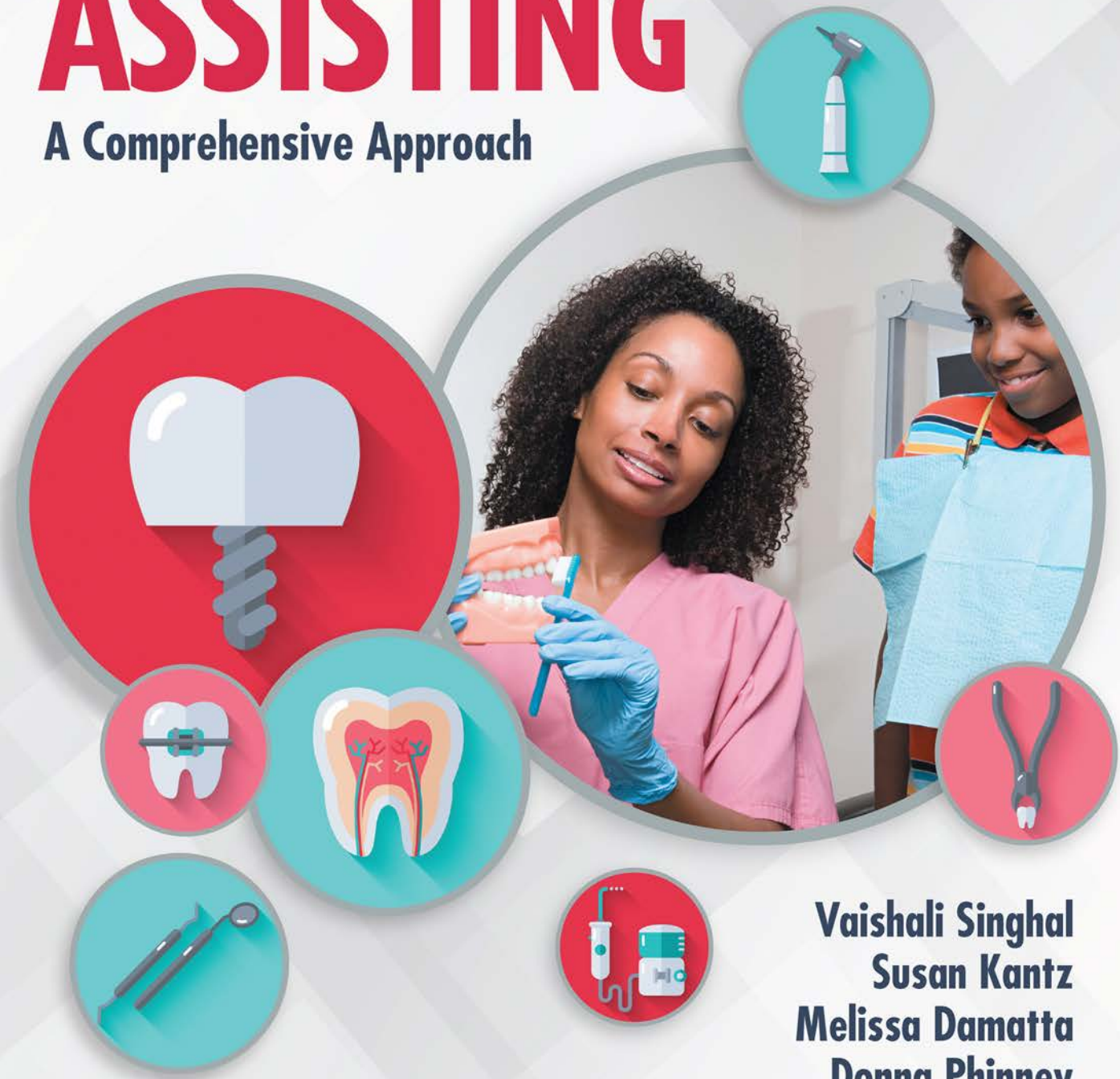
CENGAGE

SIXTH EDITION

DENTAL ASSISTING

A Comprehensive Approach



Vaishali Singhal
Susan Kantz
Melissa Damatta
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Judy Halstead

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***Dental Assisting, A Comprehensive Approach,* 6th Edition**
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Dedication

This book is dedicated to Judy Halstead and the memory of Donna Phinney. Donna and Judy's professionalism, expertise, and dedication to their students were the backbone of the first five editions. Their shared passion for Dental Assisting education created and sustained this text over the years, and we are proud to continue their legacy.

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BRIEF CONTENTS

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LIST OF PROCEDURES

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SECTION VII Assist with Restorative Procedures and Dental Materials

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NEW TO THIS EDITION

General Updates

- Key Terms feature has been updated throughout the text to include phonetic pronunciation, the meaning of root and word parts, and the definition for each key term
- Dental operator steps were added to each step-by-step procedure, as applicable
- New images have been added throughout the text, including new step-by-step procedure photos, to enhance the topics discussed

Chapter 2

- Added/expanded discussion of:
  - Several health behavior theories in addition to Maslow's and how each can be utilized to improve the oral health of the patient
  - Characteristics of children, older adults, and Generation Alpha
  - Preparing dental presentations
- Expanded on the topic of written communication to include office letters and other forms of written communication, including electronic communication

Chapter 3

- Added/expanded discussion of:
  - Ethical principles
  - Ethical dilemmas
  - The differences between criminal law and tort law
  - Regulatory and nonregulatory agencies involved in dentistry
  - HIPAA responsibilities in various areas of dentistry, including technology
- Added image of a sample patient consent
- Added image of a sample acknowledgement of HIPAA policy
- Moved CDT codes to Chapter 44

Chapter 4

- Formerly Chapter 6
- Added/expanded discussion of:
  - Information on the cell and organization of the human body
  - The urinary system
  - The brain
  - The interrelationship between oral health and the various systems
- Added anatomical images including on the cell

Chapter 5

- Removed the section "Landmarks of the Face and Oral Cavity" and moved it to a new Chapter 6
- Added a new table that includes descriptions of all the cranial nerves
- Added several tables to provide concise information about nerves, arteries and veins, as well as their branches that supply the head and neck

Chapter 6

- This is a newly added chapter
- Added/expanded discussion of:
  - Regions of the face
  - Healthy and unhealthy gingiva

Chapter 7

- Reduced the Stages of Pregnancy topic/content
- Added histological images of tooth development
- Added several images to enhance the topics discussed in the chapter

Chapter 8

- Formerly Chapter 9
- Added/expanded discussion of:
  - Tooth landmarks from each aspect
  - Tooth characteristics and distinguishing features to assist in identifying teeth
  - Primary and permanent teeth
  - Universal Numbering System
- Added color images of tooth landmarks from each aspect

Chapter 9

- Moved chapter from Dental Specialties section to Dental Sciences section
- Added/expanded discussion of:
  - Tools available for oral cancer detection
  - Educating patients to perform an oral cancer screening on themselves
- Added tables that provide standard terms used to describe lesions
- Moved dental caries topic to this chapter and added detailed information in a table format regarding stages of decay
- Added step-by-step procedure for performing an intraoral and extraoral exam

Chapter 11

- Added/expanded discussion of:
  - Covid-related infection control procedures
  - Different surfaces in the dental office, with new images
  - Sanitizing surfaces, with new images
  - The Bloodborne Pathogens Standard and Hazard Communication Standard
- Additional images added for procedure related to handwashing

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- Added new step-by-step procedures for:
  - Alcohol-based hand hygiene
  - Surgical hand scrub
  - Donning surgical gloves
  - Operating an ultrasonic cleaner
  - Operating an autoclave
- Expanded procedure related to treating a contaminated tray, with new images

Chapter 14

- Added/expanded discussion of:
  - Importance of knowing about drugs and how drugs are tested
  - Drug names
  - Routes of administration
  - Administration, distribution, metabolism, and excretion
  - Substance use disorder, including preventing drug diversion, identifying the patient with a substance use disorder, and medications used to treat substance use disorders
  - Adverse drug reactions
  - Commonly used drugs administered in a dental office or prescribed by a dentist
  - 2007 American Heart Association (AHA) guidelines for prophylactic antibiotics
  - American Society of Anesthesiologists (ASA) Classification of Risk Assessment
- Added new figures to include expanded information related to common abbreviations
- Added new tables detailing conversions for prescriptions, potential teratogenic effects of drugs, dental local anesthetics available for use in the United States, comparisons of over-the-counter analgesic medications, and comparisons of prescription pain medications
- Removed content related to caffeine, herbal and alternative medications

Chapter 15

- Added/expanded discussion of:
  - The importance of the medical history in preventing a medical emergency
  - The importance of vital signs
  - The most recent AHA blood pressure classifications and dental management protocol
  - Identification and management of the apprehensive patient
  - Stress reduction protocol
  - American Society of Anesthesiologist (ASA) classification
  - Medical consultation
  - The emergency kit
  - Each emergency that may occur in a dental office including prevention, management, medical history questions, predisposing factors, signs and symptoms, and ASA classifications
- Added new step-by-step procedures for:
  - Taking blood pressure
  - Obtaining pulse and respiration
- Added a sample medical history form
- Added a sample medical consultation
- Added tables that describe the drugs in the emergency kit along with images of drugs
- Categorized emergencies into syncope, respiratory disorders, adrenal disorders, thyroid disorders, diabetes, angina and MI, congestive heart failure, seizures, cerebrovascular accident, allergies, and airway obstruction
- Added several images to enhance the topics discussed in the chapter
- Moved discussion of dental emergencies to a separate chapter
- Removed CPR/BLS section

Chapter 23

- Added/expanded discussion of:
  - Noninjectable anesthetics
  - Complications related to local anesthesia
  - Postexposure management
- Added tables that provide coverage of:
  - Short, intermediate, and long-acting local anesthetics
  - Injection name, area anesthetized, needle insertion site, length and gauge of needle used, and depth of insertion
  - Prevention of dental local anesthetic related emergencies
  - Systemic adverse reactions of dental local anesthetics

Chapter 24

- This is a new Chapter highlighting preventative dental treatment
- Includes three new step-by-step procedures relating to preventative care: periodontal charting, oral prophylaxis, and scaling and root planning
- Formatted to focus on the ADHA standards for clinical dental hygiene practice

Chapter 25

- Added/expanded discussion of:
  - Silver Diamine Fluoride
  - Ergonomics during preventative care
  - Air-powder polishing
  - Stain
- Added a step-by-step procedure on air-powder polishing

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Chapter 27

- Added/expanded discussion of:
  - Direct and indirect damage by an x-ray photon, including images
  - Shadow casting and the principles of shadow casting
  - Inverse square law
  - Linear nonthreshold curve, including image
- Added description and table with images of types of interactions with radiation
- Added table with information related to radioresistant and radiosensitive cells
- Included use of term "image receptor" to be inclusive of films and digital sensors unless specifically referring to traditional film

