الهيئة السعودية للتخصصات الصحية
Saudi Commission for Health Specialties

Endodontics

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بسم الله الرحمن الرحيم

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DISCLAIMER

The primary objective of this curriculum is to advance and/or enrich the training experience of postgraduate trainees by outlining the learning goals to become competent, capable, and proficient future endodontists.

This curriculum may contain sections outlining some regulations of training. However, such rules need to comply with the most up-to-date "General Bylaws" and "Executive Policies" of the Saudi Commission for Health Specialties (SCFHS), which can be accessed online through the official SCFHS website (https://www.scfhs.org.sa/MESPS/TrainingProgs/RegulationBoard/Pages/default.aspx).

As this curriculum is subject to continuous development, please refer to the electronic version posted online for the most up-to-date edition.

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PREFACE

In the name of Allah, the Gracious, the Merciful.

In line with this educational program and on behalf of the scientific committee members, we are pleased to introduce the ***Saudi Board of Endodontic Curriculum: 2020 Edition***. The progressions made in this release comprise the learning process for trainers and trainees. We believe that thorough comprehension of the progressions presented is essential for the improvement and implementation of our training. We plan and/or intend to provide more thorough materials that will serve as a guideline for future improvement. The aim is to focus and concentrate on changing both how trainees learn as well as how trainers/mentors teach and instruct. Hence, the manner in which this curriculum will be applied relies upon our points of view of the program.

ACKNOWLEDGMENT

The Endodontics Program Curriculum Development Committee would like to thank **Dr. Abdullah Alzahem** for his help as a process expert as well as for providing advisory services on curriculum development to match the CanMEDS 2015 framework.

TABLE OF CONTENTS

ACRONYMS/DEFINITIONS

BDS	Bachelor of Dental Science
CanMEDS	Canadian Medical Education Directives for Specialists
CBE	Competency-Based Education
CPD	Continuous Professional Development
DDS	Doctor of Dental Surgery
DMD	Dental Medicine Doctor
SBE	Saudi Board of Endodontics
SCFHS	Saudi Commission for Health Specialties
Session	Four-hour (half day)
SSE	Saudi Specialty Certificate in Endodontics
WHO	World Health Organization

FORWARD

The necessity to change the educational program of the Saudi Board of Endodontics (SBE) program, which is known as the Saudi Specialty Certificate in Endodontics (SSE) program, is compelled by three considerations: First, the change and/or transformation plan of the Saudi Commission for Health Specialties (SCFHS) toward a new horizon by 2020. The SCFHS has characterized a new purpose to "protect and promote health in Saudi Arabia through competent healthcare practitioners based on the highest standards and best practices." Second, the number of residents and training centers are increasing yearly. While dental consultants, supervisors, and program directors are usually specialty experts, they may not be familiar with educational models and their effectiveness. A unified curriculum for SBE is a crucial step to achieving the best quality of training. Third, the Board of Trustees of the Saudi Commission for Health Specialties had approved changing the training period for the majority of its programs to three years. This decision was made based on benchmarks of programs of similar and higher standards in North American and European countries.

The SBE was established in 2006 and required four years of full-time training to acquire the necessary skills, knowledge, and experience in clinical endodontics and related biomedical sciences. Since its launch in 2006, the SBE program has become a pioneer endodontic postgraduate program both locally and regionally. This program has been conveyed via training centers authorized by the SCFHS. The SBE program includes informal participation lectures, crash courses, seminars, books and literature reviews, and case presentations, in addition to intensive clinical training requirements. The process of evaluating residents enrolled in the program comprises formative and continuous assessment throughout the training program, and summative assessment through promotion and graduation exams. The local committees of different regions and the scientific committee have made a tremendous effort in delivering, conducting, and assessing outcomes, and in coordinating all SBE program activities in all training centers. The SBE program is committed to improving health in Saudi Arabia through high standards for postgraduate training.

The SBE program book, 2020 edition, based on competency-based education (CBE), is the preferred way of delivering a training program nowadays. It is a genuinely collaborative effort toward perfection in the advanced education of endodontic postgraduate programs. Therefore, it is with great pleasure that we present the SBE program book, 2020 edition. This will be useful to all those who care about graduating as competent endodontists for better quality health care in Saudi Arabia.

SECTION I: INTRODUCTION

Context of Endodontics Practice

According to the American Association of Endodontists Glossary of Endodontic Terms 2019, endodontics is a branch of dentistry that is concerned with the morphology, physiology, and pathology of the human dental pulp and periradicular tissues. Its study and practice encompass the basic clinical sciences, including biology of the normal pulp; the etiology, diagnosis, prevention, and treatment of diseases; and injuries of the pulp and associated periradicular conditions.

To become an endodontist and to be acknowledged as such by the Saudi Commission of Health Specialties (SCFHS), a dental specialist must complete advanced training in the scope of endodontics and receive a certificate from an accredited advanced education in endodontics program. Endodontists are responsible for the advancement of endodontic knowledge through research, the transmission of information concerning the most recent advances in biologically acceptable procedures and materials, and education of the public as to the importance of endodontics in keeping the dentition in a physiologically functional state for the maintenance of oral and systemic health.

Global and National Demands of Endodontics

According to the general authority for the statistics demography survey of 2016, the total population of Saudi Arabia is 31,742,308 and it has 410 licensed endodontists, 62% of whom are non-Saudi.[1] The number of residents/students enrolled in the postgraduate endodontic program in the Kingdom of Saudi Arabia is 197, and the majority of these were enrolled in the Saudi Board Endodontics (SBE) program. Because of the rapid population and economic growth of Saudi Arabia, there will be a high need and demand for an endodontist workforce and job opportunities for a long time to come. The World Health Organization (WHO) proposes that "developing capable, motivated, and supported health workers is essential for overcoming bottlenecks to achieve national and global health goals. Healthcare is a labor-intensive service industry at the heart of every health system: the workforce is central to advancing health." The prevalence of dental caries, the leading cause of pulpal and periapical diseases, is considered very high in Saudi Arabia, and is estimated to be approximately 70% among children.[2] The prevalence of periapical lesions ranges from 1–21%, and can be even higher in medically compromised patients, especially in diabetic patients.[3] A high prevalence of periapical lesions (73%) associated with root treated teeth has been reported in the urban Saudi population.[4] For the past several decades, the endodontic specialty has progressed toward excellence in patient care and several technologies have been implemented and used. Moreover, new treatment

[1] AlBaker AA, Al-Ruthia YSH, AlShehri M, Alshuwairikh S. The characteristics and distribution of dentist workforce in Saudi Arabia: a descriptive cross-sectional study. *Saudi Pharm J*. 2017;25(8):1208–16.
[2] Al Agili DE. A systematic review of population-based dental caries studies among children in Saudi Arabia. *Saudi Dent J*. 2013;25(1):3–11.
[3] Al-Nazhan SA, Alsaeed SA, Al-Attas HA, Dohaithem AJ, Al-Serhan MS, Al-Maflehi NS. Prevalence of apical periodontitis and quality of root canal treatment in an adult Saudi population. *Saudi Med J*. 2017;38(4):413–21.
[4] Sadaf D, Alsalhy H, Alrothy R, Ahmad MZ. Prevalence of apical periodontitis in root canal-treated teeth from an urban Saudi female population: influence of root canal fillings and coronal restorations. *Int J Oral Health Sci* 2017;7(2):82–85.

strategies that aim to regenerate the dental pulp have followed an evidence-based approach; therefore, the need to redefine the SBE program, a leading postgraduate endodontic program in Saudi Arabia, in terms of its objectives, goals, and curriculum, is a must to fulfill its mission of ensuring endodontic excellence.

Mission and Goals of the Saudi Board of Endodontic Program

The SBE program's mission is to supply graduates who are competent endodontists and who will promote oral health, provide patient care, and advance research in endodontics. The SBE program provides exceptional knowledge and skills beyond the undergraduate training and has the following goals:

1. Teach endodontic knowledge and skills beyond the undergraduate level.
2. Promote evidence-based endodontics.
3. Foster community partnership.

