National Board Dental Examinations. In Section 22 of this technical report, these guidelines are reviewed against the validity evidence presented in this technical report.

7. Legal Issues

All examination programs where the scores are used for high-stakes decisions run a risk of legal challenge based on validity. Thus, it is important that such examination programs be designed to withstand legal challenge. This technical report represents a single effective way to present the validity argument and validity evidence. This public document provides an effective communication device to organize, describe, and display a large array of validity evidence. The availability of this report speaks to the fact that the Joint Commission has acted responsibly in discharging its duty to its constituency for developing and administering an examination program lending itself to valid decisions regarding candidates' knowledge of basic biomedical, dental, and clinical dental sciences.

As the stakes associated with examinations increases, the need for validity evidence and validation increases. It is sound practice for an examination program to demonstrate that it is making an active effort to validate the organization's score interpretation and uses.

8. Validity Evidence in this Technical Report

This report is organized to address major categories of validity evidence. Each section contains narrative and validity documentation. In some instances, data are provided, as appropriate. In each major category, reference is made to one or more standards (AERA, APA, & NCME, 1999). The first two standards are:

1.1 A rationale should be presented for each recommended interpretation and use of test scores, together with a comprehensive summary of the evidence and theory bearing on the intended use or interpretation, and

1.2 The test developer should set forth clearly how test scores are intended to be interpreted and used. The population (s) for which a test is appropriate should be clearly delimited, and the construct that the test is intended to assess should be clearly described.

This technical report and references to other existing documents provide evidence that standards 1.1 and 1.2 have been met. It shows that the Joint Commission has acted responsibly in validating its examinations. For the most part, the remainder of this report addresses important categories of validity evidence, which include:

9. Content Basis for the Examination
10. Item Development
11. Item Validation
12. Examination Design and Development
13. Administration
14. Reliability of Examination Scores
15. Standard Setting
16. Scaling/Equating/Comparability of Examination Forms
17. Scoring and Reporting Examination Scores
18. Rights and Responsibilities of Examination Takers
19. Threats to Validity
20. Validity Studies
21. Security
22. Guidelines for High-Stakes Examination

9. Content Basis for the Examination

The content of a certification/licensure examination of knowledge for any profession is a primary type of validity evidence. Table 9.1 lists standards related to the content of such examinations. This table gives ample proof of the importance of the content basis for the Part I and Part II examinations. Key elements for validity evidence involve (1) the use of a practice analysis that identifies the knowledge and problem-solving skills necessary for safe practice of dentistry in the U.S., (2) examination specifications, and (3) the role of content experts, who are responsible for recommending minor modifications to the examination specifications in a series of validation processes.

Examination Content

As noted previously, the dental examinations are organized into two parts, Part I and Part II. Each part is developed according to examination specifications. The examination specifications list topics included in each examination. The 2007 examination specifications appear under Appendices A (Part I) and B (Part II).

Part I. Part I is a comprehensive examination and only the computer version is available. It is usually taken after two years of dental school. The examination items focus on four disciplines in the basic biomedical and dental sciences, which are titled: Anatomic Sciences, Biochemistry-Physiology, Microbiology-Pathology, and Dental Anatomy and Occlusion. Each of the four disciplines is examined using 100 multiple-choice items, intermingled throughout the examination. Among 400 items, twenty percent of them are testlet based.

Part II. Part II is published as a computer-based examination. Part II is usually taken during the last year of dental school. It consists of a comprehensive, one and one-half day examination of 500 items. The examination has two components: 400 discipline-based, or case independent items, given on the first day and 100 case-based items given on the second day. It covers the clinical dental sciences [Operative Dentistry, Pharmacology, Endodontics, Periodontics, Oral and Maxillofacial Surgery -- Pain Control, Prosthodontics, Orthodontics, Pediatric Dentistry, Oral Diagnosis (Oral Pathology and Dental Radiology)] and Patient Management [Behavioral Science; Dental Public Health and Occupational Safety]. The 100 items based on patient cases might derive from any of the basic sciences and clinical dental sciences including patient management.

The Practice Analysis for Part I. In 2001, a validity study that involved a practice analysis was conducted using the 63 *Competencies of the New Dentist*, developed by the American Dental Education Association (American Dental Education Association, 2001). The findings of the practice analysis suggested to the Joint Commission that it should consider a more clinically relevant Part I examination. Accordingly, the Joint Commission

piloted a restructured 400-item examination to include discipline-based items (80%) and testlets (20%). Testlets involve a brief patient case in narrative form, with a summary chart, and a series of associated multiple-choice items. The findings of the pilot project were accepted and the Joint Commission approved a resolution to implement a comprehensive Part I examination in 2007.

The Practice Analyses for Part II. For Part II, the findings of the 2005 validity study (Kramer & Neumann, 2003) were used to make slight changes in the content specifications for the examination. The validation process was achieved by relating ratings of practicing dentists regarding the importance of the competencies to patient care to the Part II content specifications. Competencies represent the domain of knowledge, skills, and abilities required of a newly licensed dentist. A survey was developed and distributed to 6,930 dentists across the regions of the country to gather importance ratings. A total of 2,607 general dentists responded to the survey using a 5-point rating scale. The importance ratings were converted to the number of items devoted to each competency. The numbers of items devoted to the competencies were distributed across individual content elements based on the judgments of experts. The revised content specifications reflect the importance ratings of practicing dentists, and the overall findings of the study confirm the validity of Part II. As its annual meeting in March 2007, the methodology of the practice analysis and the revised content specifications were approved by the Joint Commission. The revised content specifications were implemented in 2008.

Table 9.1 **Standards That Apply to the Content Basis of the Examination**

1.6 When the validation rests in part on the appropriateness of test content, the procedures followed in specifying and generating test content should be described and justified in reference to the construct the test is intended to represent. If the definition of the content sampled incorporates criteria such as importance, frequency, criticality, these criteria should be clearly explained and justified.

1.7 When a validation rests in part on the opinions or decisions of expert judges, observers or raters, procedures for selecting such experts and for eliciting judgments or ratings should be presented. The description of procedures should include any training instructions provides, should indicate whether participants reached their decisions independently and should report the level of agreement reached. If participants interacted with one another or exchanged information, the procedures through which they may have influenced one another should be set forth.

1.8 If the rationale for a test use or score interpretation depends on premises about the psychological processes or cognitive operations used by examinees, then theoretical or empirical evidence in support of those premises should be provided...

3.2 *The purpose(s) of the test, definition of the domain, and the test specifications should be stated clearly so that the judgments can be made about the appropriateness of the defined domain for the stated purpose(s) of the test and about the relation of items to the dimensions of the domain they are intended to represent.*

3.3 *The test specifications should be documented, along with their rationale and the process by which they were developed. The test specifications should define the content of the test, the proposed number of items, the item formats, the desired psychometric properties of the items, and the item and section arrangement. They should also specify the amount of time for testing, directions to the test takers, procedures to be used for test administration and scoring, and other relevant information.*

3.5 *When appropriate, relevant experts to the testing program should review the test specifications. The purpose of the review, the process by which the review is conducted, and the results of the review should be documented. The qualifications, relevant experiences, and demographic characteristics of expert judges should also be documented.*

3.11 *Test developers should document the extent to which the content domain of a test represents the defined domain and test specifications.*

14.8 *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 job analysis.*

14.9 *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.*

14.14 *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 a claim that the knowledge and skills being assessed are required for credential-worthy performance in an occupation and are consistent with the purposes for which the licensing or certification program was instituted.*

10. Item Development

The essential building block of any examination is the examination item. The development and validation of examination items is one of the most important steps in examination development. The Joint Commission greatly values item development and validation, and it continues to invest considerable resources into both activities. In this

section of the technical report, the relevant standards are provided in Table 10.1 and sections are devoted to how items are developed and reviewed. Section 11 addresses item analysis and evaluation.

Who Writes Test Items?

The Joint Commission appoints members to test construction committees. The primary duty of these committees and their members is examination design and item and examination development. Details of the qualifications of the committee members, committee structures, duties, and other relevant information appear in section 12. These details are also described in the *Standing Rules* (Joint Commission on National Dental Examinations, March 2007).

Table 10.1
Standards Relevant to Item Development and Validation

3.6 The types of items, the response formats, scoring procedures, and test administration procedures should be selected based on the purposes of the test, the domain to be measured, and the intended test takers. To the extent possible, test content should be chosen to ensure that intended inferences from test scores are equally valid for members of different groups of test takers. The test review process should include empirical analyses and, when appropriate, the use of expert judges to review items and response formats. The qualifications, relevant experiences, and demographic characteristics of expert judges should also be documented.

3.7 The procedures used to develop, review, and tryout items, and to select items from the item pool should be documented. If the items were classified into different categories or subtests according to the test specifications, the procedures used for the classification and the appropriateness and accuracy of the classification should also be documented.

3.8 When item tryouts or field tests are conducted, the procedures used to select the sample(s) of test takers for item tryouts and the resulting characteristics of the sample should be documented. When appropriate, the sample(s) should be as representative as possible of the population(s) for which the test is intended.

3.9 When a test developer evaluates the psychometric properties of items, the classical or item response theory (IRT) model used for evaluating the psychometric properties of items should be documented. The sample used for estimating item properties should be described and should be of adequate size and diversity for the procedure. The process by which items are selected and the data used for item selection, such as item difficulty, item discrimination, and/or item information, should also be documented. When

IRT is used to estimate item parameters in test development, the item response models, estimation procedures, and evidence of model fit should be documented.

7.4 Test developers should strive to identify and eliminate language, symbols, words, phrases, and content that are generally regarded as offensive by members of racial, ethnic, gender, or other groups, except when judged to be necessary for adequate representation of the domain.

7.7 In testing applications where the level of linguistic or reading ability is not part of the construct of interest, the linguistic or reading demands of the test should be kept to the minimum necessary for the valid assessment of the intended construct.

After the Joint Commission approves the appointment of new test constructors, based on the recommendation of the Committee on Examination Development, a letter is sent to each new test constructor to acknowledge the appointment and familiarize him/her with the test development process. Each test constructor is given the following materials: *Test Item Development Guide*, *Orientation Manual for Dental Test Constructors*, and *National Board Dental Examination Specifications*.

When new test constructors come to their first meeting, the returning test constructors informally discuss the process with new members. These new members are mentored during their initial service as test constructors. The *Test Item Development Guide* (January 2007) describes the different item formats and general guidelines for writing items. The *Orientation Manual for Dental Test Constructors* (January 2007) describes the responsibilities of the test constructors, the general item-development process, and criteria and number of members for each committee. The *Guide* is provided to all test constructors and anyone else requesting them through the office of the Joint Commission.

Item Formats

Standard 3.3 refers to identifying item formats in the examination specifications. The National Board examinations use multiple-choice formats. Part I uses both independent items and testlet-based items addressing basic biomedical and dental sciences. For Part II, the case-independent format surveys clinical dental sciences and patient management knowledge pertinent to licensing. The case-dependent format uses case materials consisting of a patient dental/medical history, a dental chart, radiographs, and clinical photographs. These items are used in Part II and serve as stimulus material for a series of case-associated questions. For Parts I and II, the key features of multiple-choice items are a stem pairing a question or statement followed by a list of possible responses. For National Board use, an item has at least three, but not more than five possible responses.

The Process of Examination Revision

The process of reviewing and revising items for the National Board examinations involves reviewing items and revising unsatisfactory items. Items are unsatisfactory if they are too easy, too difficult, or not discriminatory. In reviewing items, test construction committees (TCCs) look at two key factors: the P (probability value) that represents difficulty, and R (point-biserial correlation between item and examination performance) that represents discrimination. The Joint Commission accepts a broad range of item difficulties, but an easy item – one that virtually all candidates answer correctly – detracts from accurate measurement. The same is true of items that are too difficult – those that no or few candidates reliably answer correctly. Discrimination of an item indicates the relation between the candidates who choose the correct answer and their rank in scoring on the total number of items. Following are the acceptable ranges of indices for difficulty and discrimination according to the standards approved by the Joint Commission.

(P): *E — Easy; M — Medium; D — Difficult*

(R): *H — High; M — Medium; L — Low*

	Part I (R)	Part II (R)	Parts I and II (P)
H	= 0.26 or higher	H = 0.26 or higher	E = 0.90 or higher
M	= 0.15 – 0.25	M = 0.08 – 0.25	M = 0.40 – 0.89
L	= under 0.15	L = under 0.08	D = 0.00 – 0.39

For an item to be considered effective, it must produce a difficulty index between 40% and 89%, and a corresponding discrimination index of 0.15 or higher for Part I or 0.08 or higher for Part II. Items that do not meet these standards are eliminated or revised. Scoring differs slightly for Part I and Part II of the National Board examinations. It is important to note that Part I consists of stand-alone and testlet items. Part II consists of discipline-based and case-based items. An item is deleted from scoring when the keyed response has 0.00 or a negative R-value. A negative R indicates that high-scoring candidates are responding to the item incorrectly and that low-scoring candidates are responding to the item correctly. An item is reviewed when: (1) the keyed response has a p-value below .25, or (2) the keyed response has a p-value less than one of the distractors and both the keyed response and the distractor have positive R values.

Revising Part I and Part II (Component A) Discipline-based Items

The following are steps for revising Part I and Part II independent items.

1. The committee reviews reports on trend statistics and an analysis of item difficulty and discrimination. These two reports, which are generated after a set period, provide information on the results of the examination.
2. The committee reviews statistical characteristics — reliability, standard deviation, and mean.
3. The committee reviews the unsatisfactory items. All items are read aloud by committee members.
4. The committee discusses each item. The facilitator helps to analyze the problematic items. The committee decides whether to retain, revise, or discard the item. The revision process involves rewording the stem or changing distractors.
5. The facilitator notes all changes. Revised items are returned to the item bank. These items are subsequently field tested to see if they can be used in future examinations. Items not meeting the Joint Commission's quality standards are discarded.

Revising Part II (Component B) Case-based Items

The following are steps for revising Part II case-dependent items.

1. The test development staff determines the number of good items and poor items in a case and presents a summary to the committee.
2. The committee determines whether a case is worth reviewing or revising based on the ratio of good to poor items. If the committee decides to delete a case, then only the case materials (patient history, chart, radiographs, photographs) are retained for future use.
3. The committee reviews cases that can be improved with modifications. The committee reviews the patient history, dental chart, radiographs, and clinical photographs. Members read all items aloud.
4. The committee discusses each item. The facilitator helps to analyze the problematic items. The committee decides whether to revise, replace, or delete the item. Revision involves rewording the stem or the distractors, or changing the distractors completely. Replacement involves writing an entirely new item. Deletion means eliminating the item from the case.
5. The facilitator notes all changes. Revised cases are saved for future use.