Chapter 28

- Updated the title for this chapter
- Added/expanded discussion of:
  - Infection control as it specifically relates to dental radiology equipment, digital systems, image receptors, supplies and processing for traditional films
  - Infection control before, during, and after exposures
  - Standard exposure sequence for paralleling and bisecting techniques
  - Anatomical landmarks to be used for bisecting technique
  - Object localization using SLOB rule and the right angle technique
- Included use of term "image receptor" to be inclusive of films and digital sensors unless specifically referring to traditional film
- Moved digital imaging from Chapter 23 to this chapter
- Added table and diagrams that specify maxillary and mandibular entry points for primary beam when using the bisecting technique
- Added step-by-step procedure for bisecting the angle technique

Chapter 29

- Updated the title for this chapter
- Added/expanded discussion of:
  - The coronal, axial and sagittal views of 3D imaging
  - Radiographic appearance of decay, with images
  - Radiographic pulpal and periapical lesions, with images
  - Radiographic appearance of periodontal disease, with images
  - Radiographic appearance of dental anomalies, with images
  - Radiographic appearance of dental materials, with images
- Added direct and indirect digital panoramic options to the panoramic exposure procedure
- Added tables that summarize radiopaque and radiolucent maxillary landmarks and radiopaque and radiolucent mandibular landmarks

Chapter 33

- Updated step-by-step procedures to include automix cartridges with extruder guns
- Due to the eradication of polysulfide impressions, this step-by-step procedure was updated with taking a polyether impression

Chapter 38

- Added/expanded discussion of:
  - The classifications of periodontal disease based on the most recent American Academy of Periodontology guidelines
  - Periodontal risk assessment
  - Adjunctive periodontal therapies
  - Peridex®
- Added tables that cover:
  - The risk factors for periodontal disease
  - Glickman's classification of furcation involvement
  - Healthy gingiva and changes that take place related to periodontal disease
  - Locally applied antimicrobial agents

Chapter 39

- Added/expanded discussion of:
  - Indications and contraindications to dental implants
  - Patient selection for dental implants
  - The role of the implant coordinator

Chapter 40

- Added/expanded discussion of:
  - Clinical considerations for bridges
  - Shade selection
  - Digital communication
- Added table covering symbols and abbreviations used in fixed prosthodontics
- Added image of digital patient charting with fixed prosthodontic procedures

Chapter 41

- Added discussion on advantages and disadvantages of CAD/CAM technology

Chapter 42

- Added/expanded discussion of:
  - Transitional partial dentures as a type of partial denture
  - Nesbit partial denture as a type of partial denture
  - Kennedy classification for edentulous arches, with image

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- Patient instructions for care of partial dentures
- Surfaces of a full denture
- Post palatal seal of a maxillary denture
- Xerostomia and impact on dentures
- Denture adhesives
- Denture sore spots

- Added image of an electronic patient charting record with removable procedures charted
- Added table covering abbreviations and symbols used in removable prosthodontics

Chapter 44

- Reorganized the chapter content for a better learning experience
- Added/expanded discussion of:
  - Language barriers
  - Teledentistry visits
  - CDT codes

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PREFACE

The world of health care changes rapidly. The twenty-first century presents health care professionals with more challenges than ever before—but with challenge comes opportunity. Job prospects for dental assistants have never been better. The Bureau of Labor Statistics expects employment in our field to grow faster than the average for all occupations through the year 2030. Population growth, an increase in the aging population, and greater retention of natural teeth will fuel demands for dental services. As the health care industry requires more services to be completed by dentists, the dental assistant will be more valuable and needed than ever before. Many states are passing legislation allowing for an expansion in the skills that dental assistants can provide—with additional training. Placing restorations, obtaining virtual impressions, and monitoring general sedation are a few examples. As a dental assistant, you'll be expected to take on an increasing number of clinical and administrative responsibilities to stay competitive. Now is the time to equip yourselves with the range of skills and competencies you'll need to excel in the field. Now is the time to maximize your potential, to expand your base of knowledge, and to dedicate yourself to becoming the multifaceted dental assistant required in the twenty-first century. This text and complete learning system, *Dental Assisting: A Comprehensive Approach*, sixth edition, will guide you as a dental assisting student on this journey. The result of years of research, writing, and testing, this system is designed to prepare you for the Dental Assisting National Board (DANB) certification examination, some state credentialing, and the workplace. It presents information in a unique manner, using a variety of formats that account for the diverse ways in which today's students learn. To receive the full value of *Dental Assisting: A Comprehensive Approach*, sixth edition, it is important to understand the structure of the text, chapters, MindTap, and accompanying workbook as well as other supplements, and how they are all integrated into a complete learning system. Together, these materials will make your dental assisting education comprehensive and meaningful, providing you with the skills, knowledge, principles, values, and understanding needed to excel in your chosen profession.

Why We Wrote This Book Three dental educators, Vaishali Singhal, Susan Kantz, and Melissa Damatta, are the lead authors who developed the sixth edition of this textbook. Additionally, the book includes a team of contributing authors that includes notable educators and practitioners with expertise and national involvement in all phases and levels of dental assisting. We developed this edition according to the Commission on Dental Accreditation (CODA) Standards for Dental Assisting as well as the American Dental Association (ADA) content areas. The expansive table of contents for this textbook addresses some of the problems we identified with other dental assisting textbooks currently on the market; for example, educators have complained, "we were still fervently shopping for supplemental texts and media to improve our programs; most available videos were outdated and expensive, and often did not match the text; the chapters of the existing texts were extremely large and were often not in a sequence suitable for our programs; and as a result the texts inhibited the flexibility of instruction." Thus, the goal of this text is to provide all inclusive text and supporting materials for dental assisting program instructors—to provide a comprehensive educational program rather than simply a text. This comprehensive program is structured to provide built-in flexibility to support the individual academic freedom of faculty. The chapters are ordered to allow for performance-based sequencing of procedures arranged from basic to complex and from general to specialty practice.

The Learning System

The components of the learning system were developed with today's learner in mind. The authors and Cengage recognize that students learn in different ways—they read, write, listen, watch, interact, and practice. For this reason, we've created a variety of products learners can use to fully comprehend and retain what they are taught. An instructor's manual ties the components together, making classroom integration easy and fun.

The Text

This text delivers comprehensive coverage of dental assisting theory and practice, supported by full-color illustrations and photographs throughout with 169 step-by-step procedures in nine sections. Section I, *Dentistry as a Profession*, introduces learners to the profession and its history as well as communication and legal issues. Section II, *Dental Sciences*, covers the basics of general anatomy, head and neck anatomy, embryology, histology, tooth anatomy, and oral pathology, creating a foundation on which learners can move forward in skills training. Section III, *Preclinical Dental Sciences,* covers microbiology and infection control in dentistry, managing hazardous materials that may be found in a dental office, managing patients who are medically compromised or have special needs, preventing and managing common medical emergencies that may occur in a dental office, and pharmacology, all of which are critical elements to the profession. This textbook contains the latest and most up-to-date infection control protocol related to the recent COVID-19 pandemic. Section IV, *Prevention and Nutrition,* discusses general techniques to maintain health and wellness of the oral cavity and the dentition. Section V, *Assist with Diagnosis and Prevention*, introduces the learner to the dental office and equipment, chairside assisting, instruments, management of pain and anxiety, and preventive techniques in dentistry. This section also includes information on advanced functions such as coronal polish and dental sealants. Section VI, *Dental Radiography*, provides updated information on radiographic techniques and procedures, including the latest on digital and three-dimensional radiography. Section VII, *Assist with Restorative Procedures and Dental Materials*, introduces

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the learner to commonly used dental materials, assisting in procedures related to amalgam, dental cements, and composite as well as the management of dental emergencies. Section VIII, *Assist with Comprehensive Patient Care*, introduces learners to the specialized areas of dentistry and the importance of comprehensive care, as well as advanced skills of retraction cord placement and tooth whitening. Section IX, *Dental Practice Management*, contains coverage of dental office management, dental computer software, dental insurance, employment portfolios, and legal and ethical considerations, which are important components for managing a dental practice properly. New features such as patient dialogues and professional encounters have been added to the sixth edition. The professional encounter feature provides real-life scenarios regarding communication with a patient, offering the learner professional experiences of those in the field. Each chapter includes the following pedagogical features as applicable:

- Specific instructional objectives
- New feature: Comprehensive approach to building medical and dental terminology using root words along with key terms
- Introduction
- Step-by-step procedures with icons indicating handwashing, gloves, masks, protective clothing and protective eyewear, basic setup, and expanded functions (see icons below)
- In-text icons identifying legal and safety areas (see icons below)
- Boxed information containing tips and summaries
- New feature: Special features in online Instructor Manual that include documentation, patient dialogue, and professional encounters
- Chapter summary
- Case studies
- Review questions, including critical thinking questions
- New feature: Most up-to-date infection control protocol related to the COVID-19 pandemic


HANDWASHING


GLOVES


LEGAL


MASK AND PROTECTIVE EYEWEAR


CLOTHING


SAFETY

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INTRODUCTION

Language of Dentistry

Specific Instructional Objectives

At the completion of this section, you will be able to meet these objectives:

1. Defend the importance of being fluent in dental/medical terminology.
2. Analyze the structure of the dental terms.
3. Define dental terms.
4. Pronounce dental terms.
5. Apply rules in making words plural.
6. Recognize acronyms, eponyms, and homonyms.
7. Use terms presented in this chapter.

Dental Terminology

If you were going to a foreign country, you would need to learn its language to be able to communicate. In dentistry, you may find the words to be as foreign as another country's language. If you looked at some of the terms and said, "This looks like Greek to me," you would be right! Many of the terms used in **dentistry** and medicine come from Greek and Latin. Before you can study dentistry, you need to learn the dental language.

Every occupation uses a special language that has its own unique slang and technical terms. Computer programmers, for example, speak of "bits" and "bytes" and "megs" and "gigs." For someone unfamiliar with computers, those professional terms seem arcane and meaningless. Similarly, for the person unfamiliar with dentistry, the terms used in dentistry can be cryptic.

Dental **terminology** is the professional language used in dentistry. Dentistry uses medical and dental terminology in describing anatomy, pathology, treatment, procedures, and many other important facts needed to communicate dental care. It is important for the dental assistant to learn the dental language to communicate with other dental professionals and to read and understand dental communications.

Dental assistants have many responsibilities that relate to the proper use of dental terminology. For example, patient records are legal documents, and the assistant must complete them using acceptable terminology. In addition, dentistry uses a very precise and scientific language that may be difficult for the patient to understand. The dental assistant needs to translate these scientific and technical terms and procedures into terms the patient can comprehend. Accomplishing this requires mastery of dental terminology. In this chapter, you will be given the tools needed to build your dental vocabulary and converse as a dental professional.

Some dental terms may seem strange and impossible to understand at first, but learning them will be much easier if you remember a simple fact: *There are no big words; all big words consist of several small words linked together.* Much like working a jigsaw puzzle, you need to be able to understand the individual pieces and then put them together to form a complete picture. As with learning any language, it will take time to master. With dedicated effort and practice, you will find speaking and interpreting dental terminology enjoyable and a rewarding experience (Figure I-1).

