Fundamentals of

Periodontal Instrumentation & Advanced Root Instrumentation

Eighth Edition

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Wolters Kluwer

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Preface for Course Instructors

Fundamentals of Periodontal Instrumentation & Advanced Root Instrumentation, Eighth Edition is an instructional guide to periodontal instrumentation that takes students from the basic skills—patient positioning, intraoral f nger rests, and basic instrumentation—all the way to advanced techniques—assessment of periodontal patients and instrumentation of the root branches of multirooted teeth, root concavities, and furcation areas. The foremost instructional goal of *Fundamentals* is to make it easy for students to learn and faculty to teach instrumentation. The eighth edition retains the features that have made it the market-leading textbook on periodontal instrumentation and adds new features and content organization designed to facilitate learning and teaching.

ONLINE INSTRUCTOR TEACHING RESOURCES

The online Faculty Resource section has a collection of instructional aids for use in teaching instrumentation. These resources are located online at thePoint website (http://thePoint.lww.com/GehrigFundamentals8e).

1. **PowerPoint Slides.** The PowerPoint slides were designed so as to be user-friendly for wide variety of software versions and equipment.
   - The PowerPoint presentations may be customized by saving the slides to your computer hard drive and using the formatting features of your slide presentation software.
   - Special effects, such as progressive disclosure, may be added to the slide presentations using the custom animation features of your slide presentation software. In addition, individual slides may be deleted and new instructor-created slides added to the presentations.
2. **Test Bank.** The test bank questions can be used for quizzes, combined to make up unit tests, or combined to create midterm and f nal examinations.
3. **Instructor Guide.** The instructor guide includes:
   - Suggestions for leading classroom discussions.
   - A list of phrases that facilitate the teaching of instrumentation.
   - Teaching tips for instruction, as well as, sources for periodontal typodonts.
   - Guidelines for introduction of alternate and advanced techniques.
4. **Module Evaluation Forms.** Evaluation forms for instructor grading are now located online in two formats.
   - Evaluations for Computerized Grading. These forms are designed to allow the instructor to enter grades and comments directly on a computer.
   - Evaluations for Paper Grading. These forms are designed to be printed out and used for "paper and pen" manual grading. Paper forms include evaluation forms for each module.

COn t En t ORGAn iZAt iOn

From an instructional viewpoint, it is important to note that *each major instrument classif cation is addressed in a stand-alone module*—sickle scalers, universal curets, and area-specific curets. Each stand-alone module provides complete step-by-step instruction in the use of an instrument classification. For example, the module on universal curets provides complete instruction on the use of universal curets. This chapter does not rely on the student having studied the previous module on sickle scalers before beginning the universal curet module. This stand-alone module structure means that it is not necessary to cover the instrument modules in any particular order or even to include all of the modules. If sickle scalers, for example, are not part of the school's instrument kit, this module does not need to be included in the course outline.

t EXt BOOK FEAt URES

1. **Module outlines.** Each chapter begins with a module outline that provides an overview of content and makes it easier to locate material within the module. The outline provides the reader with an organizational framework with which to approach new material.
2. **Learning objectives** assist students in recognizing and studying important concepts in each chapter.
3. **Step-by-step format.** The clear, step-by-step self-instructional format allows the learner to work independently—fostering student autonomy and decision-making skills. The learner is free to work at his or her own pace spending more time on a skill that he or she finds difficult and moving on when a skill comes easily. The self-instructional format relieves the instructor from the task of endlessly repeating basic information, and frees him or her to demonstrate instrumentation techniques, observe student practice, and facilitate the process of skill acquisition.
4. **Key terms** are listed at the start of each module. One of the most challenging tasks for any student is learning a whole new dental vocabulary and gaining the confidence to use new terms with accuracy and ease. The key terms list assists students in this task by identifying important terminology and facilitating the study and review of terminology in each instructional module.
5. **Study aids—**boxes, tables, and f ow charts—visually highlight and reinforce important content and permit quick reference during technique practice and at-home review.
6. **Critical thinking activities—**in the *Practical Focus* sections of the book—encourage students to apply concepts to clinical situations, facilitate classroom discussion, and promote the development of student problem-solving skills.
7. **Case-based patient experiences** allow students to apply instrumentation concepts to patient cases.
8. **The glossary of instrumentation terms** provides quick access to instrumentation terminology.
9. **Student self-evaluation checklists** guide practice, promote self-assessment skills, and provide benchmarks for faculty evaluation of skill attainment. Use of the student self-evaluation portion of the evaluation forms should be encouraged. The self-evaluation process helps students to develop the ability to assess their own level of competence rather than relying on instructor confirmation of skill attainment.