Common Conditions/Diseases in Endodontics

1. **Pulpitis:** Pulpitis is the inflammation of the dental pulp. It can be reversible, may resolve, and the pulp return to normal, or it can be irreversible with and without symptoms, where the pulp must be treated to prevent further complications.
2. **Pulp Necrosis:** A clinical diagnostic category indicating the death of the dental pulp.
3. **Previously endodontically treated teeth:** A clinical diagnostic category indicating that the tooth was endodontically treated and the canals obturated with various filling materials other than intracanal medicaments.
4. **Previously initiated endodontically treated teeth:** A clinical diagnostic category indicating that the tooth has previously been treated by partial endodontic therapy (emergency procedures: pulpotomy, pulpectomy, vital pulp therapy).
5. **Apical Periodontitis:** Inflammation of the periapical tissue of the periodontium.
6. **Apical Abscess:** A condition due to an inflammatory reaction to pulpal infection and necrosis. It can manifest as rapid onset, spontaneous pain, tenderness to palpation and percussion, pus formation, and swelling of associated tissue. The condition causes little or no discomfort, has gradual onset, and comprises intermittent discharge of pus through an associated sinus tract.
7. **Crack and Vertical Root Fracture:** A crack that extends deeper into the dentin and primarily in the mesiodistal direction, involving the marginal ridges. The most severe form is "Split tooth." The vertical root fracture is a severe crack in the tooth that extends longitudinally down the long axis of the root to the periodontium.
8. **Perforations:** A communication between the root canal system and either periradicular tissue of the oral cavity.
9. **Root Resorption:** A loss of root structure of permanent teeth due to the inflammatory process. There are different forms of root resorption—external and internal.
10. **Immature permanent teeth with pulpal and periapical diseases.**

Common Procedures in Endodontics

1. Diagnosed pulpal and periapical diseases. These include but are not limited to identifying etiological/related factors: caries, periodontal lesions, restorative and traumatic injuries. Residents shall be able to diagnose oral pain originating from the teeth and supporting structures. Residents shall master different diagnostic tools and technologies that are

available: diagnostic tests, diagnostic imaging/radiography technologies. Residents should be able to identify the etiology of pain/lesions from odontogenic and non-odontogenic sources.
2. Non-surgical endodontic treatment and retreatment.
3. Surgical endodontic treatment.
4. Emergency treatment for endodontic conditions.
5. Use of magnification technologies beyond that of magnifying eyewear. This may include but is not limited to operating microscopes, endoscopes, orascopes, or other developing magnification technologies.
6. Endodontic management of complications/mishaps that occur during root canal therapy, including but not limited to perforation and file separation.
7. Intraradicular restorations in endodontically treated teeth. This includes the preparation of post space and core build-up restorations.
8. Vital pulp management: indirect, direct-pulp capping, and Apexogenesis.
9. Endodontic management of traumatic dental injuries.
10. Management of necrotic immature teeth: apexification procedures, revascularization/regenerative endodontics.

New Program Features (2020 Edition)

Curriculum Model

Medical and dental education promotes competency-based education (CBE) as the new and preferred way of delivering the training program. The CBE model focuses on the following objectives:

1) Preparing clinicians for practice that is fundamentally oriented to graduate outcome abilities and organized around competencies derived from an analysis of societal and patient care needs, implementing Competency-Based Education.[5]
2) Promoting greater accountability, flexibility, and learner centeredness.
3) Maintaining a balance between education and patient care.
4) Focusing on outcome and achievement rather than activities.

When the SBE program was launched in 2007, it established time-based training in which residents are required to complete their training by meeting certain time and clinical requirements. It was assumed that once these requirements had been met, residents would be ready to graduate to fulfill the program's goals and objectives. Undoubtedly, the SBE program has provided essential services to the public and intense advanced training in endodontics. Excellent endodontists who graduated from the SBE program are providing high-quality endodontic care services in several governmental hospitals, universities, and private sectors. However, as outlined below, the new SBE program curriculum 2020 edition adopts the CBE model.

[5] https://files.eric.ed.gov/fulltext/EJ1147189.pdf

Program Duration

As of October 1, 2019, the central training committee of the SCHS approved changing the SBE training period to three years. This decision was based on benchmarks of similar and high standard programs in North American and European countries. The status of training centers is capable of delivering the SBE curriculum in three years and ensuring its graduates are competent endodontists based on the highest standards and best practices. Therefore, residents will have to complete their clinical training period in one accredited center with no rotations required.

Competency Exams

The assessment of clinical skills (Mini-Cases Exercise) is a crucial step toward validating the quality of SBE program graduates and takes up a large portion of the SBE program curriculum/training period. Endodontic consultants and supervisors must decide whether a resident can be trusted to manage endodontic diseases and adequately perform endodontic procedures. Therefore, in this version of the SBE program, a new set and/or arrangement of competency tests is required as a component of advancement standards.

SECTION II: COMPETENCIES

Endodontist Roles

The program adapted the main roles of the CanMEDS framework to formulate competency-based education (CBE). Each of the seven roles has key competencies with enabling competencies. Endodontic Experts play the central role, and as Endodontic Experts, endodontists integrate all of the program roles, applying dental knowledge, clinical skills, and professional values in their provision of high-quality and safe patient-centered care (Figure 1).

Figure 1. CanMEDS Framework

Graduate Attributes (Figure 1)[6]

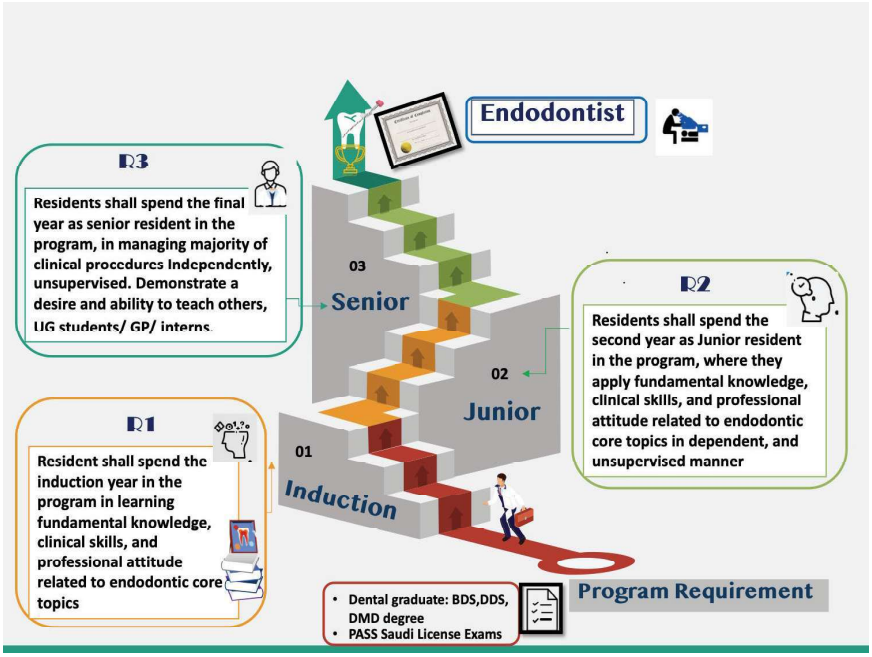
The key competency and enabling competencies for each role can be found in the appendices.

Competence Continuum

Residents in the SBE program are reminded of the fact of life-long Continuous Professional Development (CPD). They should bear in mind the necessity of CPD to meet the demands of the endodontic profession. The following table states how the role progressively expects to create and/or develop throughout junior, senior, and consultant levels of practice. Competency is a point on a continuum; it is where responsibility for learning is transferred from teachers to

[6] Modified from the original document to fit our specialty. ESSENTIAL SKILLS AND ABILITIES REQUIRED FOR THE PRACTICE .... https://medicine.usask.ca/documents/pgme/policy/PGMEEssentialSkills.pdf

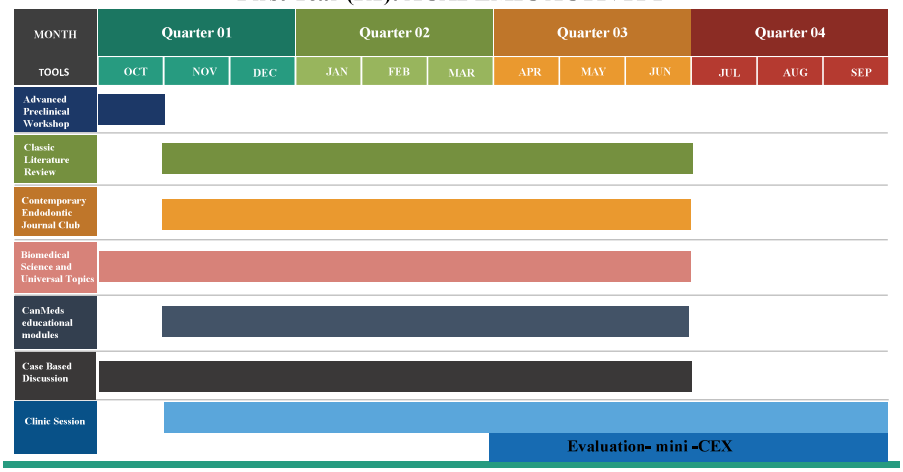
learners. Once basic competency has been achieved, the dental graduate must take the continuum to higher levels of competency through continuing education and postgraduate dental programs (Reference: Chambers).