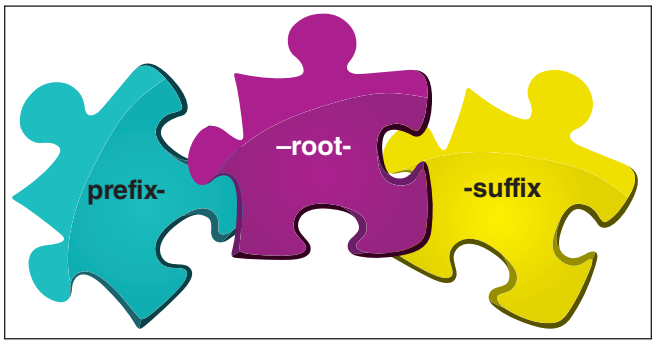

FIGURE I-1
Terminology is like pieces of a jigsaw puzzle fitting together.

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Word Parts

Most words have three parts: a **root word**, a **suffix**, and a **prefix**. Some words might consist of only a root; others have several roots, or even several prefixes or suffixes. Learning how to identify roots, suffixes, and prefixes is the first step in mastering terminology in any field.

Root Words

The root is the main body or stem of the word; it is the foundation upon which all terminology is built. All words have a root word. For example, "term" is the root in the word *terminology*. The dictionary defines "term" as: "limit in time, place, set, or appointed period" and as "a word or group of words designating something, especially in a particular field." Many times you will find more than one definition and use of the term. Some common dental root words are *dent, odont, gingiv, mandible, dens, oral, cavity, path, odyn, coron, radic, maxill*, and *alveoli*. (Refer to Table I-1 for their meanings and Table I-2 for how they are pronounced.)

Compound Words A compound word is a word composed of two or more root words. For example, the word *toothbrush* is a compound word made from the words *tooth* and *brush*.

TABLE I-1 Meaning of Root Terms

Root Word	Meaning of Root Term
alveol	**1.** a little cavity, pit, or cell **2.** any of the sockets in which the roots of the teeth are embedded; tooth socket **3.** any of the tiny air sacs in the lungs
cavity	**1.** a hollow space within the body, an organ, a bone **2.** a hollow space or a pit in a tooth, most commonly produced by caries; a cavity may be artificially made to support dental restorations
coron	**1.** a crown **2.** part of a tooth above the gum
dent	**1.** a tooth **2.** toothlike part
gingiv	**1.** technical name for gum **2.** epithelial tissue attached to the bones of the jaw; surrounds and supports the bases of the teeth
maxill	**1.** upper jaw
mandibl	**1.** lower jaw
odont	**1.** tooth **2.** having teeth
odyn	**1.** pain **2.** painful
or	**1.** mouth **2.** opening, entrance
path	**1.** disease or condition **2.** a route, course, or track on which something moves
radic	**1.** part of a tooth within the tooth socket **2.** the rootlike beginning or appearance
stoma	**1.** surgery, an artificial opening **2.** anatomy, a mouth or mouthlike part

TABLE I-2 Pronunciation of Root Words

Dental/Medical Term	Pronunciation of Root Term
alveol	(al-**vee**-ohl)
cavity	(**kav**-i-tee)
coron	(k*uh*-**rohn**)
dent	(dent)
gingiv	(jin-**jahy**-v)
maxill	(mak-**sil**)
mandibl	(**man**-d*uh*-b*uh*l)
odont	(oh-**dohnt**)
odyn	(oh-**din**)
or	(ohr)
path	(pahth)
radic	(**rad**-ik)
stoma	(**stoh**-m*uh*)

Affixes

A root word can take on different meanings by adding word attachments to it called **affixes**. Affixes can modify, describe, and change the meaning of root words. They can also give direction and tell what is happening or when it is happening. When a word part is affixed (added) to the end of the word, it is called a suffix. A word part affixed to the beginning of the word is called a prefix.

Combining Forms Sometimes when combining roots and affixes, the word parts have to change to make the term easier to read and pronounce. The new, changed form of the word is called a combining form.

No combining form is needed when combining two words parts in which the second word part begins with a vowel. For example, the word *gingivitis* (meaning inflammation of the gums) is formed by combining the root word *gingiv* (meaning gum) with the suffix *itis* (meaning inflammation). Since the second word part, *itis*, begins in a vowel, no combining form is needed.

When a word part that follows another word part begins with a consonant, you must add a **vowel** (a, e, i, o, u, and y) to make a **combining form**. For example, the word *thermometer* combines the prefix *therm* (meaning heat) with the root word, *meter*, which is an instrument used for measuring. To make the combining form, we add "o" to make "thermometer"—an instrument used to measure a patient's body heat; "o" is the most commonly used combining vowel.

Suffixes

Suffixes are attachments added to the end of the root word to modify, change, or add to the meaning to form another word. Although prefixes are added to the beginnings of words and suffixes are added to the end, we will discuss suffixes first because they show how a word is used in a sentence and what part of speech the word represents. In dental terminology, suffixes are

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used to identify diseases, conditions, and diagnostic, operative, and surgical procedures. A dental term will have only one suffix.

Let's see how suffixes change the meaning of words by adding suffixes to the word defined previously: *term*. You learned that the word *term* has two meanings; limit in time, place, set, or period, and a word descriptive in a particular field. The combining form is *termin*. Here are some suffixes that can be attached: -al, -ate, -ology. The new words are the following:

- *Terminal*: an adjective meaning "leading to an ultimate end, or death." A terminal illness would be an illness that is ultimately fatal. Terminal can also be a noun that means "either end of a transportation line" such as a bus terminal.
- *Terminate*: a verb meaning "to dismiss from a job, to end, to come to an end of time, or to kill."
- *Terminology*: a noun meaning "the study of specialized words related to a particular subject."

When a suffix is written alone, it is usually preceded by a hyphen (for example, "-ed") indicating that a word part precedes it to form a complete word. Tables I-3 through Table I-6 define common suffixes indicating parts of speech. Table I-7 and Table I-8 list some common suffixes used in dental diagnosis and treatment.

Prefixes

Prefixes are attachments added before the root word to make the meaning more precise. Most prefixes can be added to the root word without changing the form of the prefix or the root word. When a prefix is written alone, it is usually followed by a hyphen indicating that a word part is added after the prefix (pre-) to form a complete word. A dental term may have more than one prefix to describe it.

Prefixes Describing Diagnosis

Anatomical structures, diseases, and conditions are examined for diagnostic findings. They are often described by color and comparison to what is normal. The most common colors used in dentistry are listed in Table I-9, and Table I-10 describes findings from diagnosis.

Prefixes Describing Location

When describing anatomy, diseases, and conditions, the exact location must be recorded.

TABLE I-3 Suffixes Used to Form Nouns

-a = singular ending of noun	**-acy** = like, state, **-cy** or quality, pertaining to	**-ine** = belonging to	**-ness** = condition
-age = belonging to, related to	**-dom** = place or state of being	**-ist** = doer	**-on** = chemical substance
-ance = state or **-ence** quality of	**-er** = a person or thing	**-ism** = state, belief, condition	**-or** = a person or thing
-ase = names enzymes	**-hood** = state or condition of being	**-ity** = state, quality	**-tion** = act of **-sion**
-ation = act of	**-ia** = condition or quality	**-ium** = membrane **-eum**	**-ure** = action, result
-ax = anatomical structure ending	**-ion** = action state	**-ment** = state, act	**-y** = to form familiar names

TABLE I-4 Suffixes Used to Form Adjectives

-able = capable of **-ble** being	**-eal** = pertaining to	**-ible** = capable of being	**-oid** = resembling, like
-ac, -al, -an, -ar, -ary, -eal, -ic, -ive, -tic = pertaining to; having quality of	**-en** = resembling, made of	**-ic** = pertaining to; **-ical** having quality of	**-ous** = like, full of **-ious**
-an = belonging to **-ian**	**-ent** = full of	**-il** = pertaining to, **-ile** capable of	**-tic** = pertaining to
-ant = full of	**-eous** = composed of	**-ish** = like	**-y** = characterized by
-ar = pertaining to; having quality of	**-form** = having the shape or form	**-ive** = having the nature of	
-ary = like, connected with	**-ful** = characterized	**-less** = without	

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TABLE I-5 Suffixes Used to Form Adverbs

-ably = capable of	**-less** = lacking	**-ward** = indication direction
-acious = full of **-icious**	**-like** = similar to	**-wide** = a given space
-fold = having so many parts	**-ly** = in a certain manner	**-wise** = direction, manner
-ily = in a certain manner	**-most** = quality, order	
-ive = tendency, inclination	**-ular** = relating to, resembling	

TABLE I-6 Suffixes Used to Form Verbs

-ate = process	**-ify** = to make, create
-ed = past action	**-ing** = action of
-en = to be, to become	**-ise** = to become, to agree with
-fy = to make, cause to be	**-ize** = to affect, resemble
-iate = to begin, process	**-lyse** = loose, dissolve, break into

TABLE I-7 Suffixes Used in Diagnosis

-algia = pain	**-ology** = study of
-dynia = pain	**-oma** = tumor
-edema = swelling	**-opsy** = view
-gnosis = able to discern, come to know	**-osis** = abnormal condition
-ia = condition	**-path** = disease
-iasis = pathological condition	**-phylaxis** = watching, guarding
-itis = inflammation	**-rrhage** = excessive bleeding, hemorrhage **-rrhagia**

TABLE I-8 Suffixes Used in Dental Procedures

-centesis = surgical fixation	**-plasty** = surgical repair
-ectomy = excision, surgical removal, cutting out	**-rrhaphy** = suture
-ive = function	**-stomy** = formation of an opening
-pexy = surgical fixation	**-tomy** = incision, cutting into

TABLE I-9 Prefixes Describing Color

alb-, albin- = white, referring to lack of pigment	**erythr-** = red
chlor- = green	**leuk-** = white
chrom- = color **chromat-**	**melan-** = black
cyan- = blue	**xantho-** = yellow

Common prefixes used to describe specific location, position, and direction are listed in Table I-11.

Prefixes Describing Amounts In describing anatomical structures, diseases, and conditions, the dental professional has to know and explain how many, how much, and what size. Prefixes can describe numbers, quantity, size, and degree of change. See how many of these prefixes you already know in Table I-12.

Strategy for Building Dental Vocabulary

After what you've just read, do you think you would be more or less likely to suffer from ***hippopotomonstrosesquipedaliophobia***? You may be thinking, "What does that mean and how do you expect me to answer the question?" Remember, however, there are no big words, just combinations of several smaller word parts. This is the first place to start when determining the meaning of a word.