Revising items accomplishes two things, i.e., it replenishes item banks and familiarizes test constructors with the characteristics of acceptable examination items.

11. Item Validation

After an item is written, Downing and Haladyna (1997) recommend a series of reviews that improve the quality of the item. Evidence should be presented that qualified personnel have done these reviews. Table 11.1 provides a short list of standards pertaining to item validation.

Table 11.1
Standards Pertaining to Item Validation

3.6 The type of items, the response formats, scoring procedures, and test administration procedures should be selected based on the purposes of the test, the domain to be measured, and the intended test takers. To the extent possible, test content should be chosen to ensure that intended inferences from test scores are equally valid for members of different groups of test takers. The test review process should include empirical analyses and, when appropriate, the use of expert judges to review items and response formats. The qualifications, relevant experiences, and demographic characteristics of expert judges should also be documented.

3.7 The procedures used to develop, review, and tryout items, and to select items from the item pool should be documented. If the items were classified into different categories or subtests according to the test specifications, the procedures used for the classification and the appropriateness and accuracy of the classification should be documented.

3.9 When a test developer evaluates the psychometric properties of items, the classical or item response theory (IRT) model used for evaluating the psychometric properties of items should be documented. The sample used for estimating item properties should be described and should be of adequate size and diversity for the procedure. The process by which items are selected and the data used for item selection, such as item difficulties, item discrimination, and/or item parameters in test development, the item response models, estimation procedures, and evidence of model fit should be documented.

The *Standards* (AERA, APA, & NCME, 1999) suggest that those items that count toward candidates' scores should exhibit sound psychometric characteristics. Specifically, the item difficulty and discrimination should compare favorably with the item-performance standards set by the Joint Commission. Item statistics result from the analysis of data obtained from the administration of the items to a representative sample of candidates.

While the statistics are important for determining the value of items, statistics are not available for some items on National Board examinations because they are new and untested.

Items used on each National Board examination include anchor and new items. The function of anchor items is to equate examination forms across administrations since they have reliable performance statistics. New items are considered pretest items in an examination. These pretest items are removed from the final analysis if they do not meet item-performance standards. Test constructors review items with poor performance and either retain, revise, or remove the item from further testing.

Evaluating and Revising Weak or Unacceptable Items

The Joint Commission (Joint Commission on National Dental Examinations, November 1995) has published a document that is intended to help test constructors review unsatisfactorily performing items and then either revise or retire such items. This activity replenishes the item bank and helps the committee members sharpen their ability to evaluate and improve items.

Pretest Items

A pretest item is a new item that is included on a regular administration of the examination but is reviewed for acceptable item statistics before being used as a scored item on a subsequent edition of the examination. The objective of pretesting items is to ensure the use of items with acceptable item statistics. The pretesting of items enhances the quality of the examinations and the reliability of the scores while allowing for the development of a high-quality item pool. To balance the need for using only previously administered items and the need for maintaining acceptable reliabilities, the Joint Commission has set the maximum percentage of pretest items at 15%. Each examination includes at least 85% scored items and up to 15% pretest items.

Assuming that the length of examinations is not increased, the Joint Commission has considered the possibility that pretesting items has an impact on both the validity of the examination and reliability of the scores. With regard to validity, if a percentage of items is designated for pretesting on a particular form, then performance on these items will not be counted in the candidates' scores. Therefore, the content sampled by these items will not be evaluated by that particular form. On the other hand, however, if pretest items from different content areas are included on different forms, then no content area will be systematically excluded from all editions.

12. Test Design and Development

The design of each examination is a very important step in test development. Items chosen for each examination must conform to the examination specifications in precise ways. Not only must content requirements be met, but also the difficulty of the examination (based on the average of the item difficulties) must approximate previous and future examination forms. Table 12.1 lists standards that pertain to examination design and development.

Table 12.1
Standards Relevant to Test Design and Development

3.1 Tests and testing programs should be developed on a sound scientific basis. Test developers and publishers should compile and document adequate evidence bearing on test development.

3.7 The procedures used to develop, review, and try out items, and to select items from the item pool should be documented. If the items were classified into different categories of subtests according to the test specifications, the procedures used for the classification and the appropriateness and accuracy of the classification should be documented.

3.11 Test developers should document the extent to which the content domain of a test represents the defined domain and test specifications.

Examinations are designed with the full participation of content expert committees and supervised by the staff specialists from the ADA's test development area. This process ensures that the expertise of highly qualified, licensed dentists is fully used in the selection of items and the examination design. The test specialists provide technical support and guidance to ensure that the desired technical qualities of the examination are achieved during this examination design phase.

The Joint Commission convenes several committees. The details of committee eligibility, recruitment, and service that they give are provided in this section. As noted earlier in this technical report, these committees also write and evaluate test items as part of the item development phase of test development.

The Role of a Test Constructor

The role of a test constructor is based on the purpose of the National Board Dental Examinations. The role of a test constructor is fundamental to the validity of score interpretations and uses. Test constructors are responsible for evaluating and recommending

to the Joint Commission, through its Committee on Examination Development, changes to the content specifications that relate to terminology and minor shifts in focus when accompanied by appropriate justification. In addition to updating the specifications, test constructors are responsible for implementing the specifications in the items selected for each examination. This action provides content-related validity evidence. The test constructors also are responsible for constructing a clear, precise, and cohesive group of items for each examination.

Test constructors meet in discipline or case-based committees each year to engage in their test development activities. It is essential to the quality of the examinations that the test constructors use their subject-matter expertise, their familiarity with the curriculum in accredited dental schools, and their awareness of what is important in the practice of dentistry in the construction of each new examination. Most of this work is done in committee.

The Nature of Test Construction Committees

The National Board Dental Examinations are developed by several test construction committees consisting of consultants of the Joint Commission. Committee size is based on past committee experience in providing adequate content expertise. The following are the 17 Part I and Part II Test Construction Committees with the number of members appearing at the right:

Part I - Basic Biomedical Sciences Committees

Anatomic Sciences -----	5
• 2 gross anatomists	
• 2 histologists (1 embryology expert and 1 neuroanatomy expert)	
• 1 full-time practitioner	
Biochemistry-Physiology -----	5
• 2 biochemists	
• 2 physiologists	
• 1 full-time practitioner	
Microbiology-Pathology -----	5
• 2 microbiologists (1 immunology expert)	
• 2 general pathologists	
• 1 full-time practitioner	
Dental Anatomy and Occlusion -----	4

- 3 dental anatomists
- 1 full-time practitioner

Testlet Development -----	9
<ul style="list-style-type: none"> • 4 full-time practitioners • 5 experts in each Part I discipline 	

Part II - Component A (independent items) Committees

Endodontics -----	4
<ul style="list-style-type: none"> • 3 endodontists • 1 full-time practitioner 	
Operative Dentistry -----	5
<ul style="list-style-type: none"> • 4 dentists (1 dental materials expert) • 1 full-time practitioner 	
Oral and Maxillofacial Surgery–Pain Control -----	4
<ul style="list-style-type: none"> • 3 oral and maxillofacial surgeons (1 pain control expert) • 1 full-time practitioner 	
Oral Diagnosis -----	6
<ul style="list-style-type: none"> • 2 oral pathologists • 2 oral and maxillofacial radiologists • 1 dentist with advanced education in oral diagnosis • 1 full-time practitioner 	
Orthodontics–Pediatric Dentistry-----	6
<ul style="list-style-type: none"> • 3 orthodontists • 2 pediatric dentists • 1 full-time practitioner 	
Patient Management-----	8
<ul style="list-style-type: none"> • 3 behavioral scientists (1 dentist) • 2 dental public health specialists • 1 dentist with advanced training in special needs • 2 full-time practitioners 	
Periodontics -----	4
<ul style="list-style-type: none"> • 3 periodontists • 1 full-time practitioner 	

Pharmacology -----	4
• 3 pharmacologists (1 dentist)	
• 1 full-time practitioner	
Prosthodontics -----	6
• 4 prosthodontists (2 fixed prosthodontic experts; 2 removable partial/complete prosthodontics experts)	
• 1 dental materials expert	
• 1 full-time practitioner	

Part II - Component B (case-dependent items) Committees

Component B – Case Composition Committee -----	13
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This committee, composed of dental discipline experts and practitioners, prepares the case-based items for Part II of the National Board Dental Examinations.

Case Selection Committee -----	4
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As an adjunct to Component B, this committee does the preliminary work of screening new patient cases and identifying suitable cases for the examinations. In addition, it drafts and reviews the patient histories, dental charts and treatment plans associated with the cases.

Consultant Review Committee -----	2
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To ensure examination coherence and cohesion, this committee reviews the discipline-based and case-based components of the Part II examination.

Criteria for Dental Test Constructors

The *Standing Rules* (Joint Commission on National Dental Examinations, March 2007) provides criteria for the one- to five-year appointment of its test constructors. The Joint Commission selects consultants to serve on its dental test construction committees. A test constructor is appointed for a one-year term and may be reappointed for a maximum of five consecutive one-year terms. To be considered for appointment, a person must possess appropriate qualifications and must submit a completed Personal Data Form. Following are the criteria for test construction committees in Anatomic Sciences, Biochemistry-Physiology, Microbiology-Pathology, Dental Materials, Pharmacology, and Patient Management (Dental Public Health and Behavioral Science):

1. Dentist with a Master's degree in that biomedical science OR any professional with a doctoral degree in that biomedical science and
2. Three years of experience, within the last five years, teaching or in research in that biomedical science.

Following are the criteria for test construction committees in Dental Anatomy and Occlusion, Operative Dentistry, Prosthodontics, Oral and Maxillofacial Surgery and Pain Control, Orthodontics-Pediatric Dentistry, Endodontics, Periodontics, and Oral Diagnosis:

1. Dentist,
2. In the case of special areas of dentistry, graduation from an accredited advanced education program in that specialty, and
3. Three years of experience, within the last five years, teaching or in research in the pertinent specialty.

To qualify for consideration in the National Board Dental Examination construction process as a full-time practitioner, a dentist must be practicing dentistry (not necessarily as a specialist) 30 to 40 hours per week for at least 10 years.

The Selection of Committee Members

The Joint Commission annually advertises vacancies on test construction committees. A letter explaining the on-line application materials, consisting of a list of vacancies, criteria for selection, and a Personal Data Form is e-mailed to dental schools, state boards of dentistry, constituent dental societies, and other institutions and individuals well in advance of the annual meeting of the Joint Commission. The Joint Commission typically receives an average of 12 applications for each vacant position. All applications are processed by staff and forwarded to the Committee on Examination Development (a standing committee of the Joint Commission), which is responsible for recommending individuals for appointment by the Joint Commission.

Test construction committee members are appointed primarily based on subject matter expertise, although geographic location is considered. Committee membership terms are one year, and a member may be reappointed for a maximum of five consecutive one-year terms. Membership in the American Dental Association is preferred for members of committees in the clinical sciences.

A test construction committee member who has served five consecutive one-year terms is not eligible for re-appointment to the same committee.

The Responsibilities of Test Construction Committee Members

The following list shows the responsibilities of committee members.

1. Submit new items for the National Board item banks, according to Joint Commission guidelines, specifications, and content outlines by the designated time. This requirement applies to members after completion of their first year of committee service, and the number of new items expected may vary according to the needs of each committee.
2. Attend each test construction meeting for the duration of the session.
3. Construct National Board Dental Examinations according to Joint Commission guidelines, specifications, and content outlines within the designated time frame.
4. Construct additional items for the item banks when necessary.
5. Assign ownership of all examination materials to the American Dental Association/Joint Commission on National Dental Examinations by agreeing to the terms of the Copyright Assignment.
6. Inform the Joint Commission of changes in the standard curricula, and suggest modifications in examination specifications and content outlines.
7. Consider special issues and make recommendations at the request of the Joint Commission.
8. Safeguard the security and confidentiality of the National Board examinations by declining any arrangement to assist with review courses or reviewing books pertaining to the examinations while serving as a test constructor, and for at least one year following the final term of appointment.
9. Comply with the American Dental Association's policy on professional conduct. The policy includes prohibitions against sexual harassment, as well as other forms of unlawful conduct.

An Orientation Manual for Dental Test Constructors (Joint Commission on National Dental Examinations, January 2007) provides basic information to new test constructors.

How National Board Dental Examinations Are Developed

The Part I comprehensive National Board Dental Examination contains 400 items – approximately 320 discipline-based and 80 testlet-based. The Part II comprehensive examination contains 500 items—400 discipline-based items and 100 case-based items. Part I and Part II discipline-based committees meet once per year, usually for three days. The Part I testlet-based committee meets twice per year. The Part II case-based committee meets

at least twice per year. Each committee is charged with constructing a specific examination or portion of an examination. The Part II Case Selection Committee meets once per year, usually for two days, and the Review Committee meets twice per year, usually for two days.

Test construction meetings typically begin with a review of the statistical characteristics of examinations administered since the last meeting. These characteristics include reliability, mean, and standard deviation of examination scores. Individual item statistics are also reviewed. These statistics include the difficulty of the item, the proportion of candidates choosing each option, and the point-biserial correlation between each response and the total score, which is the discrimination index. Items that produce statistics below the standards set by the Joint Commission are reviewed.

Next, test constructors review the *National Board Dental Examination Specifications* (Joint Commission on National Dental Examinations, 2007) to ensure that discipline areas continue to reflect current practice and teachings in the majority of U.S. dental schools. Then they finalize the draft examinations by reviewing all items, according to the examination specifications. During the final review, before each item is read aloud for approval, committee members are asked to “take” the examination as though they were students.

The final step of the meeting is to draft new examinations using both new items and existing items with proven track records. Following the meetings, consultants and staff conduct final reviews.

Results of Test Design

Several tables provide results of the examination design effort relative to the examination specifications provided in Appendices A and B. The Joint Commission seeks clinical application of all items and directs all test construction committees to emphasize problem solving rather than simple recall of facts in the construction of examinations. While finalizing items, all committees identify each item’s clinical applicability and cognitive level. For Part I, the test constructors assert that dentists will use the basic biomedical and dental sciences knowledge as a foundation for daily practice. Therefore, each item in a basic science discipline has a direct or an indirect clinical application. The distribution of items by clinical applicability and cognitive level for two computer-based editions of the comprehensive Part I examination administered in 2007 is shown in Tables 12.2 and 12.3, respectively.

Table 12.2
Distribution of Part I Items by Clinical Applicability and Cognitive Level
Computer-based Examination Version A*

Discipline	Clinical Applicability	Understanding	Application	Reasoning
Anatomic Sciences	36	58	37	5
Biochemistry-Physiology	26	53	43	4
Microbiology-Pathology	33	48	49	3
Dental Anatomy	100	39	58	3

* This summary is based on one of the editions of the 2007 computer-based, comprehensive Part I examination.