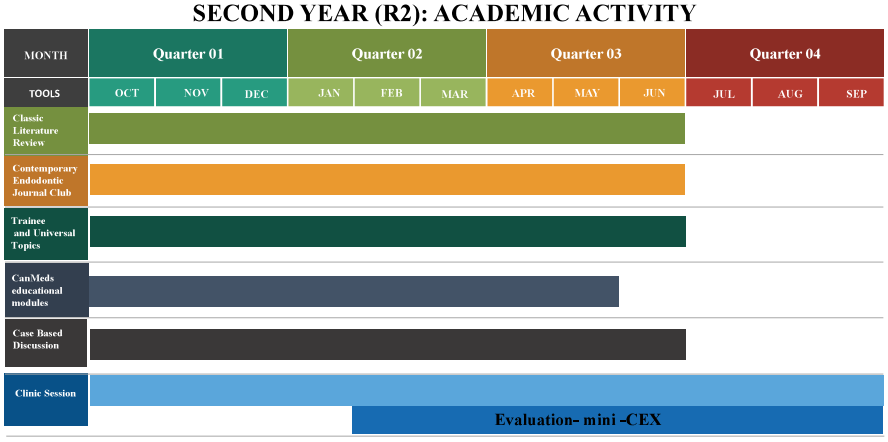
SECTION III: TEACHING AND LEARNING

Residency Program Structure

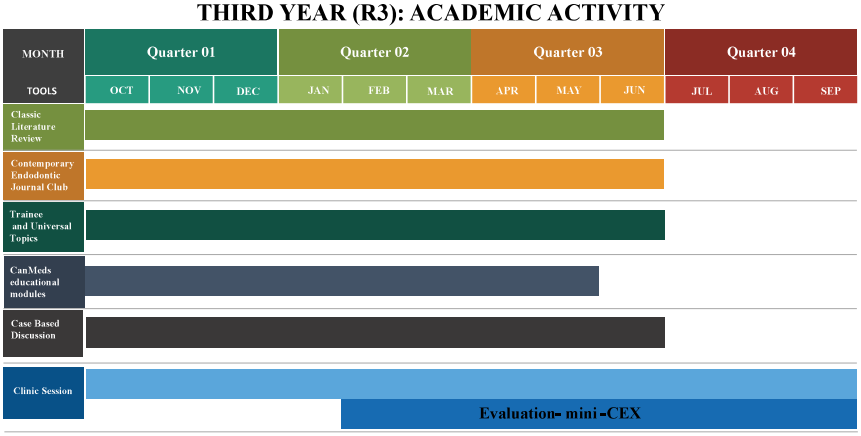
First Year (R1): ACADEMIC ACTIVITY



SECOND YEAR (R2): ACADEMIC ACTIVITY

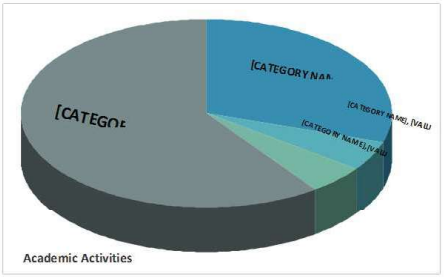


THIRD YEAR (R3): ACADEMIC ACTIVITY



General Principles

1. The didactic and clinical courses must ensure that the instructional content continues to meet the program goals and objectives.
2. The content of didactic courses and the extent of clinical experience must exceed BDS or an equivalent dental graduates' level.
3. A minimum of 60% (6 sessions/week) of the total clock hours in a 3-year (36 months) program is devoted to clinical care (Practice limited to Endodontics).
4. The educational component of the SBE program must provide information emphasizing principles and recent developments in order to meet the SBE program objectives.
5. Efforts should be focused on enhancing trainees' responsibility for self-directed learning.
6. The educational components of the SBE program encompass the following:
   A. Endodontic Core Topics and CanMEDs Roles (30%)
   B. Biomedical Sciences and Universal Topics (5%)
   C. Trainee-Selected Topics (5%)
   D. Clinical Endodontic Training (60%)



Weekly Schedule for Residents

Day	A.M.	P.M.
Sunday	Trainee-selected Topics / CanMEDs Roles[7]	Clinic
Monday	Oral Case Presentation Seminar	Clinic
Tuesday	Classic Literature Review Session/ Contemporary Endodontic Journal Club	Clinic
Wednesday	Clinic	Clinic
Thursday	Professional Session [8]	Clinic

CanMEDs Roles Teaching Sessions Minimum Number: 44 sessions[9]
- Endodontic Expert: 7 sessions
- Communicator: 4 sessions
- Collaborator: 6 sessions
- Leader: 6 sessions
- Health Advocate: 6 sessions
- Scholar: 8 sessions
- Professional: 4 sessions
- Quality Improvement: 3 sessions

Universal Topics Sessions Minimum Number: 9 sessions
- Introduction: 2 sessions
- Diabetes and metabolic disorders: 2 sessions
- Medical and surgical emergencies: 1 session
- Frail elderly: 1 session
- Ethics and healthcare: 3 sessions

Endodontic Core Topics Sessions Minimum Number: 180 sessions
- Oral Case Presentation Seminars: 90 sessions
- Classic Literature Review Sessions: 45 sessions
- Contemporary Endodontic Journal Club: 45 sessions

Clinical Endodontic Training Sessions Minimum Number: 624 sessions
- First level: 192 sessions
- Second level: 216 sessions
- Third level: 216 sessions

Trainee-selected Topics Sessions Minimum Number: 16 sessions
- Clinical Research: 8 sessions
- Practice Management: 8 sessions

[7] An estimated 20–30 sessions per year will be used for trainee-selected topics and CanMEDs Roles alternatively.
[8] The professional session will be used for Self-Directed Learning during all years, and can be utilized for universal topics.
[9] Sessions will be four hours long, either in the morning or afternoon.

Teaching Tools

- **CanMEDs Educational Modules**
- **Endodontic Core Topics**
- **Biomedical Science and Universal Topics**
- **Trainee-selected Topics**
- **Clinical Endodontic Training**

CanMEDS Educational Modules[10]

Endodontic Expert
- Lecture or Large Group Session: Foundations of the Endodontic Expert Role
- Presentation: Teaching the Endodontic Expert Role
- Guided Reflection: Endodontic Expert Role competence continuum in day-to-day practice
- Simulation: Patient-centeredness in patient-endodontist relationships
- Case-based Discussion: Oral case presentation via SNAPPS
- Coaching: One-minute preceptor template for coaching the Endodontic Expert Role
- Coaching: "I don't know" activity to develop help-seeking behaviors
- Boot camp: Advanced Preclinical Endodontics
- Classic Literature Review or Team-Based Learning Session: Background of Endodontics
- Contemporary Journal Club or Team-Based Learning Session: Updates on Endodontics

Communicator
- Lecture or Large Group Session: Foundations of the Communicator Role
- Lecture or Large Group Presentation: Teaching the Communicator Role
- Small Group Activity: Communication scripts for day-to-day communication
- Coaching: Resident coaching on common written communications

Collaborator
- Lecture or Large Group Session: Foundations of the Collaborator Role
- Presentation: Teaching the Collaborator Role
- Case Report: Intention vs. Impact
- Guided Reflection and Discussion: Understanding the roles and responsibilities of others
- Coaching: Handover in everyday practice
- Coaching: Steps and hints for managing differences and resolving conflict
- Literature Review or Team-Based Learning: Review of interdisciplinary practice

Leader
- Lecture or Large-group Session: Foundations of the Leader Role
- Presentation: Teaching the Leader Role
- Small Group Teaching: Leading and managing in everyday practice
- Case Report: Leader Role competencies
- Self-Reflection: Patient safety and quality improvement
- Self-Directed Learning: Time management assignment—where does the time go?

[10] http://canmeds.royalcollege.ca/en/tools

Health Advocate

- Lecture or Large Group Session: Foundations of the Health Advocate Role
- Presentation: Teaching the Health Advocate Role
- Guided Reflection and Discussion: Recognizing health advocacy
- Small Group Learning: Inventorying and evaluating your health advocacy
- Guided Reflection and Discussion: Health advocacy resources
- Case Report: Preparing a case report on health advocacy habits
- Classic Literature Review or Team-Based Learning Session: Review of health promotion and disease prevention

Scholar

- Lecture or Large Group Session: Foundations of the Scholar Role
- Lecture or Large Group Presentation: Teaching the Scholar Role
- Guided Reflection and Discussion: Planning for learning
- Coaching: Coaching learners to give and receive feedback
- Teaching Scripts: Teaching script sample and template for evidence-informed decision-making (EIDM)
- Case Report: Teaching report for the Scholar Role
- Guided Reflection: Evidence-informed decision-making in day-to-day practice
- Research Planning: Sample timetable for a two-year study
- Classic Literature Review or Team-Based Learning Session: Evidence-based endodontics and how to read scientific articles

Professional

- Lecture or Large Group Session: Foundations of the Professional Role
- Lecture or Large Group Presentation: Teaching the Professional Role
- Case Report: Professionalism scenarios and case discussion
- Case Report: Learner-selected case report and reflection