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TABLE I-10 Prefixes Describing Findings

brady- = slow movement	**gloss-** = tongue (referring to condition)	**onc-** = tumor, mass swelling
cheil- = lips (referring to condition)	**hemo-** = blood	**pharyn-** = throat, windpipe
dia- = thorough, complete knowledge	**labi-** = lips (referring to location) **lingual-** = tongue (referring to location)	**prog-** = probable outcome, course
dys = bad, abnormal, impaired	**lymph-** = clear fluid that bathes and nourishes tissues of body; lymphatic system	**sial-** = saliva, salivary gland
eu- = normal	**mal-** = bad, wrongful, ill **mis-** = bad, wrong,	**tachy-** = rapid, accelerated

TABLE I-11 Prefixes Describing Location

ab- = away from **abs-**	**ex-** = beyond	**post-** after, behind
ad- = toward	**infra-** = beneath, below	**pre-** = before, in front of
ante- = before, forward **anter-** = front	**inter-** = between	**proxim-** = near, adjacent
dextr- = right side	**intra-** = within	**sub-** = under
de- = away from, ending	**later-** = toward the side	**super-** = above **supra-**
dist- = directed away from midline	**mes-** = middle **med-**	**sy-, syl-, sym-, syn-** **sys-** = together
en- = inside, within, inner **end-** **ent-**	**peri-** = around	**trans-** = across, through

TABLE I-12 Prefixes Describing Amounts

a- = without, not **an-**	**iso-** = equal, like	**poly-** = many, excessive
bi- = two	**macro-** = large, long, big	**quad-** = four **quadr-**
di- = two **diplo-** = double	**meg-** = great, large **mega-** **megal-**	**semi-** = half
hemi- = half	**micro-** = small	**tetra-** = four
homo- = same	**mon-** = one	**tri-** three
hyper- = above, beyond, excessive	**multi-** = many	**uni-** one
hypo- = under, deficient	**non-** = not, lack of	**sext-** = six

Break the Word into Its Parts

To break the word into its various word parts, first identify any affixes (prefixes and suffixes) as well as any combing vowels, remembering that the most common combining vowel is "o." For example, this word (*hippopotomonstrosesquipedaliophobia*) contains no prefixes and one suffix (-ia). It also has four combining vowels—three "o's" and one "i." From this information, we can identify five root words: *hippo-poto-, monstro-, sesqui-, pedalio-*, and *phob-*, as well as the suffix *-ia*.

Define the Meaning of Each Word Part

Next define the meaning of each root word and affix. If you are not sure of the meaning, look it up in a dictionary:

hippopoto = hippopotamus; very large, massive mammal; second-largest land mammal

monstro = monstrous; abnormal, hideous, or unnatural in size, frightful in appearance

sesqui = one and a half; half as much again; many syllables

pedalio = relating to foot

phob = an intense, abnormal, or illogical fear of a specified thing; irrational fear of a specific object, activity, or situation that leads to a compelling desire to avoid it

-ia = disease; pathological, abnormal condition or mental disorder

Try to define the word.

Put the Parts Together

Now put the word parts together. Remember that the root word attached to the suffix is the stem upon which the word is built and is therefore the key to its meaning. In this case, the key to

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this word is *phobia*, which means a mental disorder caused by an intense fear of something. The rest of the word parts tell what that something is.

You have the meaning of the word parts. Can you define it now?

Assemble the Meaning

The term will not make sense until you put together the meanings of each of the word parts that compose it. Generally, you start with the suffix and key root word, and then you return to the start of the word and define the meanings of the rest of the word parts in order. In this case, that would produce: *A mental disorder, caused by irrational fear of something large and monstrous, with many syllables, a foot and a half long.* Or, as the dictionary defines *hippopotomonstrosesquipedaliophobia*: a fear of long words (words a foot and a half long with many syllables).

Use Your Senses

Cognitive research has proven that the best way to learn is to involve as many senses as possible. A popular quote says, "We learn 10% of what we read, 20% of what we hear, 30% of what we see, 50% of what we see and hear, 70% of what we discuss with others, 80% of what we experience, and 95% of what we teach to someone." Try to involve as many senses as possible in learning a new term.

For example, try to make a mental picture of what the word means. Imagine a person's reaction to a phobia: shortness of breath, smothering sensations, pounding heart, shaking, sweating, and nausea. Studying models or diagrams of technical terms, or drawing pictures, can help you commit terminology to memory models or diagrams and you can draw a picture of it.

Saying new words aloud also will help you retain new information. Dictionaries list the phonetic spelling of every word before defining it and usually provide a guide to the less familiar symbols often used in phonetic spellings. There are also online "talking dictionaries" that will pronounce any word aloud for you.

Make It Meaningful

Whenever possible, find the item you are learning and handle it; nothing can substitute for hands-on learning. This kind of "effortful processing" leads to more stable learning. According to the Association for Psychological Science, we encode based on meaning—we remember what is meaningful to us.

Meaningful repetition is the key to long-term memory, so make reviewing terms a part of your daily studies. However, do not simply memorize words; interact with and use them actively. Start a log of vocabulary words and practice using dental language every day. Take advantage of your learning environment and offer to peer-tutor a classmate who is struggling to learn the information. Explain to your friends and family what you are learning. This is good practice for teaching your patients in the dental office. Remember, we learn 95% of what we teach to someone. Think that might be why your teachers remember so much detail?

Pronunciation

When you look up a word in the dictionary to find its meaning, you will notice that the word's **pronunciation** is also provided. It is important to learn how to say the word correctly (pronounce) to understand and remember what you have read. Your memory improves with the more senses you use. By pronouncing the word, you use your ears and mouth to speak the word. It is also important to pronounce words correctly so other dental professionals will know what you are saying.

Pronunciation is defined as the act of producing sounds of speech within the reference of a standard of correctness or acceptability. There is supposedly a correct manner of pronouncing sounds in any given language. In medical/dental terminology, there is often more than one correct way to pronounce the term. The most accepted pronunciation is generally listed first in the dictionary. However, certain terms do have more than one acceptable pronunciation. This is often due to different parts of the country and even the world. But, there is only one proper spelling of a term. Any change or error in spelling can totally change the meaning of a word; it may have an entirely different meaning that may result in improper diagnosis or treatment.

In this chapter, you will study how to pronounce a word using the **phonetic** transcription of a word. Dental term pronunciations are spelled out within parentheses and are broken into phonetic syllables. A syllable is a basic unit of speech generally containing only one vowel sound. For example, the word *base* contains one **syllable** and *basic* contains two syllables. Phonetics is what the term sounds like by an accepted standard of the human speech sounds and stress patterns of a syllable. Each term is broken into "sounds-like" syllables. The word *base* is phonetically translated as "beys" written as one syllable. Basic is phonetically translated into two syllables "**bey**-sik." Notice that the syllables are separated by a dash and the first syllable is in bold font. The bold font is used to show stress patterns of the syllables.

Syllables in bold font receive the most stress (emphasis, spoken louder) than the other syllables. If another syllable has intermediate stress (slightly louder), quotation marks follow the syllable. Otherwise, all syllables are equally stressed. Can you pronounce pronunciation (pr*uh*-nuhn'-see-**ey**-sh*uh* n)? Just say it as it is spelled out.

In Table I-2, the root words defined now have the phonetic pronunciation. Practice saying these words.

Some combinations of letters are misleading in figuring out how to pronounce them. These combinations include *ps* (psych—only the s is pronounced); *pn* (pneum—only the n is pronounced); *gn* (gnath—only the n is pronounced); and *ph* (physio—ph sounds like f). Be aware of these misleading pronunciations as you study terms.

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Plurals

There are several basic rules for creating the plural forms of words. Add *es* for nouns that end in *s, ch*, or *sh*. If the word ends in *y* and has a preceding consonant (such as allergy), change the *y* to *i* and add *es* (allergies). When looking up terms, the plural form is often provided. It will be indicated by the abbreviation *pl* before the plural form. To learn more about the rules for forming more plurals, study Table I-13.

Acronyms/Eponyms/Homonyms

Not all dental language consists of word parts. Some of the terms are composed of letters representing a phrase. Others may be named after a person or place. There are even words that are spelled differently, but sound the same. As a dental professional, you need to know how to interpret all forms of dental terminology.

Acronyms

An **acronym** is a word formed from the initial letter or groups of letters or words in a set phrase or series. In the technology and health industry, there is always some new acronym. In making an acronym, the industry tries to choose a catchy, pronounceable series of letters and make a name out of it. Some of the more common acronyms that are related to dentistry are listed in Table I-14.

Eponyms

Eponyms are terms used in medicine and dentistry that are named after people, places, or things. Because of the nature of medicine, new discoveries are often attached to the people who made the discovery. The names of drugs, diseases, and treatments are named after scientists and doctors who discovered or invented them. Sometimes the name is derived from the proper name of a real or mythical person or place. Since eponyms are named after proper names, the term needs to be capitalized.

It usually involves a lot of research and publishing an article in a respected medical journal to have a medical eponym awarded. Down's syndrome is an eponym for the English physician, John Down, who described the syndrome. Down's syndrome is a genetic condition that is characterized by the presence of an extra copy of genetic material on the twenty-first chromosome. The syndrome may have some impairment of cognitive ability and physical growth and specific facial characteristics.

On occasion, an eponymous disease is named after a famous patient. Lou Gehrig's disease was named after Lou Gehrig, who was an American Major League Baseball player nicknamed "The Iron Horse" for his durability. Many eponymic diseases also have a more descriptive name. Lou Gehrig's disease is also called ALS (amyotrophic lateral sclerosis). ALS is a progressive neurodegenerative disease that affects nerve cells in the brain and the spinal cord. This disease's progressive degeneration of the motor neurons eventually leads to paralysis and to the patient's death.

Legionnaires' disease was given the name when an outbreak of pneumonia occurred among people attending an American Legion convention. Some famous medical signs and drugs are eponyms. The sounds heard when checking blood pressure called the Korotkoff sounds were discovered by Nikolai Korotkov, a cardiologist. Charles Mantoux, physician, is the developer of the eponymous serological test for tuberculosis, known as the Mantoux test.

TABLE I-13 Rules of Making Plurals

Singular Ending	Plural Ending	Examples
a	ae	gingiva, *pl* gingivae
ax	aces	thorax, *pl* thoraces
ex	ices	apex, *pl* apices
itis	ides	pulpitis, *pl* pulpitides
ix	ices	cervix, *pl* cervices
ma	s or mata	stoma, *pl* stomas stoma, *pl* stomata
nx	nges	pharynx, *pl* pharnges
oma	s	odontoma, *pl* odontomas
on	a	protozoon, *pl* protozoa
sis	oses	diagnosis, *pl* diagnoses
um	a	bacterium, *pl* bacteria
us	i	alveolus, *pl* alveoli
y	ies	biopsy, *pl* biopsies

TABLE I-14 Acronyms

Acronym	Translation
ADA	American Dental Association
ADAA	American Dental Assistants Association
ADHA	American Dental Hygiene Association
ALARA	As Low As Reasonably Achievable
CDA	Certified Dental Assistant
CDC	Centers for Disease Control
CODA	Commission on Dental Accreditation
DANB	Dental Assisting National Board
DDS DMD	Doctor of Dental Surgery Doctor of Dental Medicine
BA BS MS MA	Bachelor of Arts Bachelor of Science Master of Science Master of Arts
OSHA	Occupational Safety and Health Administration
PPE	Personal Protection Equipment
RDA EFDA	Registered Dental Assistant Expanded Function Dental Assistant
RDH LDH	Registered Dental Hygienist Licensed Dental Hygienist

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Many human anatomical parts are named after people. One of the founders of the science of human anatomy, Bartolomeo Eustachi, gained the reputation of having created the science of human anatomy because of the number of anatomical structures he discovered and wrote about. One of such structures, named after him, is the eustachian tube. The Achilles tendon was named after the Greek mythological character, Achilles.