ONLINE CONTENT

In addition to the Student and Instructor Resources, the following resources are located online at thePoint website (**http://thePoint.lww.com/GehrigFundamentals8e**).

- 1B. Getting Ready for Instrumentation: Mathematical Principles & Anatomical Descriptors
- 20B. Instrumentation of Dental Implants
- 21B. Alternate Clock Positions
- 26B. Cosmetic Polishing Procedures
- 27B. Set-Up of Hu-Friedy/EMS Air Flow Polishing Devices

I appreciate the enthusiastic comments and suggestions from educators and students about previous editions of *Fundamentals,* and welcome continued input. Mastering the psychomotor skill of periodontal instrumentation is a very challenging process. It is my sincere hope that this textbook will help students to acquire the psychomotor skills that—combined with clinical experience—will lead to excellence in periodontal instrumentation.

Jill S. Gehrig, RDH, MA

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Jill S. Gehrig, Rebecca Sroda, and Darlene Saccuzzo

Contents

1

Ergonomics and Periodontal Instrumentation

Module Overview

This module introduces the principles of positioning for periodontal instrumentation. Correct positioning techniques help to (1) prevent clinician discomfort and injury, (2) permit a clear view of the tooth being worked on, (3) allow easy access to the teeth during instrumentation, and (4) facilitate ef cient treatment of the patient. **Prior to beginning this module, readers should review the online resource:** Getting Ready for Instrumentation: Mathematical Principles and Anatomical Descriptors.

Module Outline

Access the online module, Getting Ready for Instrumentation: Mathematical Principles and Anatomical Descriptors.
This module can be viewed at http://thepoint.lww.com/GehrigFundamentals8e

Key Terms

ergonomics
Musculoskeletal disorder
Posture
Neutral posture
Static posture
Force
Repetitive task
Supine position
Semi-supine position
Chin-up position
Chin-down position
Coaxial illumination sources
dental headlights
Magnification loupes
Working distance
Angle of declination
depth of field
Field of view
Blind zone

Learning Objectives

- define the term ergonomics and discuss how ergonomic principles are helpful in the practice of dental hygiene.
- define the term musculoskeletal disorder (MSd) and discuss the significance of MSds in the practice of dental hygiene.
- Name four ergonomic hazards for dental hygienists.
- develop an understanding and appreciation for ergonomic guidelines to minimize the exposure of dental hygienists to musculoskeletal stress.
- Identify musculoskeletal disorders commonly experienced by dental health professionals, their causes and prevention.
- discuss and demonstrate the elements of neutral seated posture for the clinician.
- demonstrate correct patient position relative to the clinician and positioning of dental equipment so that it enhances neutral clinician posture.
- State the reason why it is important that the top of the patient's head is even with top edge of the chair headrest. demonstrate how to correctly position a short individual and a child in the dental chair so that (1) the patient is comfortable and (2) the clinician has good vision and access to the oral cavity.
- In the preclinical or clinical setting, self-evaluate to identify the use of incorrect ergonomic principles and demonstrate how to correct the problem(s).

Section 1
Ergonomic Risk Factors Associated with Periodontal Instrumentation

WHAT IS ERGONOMICS AND WHY SHOULD HYGIENISTS CARE?

1. Ergonomics is an applied science concerned with the 'fit' between people and their technological tools and environments (1).
   - **A.** In application, ergonomics is a discipline focused on making products and tasks comfortable and efficient for the user.
     1. A primary ergonomic principle is that equipment—such as computer keyboards and workstations—should be designed to fit the user instead of forcing the user to fit the equipment.
     2. Ergonomics is the science of making things efficient. Efficiency is quite simply making something easier to do.
   - **B. Poor Ergonomic Working Conditions and Working Practices.** When the fit between an individual and his or her tools and working environment is less than optimal studies show that worker comfort, productivity, and workplace safety all suffer (1). For dental hygienists the work environment includes the dental office layout, dental equipment, and instruments.
2. **Musculoskeletal Stresses and the Dental Professional.** The dental literature indicates that both dentists and hygienists are exposed to ergonomic risk factors that often lead to discomfort, pain, and even disability.
   - **A.** A musculoskeletal disorder **(MSD)** is a condition where parts of the musculoskeletal system—muscles, tendons, nerves—are injured over time.
     1. MSDs occur when too much stress is exerted on a body part resulting in pain. When a body part is overused repeatedly the constant stress causes damage.
     2. Almost all occupations require workers to use their arms and hands. Therefore, most MSDs affect the hands, wrists, elbows, neck, and shoulders.
   - **B. Prevalence of Musculoskeletal Problems in Dental Professionals**
     1. Many studies have investigated the prevalence of MSDs among dental professionals. A systemic review on this topic found that the prevalence of MSDs ranged as high as 64% to 93% (2).
     2. Despite this high prevalence, there is a lack of evidence regarding the efficacy of preventive measure for MSDs for the dental hygiene profession (3). A complete understanding of the progression of MSDs in dental hygienists is still far from being realized, due to the lack of longitudinal studies and standardized research techniques (3–5).
   - **C. Causes of Musculoskeletal Pain in Dental Professionals**
     1. The literature indicates that the causes of MSDs among periodontists and dental hygienists include excessive use of small hand muscles, forceful repetitive motions while maintaining muscles in same position during application of force, tight grips, and a fixed work position (maintaining the body in one position for extended periods) (2–13).
     2. The result is injury to the muscles, nerves, and tendon sheaths of the back, shoulders, neck, arms, elbows, wrists, and hands that can cause loss of strength, impairment of motor control, tingling, numbness, or pain.