Quality Improvement

- Fundamentals of QI
- QI Charter
- QI Workshop

Endodontic Core Topics

Topic	Learning outcomes
Clinical Examination, Diagnosis, Case Assessment, and Treatment Planning	• Define diagnosis and use current terminology to communicate pulpal and periapical disease. • Learn the importance of endodontic diagnosis and show confidence in a variety of clinical diagnostic scenarios. • Know how a proper diagnosis can be achieved: subjective, objective assessment, and plan analysis. • Demonstrate a sound understanding of a variety of pulp testing methodologies and techniques. • Compare the efficacy rates for different clinical diagnostic tests in identifying pulp conditions. • Able to select, expose, and interpret digital radiograph necessary to aid in endodontic diagnosis. • Establish differential diagnosis of the lesions from normal anatomic structure on the radiographs. • Construct a definitive endodontic diagnosis according to classifications suggested by the American Association of Endodontists. • Learn the clinical definition of normal and diseased pulpal and periapical tissue and its correlation with histology. • Learn proper consultation protocol. • Develop and report on an appropriate endodontic treatment plan based on the likely prognosis and outcome of various treatment options. • Explain with patient about endodontic diseases and the value of treatment in relation to overall health. • Apply multiple factors that will play a role in determining the ultimate outcome of the case. • Identify the variety of factors that may complicate proposed endodontic treatment plan, periodontal considerations, surgical considerations, restorative, prosthodontic considerations, anxiety, and scheduling considerations.
Dental Radiography and Radiographic Interpretation	• Demonstrate sound understanding of the application and limitation of radiography to endodontics. • Memorize the recommendations of the National Council on Radiation Protection and follow the recommendation for prescribing dental radiography: ALARA principle in dental radiography for patient safety. • Demonstrate sound understanding of the radiographic interpretation of normal oral anatomy, pulp space morphology, and potential pathosis. • Demonstrate sound understanding of the specific sensor placement and cone positioning. • Demonstrate understanding of the principles of cone beam computed tomography (CBCT).

	• Recognize the joint position statement of the American Association of Endodontists and the American Academy of Oral and Maxillofacial Radiology on the use of CBCT in endodontics. • Identify the ability of CBCT versus traditional periapical radiographs to identify root canal anatomy and apical lesions. • Learn radiographic analysis to determine endodontic outcome.
Magnification in Endodontic	• Identify the structure of the surgical operating microscope. • Recognize the advantages of and indications for using a microscope in endodontic treatment. • Recognize uses of various levels of magnification in endodontics. • Demonstrate a sound knowledge of the outcome in endodontics when using magnification. • Recognize operator positioning while using the surgical operating microscope. • Name armamentaria needed for operating microscope. • Point out the advantages of using a dental operating microscope during endodontic procedures.
Orofacial Pain	• Define pain and the neurophysiology pathway: perception of nociception. • Learn different etiologies of orofacial pain. • Describe the referred pain phenomenon and its theories. • Define terminologies related to orofacial pain: nociceptive, hyperalgesia, and Allodynia. • Name different classifications and disorders of orofacial pain. • Recognize clinical features and management of temporomandibular joint disorders, local masticatory muscle disorders, systemic masticatory muscle and sinuses disorders. • Recognize rhinosinusitis and endodontic disease. • Recognize pathophysiology and mechanism of neuropathic pain and management. • Recognize clinical features and management of vascular and neurovascular orofacial pain and headaches. • Recognize clinical features and management of Atypical Odontalgia/Persistent Dentoalveolar Pain. • Accurately construct a diagnosis of endodontic disease associated with both symptomatic and asymptomatic teeth. • Develop an accurate differential diagnosis of dental pain based on clinical signs and symptoms, special tests, and radiographic findings. • Recognize sources and features of non-odontogenic dental pain.

Anesthesia and Pain Control	• Demonstrate a sound understanding of the pharmacology of local anesthetics. • Demonstrate a sound understanding of the types and mechanisms of action of local anesthetics. • Apply appropriate local anesthetics for different case presentations and according to the patient's medical history. • Recognize the possible adverse effects and drug interactions of local anesthetics. • Identify the effects of systemic diseases or conditions on local anesthetics. • Apply methods of confirming anesthesia effectiveness. • Learn anatomy and techniques related to local anesthetic administrations. • Identify methods to increase success of the inferior alveolar nerve block and alternative injection sites; compare and contrast different attempts to increase success. • Identify methods of anesthesia for surgical procedures. • Identify and recognize the efficacy of analgesics for managing endodontic pain and their interactions with other drugs. • Recognize that management of endodontic pain starts with the "three Ds": diagnosis, definitive dental treatment, and drugs. • Recognize the pharmacology and therapeutics related to analgesic use for management of pain. • Recognize prevalence of different types of pain in endodontics. • Recognize factors and incidence associated with endodontic inter-appointment emergencies and flare-ups. • Apply appropriate pain and anxiety control for patients attending for non-surgical and surgical treatment on a planned or emergency basis.
Management of Urgent Endodontic Situations and Emergencies	• Define and know true endodontic urgent situations and emergencies. • Learn about the spread of infection into facial spaces and its management. • Apply the 3Ds protocol when encountering endodontic urgent and emergency cases. • Recognize how to manage and treat different endodontic emergencies in a timely manner. • Name the appropriate pharmacological adjunct and updated guidelines. • Recognize proper management of abscess and cellulitis. • List the indications of incision for drainage and describe its principles. • Explain and recognize the flare-ups, incidence, causes, predisposing factors, and management.

Structure, Function, and Reactions to Caries and Dental Procedures of Dental-Pulp Complex	• Learn the embryology of the dental-pulp complex. • Learn the dental-pulp complex structure and cells. • Identify physiology and pathology of dentin hypersensitivity. • Recognize dental-pulp complex reactions to local anesthetics, restorative materials, caries, and other dental procedures. • Describe the sequence of the dental-pulp complex after pulp exposure. • Discuss pulpal pressures, innervation, microvasculature, and pulpal hemodynamics. • Identify the age change and calcification of the dental-pulp complex.
Pulpal, Periapical Pathology and Immunology	• State the normal dental pulp structure: pulpodentin complex, cells, innervation, and circulation. • Define etiological factors for pulpal and periapical immune response. • Discuss important concepts for understanding the mammalian immune response. • Define the inflammatory response mechanisms of the dental pulp and pathogenicity of apical periodontitis. • Identify specific and non-specific mediators of pulpal and periapical inflammation. • Classify pulpal diseases and their clinical and histologic features. • Describe the pulpal immunologic response to irritation. • Name immunological defender: cells and antibodies. • Recognize the etiology, pathogenesis, and histopathology of pulp and apical periodontitis. • Recognize the correlation between clinical and histologic findings in pulp and periapical conditions. • Demonstrate understanding of the dynamic interaction between host defense mechanisms and microbial insults in case of pulp and periapical inflammation. • Distinguish the effect of genetic and systemic disease risk factors of persistent apical periodontitis.
Microbiology of Endodontic Infections	• Distinguish between various methods of identifying microbial flora and recognize their limitations. • Recognize apical periodontitis as an infectious disease and its pathogenicity. • Distinguish different bacterial types and understand their virulence properties. • Outline the prevalence of different microorganisms in endodontic infections. • Memorize the pathways by which microorganisms can infect the root canal system. • Name and compare different types of endodontic infections.

	• Recognize the historical background of microbiology in endodontics. • Describe and understand the dynamics and microbiota of primary endodontic infections. • Describe and understand the dynamics and microbiota of symptomatic endodontic infections. • Describe and understand the dynamics and microbiota of post-treatment disease. • Review the chances for developing bacteremia after different endodontic interventions. • Describe anachoresis and its clinical significance. • Debate focal infection theory. • Correlate specific microorganisms with signs and symptoms. • Understand how biofilms form and describe their structure. • Describe and understand how bacteria can withstand the disinfection process and prolonged periods of starvation induced by the inhospitable environment of the filled root canal system. • Describe and understand different forms of extra-radicular bacterial existence. • Recognize the host factor: Genetic predisposition to apical periodontitis vs. systemic diseases consequent to apical periodontitis. • Name and appraise microbiological assessment of root canal disinfection procedures.
Teeth Morphology, Anatomy, Pulp Morphology, and Morphological Anomalies	• Learn methods to identify root canal morphology. • Learn variation of clinical root canal morphology classification for individual teeth according to Weine et al. (1969). Also, recognize other classification systems of the canal configuration. • Learn the incidence and location of canals of individual teeth. • Demonstrate a sound knowledge of common root canal morphology and natural variations in canal geometry. • Illustrate a sound knowledge of apical root anatomy in the apical region. • Describe relationships between anatomic apex, radiographic spex, and actual location. • State the frequency, location, and direction of the lateral, secondary, and accessory canals. • Recognize morphological anomalies of teeth and their clinical implications.