Homonyms

Homonyms are words that sound the same, but the spelling is different and so is the meaning. These words can cause confusion in understanding the spoken word. Care should be taken to check the spelling and meaning of such words to prevent making this mistake. Some of the more common homonyms are listed in Table I-15.

Word Usage Reflects on the Dentist

Patient records are legal documents and can be the dentist's best defense in court if an incident results in litigation. All office records must be completed in detail using acceptable terminology and proper grammar.

Following is an example of an assistant's documentation of a patient's reaction after anesthetic. See if you can identify where the assistant had problems with homonyms.

The patient had sweet poring down her forehead. When asked if she had ever experienced this before, she said she felt she had a blood sugar problem and ate a very rich, sweat desert before coming for her appointment. The dentist told her she should follow up with her physician and eat well balanced meals especially on daze of her appointment. Unprofessional patient records can be the offense's best evidence.

Have you ever heard that a person's grammar reflects a person's level of education? Mastering dental terminology mirrors the assistant's knowledge of dentistry and reflects on the dentist.

TABLE I-15 Homonyms

Homonyms	Definitions
auxiliary axillary	a person that helps near the armpit
bite byte	a mouthful 8 bits
die die dye	exact replication of a structure; used as pattern to make dental appliance cease to live to color or stain
elicit illicit	to draw unlawful
esthetics aesthesia	concept of beauty; also spelled aesthetics ability to feel
facial fascial	relating to the face a band of tissue supporting internal parts of the body
heal heel	to cure of disease hind part of foot
know no	to be fully aware of meaning and implications denial or refusal
oral aural aural	pertaining to the mouth pertaining to the ear pertaining to an aura; sensation preceding a migraine or epileptic attack *two different meanings for same spelling*
pain pane	it hurts a single panel of glass
palpation palpitation	examine by touch abnormally rapid and violent beating of the heart
plural pleural	more than one related to lung
pore pore pour poor	minute opening to read or study carefully to cause flow of liquid to have little or no money
right right write rite	what is good, proper, and just side opposite location of the heart form letters with pen, pencil, etc formal act or ceremony
site cite sight	location to refer vision
suture suture	line of junction of two bones joining edges of open by stitches
week weak	a period of successive days not strong

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Key Terms: Definitions and Pronunciation

Each chapter will end with a Key Terms feature. New terms introduced in the chapter appear in the first (far-left) column of the Key Terms table. Below each term is the phonetic spelling to help with the pronunciation. The middle column breaks the term into word parts along with the definition of each part. The last column lists the dictionary definition of the term. The terms in the Key Terms chart appear in blue font within each chapter. Key Terms features and charts help you learn the meanings of the terms in each chapter before you start reading, so you can more easily build your dental and medical terminology.

It will be helpful to learn a few word parts at a time and recognize them when you see them in a term. It is much better to understand the meaning of the word parts and learn how to build words than to try to memorize, look up, or skip over every new word you encounter.

Review Questions

Multiple Choice

1. What word part is the foundation and main meaning of the word?
   a. prefix
   b. root
   c. suffix
   d. combining vowel
2. What word part is *sub* in the word *submandibular*?
   a. prefix
   b. root
   c. suffix
   d. combining vowel
3. What word part is *ular* in the word *submandibular*?
   a. prefix
   b. root
   c. suffix
   d. combining vowel
4. Which dental term means "below the lower jaw"?
   a. alveolectomy
   b. gingivitis
   c. submandibular
   d. supramaxilla
5. Which dental term means "inflammation of the gums"?
   a. alveolectomy
   b. gingivitis
   c. periodontitis
   d. supramaxilla
6. A _____ is the basic unit of speech generally having only one vowel sound.
   a. pronunciation
   b. phonetic
   c. syllable
   d. simple term
7. What is the descriptive word for "sounds like" that is used to help the reader say the word correctly?
   a. pronunciation
   b. phonetic
   c. syllable
   d. simple term
8. Which is the plural for prognosis?
   a. prognosex
   b. prognosises
   c. prognoses
   d. prognosisies
9. Which is the plural for maxilla?
   a. maxillas
   b. maxillamata
   c. maxillae
   d. maxillaces
10. For what is the following sentence an example?
    The dental auxiliary was requested to take the patient's axillary. The patient told the dentist about their heart palpitations during the palpation examination.
    a. acronym
    b. eponym
    c. homonym
    d. compound

Critical Thinking

1. Why does the assistant need to know terminology when talking to the patient?
2. How will lack of knowledge of dental terminology affect the assistant's ability to communicate?
3. Place a slash (/) between the word parts for the following terms. Which term has a combining vowel?
   a. periodontal
   b. gingivitis
   c. alveolectomy
   d. supramaxillary
4. Why is it important to say a word correctly?
5. Referring to the sentence below, what is the acronym and what is the eponym?
   A patient was diagnosed with Vincent's disease, which is also referred to as ANUG.

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Key Terms

Term and Pronunciation	Meaning of Root and Word Parts	Definition
acronym (**ak**-ruh-nim)	**acro-** = denoting something **-nym** = name, word	a word formed by combining the beginning letters of a name or phrase
affix (*uh*-**fiks**)	**af-** = to add, addition **fix-** = fasten, secure	a letter or a group of letters added to a word to change its meaning
combining vowel (k*uh*m-**bahyn-ing**) (**vou**-*uh*l)	**combine** = to unite for a common purpose **-ing** = to unite for a common purpose **vowel** = vocal letter (a, e, I, o, and y)	a vowel connects roots to suffixes and roots to other roots
dentistry (**den**-t*uh*-stree)	**dent** = relating to the teeth **-ist** = person who practices **-ry** = indicating place of business	the branch of medical science concerned with diagnosis and treatment of diseases/disorders of the teeth and gums
eponym (**ep**-*uh*-nim)	**epi-** = after **nym** = name, word	the person for whom something (such as a disease) is to be named
homonym (**hom**-*uh*-nim)	**homo-** = same **nym** = name, word	a word the same as another in sound and spelling but different in meaning
phonetic (f*uh*-**net**-ik)	**phon** = sound, voice **-tic** = pertaining to	pertaining to speech sounds in pronouncing words
prefix (**pree**-fiks)	**pre-** = before, in front of **fix-** = fasten, secure	a letter or a group of letters added to the front of a word to change its meaning
pronunciation (pr*uh*-nuhn-see-**ey**-sh*uh*n)	**pronounce** = to speak in correct way **-ate** = product of a process **-ion** =action state	the act of producing sounds of speech using an accepted standard of sound and stress patterns of a syllable or word
root word (root) (wurd)	**root** = essential, fundamental **word** = a unit of language; functions as carrier of meaning	the form of a word after all affixes are removed, main body or stem of the word; foundation for word building
suffix (**suhf**-iks)	**suf-** = secondary part of **fix-** = fasten, secure	a letter or a group of letters added to the end of a word to change its meaning
syllable (**sil**-*uh*-b*uh*l)	**syl-** = together, with **lab** = shorten **-le** = denoting repeated or continuous action	a basic unit of speech generally containing only one vowel sound
terminology (tur-m*uh*-**nol**-*uh*-jee)	**term** = a word designating something in a particular field **-ology** = to study, branch of knowledge	the body of specialized word relating to a particular subject, field, science, art

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SECTION I
Dentistry as a Profession

CHAPTER 1

Introduction to the Dental Profession

Specific Instructional Objectives

At the completion of this chapter, you will be able to meet these objectives:

1. Use terms presented in this chapter.
2. Identify the major milestones in dental history from ancient times to present day.
3. Name the individuals who had a great impact on the profession of dentistry.
4. Identify the people who promoted education and organized dentistry.
5. State the nine specialties of dentistry.
6. Describe career skills of the direct and indirect care dental team members .
7. List the education required for each dental career path.
8. List the professional organizations that represent each dental career path.
9. Explain the importance of being cross-trained.
10. Discuss the advances in dentistry.
11. Identify career opportunities for a dental assistant.

Introduction

Humans have been plagued with dental problems from the very beginning of time. It is important to be familiar with the historic struggles that took place and contributions that were made to advance the dentistry profession into what it is today.

History of Dentistry

Beginning in ancient times, dental work was done by physicians. Often, each physician specialized in only one area of care for one part of the body. In fact, during the fifth century BC, a Greek historian named Herodotus wrote, "all the country is full of physicians, some of the eyes, some of the teeth, some of what pertains to the belly, and some of the hidden diseases." The earliest recognized figure in dentistry is Hesi-Re. Hesi-Re practiced in 3000 BC. Excavations of the Egyptian pyramids have shown that the Egyptians paid great attention to teeth cleaning, relieving toothaches, and restoring teeth. Also discovered in the burial remains of Egyptian mummies of that time were teeth filled with gold **restorations**. Table 1-1 provides a history of major developments in dentistry.

During these early times, dentistry primarily consisted of removing teeth when pain occurred. Some evidence has been found on human skulls that holes were drilled near the roots to allow infection to drain so that pressure in an abscessed tooth could be relieved. Other dental problems that date from ancient times derived from food preparation techniques. Grains were ground in stone bowls with stone pestles. During this process, particles of stone mixed with the

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TABLE 1-1 Timeline of Dental History

Era	Events
Beginning of time	Tooth decay is noted.
3000 BC	First dentist, Hesi-Re, is recorded.
460–322 BC	Written information about tooth decay is recorded by Aristotle and Hippocrates.
460–377 BC	Oath of Hippocrates.
384–322 BC	Attention to oral hygiene (Diocles of Carystus).
1300–1368	Hygienic rules (Guy de Chauliac).
1452–1519	Tooth morphology identified (Leonardo da Vinci).
1678–1761	Founder of modern dentistry (Pierre Fauchard).
1760–1819	Josiah Flagg develops the dental chair.
1768–1770	Paul Revere places advertisements in a Boston newspaper offering his services as a dentist.
1790	James B. Morrison constructs the first known dental foot engine, which he adapted from his mother's spinning-wheel foot treadle.
1832	James Snell invents the first reclining dental chair.
1840	Horace Hayden and Chapin Harris establish the Baltimore College of Dental Surgery.
1840	American Society of Dental Surgeons established.
1841	Alabama enacts the first dental practice act to regulate dentistry.
1844	Horace Wells, a Connecticut dentist, discovers that nitrous oxide can be used for dental pain relief.
1859	American Dental Association (ADA) created.
1866	Lucy Beaman Hobbs Taylor, the first woman to earn a dental degree, graduates from Ohio College of Dental Surgery.
1869	Dr. Robert Tanner Freeman, the first African American to earn a dental degree, graduates from Harvard University Dental School.
1871	First commercially manufactured foot-treadle dental engine is patented by James B. Morrison.
1885	First "lady in attendance" employed by Dr. C. Edmund Kells.
1890	Dr. Ida Gray, the first African American woman to earn a dental degree, graduates from University of Michigan School of Dentistry.
1895	X-rays discovered (Wilhelm Conrad Roentgen).
1907	"Lost wax" casting machine is invented by William Taggart.
1913	Fones School of Dental Hygiene established.
1923	American Dental Hygienists' Association (ADHA) created.
1924	American Dental Assistants Association (ADAA) established; first president was Juliette Southard.
1930	First dental **specialty** board is founded, the American Board of Orthodontics.
1938	First synthetic bristle (nylon) toothbrush appears on the market.
1945	Water fluoridation era begins in the cities of Newburgh, New York, and Grand Rapids, Michigan.
1947	Dental Assisting National Board, Inc. (DANB) is established.
1950	First fluoride toothpastes are marketed.
1960	Four-handed, sit-down dentistry is utilized.
1970	The Occupational Safety and Health Administration is created by the U.S. Congress.
1980	Per-Ingvar Branemark introduced the technique for the osseointegration of implants.
1982	Hepatitis B vaccine becomes available.
1987	First digital radiography system invented by Dr. Francis Mouyen.
1988	DIAGNOdent invented by Kavo for digital detection of dental decay
1990	Tooth-whitening commercial products are marketed.
1992	Occupational Safety and Health Administration's Bloodborne Pathogens Standard becomes effective.
1997	The YAG laser, approved by the Food and Drug Administration, is used to treat tooth decay.
2000	Invisalign braces made available to public.
2006	VELscope fluorescent device to detect oral cancer became commercially available.