3. Given the high incidence of musculoskeletal pain, it is important for clinicians to understand the causes of MSDs and to take actions to prevent them.

D. Ergonomic Guidelines in Dentistry

1. It is important that dental hygiene students complete instructional modules on ergonomic principles during their education and training (3,5).
2. Research shows that among practicing hygienists, education on patient and clinician positioning can help reduce the risk of MSDs (4,14,15).
3. It is possible to define ergonomic guidelines to minimize exposure of dental healthcare providers to musculoskeletal stress.

ERGONOMIC HAZARDS FOR DENTAL HYGIENISTS

Four significant ergonomic hazards during periodontal instrumentation are (1) awkward clinician posture, static (fixed) working position, the force placed on a body part, and (4) repetitive movements. Figure 1-1 summarizes these hazards that can lead to musculoskeletal injury.

1. **Awkward Postures.** Posture is a term for the position of various parts of the body during an activity.
   - **A.** For most joints, ideal or neutral posture means that the joint is being used near the middle of its full range of motion.
   - **B.** The further a joint moves away from neutral posture, the more strain is placed on the muscles, tendons, and ligaments around the joint (37). For example, if an individual stands with his or her arms outstretched in front of the body, the elbow and shoulder joints are at their range of motion. If the individual pulls or lifts repeatedly in this outstretched position—versus held close to the body—there is a high risk of injury.
   - **C.** The literature confirms the presence of awkward postures specifically in the neck, shoulders, back, wrist, and hand for dental hygienists. Awkward postures often are adopted due to improper adjustment of the clinician's chair, improper patient position in relation to the clinician, and poor work techniques.
   - **D.** When dental hygienists use their bodies in awkward positions, the muscles must generate higher forces to accomplish a task than when muscles are used in a neutral position (38).
   - **E.** A common awkward posture in dental hygienists is wrist flexion, which results in stress to neurovascular structures and ligaments. Poor wrist positioning can diminish grip strength (39). Figure 1-2 shows the reduction in strength that occurs as the wrist deviates further away from its neutral posture (37).

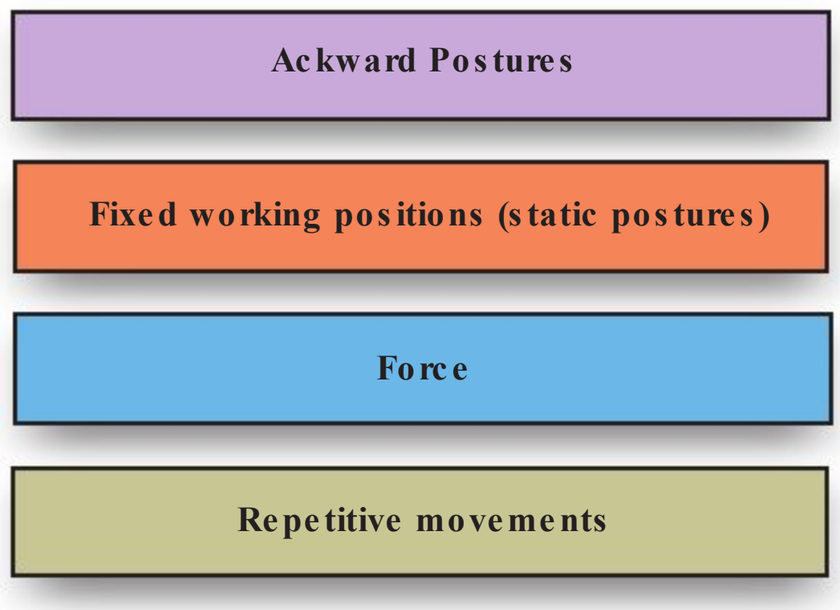

Figure 1-1. Ergonomic Hazards for Dental Hygienists. The dental hygienist has a high risk of musculoskeletal injury when awkward postures, static postures, and repetitive motions are combined with forceful movements (42–45).