Table 12.3
Distribution of Part I Items by Clinical Applicability and Cognitive Level
Computer-based Examination Version B*

Discipline	Clinical Applicability	Understanding	Application	Reasoning
Anatomic Sciences	28	65	32	3
Biochemistry-Physiology	39	51	47	2
Microbiology/Pathology	40	55	43	2
Dental Anatomy	100	49	46	5

* This summary is based on one of the versions of the 2007 computer-based, comprehensive Part I examination.

Distribution of Basic Science and Multidisciplinary Examinations

When the comprehensive Part II was first developed in the early 1990s, the Joint Commission required that each Part II examination include items that require knowledge of the basic sciences (minimum 30%) and other clinical disciplines (minimum of 30%). For example, an item on tooth extraction might be categorized under Pharmacology and Oral Surgery because of the medication and technique involved in the procedure. Classification of items according to disciplines and cognitive level is done by committees during the final phase of test construction.

The distributions of items by category and cognitive level for two 2007 Part II examination versions are shown in Tables 12.4 and 12.5.

Table 12.4
Distribution of Part II Items by Category and Cognitive Level
Computer-based Examination Version A- 2007

Part II Disciplines	Single Discipline Items	Multidisciplinary Items			Cognitive Level		
		Other Clinical Discipline	Basic Science	Behavioral Science	Reasoning	Application	Understanding
COMPONENT A Operative Dentistry (44)	18	18	9		9	21	14
Pharmacology (31)	23	3	8		3	3	25
Prosthodontics (49)	33	6	6		10	24	15
Oral and Maxillofacial Surgery and Pain Control (47)	15	14	14		9	30	8
Orthodontics -- Pediatric Dentistry (52)	15	23	10	10	11	21	20
Endodontics (31)	15	9	6		10	15	6
Periodontics (50)	17	10	18		9	28	13
Oral Diagnosis (45)	37	4	3		21	6	18
Patient Management (51)	0	28	0	28	15	8	28
Total – Component A (400 Items)	173	115	74	38	97	156	147
COMPONENT B (100 Items)	59	29	6	6	11	80	9
TOTALS (500)	232	144	80	44	108	236	156
Percent (100 %)	46.4	28.8	16	8.8	21.6	47.2	31.2

Table 12.5
Distribution of Part II Items by Category and Cognitive Level
Computer-based Examination Version B- 2007

Part II Disciplines	Single Discipline Items	Multidisciplinary Items			Cognitive Level		
		Other Clinical Discipline	Basic Science	Behavioral Science	Reasoning	Application	Understanding
COMPONENT A							
Operative Dentistry (44)	17	16	12		15	19	10
Pharmacology (31)	21	5	8		3	12	16
Prosthodontics (49)	30	5	10		12	26	11
Oral and Maxillofacial Surgery and Pain Control (47)	17	11	15		13	29	5
Orthodontics -- Pediatric Dentistry (52)	17	24	7	10	13	19	20
Endodontics (31)	17	8	5		11	11	9
Periodontics (50)	16	9	20		7	33	10
Oral Diagnosis (45)	36	4	4		21	7	17
Patient Management (51)	0	28	0	28	5	11	35
Total – Component A (400 Items)	171	110	81	38	100	167	133
COMPONENT B (100 Items)	57	28	9	6	8	76	16
TOTALS (500)	228	138	90	44	108	243	149
Percent (100 %)	45.6	27.6	18	8.8	21.6	48.6	29.8

13. Administration

Several important issues related to administration are addressed in this section and are linked to standards. Table 13.1 provides a short list of relevant standards.

Table 13.1
Standards Pertaining to Administration

3.19 The directions for test administration should be presented with sufficient clarity and emphasis so that it is possible for others to replicate adequately the administration conditions under which the data on reliability and validity, and where appropriate, norms were obtained.

3.20 The instructions presented to test takers should contain sufficient detail so that test takers can respond to a task in the manner that the test developer intended. When appropriate, sample material, practice or sample questions, criteria for scoring, and a representative item identified with each major area in the test's classification or domain should be provided to the test takers prior to the administration of the test or included in the testing material as part of the standard administration instructions.

The Joint Commission on National Dental Examinations in its *Examination Regulations* (March 2007) describes the eligibility requirements for candidates for the dental examinations who take it for the first time or who are re-examined. This publication also describes how candidates apply for the examinations.

Standardized procedures relevant to the computer format are described by the Joint Commission and the Prometric Testing Centers that administer the examination to individual candidates. Specific procedures are followed by these test administration staff members.

14. Reliability of Test Scores

A primary type of validity evidence is reliability. Reliability refers to the consistency of examination scores under repeated conditions. Another perspective on reliability is that it is based on the degree of measurement error present in scores relevant to score variability. Low reliability would suggest a large average margin of error in scores that would undermine accurate reporting of true achievement and create doubt or caution about passing or failing a candidate based on a score. Therefore, in high-stakes examination programs, it is important to achieve reliability estimates that reach or exceed 0.80. The technique for estimating reliability is coefficient alpha, and the KR₂₀ method is suitable for estimating alpha when items are scored right/wrong. The main strategy in achieving such high estimates is to have long examinations, because examination length is the single most effective way to achieve

high reliability. However, having uniformly high quality items also contributes to reliability. Table 14.1 lists the standards applicable to the Part I and Part II examinations.

Table 14.1
Standards that Apply to Reliability

2.1 For each total score, subscore, or combination of scores that is to be interpreted, estimates of relevant reliabilities and standard errors of measurement or test information should be reported.

2.14 Conditional standard errors of measurement should be reported at several score levels if constancy cannot be assumed. Where cut scores are specified for selection or classification, the standard errors should be reported in the vicinity of each cut score.

14.14 Estimates of reliability of test-based credentialing decisions should be provided.

Reliability data are reported in Appendix C. The reliabilities for the most frequently administered editions of 2007 Part I comprehensive examination are all above 0.90. Same is true for Part II.

15. Standard Setting

A critical step in the development of any pass/fail examination is the setting of the cut score that separates passing and failing candidates (AERA, APA, NCME, 1999, p. 53-54). The implication of a cut score for the Part I and Part II examinations is that the cut score represents a collective judgment that those who fail Part I or Part II are likely to make serious errors in the practice of dentistry. The setting of cut scores may involve empirical study, but value judgments by content experts are inevitable. The judges should be qualified, and documentation should be provided of their qualifications. The process for setting the cut score should be well described and documented. Table 15.1 provides standards that are relevant to setting the cut scores for Part I and Part II.

Table 15.1
Standards Pertaining to Standard Setting

4.19 When proposed score interpretation involves one or more cut scores, the rationale and procedures used for establishing cut scores should be clearly recommended.

4.20 When feasible, cut scores defining categories with distinct substantive interpretations should be established based on sound empirical data concerning the relation of test performance to relevant criteria.

4.21 When cut scores defining pass-fail or proficiency categories are based on direct judgment about the adequacy of items or test performances or performance levels, the judgmental process should be designed so that judges can bring their knowledge and experience to bear in a reasonable way.

14.16 Rules and procedures used to combine scores on multiple measures to determine the overall outcome of a credentialing test should be reported to test takers, preferably before the test is administered.

14.17 The level of performance required for passing a credentialing test should depend on the knowledge and skills necessary for acceptable performance in the occupation or profession and should not be adjusted to regulate the number or proportion of persons passing the test.

The criterion-referenced approach that has been successfully used by the Joint Commission is the method described by Grosse and Wright (1985) and Kramer and DeMarais (1992). Using this approach, Rasch calibration statistics for criterion items are used, in concert with judgments about the ability of candidates, to set the cut score. The advantages of using a Rasch measurement approach have been described in detail in Wright and Stone (1979).

There are essentially three steps involved in the standard setting procedures used by the Joint Commission.

1. A standard setting committee is convened. The committee includes specialists in the disciplines included on the examination and general practitioners. The size of the committee and its exact composition are determined by the purpose and content of the examination.
2. The committee members engage in a complete and thorough discussion of the characteristics and behaviors of the minimally competent candidate and the importance of individual content elements on the examinations.
3. Following this discussion phase, three types of information are gathered from the committee members using a sample examination. The first type of information is related to an estimate of the percentage of the reference group that does not possess the requisite knowledge and problem-solving skills to pass, i.e., the failure rate. For

the National Board, the reference group is defined as those candidates who are enrolled in dental programs with approval accreditation status and who are being examined for the first time (Joint Commission on National Dental Examinations, 2004). The second type of information relates to examination content. This information is independent of the abilities of the candidates. Information regarding examination content requires that committee members select a subset of items that they consider to be of critical importance. These are designated as the criterion items. Selection rules have been established for use by the committee members in order to achieve consistency in judgments. These rules are based on research in the area of criterion-referenced examination (Kramer & DeMarais, 1992), and are cited below. The third type of information is related to the ability level of minimally-competent candidates. Committee members are asked to indicate the passing rule. Specifically, what level of criterion item difficulty is necessary for candidates to pass the examination?

Selection Rules

1. The content of criterion items must be *central*, or *directly related*, to the practice of dentistry.
2. Criterion items must assess the knowledge and problem-solving skills that are *employed frequently* in the practice of dentistry.
3. Criterion items must assess the knowledge and problem-solving skills that are subject to change with *current research and development* in the field of dentistry.
4. The content of the criterion items must be of *fundamental and critical importance* to the successful practice of dentistry.
5. The content of the criterion items must assess the knowledge and problem-solving skills that *the minimally-competent candidate* is to have acquired in order to be licensed.
6. Criterion items must be *selected from Components A and B*.
7. Criterion items must be *selected from a full range of the content* included on the examination.

Using these types of information, the cut score can be set with the Rasch measurement model. Using the Rasch model, candidate ability and item difficulty are

described by a single measurement scale. This means that candidate ability can be directly related to the specific abilities, knowledge, and problem solving skills that underlie items on the examination. The Rasch ability scale is based on the log odds of responding to an item correctly. The measurement scale is defined in terms of these log-odds or logits. The Rasch model is defined by the expression:

$$P\{x_{vi} = 1 | \beta_v, \delta_i\} = \frac{\exp(\beta_v - \delta_i)}{[1 + \exp(\beta_v - \delta_i)]}$$

where P_{vi} is the probability of person v correctly responding to item i , β_v is the ability of the person v , and δ_i is the difficulty of the item i (Wright and Stone, 1979).

The underlying log-ability scale is centered on zero and typically ranges from a -5.00 to a +5.00 logits, with more negative values indicating relatively easier items and lower-scoring candidates. In like manner, more positive values indicate relatively more difficult items and higher-scoring candidates. Because candidate ability and item difficulty are on the same measurement scale, it is possible to directly relate the two statistics relative to the criterion items. Therefore, if the passing rule sets the cut score at the average logit difficulty of the criterion items, then the cut score is set at that point along the scale. Those candidates who score at or above this point would pass. This point along the measurement scale is assigned a standard score of 75.

Standard-setting for the Comprehensive Part I Examination

The Joint Commission routinely confirms the standard or cut score that separates passing and failing candidates on the National Board Dental Examinations. Both the Objective Standard Setting (OSS) method and the Angoff method (Angoff, 1971) were used to confirm a standard on Part I. For the Angoff method, a slight variation of this procedure was conducted by asking each judge to determine the proportion that the “minimally competent candidate” would answer each item correctly. In effect, the judges estimated the proportion of minimally competent candidates who would answer each item correctly. The sum of these proportions then represents the minimally passing score. The interpretation of “minimally competent candidates” is candidates who have the minimum level of knowledge necessary to safely and effectively practice dentistry or proceed to clinic-based courses. The interpretation of proportion is to imagine a hundred minimally competent candidates. Of these, how many would answer the item correctly? After the proportion correct for each item for the reference group of candidates at the level of minimally competent performance on Part I was determined by judges, the minimally passing score for the Part I examination was computed.

Like the comprehensive Part I examination, Part II is based on a single composite score. The pass/fail decision is based on candidate performance across all 500 items. A candidate passes if his or her score is 75 or higher. Concomitantly, a candidate has a failure on the examination with a score of 74 or below. If a candidate records a failure for Part II, he or she must retake the examination in its entirety.

16. Scaling/Equating/Comparability of Test Forms

The *Standards* (AERA, APA, NCME, 1999) devote Chapter Four to this topic. When different versions of the same examination are used, it is critical to ensure that every candidate take an examination of equal difficulty relevant to the passing cut score on the standardized examination score scale. Table 16.1 lists the relevant standards that apply to scaling/equating/comparability.

Table 16.1
Standards Pertaining to Scaling/Equating/Comparability

4.10 A clear rationale and supporting evidence should be provided for any claim that scores earned on different forms of a test may be used interchangeably. In some cases, direct evidence of score equivalency may be provided. In other cases, evidence may come from a demonstration that the theoretical assumptions underlying procedures for establishing score comparability have been sufficiently satisfied. The specific rationale and the evidence required will depend in part on the intended uses for which score equivalence is claimed.

4.11 When claims of form-to-form score equivalence are based on equating procedures, detailed technical information should be provided on the method by which equating functions or other linkages were established and on the accuracy of equating functions.

4.13 In equating studies that employ an anchor test design, the characteristics of the anchor test and its similarity to the forms being equated should be presented, including both content specifications and empirically determined relationships among test scores. If anchor items are used, as in some IRT-based and classical equating studies, the representativeness and psychometric characteristics of anchor items should be presented.

4.17 Testing programs that attempt to maintain a common scale over time should conduct periodic checks of the stability of the scale on which scores are reported.

Different forms of the National Board Dental Examinations are used for each administration of the examination. In order to assure that the scores of candidates completing the examination at different examination administrations can be compared, some statistical

adjustment to their scores is necessary. The Joint Commission uses two methods to guarantee the comparability of scores. These two methods are equating and score conversions from the item bank. Equating raw scores can provide an indication of how well a candidate has performed when compared to others taking the same examination, but comparing scores across examination forms or examination administrations is inappropriate without assuming that the distribution of examination scores remains constant from one examination situation to another. Because examination score distributions vary, raw scores must be modified to enable the achievement of each candidate to be evaluated properly. The process of adjusting scores to make them comparable to the scores on other administrations is known as *test equating*.

Once standardized examination scores are equated, they are on a common scale. Thus, the scores of candidates completing different forms can be evaluated on the same scale using the same cut score of 75. In addition, because the mean scores obtained by different groups of candidates may be expressed on the same metric, yearly trends in examination performance can be evaluated fairly.