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grain. This grit in the food caused severe wear of the biting (occlusal) surfaces of the teeth and possible pulp exposure.

Hippocrates (460–377 BC), the father of medicine, attempted to explain health and disease. Hippocrates was a pivotal figure in the history of dentistry. At the time, the theory that magic, demons, and spirits caused illnesses was an accepted notion. Hippocrates did not agree with those theories and started to teach a more educated method of medical care and medicine. Due to his advancements in the medical field, he was given the title "Father of Medicine." Hippocrates was not just interested in medicine, he also had opinions pertaining specifically to dentistry. He felt it was extremely important that teeth be kept in good condition, and he even developed his own toothpaste and mouth rinse to aid in oral health. He wrote about formation, **eruption**, diseases of teeth, and methods of dental treatment. He designed and invented some **extraction** instruments to make the removal of teeth easier and safer. Hippocrates felt strongly that physicians have an obligation to their patients to not allow any wrongdoing and adhere to **confidentiality** when treating all patients. From this belief, the establishment of the Hippocratic Oath was founded. To this day, the Hippocratic **Oath** is still a basic code of ethics for medical and dental professionals to "do no harm." An Athenian physician and pupil of Aristotle (384–322 BC), Diocles of Carystus, stated that oral hygiene should get proper attention, and he even gave instructions to this end. During the next couple of centuries, more importance was placed on good oral hygiene. A number of cleaning powders were made from crushed bones, oysters, and egg shells. At times, these substances were mixed with honey to make a paste to use in cleaning.

Later Progress of Dentistry

In France, a surgeon named Guy de Chauliac (1300–1368) became one of the fourteenth century's most influential authors on surgery. He also wrote the "Hygienic Rules for Oral Hygiene."

It is now known that the information given by de Chauliac was not entirely accurate. However, because it was based on sound logic, much of it is used today. For example, it is well known that sticky, sweet foods increase dental decay. During the fifteenth and sixteenth centuries, artists became more interested in human anatomy to enhance the accuracy of their artwork. Leonardo da Vinci (1452–1519) painstakingly dissected the human skull and then drew his discoveries. He was the first to make a distinction between premolars and molars. His writings further define the morphology of teeth.

Pierre Fauchard (1678–1761), a French dentist, organized all known information about dentistry in a manuscript titled "Le Chirurgien Dentiste," relating to a title he used to refer to himself as a surgical dentist. It was clearly written and had step-by-step pictures that depicted easy-to-follow procedures. He rejected the idea that a tooth worm caused decay and noted that "caries" (his term for decay) were a result of a "hormonal imbalance" and was an early advocate of treating diseased **gingival** tissue. He combined early information and operative methods for replacing or transplanting teeth. He even noticed that he could straighten teeth by using gold braces that were fastened by waxed linen or silk threads and allowed the teeth to follow a pattern of wires. Pierre Fauchard developed a manual drill for use in dentistry that was powered by a catgut twisted around a cylinder. Fauchard believed that once the decay had been removed, something should replace the missing tooth structure. He would use tin or lead as the replacement. If the decay was too deep and the nerve was disturbed, he utilized oil of cloves to calm down the nerve. This technique is still used today. He believed that the use of urine as a mouthwash could maintain good oral hygiene. Fauchard also believed that in the event a tooth became avulsed (knocked out), the tooth should be reimplanted. Pierre Fauchard's findings were so highly admired and beneficial in dentistry that they were used for over a hundred years. Many refer to Pierre Fauchard as the "Founder of Modern Dentistry."

Wilhelm Conrad Roentgen (1845–1923), a German physicist, discovered x-rays in 1895. This discovery allowed dentists to further their knowledge of the diseases and structures of the mouth.

Hygienic Rules for Oral Hygiene

Written by Guy de Chauliac

1. Avoid food that putrefies readily.
2. Avoid food or drink that is too hot or too cold, and especially avoid swallowing extremely cold food after extremely hot food, and vice versa.
3. Do not bite into things that are too hard.
4. Avoid foods that stick to the teeth, such as figs and confections made with honey.
5. Avoid certain foods known to be bad for the teeth (his example was leeks).
6. Clean the teeth gently with a mixture of honey and burnt salt to which some vinegar has been added.

Progress of Dentistry in the United States

One of the first dentists to arrive in the United States from England was Robert Woofendale. Woofendale placed an advertisement in the *New York Mercury* on November 17, 1766, stating that he "performs all operations upon the teeth, sockets, gums, and palate, likewise fixes artificial teeth, so as to escape discernment." Soon after Woofendale arrived, John Baker came and started advertising in the Boston area. He spoke and wrote about fillings and artificial teeth. Baker was well known and was one of the dentists who treated George Washington. John Greenwood (1760–1819) was said to be the first president's favorite dentist (Figure 1-1). Greenwood had very little formal education but was a proficient practitioner in the eighteenth century. He thought children should care for their teeth and offered parents reduced rates for children's dental care. He also thought that tartar came from bad breath and was adamant about the regular removal of it for good oral health.

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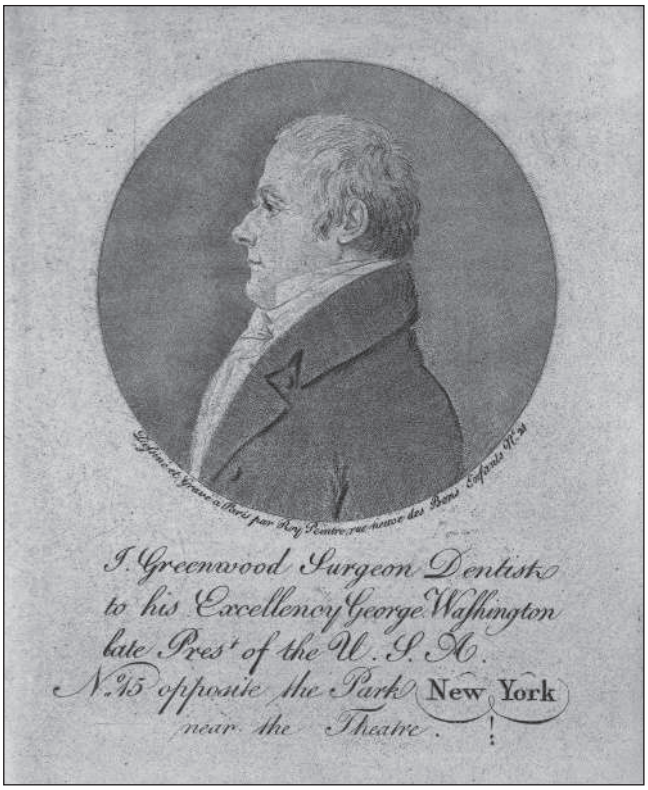
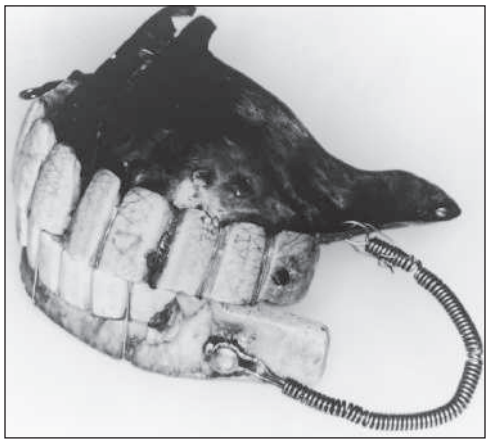


Courtesy of the Library of Congress

FIGURE 1-1
John Greenwood.



Courtesy of the National Museum of Dentistry, Baltimore, MD

FIGURE 1-2
The last dental prosthesis worn by George Washington was made for him by John Greenwood. It is made of gold and ivory and is held together with springs.

Courtesy of the Paul Revere Memorial Association, Gift of Miss Marion Cole. Photo: John Miller

FIGURE 1-3
Paul Revere, shown as a silversmith.

At one time or another, George Washington was probably treated by every notable dentist of the time. A number of references in his diary note continual pain and discomfort from his teeth. At the time the picture that is currently on the one-dollar bill was painted, the president had only one tooth left, a lower-left bicuspid (premolar). In fact, the artist had to pad out the cheeks and lips with cotton to give the president's sunken face a more normal appearance. Washington's last set of **dentures**, made by Greenwood, were composed of ivory and gold and had two springs holding them together (Figure 1-2). A number of dentures were made for the president; however, contrary to popular belief, they were not made of wood.

Paul Revere (1735–1818), a silversmith (Figure 1-3), was a dentist for several years, but his greatest contribution to dentistry was making surgical instruments and artificial teeth. Paul Revere is also the first dentist documented to use **forensics** to identify the remains of a soldier from the Revolutionary War by an artificial tooth he had made for him. He may have had a part in training a notable dentist of the late 1700s, Josiah Flagg. Flagg's father was a partner to Revere. Flagg, a skilled surgeon, was accomplished in corrective procedures on cleft lips, orthodontics, **endodontics**, and operative dentistry. However, one of his major contributions to dentistry was the construction of a dental chair. It had an extension on the arm to hold dental instruments and an adjustable headrest.

In the early 1800s, U.S. dentistry took a giant leap forward. The establishment of a popular democracy—with the opportunity for personal financial gain, free public school education, and population growth—prompted some of the most notable dentists in the world to relocate to America. The literature and knowledge base expanded a great deal during this time. Most large cities now had resident dentists rather than traveling barbers who extracted teeth and sold tooth powders. The dentists of the time were better educated and involved in the communities they served. The profession was progressing far beyond massive tooth removals and occasional cleanings. Additionally, as dental techniques improved and developed, so did dental materials. The first dental engine with a functioning handpiece, motor, and foot treadle was manufactured and patented by James B. Morrison in 1871. This apparatus allowed dentists to restore teeth much more quickly. Organized dentistry was rapidly approaching.