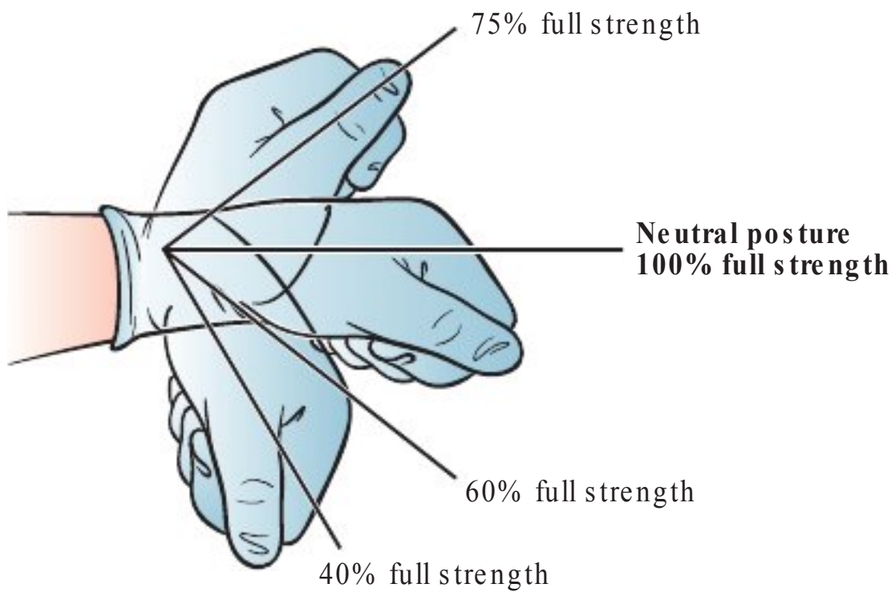

Figure 1-2. Effect of Poor Positioning on Wrist Strength. This illustration shows the reduction in strength that occurs as the wrist deviates away from its neutral position (37).

2. Static Postures

A. A static posture is defined as a fixed working position (maintaining the body in one position for an extended period of time) (1). The human body was not designed to maintain the same body position—prolonged static posture—hour after hour, day after day. In a static position, tensed muscles compress the blood vessels and reduce blood flow decreasing the oxygen and energy supply to the muscles. Waste products from the muscles accumulate causing muscle fatigue and eventually pain (1).

B. Dental clinicians have been observed statically holding postures that require greater than 50% of the body's musculature to contract (37).

C. Static gripping of instrument handles for durations exceeding 20 minutes is common during periodontal instrumentation (40).

3. Force

A. Force refers to the amount of effort created by the muscles, as well as, the amount of pressure placed on a body part.

B. Holding a small instrument for a prolonged period of time is an example of a gripping task requiring high force application. This task is commonly performed with a pinch grip where the fingers are on one side of the object and the thumb is on the other. This form of gripping is undesirable, as it requires a much greater force application than holding an object in the palm of the hand.

C. Researchers suggest that excessive use of a pinch grip is the greatest contributing risk factor in the development of MSDs among dental hygienists (40,41).

4. Repetitive Movements

A. Silverstein (42), in an article in the British Journal of Industrial Medicine, defined a repetitive task as a task that involves the same fundamental movement for more than 50% of the work cycle. Periodontal instrumentation would certainly be categorized as a repetitive task under this definition.

B. The human body was not designed to engage in fine hand movements hour after hour, day after day. The risk of developing an MSD increases when the same or similar parts of the body are used continuously, with few breaks or changes for rest (37).

C. Periodontal instrumentation requires excessive upper-body immobility while the tendons and muscles of the forearms, hands, and fingers overwork. Three critical components to consider with repetitive motions include:

1. Frequency: how many times an action is repeated; such as how many instruments are gripped by one hand throughout the day.
2. Duration: how long an action is performed; such as the length of time sitting in a static posture during the workday.
3. Recovery time: periods of rest that break a repetitive cycle, such as time spent doing muscle stretches between patients.