To equate two examinations, certain requirements need to be met (Lord, 1980). First, both examinations must assess the same content. Second, the equation used to adjust scores remains the same regardless of the groups used. And third, the correspondence between the scores must be symmetric, that is, it should make no difference whether examination X is adjusted to the scale of examination Y or vice-versa. The equating procedures are presented here within the context of *horizontal score* transformations. That is, the alternative forms of the examination are of similar difficulty and identical content, and have been constructed for the same population of candidates.

Equating Designs

Many different data collection designs have been used for equating (Petersen, Kolen, and Hoover, 1989). These designs require that the same group (or equivalent groups) of candidates complete both forms of the examination or that a group of common items, called *anchor* items, appear on both forms of the examination.

In the simplest of the designs, the same group of candidates completes both examinations. Because only one group is used, possible between-group differences in ability cannot influence the equating, as might occur when multi-group designs are used. However, the use of a single group could produce fatigue, practice, and order effects. This equating design is not feasible due to the length of the Part I and Part II examinations.

Random differences between equivalent groups may be controlled by the use of anchor items. Anchor items contain items administered to both groups in the design and may or may not be counted in computing total scores. Performance on the anchor items can be

used to make statistical adjustments to each of the examination forms so that an estimate can be made of how the combined group of candidates would score on both forms of the examination. Because the anchor items serves as the link among the alternate forms, the format and content of the anchor items should be similar to those of the other items administered. Not only is this design feasible, it is widely used and accepted throughout large-scale examination.

Statistical Methods for Adjusting Scores

Once a design has been chosen for equating, the next decision to be made concerns which statistical method should be used to establish equivalent scores on the two parallel content examinations. The three most often used techniques are linear, equipercentile, and item response theory (IRT). Equivalence of scores is defined differently in each method, and each makes different assumptions about the data and the distributions of examination scores.

The IRT method has many advantages that warrant its use. First, IRT approaches to equating are based on the item level rather than the total examination score level. Traditional methods, such as equipercentile equating, require entire examination score distributions. The use of cumulative distributions of examination scores introduces imprecision into the equating process. Rounding and interpolation errors may occur. The IRT model currently used with the National Board examinations is called the one-parameter, or Rasch model. The Rasch model is more precise. Second, the Rasch model allows each candidate to complete a set of items different from those attempted by any other candidate, and still be scored on the same scale of measurement. This process, now used in adaptive examination, has the potential to improve measurement accuracy for most candidates, but requires that IRT methods of equating be implemented. Third, Rasch equating allows for extensive cross-checking of item parameters. Because each equating event may introduce error into the estimation of item and person parameters, it is essential to double check item parameters by linking them through various paths back to the scale of the base year. This precaution prevents item difficulties from drifting too far away from the correct scale, but is cumbersome to do with any method other than Rasch equating. The versatility and precision of Rasch equating enables the item bank to be managed more easily and updated more accurately.

IRT postulates that the response of an individual to an item is a function of that person's ability and certain characteristics, or parameters, of the item. Under the Rasch model, the only characteristic of the item which can influence a response is its difficulty. The function used to determine the probability of a correct response of person v to item i is shown below (Wright & Stone, 1979):

$$P(x_{vi} = I) = \exp(\beta_v - \delta_i) / [1 + \exp(\beta_v - \delta_i)] \quad [16.1]$$

where β_v is the ability of person and δ_i is the difficulty of item i . Both item difficulty and person ability are expressed in the same unit of measurement, called the logit. A logit may be defined as the natural log odds of a correct response to an item chosen to represent the center (or "zero" point) of the measurement scale.

The Rasch item response model assumes that all the items in an examination measure the same construct, and that the logistic curve, defined by Equation 1 is a satisfactory representation of the data. Items that do not fit the model can be detected statistically and discarded. An important reason for using the Rasch model is that it provides objective measurement. By this is meant that the estimate of a person's ability does not depend on the items attempted and that the estimate of an item's difficulty does not depend on the particular sample of individuals used in its calibration. Thus, when a set of items is administered to two samples, and calibrated separately for each, the two resulting sets of Rasch item difficulties will be linearly related. Therefore, a set of common items, present in each of two different examinations administered to two different samples, may assume the linking function of an anchor examination. Determining the linear relation between the linking items yields a constant which, if added to the difficulties of the anchor items as calibrated in Examination Y, will transform them to the scale of Examination X. The same constant, added to the difficulties of the remaining items of Examination Y, also places them on the Examination X scale of measurement because the same linear relation must apply to all the items, even those present on only one of the examinations.

The necessary constant used to transform the item difficulty parameters of Examination Y onto the scale of Examination X is given by Wright and Stone (1979):

$$G_{xy} = \frac{\sum_{i=1}^K (\delta_{ix} - \delta_{iy})}{K} \quad [16.2]$$

where δ_{ix} is the difficulty of item i when calibrated with the items on Examination X; δ_{iy} is its difficulty on the Examination Y scale; and K is the number of items in the anchor examination.

After two examinations have been linked in this manner, the same procedure may be repeated to link one of the examinations with yet another examination using a (possibly) new set of linking items. In this way, many alternate versions of an examination may be equated, enabling examination performance to be evaluated over periods of several years. Large inventories of items (item banks) may also be built up systematically over time using the chaining process. A certain degree of error, however, accompanies each linking step, so it is advisable to cross-check item difficulty parameters periodically to insure that the equating process remains accurate.

Person ability estimates, β_v , also expressed on the logit scale, may be transformed by the same constant used to place items on a common scale. Equating the ability scales allows for the comparison of group differences even though alternate forms may have been used at each administration.

National Board examinations are scored according to the Rasch model using the unconditional/maximum likelihood estimation procedure (Wright & Panchapakesan, 1969) using the WINSTEPS computer program (Linacre, 2002). Output includes person and item parameters scored in logits, and indices of how well the responses of each person and item fit the model. Included among the items is a set of linking or anchor items. As discussed above, links enable each item and each examinee to be located on the same scale of measurement as that of the base year of the examination.

The following simple example illustrates how common item equating is carried out. Table 16.2 presents item statistics obtained on two separate administrations on seven anchor items. The first column shows item difficulties scaled on the base year logit scale. Standard errors show how accurately difficulty has been estimated. The corresponding statistics for the new examination are shown in the next two columns. The linking constant is simply the difference between the mean item difficulties of the two calibrations. In this example the linking constant is -0.36. Ideally, when the link is added to the new difficulty, the sum should equal the corresponding base year difficulty for each item. However, error due to sampling and imperfect measurement usually results in a discrepancy between these two values. If the difference is too large for a given item, it should not be included in the equating process. Wright and Stone (1979) provide a statistical chi-square test that allows for determining how large a difference in difficulties one may expect by chance.

Table 16.2.
Difficulties of Anchor Items Calibrated on Two Test Administrations

<i>Item</i>	<i>Base Year</i>		<i>New Testing</i>		<i>New Testing</i>	<i>Square Error</i>
	<i>Diff.</i>	<i>S.E.</i>	<i>Diff.</i>	<i>S.E.</i>	<i>Diff. + Link</i>	
1	-0.88	.05	-0.72	.04	-1.08	.0400
2	-0.74	.05	-0.42	.04	-0.78	.0016
3	-0.62	.05	-0.28	.04	-0.64	.0004
4	-0.15	.04	-0.02	.04	-0.34	.0361
5	0.26	.04	-0.61	.04	-0.25	.0001
6	-0.18	.04	-0.05	.04	-0.31	.0169
7	-1.03	.05	-0.08	.04	-0.44	.3481**
<i>Sum</i>	-3.34		-0.82		-3.34	.4432**
<i>Mean</i>	-0.48		-0.12		-0.48	

** $p < .01$

In the example, Item 7 produced a difference in difficulties greater than that that would be expected by chance alone. As a result, the overall fit of the equating was not acceptable.

When an unsuitable item is detected, the equating process begins again without it. This requires that the mean item difficulties be recalculated for the remaining items, a new linking constant determined, and the discrepancies between the old and new calibrations recalculated. In this case, the new linking constant is equal to -0.27. Once a satisfactory equivalence between the base year and current year anchor items has been established, the next step is to adjust the difficulties of all the remaining items in the new examination by adding the link constant to them. This adjustment places all the items on the original base year scale, even though none of the non-anchor items were administered in the base year. Because all the item parameters are grounded in the same scale of measurement used in the base year, estimates of person ability (determined from Equation 16.1 using the WINSTEPS Rasch scaling program) will be on that scale. This enables any person's score to be compared to that of any other person, regardless of the year in which they completed the examination and regardless of which particular items were included on that examination. Mean scores, too, may be compared from examination to examination.

Developing Score Conversions for Test Editions from the Item Bank

The Part I and Part II examinations placed on the Prometric computer network are linear editions developed directly from the Joint Commission's item banks. For these linear editions constructed directly from the item banks, score conversions are developed using statistical methods based in the Rasch measurement model.

With regard to the estimation of ability for candidates, items for the examinations are drawn from the item banks according to the content requirements of the individual examination. Each new edition of the examination is composed of a combination of items, which is unique. The assembly of an examination based on items selected in this way means that the procedure of estimating converted scores based on raw scores must be modified from that used with intact examinations. The Rasch model provides a way to establish person abilities, even when the items are not drawn from a previously used print edition.

Because the Rasch model evaluates person ability and item difficulty in the same units of measurement (i.e. logits), person ability may be estimated using the following two steps. (See *Best Test Design* by Wright and Stone, 1979, p.27 for details). First, the difficulties of the selected items are averaged. Part I and Part II item banks contain both Rasch parameters and traditional item statistics such as the percent of candidates responding correctly. The variance of the Rasch difficulties of these items is also computed.

Second, a Rasch ability is computed for each possible raw score according to the following formula:

$$B_v = H + (1 + w^2 / 2.89)^{1/2} \ln [rv / (L - rv)], \text{ in which} \quad [16.3]$$

- B_v is the ability estimate in logits for candidate v
- H is the average difficulty of the items
- w^2 is the variance of the item difficulties
- \ln Take the natural logarithm of the term in brackets
- rv is the number of correct answers for candidate v
- L is the number of items in the examination

The standard error of B_v is:

$$SE(B_v) = (1 + w^2 / 2.89)^{1/2} [L / rv(L - rv)]^{1/2} \quad [16.4]$$

The above formula may be applied to all raw scores from 1 to $(L-1)$. For zero and perfect scores, an approximation may be applied. A "raw score" of 0.5 is substituted for zero scores, and $(L - 0.5)$ substituted for perfect scores.

Once an estimate in logits has been calculated for every possible raw score, conversion tables, based on the findings of standard-setting exercises, are used to translate raw score scales to the converted score scales in use for all editions of Part I and Part II.

This approach has been successfully used with a variety of examination programs, including admission and licensure examinations. For a number of separate editions of the examinations, raw-score to standard-score conversions have been developed. The performance of candidates across these forms was consistent with performance on previous intact editions. Comparable performance across editions is one source of evidence, which supports the use of this approach to standard score development.

17. Scoring and Reporting Test Scores

Standards pertaining to scoring and reporting of examination scores appear in Table 17.1 below. Quality control in scoring is an important, yet often invisible, feature of any examination program. Standard 5.8 refers to the scoring and potential scoring errors. Standard 5.10 refers generally to making responsible interpretation of scores to recipients of these scores. Standard 5.13 makes certain the transmission of scores is done responsibly. Standard 5.15 and 5.16 refers to record keeping.

Table 17.1
Standards Pertaining to Scoring and Reporting of Test Scores

5.8 *Test scoring services should document the procedures that were followed to assure accuracy of scoring. The frequency of scoring errors should be monitored and reported to users of the service on reasonable request. Any systematic source of scoring error should be corrected.*

5.10 *When test information is released to students, parents, legal representatives, teachers, clients, or the media, those responsible for testing programs should provide appropriate interpretations. The interpretations should describe in simple language what the test covers, what scores mean, the precision of the scores, common misinterpretations of test scores, and how scores will be used.*

5.13 *Transmission of test scores to authorized individuals or institutions should be done in a manner that protects the confidential nature of the scores.*

5.15 *When test data about a person are retained, both the test protocol and any written report should also be preserved in some form. Test users should adhere to the policies and record-keeping practice of their professional organizations.*

5.16 *Organizations that maintain test scores on individuals in data files or in an individual's records should develop a clear set of guidelines on the duration of retention of an individual's records, and on the availability, and use over time, of such data.*

Scoring of the Examinations

Procedures for scoring the examinations are presented in *Examination Regulations* (Joint Commission on Dental Examination, March 2007). A quality control system is in place that increases confidence in scoring. For the computer-based examinations, the raw and standard scores for each candidate are confirmed by comparing the candidate's responses to the examination's answer key, computing a raw score, and converting the raw score to a standard score. Any discrepancy is resolved prior to the generation of the official score report. Each week the roster of candidates who took either board examination is compared with the candidates in the result files to assure no result files are missing.

Candidate's Scores

Candidate score reporting is more fully discussed in *Examination Regulations* (Joint Commission on National Dental Examinations, March 2007). Factors that affect a candidate's score include the number of correct answers selected by the candidate and the

score scale conversion for the examination. If an examination item does not meet the standards articulated by the Joint Commission, the item may be excluded from the scoring process. Also, on any edition of the examination up to 15 percent of the items are administered in order to determine if they meet established standards of quality. These pretest items are not included in the scoring process and, therefore, do not contribute to candidates' scores.

The score scale and the minimum passing score are determined by a standard-setting committee using a criterion-referenced method. The minimum passing score on the examination, resulting from the committee, is then reported with a standard score of 75. The examination results are reported in standard scores of 49 to 99. Under some circumstances, a zero is reported. A score below 75 is considered a failure and does not earn National Board credit.

Part I Score Reports

The Joint Commission reports the following Part I scoring information on the candidate's score report: 1) one comprehensive standard score and 2) the number of items, the candidate's number of corrects, and the national means for the four disciplines. Results are mailed approximately three to four weeks after the examination. Currently, Joint Commission regulations prohibit reporting scores by telephone, e-mail, or fax.

By signing the application, a candidate enrolled in an accredited dental school (or graduated within the last five years) gives expressed permission to provide a report of scores to the dean of the dental school. Reports of scores are provided to others only if permission is granted in the form of a written request from the candidate.

The Part I examination fee covers the cost of sending a report of scores to the candidate and the dean of an accredited dental school. The candidate's report of scores is sent only to the home address of the candidate.