Education and Organized Dentistry

Horace H. Hayden (1769–1844) (Figure 1-4) sought dental care from John Greenwood, the dentist who cared for George Washington. Hayden was inspired and encouraged to take up dentistry as a vocation. He became very active in the dental profession, writing for journals and lecturing on medical and dental topics. Hayden practiced dentistry in Baltimore,

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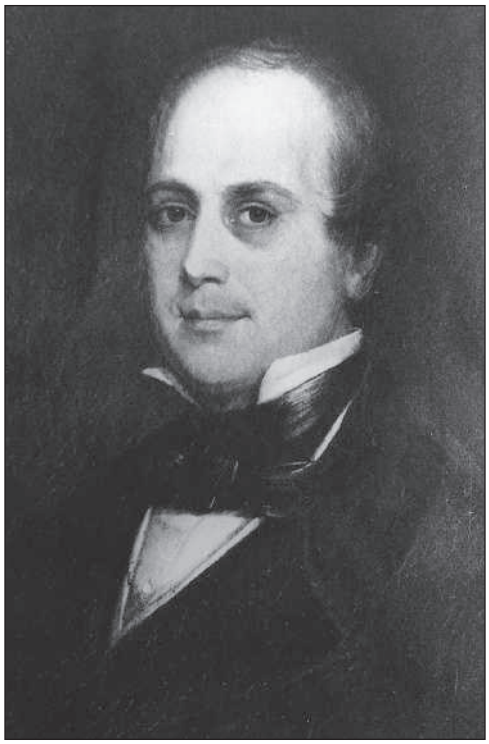
Courtesy of the National Museum of Dentistry, Baltimore, MD

FIGURE 1-4
Horace Hayden, one of the founders of professional dentistry in the United States, helped establish the world's first dental college.



Courtesy of the National Museum of Dentistry, Baltimore, MD

FIGURE 1-5
Chapin Harris, one of the founders of professional dentistry in America, helped establish the first dental college in the world and the first national association representing dentistry.

Maryland, while concurrently attending medical school. He felt it was important that the field of dentistry require more formal education and scientific research and he is regarded as a leader in establishing a formal system of dental education.

One of the students who studied with Hayden was Chapin A. Harris (1806–1860) (Figure 1-5). Harris believed in education and built an extensive library of dental literature, including his own work, *The Dental Art: A Practical Treatise on Dental Surgery*. Due to the efforts of Hayden and Harris, the first dental college in the world, the Baltimore College of Dental Surgery, was founded on March 6, 1840. It is now called the School of Dentistry at the University of Maryland and is the home of the Dr. Samuel Harris National Museum of Dentistry.

Chapin Harris was a main founder and the first president of the American Society of Dental Surgeons in 1840, which was later to become the American Dental Association. He continued to pursue the advancement of dentistry in the United States until he died in 1844. The efforts of Horace Hayden and Chapin Harris took dentistry out of the association with medicine and hands of **preceptorship** to professional independence and one step closer to the modern world. Harris is considered one of the founding members of the profession of dentistry and a pioneer of dental journalism. He was the founder and chief editor of the first dental periodical, the *American Journal of Dental Science*, and published the first dental dictionary in the English language.

Dr. Samuel D. Harris, after whom the museum was named, was instrumental in founding the museum. It is the largest and most complete museum of dental artifacts and history. Visitors can learn about the heritage of dentistry and how to maintain their oral health. They can learn if President George Washington's teeth were really made of wood, engage in interactive exhibits, and partake in educational programs.

Dr. Greene Vardiman Black (1836–1915), known as G.V. Black (Figure 1-6), taught in dental schools such as the University of Iowa and the Northwestern University Dental School in Chicago. As the dean, he increased the library holdings and authored more than 500 articles and several books. He invented numerous machines for testing alloys and instruments to refine cavity preparations. Black later enlarged these instruments for demonstrations to students in the classroom. Many refer to him as the "grand old man of dentistry" or as one of the "founders of modern dentistry in the United States." His goal was to make dentistry independent from medicine. He wrote a number of books and articles, coining the term *extension for* ***prevention*** in **cavity preparation**. He conducted vast research, especially in the formulation of silver **amalgam**. His contributions are still being used today in his classification of instruments and restorations. His son, Arthur D. Black, followed in his footsteps, becoming dean of the Northwestern University Dental School in Chicago. In 1921, he developed the *Index to Dental Periodical Literature in the English Language*. Not only did this allow researchers to access the literature, but it also provided access to general practicing dentists who wanted to improve their knowledge and skills.

Lucy Beaman Hobbs Taylor, the first woman to graduate from a recognized dental college, earned her dental degree in 1866 (Figure 1-7). She was a teacher who became interested

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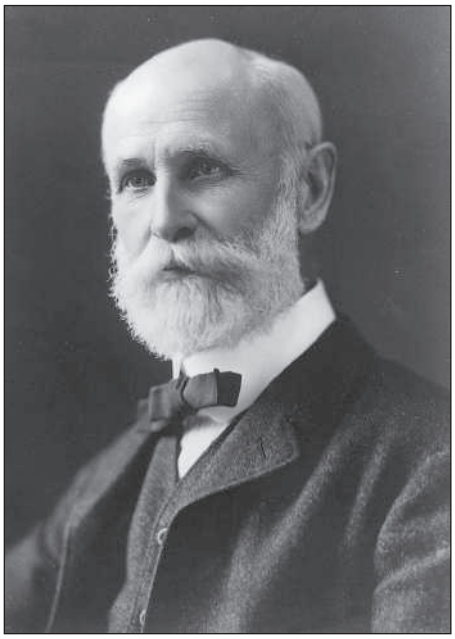

Courtesy of the National Museum of Dentistry, Baltimore, MD

FIGURE 1-6
Dr. Greene Vardiman Black (1836–1915), known as the "grand old man of dentistry" or as one of the "founders of modern dentistry in the United States."

Courtesy of the Kansas State Historical Society

FIGURE 1-7
Lucy Beaman Hobbs Taylor.

Courtesy of Harvard University Library

FIGURE 1-8
The first African American to earn a DMD, Dr. Robert Tanner Freeman graduated from the Harvard School of Dental Medicine in 1869.

Courtesy of Harvard University Library

FIGURE 1-9
Dr. George Franklin Grant graduated from the second class of Harvard School of Dental Medicine.

in medicine and then pursued further education. She met with resistance, but after the Iowa State Dental Society amended its constitution and bylaws, she was admitted into the dental college.

Dr. Robert Tanner Freeman (Figure 1-8), the first African American to earn a dental degree, graduated from Harvard University Dental School in 1869. Eleven years later in 1890, Ida Gray became the first African American woman to earn a dental degree upon graduation from the University of Michigan School of Dentistry. George Franklin Grant (Figure 1-9), an African American, graduated from the second class in dentistry in 1870 at Harvard University. He is credited as an authority on the cleft palate.

American Dental Association

At a time when dentistry education and literature were developing, it was thought that organizing dentists would promote sharing of information concerned with excellence in dentistry. Horace Hayden and Chapin Harris collaborated on endeavors such as forming the first nationwide association of dentists.

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Courtesy of the American Dental Assistants Association, Chicago, IL

FIGURE 1-10
Logo for the American Dental Assistants Association.

The American Society of Dental Surgeons was formed in 1840, but was dissolved in 1856. Harris had long believed in the need for an informative dental periodical and was instrumental in its founding in 1839. This journal was called the *American Journal of Dental Science (AJDS)*. Later, in 1859, 25 delegates gathered in Niagara Falls, New York, and organized the American Dental Association (ADA). The association was small at first, but after grouping all local associations according to states and then giving all states representation in the national organization, membership began to increase. Today, each state has its own organization with bylaws approved by the ADA, and each local (regional) organization has ADA-approved bylaws that are sent to each state organization. For example, Texas is represented in the ADA by the Texas State Dental Association, and the Texas State Dental Association comprises individual local dental associations. The official publication of the ADA is the *Journal of the American Dental Association (JADA)*. The ADA also has a website, https://www.ada.org/en, which provides a link to the ADA for dental professionals and dental consumers.

Some offices/clinics are hiring a dental assistant called a **sterilization assistant** to do all the disinfecting/sterilizing of treatment rooms and instruments. This individual is responsible for monitoring all sterilizers, water lines, ultrasonic units, cold chemical solutions, and biohazard materials. They stay informed regarding updates on chemicals and the personal protective equipment required when using them.

American Dental Assistants Association The early 1900s became the groundbreaking period of the American dental assistants. The American Dental Assistants Association (ADAA) was founded in 1924 by Juliette Southard, its first president (Figure 1-10 and Figure 1-11). It was founded on four principles: education, efficiency, service, and loyalty. Membership offers a voice in national affairs regarding the career of dental assisting, opportunities in continuing education, professional liability insurance, and interaction with other professionals in the field. ADAA members can remain current in their knowledge through the ADAA publication *The Dental Assistant, Journal of the American Dental Assistants Association*, or by accessing the ADAA website (http://www.adaausa.org/).

Courtesy of the American Dental Assistants Association, Chicago, IL

FIGURE 1-11
Juliette Southard, founder and first president of the American Dental Assistants Association.

When pursuing a career in dental assisting, it is beneficial to use the "Creed for Dental Assistants" (Figure 1-12) and the "Dental Assistants Pledge" (Figure 1-13) as guidelines for professional behavior.

Advances in Equipment and Pharmaceuticals

During the nineteenth and twentieth centuries, many advances were made in science and technology, some of which were accelerated in the 1930s to help win the Second World War. New ideas, materials, and concepts resulted in the development of new dental techniques, medicines, instruments, equipment, and procedures. By the early 1960s, the practice of dentistry was in transition.

High-Speed Handpiece

Many types of drills, such as the bow drill, were developed over the years, even as far back as during the Mayan civilization. Hand drills with long handles spun by hand were attempted, but they were very cumbersome and inefficient. John Greenwood even attempted to construct a dental engine in the 1790s. The first foot treadle dental engine was developed by James Morrison. He received a patent for the machine in 1871. By the late 1800s, electricity was developed and the electric drill was invented. By 1915, the foot treadle drill was being surpassed by an early version of the electric drill.

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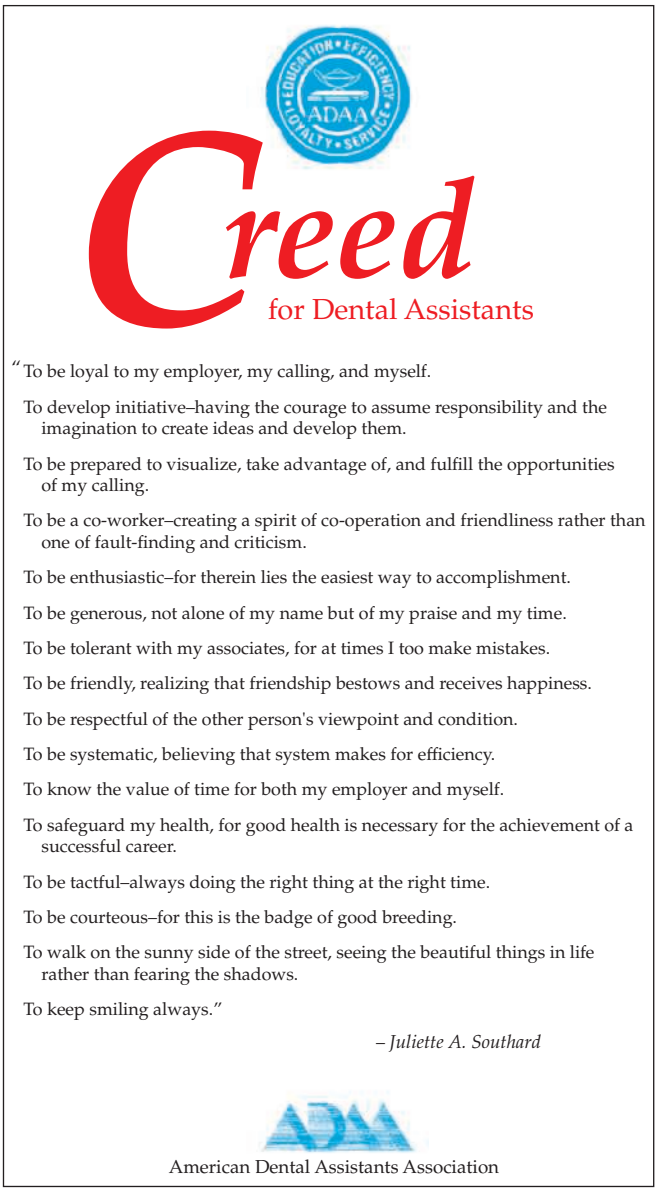


Creed
for Dental Assistants

"To be loyal to my employer, my calling, and myself.