Access, Cleaning, and Shaping of the Root Canal System	• Learn historical perspectives of access, cleaning, and shaping the root canal system. • Describe mechanical and biologic objectives of access, cleaning, and shaping. • Recognize steps of cleaning and shaping: access, working length, cleaning, and shaping. • Learn principles, anatomy, and guidelines for access and identification of root canal orifices for each tooth. • Apply knowledge of root canal anatomy, microbiology, and endodontic instruments to achieve proper cleaning and shaping of the root canal system. • Learn instruments, devices, and tools used for each step of cleaning and shaping the root canal system. • Describe the different techniques for cleaning and shaping the root canal system. • Recognize examples of historic and controversial concepts of canal preparation. • Illustrate principles for preparation of complex root canal systems, including confluence of canals, deep spitted canals, S-shaped root canals, oval canals, and C-shaped root canals. • Learn the biological and chemical principles/properties of classic and modern irrigants solutions used during cleaning and shaping the root canal system. • Learn different devices and protocols of irrigation delivery systems. • Learn the antimicrobial effect of irrigation solutions used during cleaning and shaping of the root canal system.
Mechanical Properties of Root Canal Instruments	• State the basic design (Taper, Flutes, Pitch length, Cross-sectional, and tip configuration) of the most common root canal instruments and their effect on the instrument's mechanical behaviors (cutting efficiency, centering ability, debris removal, flexibility, and safety). • Memorize sound understanding of the modes of action of different root canal instruments (Hand, Rotary, Reciprocating). • Define the metallurgy of different root canal instruments (Carbon steel alloy, Stainless steel alloy, Nickel Titanium alloy) and their effect on the physical properties of root canal instruments. • Recognize the influence of rotary instrument design on its mechanical behavior. • Describe the operating principle between sonic and ultrasonic systems. • Describe the proper use of instruments and factors to prevent complications.

	• Describe techniques for sterilization and disinfection of root canal instruments. • Explain the rationale for the selection and use of each instrument in endodontic practice.
Obturation of the Cleaned and Shaped Root Canal System	• State the biological aspects of root canal obturation. • Memorize the proper timing for obturation. • Determine the ideal characteristics of adequate obturation. • Learn properties of obturation materials: physical and biological consideration. • Learn different obturation techniques: historical and modern. Discuss clinical applications for each technique. • Identify the tools and devices used for root canal obturation. • Learn outcome measures and data related to obturation materials/techniques and risk factors.
Nonsurgical Endodontic Retreatment	• Define orthograde retreatment and recognize various etiological factors/pathogenicity related to post-treatment endodontic disease. • Design a diagnostic plan for diagnosing post-treatment endodontic disease. • Recognize decision-making process in assessing teeth with post-treatment endodontic disease. • Learn methods to gain access to root canal and coronal disassembly, removal of crowns, posts, and blockage. • Recognize armamentarium and the techniques of post removal, and other intra-canal instruments. • State efficacy and drawbacks of retreatment techniques: ultrasonic vs retrieval kits. • Possess a sound understanding of the solvents for root canal fillings. • Learn outcome measures and data for orthograde retreatment endodontics and risk factors.
Surgical Endodontic Treatment	• Describe history, indications, and contraindications of surgical endodontics. • Demonstrate a sound knowledge of the general biologic principles of wound healing. • Point out the need for proper preoperative assessment of the type of procedure planned, anatomical considerations, and type of patient. • State the potential application of CBCT in preoperative surgical planning. • Describe different surgical endodontic procedures: incisions & drainage, periapical surgery, and intentional replantation. • Demonstrate a sound knowledge of different procedures/techniques and materials of surgical endodontics: local anesthesia, flap design, osteotomy, root resection, retrograde preparation and filling, hemostasis and sutures.

	• Name hemostatic agents and materials available to control bleeding during a surgical procedure. • List the advantages of using an ultrasonic system during retro-preparation. • Memorize the properties of the different retro-filling materials and be able to choose the most suitable one. • Describe the postoperative instructions and care needed to improve the prognosis. • Demonstrate a critical understanding of the retrograde approach in the use of a surgical endodontics microscope and patient positioning. • Understand the techniques involved in guided tissue regeneration and evaluate their appropriateness to given clinical situations. • Learn outcome measures and data for surgical endodontics and risk factors.
Management of Mishaps and Complications	• Identify and recognize how to prevent endodontic procedural mishaps. • Identify types, causes, and mechanisms of endodontic procedural mishaps, including, but not limited to, irrigants extrusions, perforations, transportation, ledges, blocks, fractured posts, and file separation. • Learn different methods, protocols, and materials to manage endodontic procedural mishaps. • Identify common causes of injury to the inferior alveolar nerve related to endodontics. • Learn outcome measures and data for management of teeth with endodontic procedural mishaps and risk factors.
Endodontic Traumatology	• Learn and identify the most common types of dental trauma injuries. • Learn how to conduct the history, medical clearance, diagnostic tests, clinical and radiographic examinations, and analysis for patients with dental injuries. • Describe the endodontic considerations and different treatment strategies for each type of traumatic dental injury: historical and current guidelines. • Identify follow-up rates and procedures for each type of traumatic dental injury. • Describe possible sequelae that may develop over time to pulp, periradicular tissues, and hard tissues for each type of traumatic dental injury. • Recognize surface resorption, inflammatory resorption, and replacement resorption and describe their treatment strategies. • Learn outcome measures and data for management of teeth with dental injuries and risk factors.

Endodontic Management of Immature Teeth	• Describe the tooth development: biological and anatomical considerations. • Express the role of pulpal diagnosis and case assessment in treatment planning of immature teeth. • Describe different procedures for management of immature teeth with pulpal and periapical diseases. • Learn mechanism of action material used to manage immature teeth. • Learn outcome measures and data for management of immature teeth and risk factors.
Vital Pulp Therapy	• Describe mechanisms of reparative bridge formation, including pulpal immune responses. • Describe the techniques/procedures and materials for vital pulp therapy. • Describe the indications and contraindications for vital pulp therapy. • Describe diagnostic criteria for successful vital pulp therapy. • Describe restorative options after vital pulp therapy. • Learn outcome measures and data for vital pulp therapy and risk factors.
Endodontic Regeneration	• Define and identify biological principles associated with regenerative endodontics. • Identify the considerations and indications for regenerative endodontics. • Learn translational studies in regenerative endodontics. • Learn regenerative endodontic procedure: case selection and clinical protocol. • Describe the effect of techniques, materials, and irrigants on clinical and radiographical outcomes of regeneration. • Learn outcome measures and data for regenerative endodontics and risk factors.
Outcomes in Endodontics	• Learn the historical studies and methods of endodontic outcomes. • Define different terms and definitions used for outcome assessment: success and survival. • Define different tools used in the outcome assessment: clinical and radiographic. • Define factors affecting endodontic outcomes. • Learn outcome measures and data for endodontic treatment: non-surgical and surgical. • Appraise the differences in outcome assessment of implants compared to that of non-surgical endodontic treatment. • Appraise the evidence presented on the survival of root-filled teeth: Studies conducted in a controlled clinical setting vs. epidemiological studies (Studies utilizing insurance databases vs. Studies utilizing radiographic assessment).

	• Identify the effect of primary root canal treatment on patients' quality of life. • Compose reasons for endodontic post-treatment diseases.
Restoration of Endodontically Treated Teeth	• Recognize specific modifications and changes to teeth following loss of vitality or endodontic treatment and distinguish their clinical implications. • Apply a multidisciplinary assessment before any treatment is initiated. • Describe the requirements and timeline of an adequate restoration after endodontic treatment. • Identify all options of restorative materials available for endodontically treated teeth. • Identify the need for full coverage to be placed on endodontically treated teeth. • List indications for post placement, common types, advantages, and disadvantages. Also, describe clinical procedures for tooth preparation, post placement, adhesive, and partial restorations. • Recognize postoperative risks to unrestored teeth and rationale for immediate restoration. • Appraise studies of coronal leakage and persistent endodontic infection. • Discuss clinical failure rate related to different types of restoration.
Root Resorption	• Define the different types of resorption and identify their sub-classifications. • Determine the etiology and pathogenesis of each type of resorption. • Describe the histological features of resorption. • State the clinical and radiographic characteristics of each resorption type. • Assess potential use of CBCT in diagnosing root resorption. • Describe the different treatment strategies. • Illustrate the prognoses of each resorption type.
Bleaching	• Identify the etiology of tooth discoloration. • Recognize the means of preventing coronal discolorations. • Develop a proper treatment plan, alternatives, and outcomes for internal bleaching. • Illustrate the contraindications of bleaching. • Learn internal bleaching materials. • Describe the different methods for internal bleaching. • Apply appropriate methods to restore the access cavity after bleaching. • Recognize the complications associated with bleaching and the means of prevention.