After receiving scores, a candidate may request that additional reports be sent to others. Candidates may submit their score report requests electronically and pay by credit card or print a request form to submit by mail. For written requests, all fees are payable by certified check or money order. No personal checks or cash will be accepted. The American Dental Association (ADA) and American Student Dental Association (ASDA) members may write personal checks, but their membership number must be recorded on the check. A score report request form is available at www.ada.org. Requests for score reports must be in writing and must be accompanied by payment of the appropriate fee. Processing of requests requires approximately three weeks. When requesting additional official score reports, candidates must specify their reference number, the month and the year when the examination was taken. Also, the Joint Commission will provide a history of National Board

scores (recent and previous scores) upon receipt of a written request from the candidate.

Periodically, candidates request that their scores be sent to advanced dental educational programs. To avoid delays in processing these requests, candidates are urged to request scores at least two months preceding application deadlines for those programs. Besides submitting payment, candidates should include their National Board reference number, most recent examination date and indicate whether they have only taken Part I or both Parts I and II with their requests. In order to process the request, payments must be made by money order or certified check. No personal checks or cash will be accepted. ADA and ASDA members may write personal checks, but their membership number must be recorded on the check.

A candidate who requests scores after the time of application should note any name change in the request. If a change in National Board records is desired, a copy of the legal documentation or marriage certificate must be provided.

Candidates, who previously earned National Board credit, may retake the examination. However, the most recent scores are always reported. A candidate could jeopardize his or her passing status if the candidate performs poorly on the reexamination.

Part II Score Reports and Certificates

Because Part II is a comprehensive examination, one overall comprehensive score is reported. The candidate also receives additional performance information for each of the disciplines including the candidate's number of correct responses, the number of items, and the national mean. This information is reported to help the candidate understand areas of strong or weak performance. Results are mailed approximately three to four weeks after the examination. Joint Commission regulations prohibit reporting scores by telephone, fax or e-mail.

By signing the application, candidates enrolled in accredited dental schools (or graduated within the last five years) give expressed permission to provide reports of scores to the deans of the dental schools. Reports of scores are provided to others only if permission is granted in the form of a written request from the candidate. Reports of scores are always sent directly to dental licensing boards or advanced dental education programs when requested. The Joint Commission does not provide official score reports to the candidates to forward to licensing boards or educational programs.

The Part II examination fee covers the cost of sending a report of scores to the candidate, to the dean of the accredited dental school, and to three dental licensing boards if requested on the Part II application form.

On the application the candidate may request that reports of scores be sent to more than three licensing boards. After receiving scores, a candidate may request that additional reports be sent directly to dental licensing boards or to advanced dental education programs. Candidates may submit their score report requests electronically and pay by credit card, or print a request form to submit by mail. For written requests, all fees are payable by certified check or money order. No personal checks or cash will be accepted. The ADA and ASDA members may write personal checks, but their membership number must be recorded on the check. A score report request form is available at www.ada.org. Requests for score reports must be in writing and must be accompanied by payment of the appropriate fee. Processing of requests requires approximately three weeks. When requesting additional official score reports, candidates must specify their reference number, the month and the year when the examination was taken. Also, the Joint Commission will provide a history of National Board scores (recent and previous scores) upon receipt of a written request from the candidate.

Periodically, candidates request that their scores be sent to advanced dental educational programs. To avoid delays in processing these requests, candidates are urged to request scores at least two months preceding application deadlines for those programs. Besides submitting payment for each school, candidates should include their National Board reference number, most recent examination date and indicate whether they have only taken Part I or both Parts I and II with their requests. In order to process the request, payments must be made by money order or certified check. No personal checks or cash will be accepted. The ADA and ASDA members may write personal checks, but their membership number must be recorded on the check.

A candidate who requests scores after the time of application should note any name change in the request. If a change in National Board records is desired, a copy of the legal documentation or marriage certificate must be provided.

Candidates, who previously earned National Board credit, may retake the examination. However, the most recent scores are always reported. A candidate could jeopardize his or her passing status if the candidate performs poorly on the reexamination.

As part of the score report, a small National Board certificate is issued to each candidate who passes both Part I and II of the National Board Dental Examinations. After receiving scores, any passing dental candidate may order a full-size (8½" x 11") certificate. A certificate request form and information are provided with the test results. The certificate request form is available electronically at www.ada.org.

Score Audits

The responses from an examination are audited for accuracy before score reports are distributed. However, a candidate may make a written request to have his/her examination

responses audited, or re-checked for scoring accuracy. There is a charge for examination audits. The score audit fee is payable to the American Dental Association in the form of a money order or certified check. Score audits may require approximately four to six weeks to complete and must be requested within 30 days of receipt of the original score report.

18. Rights and Responsibilities of Test Takers

Chapter 8 of the *Standards* (AERA, APA, NCME, 1999) addresses the issue of fairness and the interests of the Part I and Part II candidates. Because so much is at stake in taking these examinations, the Joint Commission should ensure that candidates for licensure receive utmost fair treatment in the preparation, administration, and scoring of the examinations. Table 18.1 below provides four relevant standards. Standards 8.1 and 8.2 require that examination information is made available to all candidates. Generally, a candidate guide or web page is the most suitable way of accomplishing this. Standard 8.7 refers to cheating, and standard 8.13 refers to challenges and other conflicts in examination scoring.

Table 18.1
Standards Addressing Rights and Responsibilities of Test Takers

8.1 Any information about test content and purposes that is available to any test taker prior to testing should be available to all test takers. Important information should be available free of charge and in accessible formats.

8.2 Where appropriate, test takers should be provided, in advance, as much information about the test, the testing process, the intended test use, test scoring criteria, testing policy, and confidentiality protection as is consistent with obtaining valid responses.

8.7 Test takers should be made aware that having someone else take the test for them, disclosing confidential test material, or any other form of cheating is inappropriate and that such behavior may result in sanctions.

8.13 In educational testing programs and in licensing and certification applications, test takers are entitled to fair consideration and reasonable process, as appropriate to the particular circumstances, in resolving disputes about testing. Test takers are entitled to be informed of any available means of recourse.

Candidate Guides for National Board Dental Examinations

The single most effective means for satisfying the standards appearing in Table 18.1 is the publication of a Candidate Guide. Annually, the Joint Commission publishes the

Candidates Guides for the National Board Dental Examinations. Separate Guides are produced for the Part I and the Part II examinations. These documents provide detailed information related to the examination policies of the Joint Commission, the format and content of the examination, eligibility requirements, examination regulations, the appeal process, the scoring of the examination, and examples of item formats. Each year the Candidates Guides are updated and amended as necessary. This information is available through the American Dental Association's website, www.ada.org.

Obligations of Candidates

Some frequently asked questions about examinations regulations are listed in Appendix E along with the answers to those questions.

Examination Preparation Materials

The Joint Commission recommends that candidates use textbooks and lecture notes as primary sources for study. Although some items or editions of the National Board Dental Examinations are released periodically, the Joint Commission believes they are best used to familiarize candidates with test item formats. The Joint Commission does not guarantee that the information in released National Board Examinations is accurate, current, or relevant. Released materials may no longer be consistent with the current test specifications, content emphasis or examination structure. Due to the dynamic nature of dental practice and the biomedical sciences, these materials may be outdated. Candidates are cautioned not to limit the preparation for the examination to the review of released editions of the examination. Copies of released editions are available in most dental school libraries, and in the library of the American Dental Association. Copies may be purchased from the American Student Dental Association, 211 East Chicago Avenue, Suite 1160, Chicago, Illinois 60611 or www.asdanet.org.

The Joint Commission does not endorse or recommend any specific texts or other teaching aids (e.g., review courses) that are identified as "National Board Dental Examination" preparation materials.

Testing Candidates with a Disability

At the discretion of the Joint Commission, testing accommodations may be made to enable a candidate with a disability to be examined. Candidates are expected to submit a written request with the appropriate supportive documentation at least 60 days in advance of the testing date. The Joint Commission complies with the requirements of the Americans with Disabilities Act. The procedures are clearly stated in the Candidate Guide.

Eligibility Requirement

The basic eligibility requirements for Part I and Part II are described in detail in the Candidate Guides. The eligibility of each candidate is verified before he/she is allowed to test. National Board Dental Examination candidates who have not passed an examination after three attempts will be required to wait 12 months after their third attempt before they can apply for reexamination. This policy includes any previous examination attempts. An examination attempt is defined as any examination administration where the candidate has been seated at a computer examination facility and electronically agreed to the confidentiality statement to start the examination. After the 12 month waiting period has lapsed, a new cycle of three examination attempts will apply. Candidates are encouraged to seek formal remediation before reexamination.

Privacy and Security

The Joint Commission is concerned with maintaining the privacy and security for all personal information of test-takers. The Joint Commission takes the responsibility for protecting candidate personal information very seriously and uses industry standard methods to secure and protect the candidate's confidential information.

The NBDE program collects and retains personal information only to the extent necessary to serve the candidate's needs, administer the NBDE; fulfill NBDE program responsibilities, including maintaining the integrity of the test and detecting and preventing unlawful activity; and fulfill legal requirements. NBDE scores are retained indefinitely, along with testing records and necessary personal data.

NBDE scores are released and/or reported to state dental boards, education programs or other entities only on the candidate's written authorization or designation by electronic means through the online application or score report request form. Scores will not be reported to a candidate or others by telephone, in person or by other informal means.

The ADA provides technical support for the NBDE program and uses data security procedures to protect the integrity of personal and test information at all times. Security safeguards include administrative, technical, and physical safeguards over data and data processing systems.

By registering for the test, candidates consent to the collection, processing, use and transmission of personal information for purposes related to the NBDE program as outlined in the Candidate Guide.

19. Threats to Validity

According to Messick (1989), two major threats to validity are construct-irrelevant variance (CIV) and construct under representation (CUR). This part of the technical report discusses validity evidence bearing on these two threats.

Construct-Irrelevant Variance (CIV)

This threat to validity involves systematic error in examination scores. Haladyna (2002) identifies many sources, including non-equivalent examination forms, cheating on an examination, improper examination preparation, and errors in scoring examination results, and faulty items.

The Joint Commission periodically releases editions of National Board examinations or collection of items in order to familiarize candidates with item format. However, the Joint Commission recommends that candidates use textbooks and lecture notes as their primary sources of study material. Released dental examinations are available in most dental school libraries and the library of the American Dental Association. In addition, copies of the released examinations may be purchased from the American Student Dental Association. The Joint Commission discourages superficial learning as a basis for examination preparation.

The Joint Commission does not discriminate based on race, color, religion, gender, age, sex, national origin, disability, sexual orientation, or marital status. One source of CIV is such discrimination.

Irregularities and Appeals

Standard 5.7 Test users have the responsibility of protecting the security of test materials at all times.

The integrity of any National Board examination score is dependent on each candidate working independently. Each candidate is responsible for protecting his or her answers from copying by another candidate. If a candidate finds testing facilities too crowded or poorly arranged to protect his or her answers, the candidate should immediately register a complaint with the examination administrator. Also, candidates should record any unresolved problem after the last examination session in the appropriate section of the post-examination survey. Furthermore, candidates should not share unreleased examination content.

When an irregularity is reported by a test administrator or noted during the processing

of examinations or analysis of results, scores of the candidate or candidates involved will be withheld and may be voided. A candidate whose scores are being withheld is notified in writing. If a candidate whose scores are being withheld is enrolled in an accredited dental school, notification is sent to the dean. This notification to the dean does not provide reason or evidence for withholding scores.

Provisions that apply when scores are withheld are contained in the Joint Commission's Examination Regulations. A copy of the Limited Right of Appeal for Examination Candidates is provided to the candidate or candidates whose scores are being withheld, as well as specific information regarding the appeal process.

Candidates should be aware that the Joint Commission considers irregularities other than natural disasters and emergencies beyond the control of the candidate to be a serious breach of the examination process. Moreover, candidates should be aware that reports of irregularities may have consequences which go beyond the withholding of the candidate's scores if the irregularities are brought to the attention of the school authority or governmental regulatory bodies. The Joint Commission, however, does not initiate such communication. Candidates can report suspicious activity or observations of violations of examination regulations to the Joint Commission office or through www.ada.org.

In accordance with its rules, the Joint Commission may consider an appeal. An appeal must be submitted in writing and must include adequate documentation. A candidate's appeal may include documentation that he/she believes supports his/her appeal. The appeal should also indicate the specific relief requested.

Appeals pertaining to examination irregularities must be initiated within 60 days of official notification of the irregularity. The candidate will be notified of the Joint Commission's action within 60 days after receipt of the appeal.

When considering an appeal, the Joint Commission will strive to ensure that the appealing candidate has an opportunity to gain National Board certification equal to, but not greater than, the opportunity provided to other candidates.

Construct Under Representation

Another threat to validity is construct under representation. When an examination does not completely represent the domain of knowledge intended in the initial creation of the content or the ongoing practice analyses, this bias leads to inadequate validity and caution or doubt about the meaning of an examination score and its legitimacy in making a pass/fail decision. The processes in defining the domain of knowledge to be tested and determining the examination specifications goes very far in assuring the public and the dental community that the Part I and Part II examinations do not under represent essential basic biomedical

science and professional knowledge deemed essential for entering dentists.

20. Validity Studies

Studies are undertaken to address significant problems that threaten validity or may provide a new source of validity evidence strengthening the argument to use examination scores to make pass/fail licensing decisions in states that use these examination scores. Validity studies varying significantly in type and scope are described below.

Studies involving practice analyses are conducted to update the examination specifications and ensure that the examination is current (Kramer & Neumann, 2003; Tsai, Kramer, & Neumann, 2008).

Standard-setting studies are conducted to confirm the standard or the passing score that separates passing and failing candidates for the National Board Dental Examinations. A good example of this type of study is Kramer and DeMarais (1992).

Studies which examined the content and content structure of the National Board Dental Examinations are also essential to confirm content-related validity of the examinations. Kramer and DeMarais (1992) confirm that the National Board Dental examinations are unidimensional. The unidimensionality is essential because the measurement model (e.g., Rasch), which is based on item response theory, is used for constructing and scoring the National Board Dental examinations; the model requires that the examination is unidimensional.

21. Security

A threat to validity refers to any security leak. Table 21.1 provides a list of standards that pertain to security. The Joint Commission has policies and procedures in place to provide for security.

Table 21.1
Standards Pertaining to Security

5.7 Test users have the responsibility of protecting the security of test materials at all times.

8.6 Test data maintained in data files should be adequately protected from improper disclosure. Use of facsimile transmission, computer networks, data banks, and other electronic data processing or transmittal systems should be restricted to situations in which confidentiality can be reasonably assured.

11.7 Test users have the responsibility to protect the security of tests, to the extent that developers enjoin users to do so.