To develop initiative–having the courage to assume responsibility and the imagination to create ideas and develop them.

To be prepared to visualize, take advantage of, and fulfill the opportunities of my calling.

To be a co-worker–creating a spirit of co-operation and friendliness rather than one of fault-finding and criticism.

To be enthusiastic–for therein lies the easiest way to accomplishment.

To be generous, not alone of my name but of my praise and my time.

To be tolerant with my associates, for at times I too make mistakes.

To be friendly, realizing that friendship bestows and receives happiness.

To be respectful of the other person's viewpoint and condition.

To be systematic, believing that system makes for efficiency.

To know the value of time for both my employer and myself.

To safeguard my health, for good health is necessary for the achievement of a successful career.

To be tactful–always doing the right thing at the right time.

To be courteous–for this is the badge of good breeding.

To walk on the sunny side of the street, seeing the beautiful things in life rather than fearing the shadows.

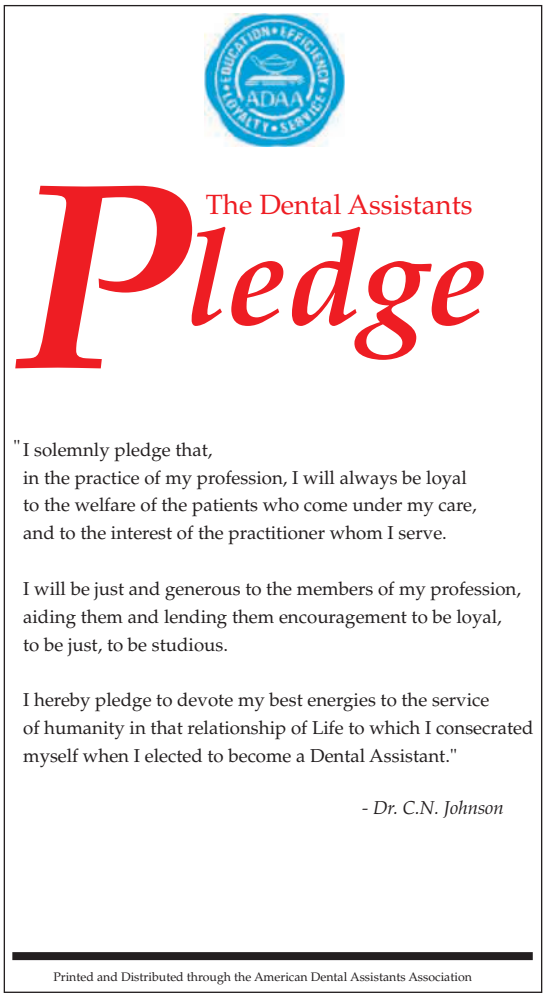
To keep smiling always."

– Juliette A. Southard

American Dental Assistants Association

Courtesy of the American Dental Assistants Association, Chicago, IL

FIGURE 1-12
The "Creed for Dental Assistants" by Juliette A. Southard.



The Dental Assistants
Pledge

"I solemnly pledge that,
in the practice of my profession, I will always be loyal to the welfare of the patients who come under my care, and to the interest of the practitioner whom I serve.

I will be just and generous to the members of my profession, aiding them and lending them encouragement to be loyal, to be just, to be studious.

I hereby pledge to devote my best energies to the service of humanity in that relationship of Life to which I consecrated myself when I elected to become a Dental Assistant."

- Dr. C.N. Johnson

Printed and Distributed through the American Dental Assistants Association

Courtesy of the American Dental Assistants Association, Chicago, IL

FIGURE 1-13
"The Dental Assistants Pledge" by Dr. C. N. Johnson.

A number of other prototypes were developed, but none compared to the Airotor **handpiece** developed by John Borden in 1957. The Airotor high-speed handpiece had rotational speeds up to 200,000 rpm (rotations per minute) and operated by air compression. This allowed the dentist to provide a more detailed, accurate preparation of a tooth for a restoration. This method was much safer and quicker. Newer versions of the high-speed handpiece now surpass speeds over 300,000 rpm.

Sit-Down Dentistry

Originally dentists worked standing up with the patient in an upright position. This was difficult and uncomfortable for the dentist and the assistant. With the use of the high-speed handpieces and their attachments, dentists began sitting down on stools and placing the patient into a reclined position. In the early 1960s, new delivery systems and cabinetry were designed to accommodate sit-down dentistry. Dentists began four-handed dentistry, but it was several years before this became standard.

Infection Control and Prevention

Can you imagine not washing your hands before performing surgery? Up until the 1850s, physicians and dentists did not wash their hands prior to surgery. In the late 1840s, the need for health care workers to participate in routine handwashing to prevent the spread of infectious disease was finally explored. Dr. Ignaz Semmelweis, a Vienna physician, recognized that maternity patients were dying at an alarming rate from hospital deliveries. He researched and demonstrated that routine handwashing could prevent the spread of disease. Dr. Semmelweis later discovered that disinfecting hands could further decrease the spread of disease for maternity patients. In 1847, he had all medical students wash their hands with chlorinated lime before assisting in deliveries. Oliver Wendell Holmes Sr. made similar discoveries in early 1837. He wrote about the moral obligation of physicians to purify their instruments to prevent the spread of contagious diseases, a practice his peers ridiculed.

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Infection control and prevention were introduced to health care in England by Florence Nightingale (1820–1910), an English nurse. Although she did not have a scientific understanding of disease transmission, her research into hospital sanitary problems during the Crimean War (1853–1856) made her a believer in the need for pure air, pure water, and cleanliness. She was born into a rich upper-class, well-connected family with a lot of influence. With this influence, she was able to formalize standard cleanliness and sanitation in hospitals and the military.

There were no standards for infection control in health care until 1867 when Joseph Lister advocated disinfection with chemicals. He reasoned that Louis Pasteur's "germ theory" introduced in 1861 may also infect wounds, so he introduced disinfection in the operating rooms and gloves to prevent dermatitis from the disinfecting solutions. Up until then it was common practice that most dental instruments only had to be as clean as knives and forks. Dentists sterilized their needles and surgical instruments in boiling water. The primary means of disinfection by chemicals continued into the 1950s. The early 1960s was a new era of sterility as the use of sterilizers increased and cold disinfectants became commonplace. Infection control was not upgraded for more than a decade when the CDC began infection control training in the 1970s. The mission of the CDC expanded in the 1970s from a center of **epidemiology** to include the application of principles to prevent and control the spread of infection. The name was changed from Communicable Disease Center to Centers for Disease Control. In 1987, universal precautions were developed by the CDC to prevent the transmission of bloodborne infectious disease. The CDC published guidelines that included the use of protective barriers such as gloves, protective clothing, eyewear, and masks.

Up until the early 1980s, dentists did not routinely wear gloves while working in the patient's mouth despite the direct contact with blood. In 1988, the CDC recommended specific infection control practices for dentistry. Congress directed the Occupational Safety and Health Administration (OSHA) to finalize the **Bloodborne Pathogens Standard** by 1991 to protect the nation's health care workers from exposure to infectious pathogens. The standard included an exposure control plan and the use of personal protective equipment (PPE). Dental health care workers now wash their hands between patients and the use of gloves, eyes protection, protective clothing, and surgical masks has become the standard.

Nitrous Oxide

Pain during dental procedures deterred many patients from receiving any type of dental treatment. Dentists were searching for something to relieve that pain and make the patients less anxious. In 1844, Horace Wells, a dentist, heard a lecture on the effects of nitrous oxide. He learned that a patient under the influence of nitrous oxide did not remember being injured or the pain involved with the injury. Wells had the revelation that nitrous oxide could be used effectively for dental treatment. In order to research the use of nitrous oxide, Wells allowed his preceptor dentist to remove one of his teeth. Wells felt no pain from the procedure. With this discovery, the use of nitrous oxide was inducted into dental treatment. Nitrous oxide is still commonly used today to reduce patient anxiety associated with dental care.

Local Anesthesia

Nitrous oxide was a major advancement in making patients more comfortable during dental treatment, but some type of localized medicine was still being sought. In 1884, the **analgesic** property of cocaine was discovered by Carl Koller, an ophthalmic surgeon. Cocaine is highly addictive and ultimately was not the best product to use. In 1904, the synthetic analgesic *procaine* (Novocaine®) was developed in Germany. By 1950, an even safer version of analgesic, *lidocaine* (Xylocaine®), was introduced. Lidocaine was much safer than Novocaine and became the analgesic of choice for dentists. Lidocaine is currently the most commonly used local anesthetic.

Advances in Imaging

Although not a dentist, Wilhelm Conrad Roentgen was another great contributor to the dental field (Figure 1-14). Trained in the field of mechanical engineering, Roentgen later became a faculty member teaching physics. In 1895, he performed an experiment by passing an electrical current through gas in a tube. Roentgen discovered that by working in darkness and not allowing light in the tube, the rays coming out the other end would leave an image on paper plating. He placed a photographic plate with his wife's hand on the area and found that the rays permeated her soft tissues, leaving an outline of her skeletal bones and ring on the plate. The name of *x-ray* was given because the makeup of these rays was unknown.

Dr. C. Edmund Kells has been given credit for utilizing x-rays in the dental field after reading Roentgen's works. Kells developed a film and holder to fit in the patient's mouth. Even though the process of taking an intraoral dental film took 15 minutes and was tedious, the use of dental x-rays was born in 1895. Dental x-rays allowed the dentist to view inside the hard tissues of the mouth on a **radiograph**. This allowed dentists to see areas of decay and bone loss that was not visible before. The amount of radiation, speed of the dental film, and technique for traditional x-rays have evolved and improved and

Infection Control

At a minimum the CDC recommended that, "gloves must be used where there is reasonable anticipation of employee hand contact with blood or other potentially infectious materials (OPIM), or non-intact skin (MMWR, 1988; 37:379). OSHA used the research of the CDC in developing it Bloodborne Pathogen Standard.

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