Endodontic and Periodontal Interrelationships	• Analyze the interrelationships between endodontic and periodontal diseases. • Point out the anatomic pathways of communication between the dental pulp and periradicular tissues. • Recognize the influence of pulpal pathologic condition and endodontic procedures on the periodontium. • Recognize the influence of periodontal disease and procedures on the dental pulp. • State etiological and contributing factors for endodontic-periodontal diseases. • Memorize clinical classification of endodontic-periodontal diseases according to leading international societies/organizations and endodontic textbooks. • Identify the clinical and radiographic characteristics of each type and distinguish between them. • Determine differential diagnosis between pulpal and periodontal disease. • Describe the clinical procedure and management strategies for different types of endodontic-periodontal disease. • Illustrate the prognoses for each type of endodontic-periodontal disease. • Identify treatment alternatives and their indications.
Endodontic and Orthodontic interrelationships	• Identify types of orthodontic movements and their effect on the dental pulp. • Describe the influence of orthodontic forces on the cellular responses of the human dental pulp. • Define the effect of orthodontic forces on teeth response to pulp vitality tests. • Describe the influence of orthodontic forces on pulpal response of traumatized teeth. • Describe the role of orthodontic forces in external root resorption, internal root resorption, and invasive cervical root resorption. • Recognize the impact of orthodontic treatment on non-surgical and surgical root canal treated teeth. • Recognize the influence of teeth undergoing regeneration, apexogenesis, or apexification by orthodontic forces. • Describe the orthodontic aids for endodontic treatment. • Learn the physiological pathological process of root resorption during orthodontic treatment and its endodontic consideration.

Evidence-based Endodontics	• Learn levels of evidence-based practice. • Learn and understand the design of systemic review and how to critically appraise it. • Learn the anatomical and physiological features of a scientific article. • Able to select and appraise scientific literature that is relevant to endodontics. • Understand the implications of research findings for individual patients, elicit patients' own preferences, and develop an appropriate management plan based on the combination of this information. • Learn how to critically appraise endodontic literature to identify the strengths and weaknesses in order to assess the usefulness and validity of the research findings. • Different types of research investigation.

Biomedical Science and Universal Topics

Topic	Learning outcomes
Advanced Head and Neck Anatomy	• Learn general and special gross anatomy, embryology, and neuroanatomy of the human body with emphasis on the head and neck. • List the structures and blood supply of the head and neck. • List the cranial nerves and describe their function. • Learn the pain processing center. • Learn function tests of trigeminal and facial nerves. • Learn the structure of the tongue, oropharynx, and temporomandibular joint. • Describe the masticatory muscles. • Learn nasal and oral cavities and sinuses. • Interpret pathological implications: facial space infection.
Advanced Dental Radiology	• State basic principle of intra/extra-oral radiographic techniques in endodontics. • State functions, strengths, and weaknesses of two-dimensional dental radiology about endodontics. • State essential functions, strengths, and weaknesses of three-dimensional dental radiology about endodontics. • Distinguish radiographic, interpret potential endodontic pathosis. • Learn causes for Unsatisfactory Intraoral Radiographic Examinations.
Advanced Oral Pathology	• Learn common oral lesions resulting from developmental, inflammatory, metabolic, and neoplastic changes. • Construct a differential diagnostic approach to jaw lesions, that is, cysts of the oral region, odontogenic tumors, benign and malignant nonodontogenic tumors, inflammatory jaw lesions, and metabolic and genetic jaw diseases. • Learn the histopathology of common oral lesions. • Differentiate some common diseases that might be confused with other conditions in daily endodontic practice. • Better understanding of oral pathology as an integral part of their education. • Point out appropriate approach to recognize, examine, and diagnose different kinds of oral disease. • Construct the best differential diagnosis of bone and soft tissue lesions. • Recognize when to proceed with treatment and when to refer the case for additional information. • Point out some developmental origin that might be implicated in the formation of some lesions. • State the risk factors and high-risk areas of oral cancer.

Advanced Oral Biology	• Describe the biology and ecology of the oral cavity. • Name advances in molecular, cell biology, and its relation to endodontics. • Identify the molecular biology of gene expression. • State histology and physiology of the pulp. • State the principles of initiation, proliferation, differentiation, and development of the craniofacial, oral, and dental tissues. • Express a fair knowledge of the relevance of stem cells in human development and their clinical implication and significance in tissue engineering and regeneration. • Identify the most relevant genetic and epigenetic dental anomalies. • State the mechanism of wound healing and repair and regeneration of soft and hard tissues in relation to endodontics. • Express the latest literature information and current controversies on these topics related to endodontics.
Advanced Pharmacology	• Identify drugs commonly used by dentists and their patients: adult and pediatric dosing, alternatives, contraindications, and pharmacology/drug interactions. • Select analgesics and antibiotics correctly. • Analyze the impact of a patient's medications on dental management (modification of treatment plan). • Learn top prescribed drugs for medically compromised patients.
Dental Management of Medically Compromised Patient	• Learn the most common medical diseases in the Kingdom of Saudi Arabia. • Show dental management of most common medical diseases in the Kingdom of Saudi Arabia. • Identify general and systemic disease and explain their relevance to oral health and their impact on clinical treatment. • Recognize potential medical emergencies and their management. • Compose a thorough medical history and assess the medical status for a medically compromised patient. • Recognize potential medical findings and communicate with the patient's healthcare providers. • Describe clinical signs and symptoms associated with the medical condition. • Recognize the impact of non-oral (systemic) diseases on oral health. • Recognize the impact of oral health on non-oral (systemic) diseases. • Plan how to evaluate and assess the safety of providing dental care to medically complex patients.

	• Identify appropriate laboratory tests for assessing medically complex patients. • Describe and interpret clinical and laboratory assessment of patients with various medical disorders. • Construct dental treatment modifications associated with the medical conditions. • Recognize the potential impact of the medical conditions or drugs on homeostasis. • Describe the pre-operative assessment and post-operative management of patients with impaired homeostasis. • Recognize the potential impact of medical conditions or drugs on immunity. • State indications for pre-operative or post-operative prophylaxis antibiotics. • State the rationale and justification for implementing modifications to dental care and medications. • State the potential side effects and interactions associated with the medication. • List the effects of medications on the oral cavity, including adverse drug effects. • State pre- and post-operative measures to prevent medical emergency.

Universal Topics (To be completed through the training period)

Universal topics are educational activities that are developed for and aimed at all specialties.

Priority will be given to subjects that are of:
- High value
- Interdisciplinary and integrated
- Require expertise that might be beyond the availability of local clinical training sites.

Universal topics will be developed centrally by SCFHS and will be available as e-learning. Personalized access to the online module will be approved for each trainee. Each universal topic will have a self-assessment at the end of the module (Figure 2). As indicated in the "executive policies of continuous assessment and annual promotion," universal topics will be a mandatory component of the criteria for the annual promotion of trainees from their current to subsequent level of training. Universal topics will be **distributed over the whole period of training** according to the study plan approved by the scientific council. These topics may include the following:

Module 1: INTRODUCTION	
Topic	**Learning outcomes**
Safe drug prescribing	• Recognize the importance of safe drug prescription in healthcare. • Describe various adverse drug reactions with examples of commonly prescribed drugs that can cause them. • Apply the principles of drug–drug interactions, drug–disease interactions, and drug–food interactions in common situations. • Apply the principles of prescribing drugs in special situations such as renal failure and liver failure. • Apply the principles of prescribing drugs in elderly, pediatric, pregnant, and lactating patient groups. • Promote evidence-based, cost-effective prescription. • Discuss the ethical and legal frameworks governing safe-drug prescription in Saudi Arabia.
Antibiotic Stewardship	• Recognize antibiotic resistance as one of the most pressing global public health threats. • Describe the mechanism of antibiotic resistance. • Determine appropriate and inappropriate use of antibiotics. • Develop a plan for safe and proper antibiotic use that includes the correct indications, duration, types, and discontinuation. • Be aware of local guidelines for the prevention of antibiotic resistance. Describe the prognosis of sepsis, SIRS, and DIC.
Module 3: Diabetes & Metabolic Disorders	
Topic	**Learning Outcomes**
Recognition and management of diabetic emergencies	• Describe the pathogeneses of common diabetic emergencies including their complications. • Identify risk factors for and groups of patients vulnerable to such emergencies. • Recognize patients presenting with diabetic emergencies. • Institute immediate management. • Refer patients to the appropriate subsequent level of care. • Counsel patients and their families in the prevention of such emergencies.
Management of diabetic complications	• Describe the pathogeneses of the important complications of Type 2 diabetes mellitus. • Screen patients for such complications. • Provide preventive measures for such complications. • Treat such complications. • Counsel patients and families, with special emphasis on prevention.