General Principles: Effective examination security procedures are critical to the success of any examination program. Responsibilities for examination security are clearly defined for test developers, test administrators, and examination users. Examination security is maintained throughout the test development and administration processes in a variety of ways. Policies of the Department of Testing Services address issues related to examination security and are reviewed periodically by the Joint Commission and staff of the department.

Identification of Secure Materials: The Joint Commission has identified certain materials as secure. These include:

1. individual items, testlets, and case material, e.g. radiographs, clinical photographs, and dental charts in development, in camera-ready copy, in the printing process, in waste materials from printing, and in electronic files for transmission to administration sites;
2. answer keys;
3. scoring material, e.g., item analyses and statistical analyses;
4. computer scoring software;
5. standard setting materials and meeting notes;
6. item banks; and
7. candidate personal information and scores.

Departmental Procedures

- Policies and legal issues: All items and examinations are copyrighted to establish ownership and restrict their use or dissemination through unauthorized means. Policies and procedures for handling secure materials require continuous secure custody of materials and a chain of evidence attesting to the status and location of secure materials.
- Personnel: The team that maintains security on the examination materials includes Joint Commission staff, vendors, and volunteers.
 - Personnel handling examination materials must be screened at the time of hire or selection for committee assignment to disqualify individuals whose history may show them to be untrustworthy.
 - All staff members are trained in the procedures for handling secure materials and are required to comply with policies on confidentiality and conflict of interest.

- Staff: The test development staff maintains security on examination materials during the development process by storing materials in locked storage areas.
- Vendors: All vendors are responsible for maintaining security on materials. The operations of vendors are reviewed by the Joint Commission staff to ensure compliance with security policy. All service agreements with vendors require adherence to security procedures specified by the Joint Commission.
- Volunteers: Volunteers who assist in the development of items and editions of the examination must complete agreements regarding confidentiality, copyright assignment and conflict of interest. Volunteers are thus prohibited from releasing information regarding examination content.
- Facilities and storage of examination materials: Access to the offices of the Joint Commission are restricted and secure storage is provided for examination materials.

Security of Test Materials in Electronic Format: Departmental and vendor computers are protected with firewalls, login identifications, passwords and other forms of security. Access to electronic files is limited to authorized individuals.

Testing Procedures: Computer versions are administered by Prometric at its nationwide testing centers. The Candidate Guide describes procedures for identification of candidates, including requirements for multiple forms of positive identification. Conduct of candidates is closely monitored during the examination period and is limited by the *Examination Regulations* (Joint Commission on National Dental Examinations, March 2007) and testing center policies to deter cheating and breaches of security.

Policies and Procedures for Dealing with Breaches in Security: Specific procedures for observing and reporting breaches in security are established and communicated to Test Administrators. Reports of security breaches are promptly investigated. Once it has been established that security has been breached, an examination is removed from use. Appropriate sanctions are applied or legal action is taken when the source of a security breach is identified.

22. Guidelines for High-Stakes Testing

The American Educational Research Association (AERA) is the largest organization in the world devoted to the scientific study of education. In 2000, it issued a brief publication listing guidelines that should be followed in designing and using a high-stakes examination. These guidelines are intended for educational examinations given in a high-stakes setting, such as for high-school graduation. However, some of the guidelines seem

very appropriate for the Joint Commission's National Board Dental Examinations. This section presents a selected set of these guidelines and provides a brief discussion of each guideline for the Part I and Part II examinations.

Protection Against High-Stakes Decisions Based on a Single Test

Can a single examination prevent a candidate from practicing dentistry after other criteria for licensure are met? The National Board Dental Examinations provide repeated opportunities for candidates to prepare for and pass these examinations. The decision to license a dentist is based on meeting many other criteria. Since the public welfare and safety are at issue, the Joint Commission bears a heavy responsibility along with states for using this examination information with other information for making licensing decisions.

Adequate Resources and Opportunity to Learn

The Joint Commission has no responsibility for the preparation of dentists. This task falls to the dental schools in the United States. Failure to provide adequate opportunities to learn basic scientific and professional knowledge can lead to a candidate failing the Part I or Part II examination.

Validation for Each Separate Intended Use

For each use of a examination score, there is a separate validation. The Joint Commission has followed this guideline, as this technical report shows.

Full Disclosure of Likely Negative Consequences of High-Stakes Testing Programs

Where credible scientific evidence suggests that a given type of examination program is likely to have negative side effects, examination developers and users should make a serious effort to explain these possible effects to policy makers. This guideline does not seem relevant to this examination program.

Alignment Between the Test and the Curriculum

While the examinations' content is not aligned with dental school curriculum, it is the responsibility of the dental schools to align student learning with the knowledge, skills, and abilities that national practice analyses have determined is the core knowledge of practicing dentists.

Validity of Passing Scores and Achievement Levels

The Joint Commission has determined its passing scores using methodology that is consistent with the *Standards for Educational and Psychological Testing* (AERA, APA, NCME, 1999).

Opportunities for Meaningful Remediation for Candidates Who Fail High-Stakes Tests

The Joint Commission bears no responsibility for remediation, but dental schools may choose to provide remediation if a candidate fails.

Appropriate Attention to Language Differences Among Examinees

In today's multicultural society, many Americans are learning to read, write, speak, and listen in the English language. Their examination scores may contain construct-irrelevant variance due to their language inability instead of lack of knowledge. There is no validity evidence bearing on this problem.

Appropriate Attention to Candidates with Disabilities

In examination individuals with disabilities, steps should be taken to ensure that the examination score inferences accurately reflect the intended construct rather than any disabilities and their associated characteristics extraneous to the intent of the measurement. The Joint Commission complies with Federal regulations bearing on examination administration of candidates with disabilities.

Sufficient Reliability for Each Intended Use

Reliability refers to the accuracy or precision of examination scores. It must be shown that scores reported for individuals or for schools are sufficiently accurate to support each intended interpretation. Accuracy should be examined for the scores actually used. For example, information about the reliability of raw scores may not adequately describe the accuracy of percentiles; information about the reliability of school means may be insufficient if scores for subgroups are also used in reaching decisions about schools. This technical report provides solid evidence of the adequacy of reliability estimates.

Ongoing Evaluation of Intended and Unintended Effects of High-Stakes Testing

With any high-stakes examination program, ongoing evaluation of both intended and unintended consequences is essential. In most cases, the governmental body that mandates the examination should also provide resources for a continuing program of research and for dissemination of research findings concerning both the

positive and the negative effects of the examination program. This guideline does not seem relevant to this examination program.

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Appendix A
Part I Examination Specifications, 2007

The National Board Dental Examinations are administered in two parts. The comprehensive Part I examination consists of 400 items. For each discipline, approximately 80% of the items are discipline-based and approximately 20% are interdisciplinary testlet-based items. A testlet consists of the patient scenario and a set of items from the various disciplines that are associated with the scenario. The test items for the comprehensive Part I are drawn from the following disciplines:

- | | |
|----------------------------|---------------------------------|
| 1. Anatomic Sciences | 3. Microbiology-Pathology |
| 2. Biochemistry-Physiology | 4. Dental Anatomy and Occlusion |

Items addressing the various disciplines are intermingled throughout the examination. One item from each of the disciplines listed above will be designated for the testlets under the topic, Professional Ethics/ Patient Management. These items will require a basic understanding of professional ethical principles in patient management.

ANATOMIC SCIENCES [100]

- 1.0. Gross Anatomy* [49]
 - 1.1. Head
 - 1.1.1. Oral cavity
 - 1.1.2. Extraoral structures
 - 1.1.3. Osteology
 - 1.1.4. TMJ and muscles of mastication
 - 1.2. Neck
- 1.3. Axilla, shoulders, and upper extremities
 - 1.4. Thoracic cavity
 - 1.5. Abdominopelvic cavity
 - 1.6. Central nervous system & neuroanatomy
- 2.0. Histology [23]
 - 2.1. Ultrastructure
 - 2.2. Basic tissues
 - 2.3. Bone, cartilage, and joints
 - 2.4. Lymphatic and circulatory systems
 - 2.5. Endocrine system
 - 2.6. Respiratory system
 - 2.7. Gastrointestinal system
 - 2.8. Genitourinary system
 - 2.9. Integument
- 3.0. Oral Histology [16]
 - 3.1. Tooth and supporting tissues
 - 3.2. Soft oral tissues
 - 3.3. Temporomandibular joint
- 4.0. Developmental Biology [11]
 - 4.1. Osteogenesis
 - 4.2. Tooth development, eruption, and movement
 - 4.3. Facial and branchial arch development
 - 4.4. General embryology
- 5.0. Professional Ethics/Patient Management [1]

* The following topics will be considered under each category of gross anatomy.

Bone
Muscles
Fascia
Nerves (peripheral and autonomic)
Arteries, veins, and lymphatics
Spaces and cavities
Joints and ligaments
Endocrines and exocrines

BIOCHEMISTRY-PHYSIOLOGY [100]

- 1.0. Biological Compounds [10]
 - 1.1. Sugars and carbohydrates
 - 1.2. Amino acids and proteins
 - 1.3. Lipids
 - 1.4. Nucleic acids and metabolism
 - 1.5. Nutrients and minerals
 - 1.6. Intradisciplinary and clinical/cross correlation
- 2.0. Metabolism [17]
 - 2.1. Bioenergetics
 - 2.2. Enzymology
 - 2.3. Catabolism
 - 2.4. Anabolism
 - 2.5. Urea cycle
 - 2.6. Regulation
 - 2.7. Intradisciplinary and clinical/cross correlation
- 3.0. Molecular and Cellular Biology [9]
 - 3.1. DNA/RNA and protein synthesis
 - 3.2. Genetic engineering
 - 3.3. Cell cycle
 - 3.4. Intradisciplinary and clinical/cross correlation
- 4.0. Connective Tissues [8]
 - 4.1. Soft tissue
 - 4.2. Hard tissue/calcification
 - 4.3. Intradisciplinary and clinical/cross correlation
- 5.0. Membranes [4]
 - 5.1. Structure
 - 5.2. Function
 - 5.3. Intradisciplinary and clinical/cross correlation
- 6.0. Nervous System [6]
 - 6.1. General properties
 - 6.2. Central nervous system
 - 6.3. Autonomic nervous system
 - 6.4. Somatic nervous system
 - 6.5. Intradisciplinary and clinical/cross Correlation
- 7.0. Muscle [6]
 - 7.1. Skeletal
 - 7.2. Smooth
 - 7.3. Cardiac
 - 7.4. Intradisciplinary and clinical/cross correlation
- 8.0. Circulation [9]
 - 8.1. Fluid content and dynamics

- 8.2. Coagulation
- 8.3. Cardiodynamics and electrophysiology
- 8.4. Regulatory mechanisms
- 8.5. Intradisciplinary and clinical/cross correlation

- 1.5.2. Viruses
- 1.5.3 .Fungi
- 1.6. Antibiotics and chemotherapy
- 1.7. Oral ecology and epidemiology

BIOCHEMISTRY-PHYSIOLOGY

- 9.0. Respiration [6]
 - 9.1. Mechanical aspects
 - 9.2. Gas exchange and transport
 - 9.3. Regulation
 - 9.4. Intradisciplinary and clinical/cross correlation
- 10.0. Renal [8]
 - 10.1. Functional anatomy
 - 10.2. Blood flow and filtration
 - 10.3. Reabsorption and secretion
 - 10.4. Regulation
 - 10.5. Acid-base balance
 - 10.6. Intradisciplinary and clinical/cross correlation
- 11.0. Oral Physiology [3]
 - 11.1. Taste
 - 11.2. Mastication (with reflexes)
 - 11.3. Swallowing
- 12.0 Digestion [5]
 - 12.1. Neuromuscular
 - 12.2. Secretions
 - 12.3. Absorption
 - 12.4. Regulation
 - 12.5. Intradisciplinary and clinical/cross correlation
- 13.0 Endocrines [8]
 - 13.1. Pituitary/hypothalamus
 - 13.2. Reproduction
 - 13.3. Signaling systems
 - 13.4. Pancreas/parathyroid
 - 13.5. Adrenal/thyroid
 - 13.6. Intradisciplinary and clinical/cross correlation
- 14.0. Professional Ethics/Patient Management [1]

MICROBIOLOGY-PATHOLOGY [100]

- 1.0. General Microbiology [20]
 - 1.1. Microbial biochemistry and physiology
 - 1.2. Microbial cytology
 - 1.3. Microbial variations and genetics
 - 1.4. Sterilization and disinfection
 - 1.5. Biology of microorganisms
 - 1.5.1. Bacteria

- 2.0. Reactions of Tissue to Injury [10]
 - 2.1. Inflammation and repair
- 2.2. Physical and chemical injury
- 2.3. Hemodynamic disorders

MICROBIOLOGY-PATHOLOGY

- 3.0. Immunology and Immunopathology (at least 3 on oral immunology) [13]
 - 3.1. Host defense mechanisms
 - 3.2. Hypersensitivity
 - 3.3. Immune system
- 4.0. Microbiology, Immunology, and Pathology Specific Infectious Diseases (at least 8 on oral diseases) (22)
 - 4.1. Bacterial
 - 4.2. Viral
 - 4.3. Fungal
 - 4.4. Chlamydial and rickettsial
- 5.0. Systemic Pathology [22]
 - 5.1. Cardiovascular
 - 5.2. Respiratory
 - 5.3. Gastrointestinal and hepatobiliary
 - 5.4. Genitourinary
 - 5.5. Blood-lymphatic
 - 5.6. Endocrine
 - 5.7. Musculoskeletal
 - 5.8. Genetic diseases
 - 5.9. Nervous system
- 6.0. Growth Disturbances [12]
 - 6.1. Non-neoplastic
 - 6.2. Neoplasms--etiology, epidemiology, & biology
 - 6.3. Specific neoplasms
- 7.0. Professional Ethics/Patient Management [1]

DENTAL ANATOMY AND OCCLUSION [100]

- 1.0. Tooth Morphology [43]
 - 1.1. Primary
 - 1.2. Permanent
 - 1.2.1. Incisors
 - 1.2.2. Canines
 - 1.2.3. Premolars
 - 1.2.4. Molars
- 2.0. Pulp Cavity Morphology [5]

- 3.0. Calcification and Eruption [6]
- 4.0. Principles of Occlusion and Function [37]
 - 4.1. Functional anatomy
 - 4.1.1. Interarch (static and movement)
 - 4.1.1.1. Anterior teeth
 - 4.1.1.2. Posterior teeth
 - 4.1.2. Intra-arch
 - 4.2. Masticatory physiology and biomechanics
 - 4.2.1. Temporomandibular joint
 - 4.2.2. Muscles and ligaments
 - 4.2.3. Determinants of occlusion
- 5.0. Clinical Considerations—Tooth Morphology and Anomalies [8]
- 6.0. Professional Ethics/Patient Management [1]

Appendix B

Part II Examination Specifications, 2007

The comprehensive Part II examination consists of 500 items. The discipline-based component (Component A) includes 400 items and the case-based component (Component B) includes 100 items based on 8-10 case problems. The Part II examination will include items (approximately 30 percent) that have references pertinent to the basic sciences.