Module 4: Medical & Surgical Emergencies	
Topic	Learning Outcomes
Management of hypotension and hypertension	• Triage and categorize patients. • Identify patients who require prompt medical and surgical attention. • Generate preliminary diagnoses based on history and physical examination. • Order and interpret urgent investigations. • Provide patients with appropriate immediate management. • Refer patients to the subsequent level of care if required.
Module 6: Frail Elderly	
Topic	Learning outcomes
Care of elderly patients	• Describe the factors that should be considered while planning care for elderly patients. • Recognize the needs and well-being of caregivers. • Identify local and community resources available for the care of elderly patients. • Develop individualized care plans for elderly patients with input from other healthcare professionals.
Module 7: Ethics & Healthcare	
Topic	Learning outcomes
Evidence-based approach to smoking cessation	• Describe the epidemiology of smoking and tobacco use in Saudi Arabia. • Review the effects of smoking on smokers and their family members. • Use pharmacological and nonpharmacological measures to effectively treat tobacco use and dependence. • Effectively use pharmacological and nonpharmacological measures to treat tobacco use and dependence in special population groups, such as pregnant women and patients with psychiatric problems.
Patient advocacy	• Define patient advocacy. • Recognize patient advocacy as a core value that governs medical practice. • Describe the role of patient advocates in the care of patients. • Develop a positive attitude toward patient advocacy. • Be a patient advocate in conflictive situations. • Be familiar with local and national patient advocacy groups.

Ethical issues: treatment refusal, patient autonomy	• Predict situations where a patient or family is likely to decline prescribed treatment. • Describe the concept of "rational adult" in the context of patient autonomy and treatment refusal. • Analyze key ethical, moral, and regulatory dilemmas in treatment refusal. • Recognize the importance of patient autonomy in the decision-making process. • Counsel patients and families declining medical treatment in light of patients' best interests.

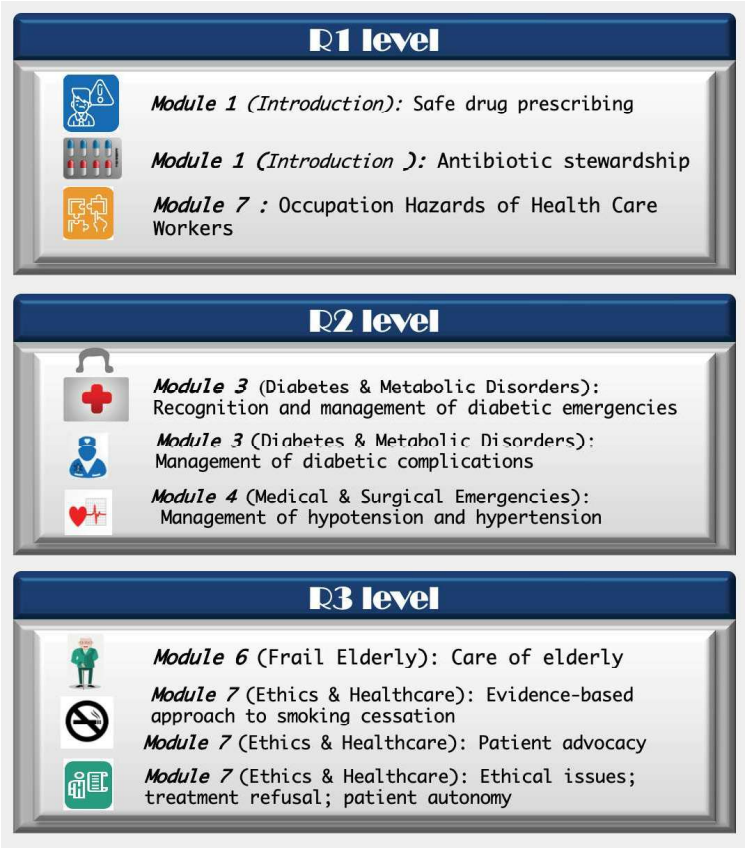


Figure 2: Universal Topics Modules

Trainee-Selected Topics

Residents will have the opportunity to choose any of the following educational sessions to fulfill their needs and enrich their learning experience:

Clinical Research
- Research idea and question
- Grant request/Research proposal
- Electronic literature search
- Epidemiology and study design
- Data management
- Reference management
- Manuscript writing
- Submission for publication

Dental Practice
- Project Plan (Project Charter)
- Project Management
- Personal Traits and Behaviors
- Leadership Styles
- Organization Structure
- Change Management
- Communication
- Decision Making

Clinical Endodontic Training

A minimum of 60% of total clock hours during resident training should be devoted to clinical care.

Residents should achieve competencies in the following areas:
- Clinical examination, diagnosis, treatment plan
- Outcome evaluation (recall and follow-up)
- Dental radiography and other diagnostic imaging technology
- Nonsurgical root canal treatment of all teeth types
- Nonsurgical endodontic retreatment of all teeth types
- Management of endodontic treatment on medically compromised patients
- Perform nonsurgical endodontic therapy under sedation and general anesthesia
- Management of mishaps and complications
- Surgical endodontic therapy
- Emergency treatment for various endodontic conditions
- Management of patients with orofacial pain and anxiety
- Preparation of space for intraradicular restoration of endodontically treated teeth
- Perform all endodontic procedures under a microscope
- Endodontic management of immature teeth
- Vital pulp therapy
- Apexification/apexogenesis
- Regenerative endodontics
- Endodontic care of teeth with traumatic injuries

According to the resident's achievement of competencies to perform specific procedures, a committee will make a decision regarding performing competencies under one of the following supervision levels:

1	Observing the activity
2	Acting with direct supervision present in the same clinic
3	Acting with supervision available within minutes
4	Acting unsupervised
5	Providing supervision to juniors

The following table shows supervision/competency:

Supervision / Competency	Induction	Junior	Senior
	R1	R2	R3
Diagnose pulpal and periapical diseases	2	3	4
Non-surgical endodontic treatment and retreatment	2	3	4
Surgical endodontic treatment	1	2	4
Emergency treatment for endodontic conditions	3	4	5
Use of magnification technologies beyond that of magnifying eyewear. These may include but are not limited to operating a microscope, endoscope, orascope, or other developing magnification technologies.	2	4	5
Endodontic management of complications/mishaps occurring during root canal therapy, including but not limited to perforation and file separation.	1	2	4
Intraradicular restorations in endodontically treated teeth. This includes the preparation of post space and core build-up restorations.	2	4	5
Vital pulp management: indirect, direct-pulp capping, and apexogenesis	2	4	5
Endodontic management of traumatic dental injuries	2	4	5
Management of necrotic immature teeth: apexification procedures, revascularization/ regenerative endodontics	2	4	5

SECTION IV: ASSESSMENT AND EVALUATION

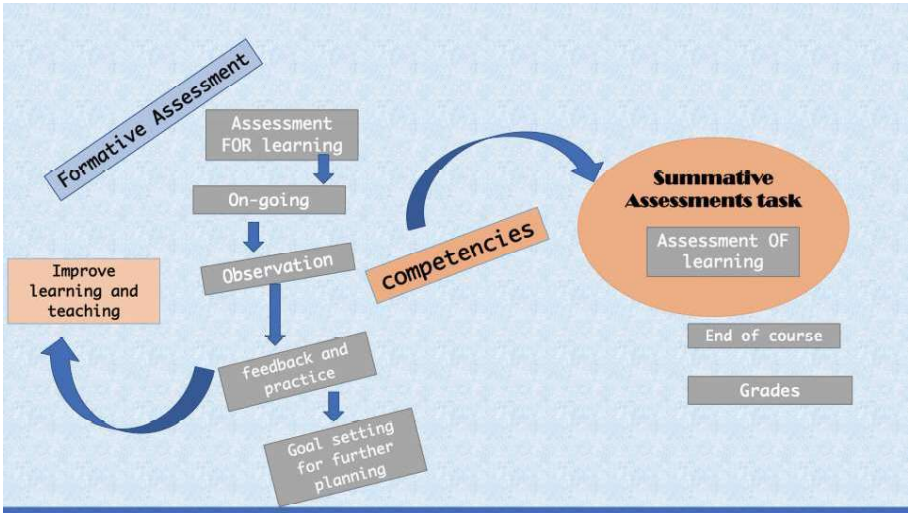
Introduction

The assessment plan is the most dynamic power of the curriculum and drives the learning process. While designing the competency-based assessment, all domains of learning—knowledge, skills, and attitude—should be considered. In this curriculum, competencies will be assessed via a **formative** and **summative** assessment tool that addresses all three domains of learning.

The formative assessment provides continuous multiple and variable insights into residents' performance year round. It is composed of different tools that intend to measure various aspects of competencies. On the other hand, the summative assessment evaluates residents' learning at the end of an instructional unit by comparing it against standards or benchmarks.

Promotion Rules and Regulations are adopted by the SCFHS, aligned with the CanMEDS framework of competencies, **and encompass the following general rules:**

- The assessment evaluation progresses throughout the program years starting from day one to the final assessment at the end of training.
- The assessment methods are composed of formative and summative assessment.
- The assessment methods are to facilitate learning through processes of feedback, identification of learning gaps, and repeated attempts to correct failures.
- Formative assessment includes a portfolio-based assessment, a continuous, progressive, and diverse method that should provide a broad and deep insight into residents' performance in all training components.