Discipline-Based Component (400 items)

The test items that comprise the discipline-based component are derived from the following disciplines:

- | | |
|--|-----------------------|
| 1. Endodontics | 6. Patient Management |
| 2. Operative Dentistry | 7. Periodontics |
| 3. Oral and Maxillofacial Surgery / Pain Control | 8. Pharmacology |
| 4. Oral Diagnosis | 9. Prosthodontics |
| 5. Orthodontics / Pediatric Dentistry | |

Case-Based Component (100 items)

The case-based component of the Part II examination presents events dealing with actual patients. The patient cases are developed to include the following approximate distribution: Adults--70 percent, Children--30 percent. A minimum of 15 percent of Component B test questions will address the medical management of compromised adults and children. A *compromised patient* is defined as a person whose health status requires modification of standard treatment.

Each case presentation in the examination contains two sections: the first section appears in a *Booklet of Cases* and consists of:

1. a synopsis of a patient's health and social histories,
2. the patient's dental charting,
3. radiographs, and
4. clinical photographs of the patient (when necessary).

The second section appears in a *Test Booklet* and contains from 10 to 15 questions about various aspects of this patient's dental care. These questions, totaling 100 for all of the cases, might derive from any of the basic sciences and clinical disciplines, including Patient Management. The proportion stemming from any particular discipline depends upon the nature of the case itself. For example, the case of an elderly adult might be based upon Maxillofacial Surgery / Pain Control, Prosthodontics, and Operative Dentistry; whereas, a child's case might derive from Orthodontics, Pediatric Dentistry, and Patient Management.

In responding to these questions, the test taker must:

1. interpret the findings and information provided.
2. identify the problems and make diagnoses.
3. select materials, technique, and armamentarium.
4. apply treatment.
5. evaluate progress and complications.
6. establish procedures for prevention and maintenance.

ENDODONTICS [30]

- 1.0. Clinical Diagnosis, Case Selection, Treatment Planning, and Patient Management [14]
 - 1.1. Pulpal
 - 1.2. Periradicular
 - 1.3. Periodontal
 - 1.4. Differential diagnosis of orofacial pain
 - 1.5. Therapeutics
 - 1.6. Clinical examination
 - 1.7. Testing procedures
 - 1.8. Radiographic interpretation
 - 1.9. Medical emergencies
- 2.0. Basic Endodontic Treatment Procedures [8]
 - 2.1. Non-surgical
 - 2.2. Surgical
 - 2.3. Emergency
 - 2.4. Sterilization and asepsis
 - 2.5. Radiographic techniques
 - 2.6. Endodontic instruments and material
 - 2.7. Resorptions
- 3.0. Procedural Complications [3]
 - 3.1. Ledging
 - 3.2. Perforations
 - 3.3. Separated instruments
 - 3.4. Root fractures
- 4.0. Traumatic Injuries [2]
 - 4.1. Crown fractures
 - 4.2. Root fractures
 - 4.3. Displacements
 - 4.4. Avulsions
- 5.0. Adjunctive Endodontic Therapy [1]
 - 5.1. Vital pulp therapy
 - 5.2. Treatment of developing teeth
 - 5.3. Bleaching
 - 5.4. Restoration
 - 5.5. Endodontic instruments and materials
- 6.0. Post-Treatment Evaluation [2]
 - 6.1. Outcomes
 - 6.2. Management of endodontic failures

OPERATIVE DENTISTRY [45]

- 1.0. Dental Caries [8]
 - 1.1. Etiology
 - 1.2. Pathogenesis
 - 1.3. Prevention
 - 1.4. Remineralization
- 2.0. Examination, Diagnosis, and Treatment Planning [25]
 - 2.1. Examination and diagnosis
 - 2.1.1. Caries
 - 2.1.2. Abrasion, cracked tooth, others
 - 2.2. Treatment sequencing, placement, and replacement
 - 2.3. Selection of restorative materials
 - 2.4. Restorative failure
 - 2.5. Postoperative problems
- 3.0. General Operative Procedures [3]
 - 3.1. Instruments and equipment
 - 3.2. Control of the operating field
 - 3.3. Soft tissue management
 - 3.4. Esthetic considerations--bleaching, color
- 4.0. Preparation of Cavities [3]
 - 4.1. Basic principles, instrumentation, and nomenclature
 - 4.2. Preparation
 - 4.2.1. Dental amalgams
 - 4.2.2. Cast gold
 - 4.2.3. Tooth colored restorative materials
- 5.0. Restoration of Prepared Cavities [6]
 - 5.1. Biomaterials science – principles, properties, composition, color science
 - 5.2. Manipulation and finishing of restorative materials
 - 5.2.1. Dental amalgam
 - 5.2.2. Indirect restoration
 - 5.2.3. Direct esthetic materials
 - 5.2.4. Cements, bases and liners, and interim restorations
 - 5.2.5. Occlusion

**ORAL AND MAXILLOFACIAL SURGERY/
PAIN CONTROL [43]**

- 1.0. Surgery [18]
 - 1.1. Dentoalveolar
 - 1.2. Reconstructive (including preprosthetic implants, transplants, bone grafting)
 - 1.3. Trauma
 - 1.4. Orthognathic
 - 1.5. Facial Pain -- temporomandibular joint
 - 1.6. Lesions
 - 1.7. Infections
- 2.0. Anxiety and Pain Control [6]
 - 2.1. Local anesthesia
 - 2.1.1. Anatomy and technique
 - 2.1.2. Clinical pharmacology
 - 2.1.3. Complications
 - 2.2. Conscious sedation
 - 2.2.1. Oral
 - 2.2.2. Inhalation
 - 2.2.3. Intravenous
 - 2.2.4. Complications
- 3.0. Medical Assessment and Emergency Care [15]
- 4.0. Treatment Plan [2]
- 5.0. Diagnosis [2]

ORAL DIAGNOSIS [44]

- 1.0. Oral Pathology [37]
 - 1.1. Developmental defects of the oral and maxillofacial region
 - 1.1.1. Defects
 - 1.1.2. Developmental cysts
 - 1.1.3. Other rare developmental anomalies
 - 1.2. Abnormalities of the teeth
 - 1.2.1. Environmental alterations of teeth
 - 1.2.2. Developmental alterations of teeth
 - 1.3. Pulpal and periapical disease
 - 1.4. Bacterial infections
 - 1.5. Fungal and protozoal diseases
 - 1.6. Viral infections
 - 1.7. Physical and chemical injuries
 - 1.8. Allergies and immunologic diseases
 - 1.9. Epithelial pathology
 - 1.10. Salivary gland pathology
 - 1.11. Soft tissue growths
 - 1.12. Hematologic disorders
 - 1.13. Bone pathology
 - 1.14. Odontogenic cysts and tumors
 - 1.14.1. Cysts
 - 1.14.2. Tumors
 - 1.15. Dermatologic Diseases
 - 1.16. Oral Manifestations of Systemic Disease

- 1.17. Facial Pain and Neuromuscular Diseases
- 2.0. Oral Radiology [7]
 - 2.1. Physical principles of x-radiation (radiation physics)

ORAL DIAGNOSIS

- 2.2. Radiobiological concepts (radiobiology)
- 2.3. Radiographic technique
- 2.4. Normal radiographic anatomy

ORTHODONTICS / PEDIATRIC DENTISTRY [58]

- 1.0. Individual Tooth Pathology [15]
 - 1.1. Basic background and epidemiology
 - 1.1.1. Tooth development
 - 1.1.2. Etiology
 - 1.1.3. Prevention
 - 1.2. Database, diagnosis, and treatment planning
 - 1.2.1. Clinical Findings
 - 1.2.2. Radiographic
 - 1.2.3. Laboratory studies
 - 1.3. Clinical procedures
 - 1.3.1. Restorative
 - 1.3.2. Surgery
 - 1.3.3. Local anesthesia
 - 2.3.4. Sealants
- 2.0. Supporting Tissue Pathology [9]
 - 2.1. Basic background and epidemiology
 - 2.1.1. Etiology
 - 2.1.2. Incidence
 - 2.2. Database, diagnosis, and treatment planning
 - 2.2.1. Clinical findings
 - 2.2.2. Radiographic
 - 2.2.3. Laboratory
 - 2.3. Clinical Procedures
 - 2.3.1. Medication
 - 2.3.2. Hygiene
- 3.0. Dentofacial Variations [7]
 - 3.1. Basic background and epidemiology
 - 3.1.1. Growth patterns
 - 3.1.2. Occlusal development
 - 3.1.3. TMJ dysfunction
 - 3.1.4. Etiology
 - 3.2. Database, diagnosis, and treatment planning
 - 3.2.1. Casts
 - 3.2.2. Clinical findings
 - 3.2.3. Cephalometric
 - 3.2.4. Facial appearance
 - 3.3. Clinical procedures
 - 3.3.1. Diagnosis and space management
 - 3.3.2. Removable appliances
 - 3.3.3. Fixed appliances
 - 3.3.4. Tooth movement principles
 - 3.3.5. Surgery
 - 3.3.6. TMJ dysfunction

ORTHODONTICS / PEDIATRIC DENTISTRY

- 4.0. Behavior [12]
 - 4.1. Basic background and epidemiology
 - 4.1.1. Developmental psychology
 - 4.1.2. Cultural variation
 - 4.2. Database, diagnosis, and treatment planning
 - 4.2.1. History and interview
 - 4.3. Clinical management procedures
 - 4.4. Pharmacologic anxiety management
- 5.0. Systemic Pathology [15]
 - 5.1. Basic background and epidemiology
 - 5.1.1. Congenital
 - 5.1.2. Endocrine
 - 5.1.3. Nutrition
 - 5.2. Database, diagnosis, and treatment planning
 - 5.2.1. History and review
 - 5.2.2. Handicapped
 - 5.3. Clinical procedures
 - 5.3.1. Treatment modifications
 - 5.3.2. Special care
 - 5.3.3. Emergencies

PATIENT MANAGEMENT [56]

- 1.0. Communication and Interpersonal Skills [11]
 - 1.1. Nonverbal communication
 - 1.2. Verbal communication
 - 1.2.1. Listening skills
 - 1.2.2. Responding skills
 - 1.3. Interviewing skills
 - 1.4. Management and problem behavior
 - 1.5. General principles of dentist/patient relationship
 - 1.6. Case presentation or treatment planning
 - 1.6.1. Giving information
 - 1.6.2. Minimizing resistance
 - 1.6.3. Patient education
- 2.0. Anxiety and Pain Control [6]
 - 2.1. Anxiety
 - 2.1.1. Etiology
 - 2.1.2. Recognition
 - 2.1.3. Management
 - 2.2. Pain
 - 2.2.1. Psychophysiology
 - 2.2.2. Management
 - 2.3. Stress
- 3.0. Health Behavior Change [3]
 - 3.1. Factors influencing health behavior
 - 3.1.1. Motivational factors
 - 3.1.2. Social & physical environmental factors
 - 3.1.3. Cultural factors
 - 3.2. Behavior change techniques

- 3.2.1. Assessment
- 3.2.2. Behavioral strategies
- 3.2.3. Cognitive strategies
- 3.2.4. Information transfer

3.3. Risk factors

PATIENT MANAGEMENT

- 4.0. Disabled and Medically Compromised [8]
 - 5.0. Epidemiology [7]
 - 5.1. Epidemiology of oral diseases
 - 5.1.1. Caries
 - 5.1.2. Periodontal disease
 - 5.1.3. Oral cancer
 - 5.2. Epidemiological measures
 - 6.0. Prevention of oral diseases [1]
 - 6.1. Community and school-based methods
 - 6.2. Office-based methods
 - 6.3. Home-based methods
 - 7.0. Evaluation of Dental Literature [4]
 - 7.1. Types of studies
 - 7.1.1. Descriptive
 - 7.1.2. Analytical
 - 7.1.3. Experimental
 - 7.2. Components of a scientific article
 - 7.3. Basic statistics
 - 7.3.1. Descriptive
 - 7.3.1.1. Central tendency
 - 7.3.1.2. Dispersion
 - 7.3.2. Inferential
 - 8.0. Infection Control [2]
 - 8.1. Diseases and routes of transmission
 - 8.2. Barrier techniques
 - 8.3. Sterilization and disinfection
 - 8.4. Disposal of contaminated waste
 - 9.0. Materials and Equipment Safety [2]
 - 9.1. Mercury hygiene
 - 9.2. Environmental contaminants
 - 9.3. Operator equipment
 - 9.4. Chemicals
 - 10.0. Professional Responsibility/Liability [12]
 - 10.1. Ethical principles
 - 10.2. Jurisprudence
 - 10.3. Informed consent
 - 10.4. Risk prevention/management
 - 10.5. Dental care delivery systems
- ## **PERIODONTICS [45]**
- 1.0. Diagnosis [6]
 - 2.0. Etiology [6]

- 2.1. Periodontal microbiology
- 2.2. Contributing factors
 - 2.2.1. Local factors
 - 2.2.2. Systemic factors

3.0. Pathogenesis [1]

4.0. Treatment Planning [6]

5.0. Prognosis [1]

PERIODONTICS

6.0. Therapy [19]

- 6.1. Rationale
- 6.2. Scaling and root planing
- 6.3. Surgery
 - 6.3.1. Gingival
 - 6.3.2. Mucogingival
 - 6.3.3. Osseous surgery
 - 6.3.4. Periodontal regeneration
 - 6.3.5. Implants
- 6.4. Pharmacologic therapy
- 6.5. Wound healing, repair, and regeneration
- 6.6. Splinting and occlusal correction
- 6.7. Special therapeutic problems
 - 6.7.1. Acute problems
 - 6.7.2. Other

7.0. Prevention and Maintenance [6]

PHARMACOLOGY [34]

1.0. General Principles [5]

- 1.1. Prescription writing, drug laws, and drug abuse
- 1.2. Toxicity and drug interaction
- 1.3. Dose response
- 1.4. Mechanism of action
- 1.5. Biotransformation
- 1.6. Absorption, distribution, excretion
- 1.7. Alternative (herbal) medications

2.0. Central Nervous System [4]

- 2.1. Sedatives -- hypnotics and alcohols
- 2.2. Antianxiety and conscious sedation agents
- 2.3. Anticonvulsants -- anti-Parkinson
- 2.4. Psychotropics (antipsychotic, antidepressant)

3.0. Autonomic [3]

- 3.1. Adrenergics
- 3.2. Cholinergics
- 3.3. Blocking agents (adrenergic, cholinergic, etc)

4.0. Cardiovascular [4]

- 4.1. Cardiac glycosides
- 4.2. Antiarrhythmics
- 4.3. Antihypertensives -- diuretics
- 4.4. Anti-anginal agents
- 4.5. Anticoagulants, coagulants, antihyperlipidemics

5.0. Local anesthetics [4]

- 5.1. Basic pharmacology
- 5.2. Vasoconstrictors

6.0. Chemotherapy [5]

- 6.1. Antibacterials
- 6.2. Antifungals
- 6.3. Antivirals
- 6.4. Antineoplastics

7.0. Endocrines/Immunosuppressants [2]

PHARMACOLOGY

8.0. Analgesics [5]

- 8.1. Opioids
- 8.2. Non-opioids, nonsteroidal anti-inflammatory agents

9.0. Antihistamines and Autocoids [2]

PROSTHODONTICS [45]

1.0. General Considerations [21]

- 1.1. Diagnosis and treatment planning
- 1.2. Preprosthodontic treatment
- 1.3. Maxillomandibular relations
- 1.4. Impressions and casts
- 1.5. Esthetics and phonetics
- 1.6. Restorative implantology

2.0. Complete and Removable Partial Denture Pros. [8]

- 2.1. Design of prosthesis and mouth preparation
- 2.2. Occlusion
- 2.3. Dental materials
- 2.4. Insertion and postinsertion

3.0. Fixed Partial Prosthodontics [16]

- 3.1. Design of prosthesis and mouth preparation
- 3.2. Occlusion
- 3.3. Ceramic techniques
- 3.4. Dental materials
- 3.5. Insertion and postinsertion

Appendix C Examination Summary Statistics

The tables to follow provide information related to the quality of the Part I and Part II examinations. The terms used in the tables are described below.

Reference Group: The reference group is comprised of all students enrolled in schools with approval accreditation status who took the examination for the first time. Performance of the reference group establishes standards for all candidates taking the examination.

Raw Score Mean and Mean %: The raw score mean and mean % are the average number or percentage of items answered correctly by the reference group.

Standard Deviation: The standard deviation provides a measure of spread in scores.

Reliability KR₂₀: Reliability refers to accuracy of examination scores from one occasion to the next. Perfect reliability of examination scores produces a reliability coefficient of +1.00, but no set of scores is perfectly reliable. The higher the coefficient, the more reliable are the examination scores.

Prophecy Formula: The Spearman-Brown prophecy formula estimates the number of additional items needed to obtain a reliability (KR₂₀) of +0.90. An underlying assumption is that quality of added items is similar to that of existing items.

Minimal Passing Raw Score: The minimal passing raw score is the lowest number of items that a candidate had to answer correctly to pass. The minimal passing raw score is always converted to the reported score of 75.

Failure Rate: The failure rate reported here is the percentage of the reference group who scored below the minimal passing score.

Table C.1
Statistics for the Comprehensive Part I Examination*

TEST INFORMATION	2007	
	Exam A	Exam B
Number in Reference Group	1,814	1,822
Number of Test Items	400	400
Raw Score Mean	275.2	278.1
Mean Percent (%)	68.8	69.5
Raw Score Standard Deviation	35.0	33.0
Reliability (KR_{20})	0.95	0.92
Prophecy Formula	0	0
Minimum Passing Raw Score	214	214
Failure Rate (%)	3.8	2.4

* Part I became comprehensive since 2007. The statistics reported in this table reflect the most frequently administered editions for 2007.

Table C.2
Statistics for the Part II Examination*

TEST INFORMATION	2006		2007	
	Exam A	Exam B	Exam A	Exam B
Number in Reference Group	573	540	1,134	908
Number of Test Items	478	488	488	490
Raw Score Mean	335.6	343.5	337.4	342.6
Mean Percent (%)	70.2	70.4	69.1	69.9
Raw Score Standard Deviation	25.9	28.4	31.1	29.1
Reliability (KR ₂₀)	0.88	0.90	0.91	0.90
Prophecy Formula	1.18	0	0	0
Minimum Passing Raw Score	283	283	283	281
Failure Rate (%)	0.3	0.0	2.7	1.4

* Part II has been completely computerized since 2006. The statistics reported in this table reflect the most frequently administered editions for 2006 and 2007.

Appendix D
Trends in Numbers of Examinations and Failure Rates

Tables D.1, D.2, and D.4 provide the numbers of Part I and Part II examinations administered and the failure rates during the ten year period ending in 2007. Tables D.3 and D.5 present the numbers and failure rates for first-time and repeating candidates taking the Part I and Part II examinations during 2007.

Table D.1
Summary of Failure Rates on
National Board Dental Examinations

Year	Part I		Part II	
	Number of Examinations	Percent Failed	Number of Examinations	Percent Failed
1998	7,490	30.8%	6,632	27.6%
1999	8,219	33.5%	6,400	23.4%
2000	8,832	35.9%	6,347	18.5%
2001	10,000	39.0%	6,821	18.7%
2002	10,509	41.0%	7,276	20.5%
2003	9,589	36.5%	6,788	21.1%
2004	7,732	27.1%	6,079	17.3%
2005	7,978	25.6%	5,576	12.9%
2006	8,751	20.1%	5,041	13.8%
2007	6,479	15.3%	5,961	13.1%

* From 1999 to 2006, the failure rates include any candidate who failed all of Part I or any area in Part I. Part I became comprehensive since 2007, the failure rate was computed based upon candidates who failed the entire Part I examination.

Table D.2
Failure Rates for Candidates from Accredited and Non-Accredited Programs
The Part I Examination

Test Date	Accredited			Non-Accredited		
	Total	Failed	% Failed	Total	Failed	% Failed
Jul 1998	3,899	462	11.9%	1,247	801	64.2%
Dec 1998	998	215	21.5%	1,346	832	61.8%
1998	4,897	677	13.8%	2,593	1,633	63.0%
Jul 1999	3,972	357	9.0%	1,558	981	63.0%
Dec 1999	980	185	18.9%	1,709	1,230	72.0%
1999	4,952	542	11.0%	3,267	2,211	67.7%
Jul 2000	3,808	317	8.3%	1,941	1,219	62.8%
Dec 2000	957	200	20.9%	2,126	1,434	67.5%
2000	4,765	517	10.8%	4,067	2,653	65.2%
Jul 2001	3,820	334	8.7%	2,663	1,634	61.4%
Dec 2001	843	152	18.0%	2,674	1,778	66.5%
2001	4,663	486	10.4%	5,337	3,412	63.9%
Jul 2002	4,005	401	10.0%	2,981	1,715	57.5%
Dec 2002	828	239	28.9%	2,695	1,949	72.3%
2002	4,833	640	13.2%	5,676	3,664	64.6%
Jul 2003	4,367	451	10.3%	2,423	1,569	64.8%
Dec 2003	834	212	25.4%	1,965	1,271	64.7%
2003	5,201	663	12.8%	4,388	2,840	64.7%
Jul 2004	3,411	333	9.8%	1,241	757	61.0%
Dec 2004	368	64	17.4%	640	449	70.2%
Computer	1,177	199	16.9%	895	293	32.7%
2004	4,956	596	12.0%	2,776	1,499	54.0%
Jul 2005	2,657	317	11.9%	594	361	60.8%
Dec 2005	309	46	14.9%	433	270	62.4%
Computer	2,505	482	19.2%	1,480	568	38.4%
2005	5,471	845	15.4%	2,507	1,199	47.8%
Jul 2006	1,387	60	4.3%	385	199	51.7%
Dec 2006	261	38	14.6%	318	252	79.2%
Computer	4,241	457	10.8%	2,159	757	35.1%
2006	5,889	555	9.4%	2,862	1,208	42.2%
2007	4,419	216	4.9%	2,060	773	37.5%

Table D.3
Failure Rates for First-Time and Repeating Candidates
The Comprehensive Part I Examination

Year		Total Number	Number Failed	Fail Rate
2007				
Accredited	First-time	4,179	148	3.5%
	Repeating	240	68	28.3%
Non-accredited	First-time	1,240	403	32.5%
	Repeating	820	370	45.1%

Table D.4
Failure Rates for Candidates from Accredited and Non-Accredited Programs
The Part II Examination

Test Date	Accredited			Non-Accredited		
	Total	Failed	% Failed	Total	Failed	% Failed
Mar 1998	1,117	363	32.5%	767	427	55.7%
Dec 1998	3,961	560	14.1%	787	481	61.1%
1998	5,078	923	18.2%	1,554	908	58.4%
Mar 1999	827	337	40.8%	641	409	63.8%
Dec 1999	3,489	248	7.1%	479	288	60.1%
Computer	522	85	16.3%	442	128	29.0%
1999	4,838	670	13.9%	1,562	825	52.8%
Apr 2000	445	114	25.6%	355	186	52.4%
Dec 2000	3,399	209	6.2%	430	194	45.1%
Computer	866	182	21.0%	852	289	33.9%
2000	4710	505	10.7%	1,637	669	40.9%
Mar 2001	317	59	18.6%	371	192	51.8%
Dec 2001	3,214	197	6.1%	386	180	46.6%
Computer	1,161	196	16.9%	1,372	451	32.9%
2001	4,692	452	9.6%	2,129	823	38.7%
Mar 2002	286	52	18.1%	321	183	57.0%
Dec 2002	3,149	184	5.8%	436	218	50.0%
Computer	1,336	220	16.5%	1,748	635	36.3%
2002	4,771	456	9.6%	2,505	1,036	41.4%
Apr 2003	280	38	13.6%	339	195	57.5%
Dec 2003	2,881	182	6.3%	321	184	57.3%
Computer	1,449	251	17.3%	1,518	579	38.1%
2003	4,610	471	10.2%	2,178	958	44.0%
Mar 2004	273	39	14.3%	277	133	48.0%
Dec 2004	2,548	146	5.7%	216	143	66.2%
Computer	1,986	288	14.5%	779	302	38.8%
2004	4,807	473	9.8%	1,272	578	45.4%
Mar 2005	182	17	9.3%	137	64	46.7%
Dec 2005	2,170	50	2.3%	124	84	67.7%
Computer	2,216	249	11.2%	747	255	34.1%
2005	4,568	316	6.9%	1,008	403	40.0%
2006	4,175	365	8.7%	866	333	38.5%
2007	4,869	393	8.1%	1,092	389	35.6%

Table D.5
Failure Rates for First-Time and Repeating Candidates
The Comprehensive Part II Examination

Year		Total Number	Number Failed	Fail Rate
2007				
Accredited	First-time	4,464	287	6.4%
	Repeating	405	106	26.2%
Non-accredited	First-time	755	203	26.9%
	Repeating	337	186	55.2%

Appendix E
Frequently Asked Questions about Examination Regulations

Frequently Asked Questions about *Examination Regulations*

What is the purpose and intent of the National Board Examination Regulations?

Examination Regulations are established to ensure that examination results are valid. This means that a candidate's score is an accurate reflection of his or her knowledge and understanding. Candidates are expected to recall and interpret information and respond to examination questions without assistance or the advantage of having prior knowledge of questions or answers. The *Examination Regulations* are intended to prevent candidates from retaining or remembering questions and sharing them with other candidates and to prevent candidates from obtaining unreleased questions or answers from any source.

The National Board examinations are criterion-referenced, i.e., candidates are not graded on a curve but against a pre-determined standard. *Examination Regulations* are also intended to provide all candidates with an equivalent opportunity to gain National Board certification; no candidate should have an unfair advantage over others.

All examination materials including released materials that are made available by the Joint Commission through various authorized channels, are copyrighted to protect the security and confidentiality of the examination content, as well as the investment of resources, primarily from candidate fees, that support the examination program.

How are candidates informed of the Examination Regulations?

The *Examination Regulations* are provided in writing in the *Candidate Guide* for each examination. The guides are provided in the education area of the ADA website, www.ada.org. Information in the guides is updated annually; but the general nature and intent of the regulations remains the same as described above. Information about Prometric Test Center rules is available on the Prometric website, www.prometric.com. Each examination session begins with a confidentiality statement that candidates must agree to as a condition of testing.

What happens if a candidate violates Examination Regulations?

When the Joint Commission receives information that indicates possible inappropriate behavior or violation of *Examination Regulations*, the candidate's results may be withheld or invalidated. Established Joint Commission regulations identify prohibited activities and behavior and related penalties. In most cases, scores are voided and the candidate must wait up to two years to retest. When scores are withheld or invalidated, the candidate is notified of the regulation that has been breached and the related penalty. Joint Commission policies provide an appeal process and candidates who are notified that their scores have been withheld or invalidated receive information about the appeal process. If a candidate's scores

have been reported prior to notification of an irregularity, submission of an appeal will stay the decision to withhold or void scores until such time as the appeal is decided.

Is it acceptable for candidates to remember and share unreleased questions or to solicit or use unreleased questions that have been recalled or obtained by others?

No. This violates the *Confidentiality Agreement* that all candidates sign before they begin either the examination. In addition, all examinations are protected by Federal Copyright Law and sharing or soliciting recalled questions violates the law. These practices are also unethical in that they violate principles of veracity (truthfulness) and justice (fairness).

Why is it unethical to ask someone for unreleased, recalled questions or to otherwise obtain and use recalled questions?

First, all candidates are expected to pass the examination on their own merit without assistance. Members of the public who entrust dentists with their well-being expect that they are trustworthy and competent individuals. The purpose of the examination is to ensure that you, as a candidate for licensure, have achieved entry-level competence. By asking previous test-takers to share unreleased questions, or by obtaining them, you undermine the very purpose of the examination.

What information can I share about the examination?

You can tell others whether you thought it was difficult or easy. You can tell them that you felt well prepared, or not. You can share any broad topic areas that are also listed in the National Board examination specifications that are published in the Candidate Guide or on the Joint Commission website, e.g., osteogenesis, premolar tooth morphology. You *cannot* describe specific questions and answers or context of questions related to these topics. If another student or member of the faculty suggests that you should remember and/or share confidential examination information with other students or faculty, you should decline and explain that this is not permitted.

What if someone offers unreleased questions to me?

You should not agree to accept unreleased examination items or confidential examination information or participate in the exchange of this information. If you receive unsolicited confidential or unreleased examination materials, you should inform the dean or associate dean at your school or contact the Joint Commission office. They may request that you forward the materials for evaluation to determine whether the materials are indeed unreleased or confidential. Failure to do so could inadvertently implicate you in activity that violates *Examination Regulations* and may jeopardize your ability to achieve National Board certification and licensure.

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