Features of any assessment system for Competency-Based Assessment

- All assessments are considered samples of what is there. The greater the volume and diversity of a sample, the better the validity of the results.
- The higher the risk of the competency, the bigger the sample required.
- No single assessment tool can represent all aspects of clinical competence.
- All assessment involves judgment in every component.
- Quantitative and qualitative methods of assessment complement one another.
- Feedback is an essential element of assessment.
- Assessment drives learning.
- Validity is the most important characteristic of assessment data.

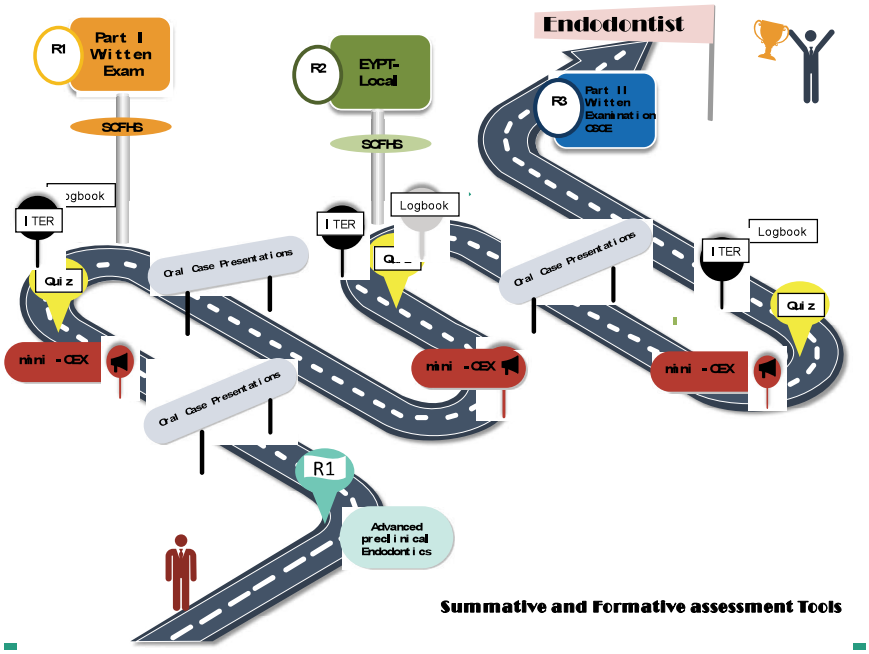
Promotion Criteria

Residents will be assessed in three domains for promotion from one level to the next. These domains are:

1. **Knowledge**
   - Specific academic tasks (Case-based Discussion & Quizzes)
   - End of year progress test (EYPT)
   - Part I written examination
   - Part II written examination
2. **Skills**
   - Logbook
   - Objective Structured Clinical Exam (OSCE)
3. **Attitude**
   - In-Training Evaluation Report (ITER)
   - Mini-Clinical Evaluation Exercise (Mini-CEX)

Assessment Road Map

Knowledge		R1		R2		R3
Academic Activity	Quizzes	✓	✓	✓		✓
	Oral Case Presentation	✓	✓	✓		✓
EYPT-Local		-	✓	✓		-
Part I Written Exam		✓		-		-
Part II Written Exam		-	✓	-		✓
Skills						
Logbook		✓		✓		✓
OSCE		-	✓	-		✓
Attitude						
ITER		✓		✓		✓
Evaluation mini-CEX		✓	✓	✓		✓



Formative Assessment Tools[11]

In-Training Evaluation Reports (ITER)

The CanMEDS-based competencies "In-training Evaluation Report (ITER)" form must be completed in electronic format on the One 45 portal, with signatures of at least two clinical supervisors, within two weeks before the end of each rotation. The program director will discuss the ITER with the resident, as necessary. The ITER will be submitted to the Regional Training Supervisory Committee of the SCFHS at the end of the rotation. The ITERs should be conducted at least three times, covering nine training months per year.

Logbook

Clinical assignments should be documented on a daily basis using the manual logbook (Excel and PowerPoint format). Evaluations will depend on accomplishment of the minimum requirements for the procedures and clinical skills, as determined earlier by Saudi Endodontic Council (SEC). Any amendments and/or modifications will be reported by the SEC as deemed necessary in response to any unforeseen circumstances. Residents are responsible for keeping full records of all treated cases throughout the program.

[11] **https://www.scfhs.org.sa/en/MESPS/Documents/General%20Bylows%20of%20Traing%20in%20Postgraduate%20Programs.pdf**

Mini Clinical Evaluation Exercise (Mini-CEX)

Assesses clinical skills, attitudes, and behaviors in a clinical situation. The Mini-CEX provides three cases for each level R1, R2, and R3 of how the trainee may interact and treat the patients. Each Mini-CEX should represent a different clinical problem and should provide samples from a wide range of problem groups. The step/stage of each case must be evaluated by two instructors, and the following skills will be assessed using Mini-CEX: endodontic assessment & diagnosis encounter, treatment management & progress encounter, and case finishing encounter.

Case-Based Discussion (CBD)

During the weekly Oral Case Presentation, the residents will present their cases according to SNAPPS reference sheet and will be assessed by a tutor utilizing a special form (Appendices). The overview CBD encounter involves a comprehensive review of clinical cases between a trainee and evaluator.

Quizzes

The quizzes are to be conducted in written MCQ format for all levels to assess residents' knowledge of the classic literature.

Training-Completion Certificate

To be eligible to sit for the final specialty examinations, each trainee is required to obtain a "Training-Completion Certificate." Based on the training bylaws and executive policy (please refer to www.scfhs.org.sa), trainees will be granted a "Training-Completion Certificate" at the end of year **R3**. The "Training-Completion Certificate" will be approved and issued by the local supervisory committee or its equivalent according to SCFHS policies.

Summative Assessment Tools[12]

Principles of Endodontics and Biomedical Examination (Part I Written Exam)

This examination is conducted in written MCQ format, held at the end of the first year (R1), and limited to junior residents. The number of examination items, eligibility, and passing score are established in accordance with the Commission's training and examination rules and regulations. Examination details and a blueprint are published on the Commission website at www.scfhs.org.sa.

End of Year Progress Test (EYPT-Local)

The end-of-year examination will be limited to R2 residents. The number of examination items, eligibility, and passing score are established in accordance with the Commission's training and examination rules and regulations. Examination details and a blueprint are published on the Commission website at www.scfhs.org.sa.

[12]**https://www.scfhs.org.sa/en/MESPS/Documents/General%20Bylows%20of%20Traing%20in%20Postgraduate%20Programs.pdf**

Final Endodontic Saudi Board Examination (Saudi Board Examination: Part II)

The final Saudi board examination consists of two parts:

Written Examination
After obtaining the "Training-Completion Certificate," candidates are allowed to sit this exam, which assesses their theoretical knowledge base (including recent advances) and problem-solving capabilities in the endodontics specialty. It is delivered in MCQ format and held at least once a year. The number of examination items, eligibility, and passing score are established in accordance with the Commission's training and examination rules and regulations. Examination details and a blueprint are published on the Commission website at www.scfhs.org.sa.

Clinical Examination (OSCE)
This examination assesses a broad range of high-level clinical skills including data gathering, patient management, communication, and counseling. The examination is held at least once per year, preferably as an objective structured clinical examination (OSCE) in the form of patient management problems (PMPs). Trainees will be required to pass the final written exam in order to be eligible to sit for the final clinical exam. Eligibility and the passing score are established in accordance with the Commission's training and examination rules and regulations. Examination details and a blueprint are published on the Commission website at www.scfhs.org.sa.

Board Certification

The certificate for training completion will be awarded to endodontics residents only upon successful fulfillment of all program requirements. Candidates need to pass both written and clinical examinations independently (i.e., there is no compensation for unsatisfactory results). Candidates passing all components of the final specialty examination are awarded the "Saudi Board of Endodontics" certificate.

Assessment Tools[13]

Endodontic Expert

- Multisource Feedback Assessment Tool (Appendices)
- Quarter Evaluation (Appendices)
- Direct Observation: In-Training Evaluation Report (Appendices)
- Direct Observation: Mini-Clinical Evaluation Exercise (Mini-CEX) a, b (Appendices)
- Direct observation: Advanced Preclinical Endodontics Competencies (Appendices)
- Monitoring Form: Oral Case Presentation Assessment (Appendices)
- Written Exams and Quizzes: Multiple Choice Questions (MCQs)

Communicator

- Consultation Letter Rating Scale (Appendices)
- Questions and answers: for the Communicator Role (Appendices)

[13] http://canmeds.royalcollege.ca/en/tools

Collaborator

- Multisource feedback: Multisource feedback for collaborator skills
- Collaborator Role Encounter Form (Appendices)
- Team Meeting Encounter Form (Appendices)
- Assignment: Collaborator Quotient (Appendices)
- Objective Structured Clinical Exam (OSCE) for the Collaborator Role

Leader

- Multisource Feedback: Leadership skills in the Leader Role
- Multisource Feedback: Managing people and resources in the Leader Role
- Quality Improvement Project: Leader Role quality improvement project
- Case Report: Leadership reflection (Appendices)

Health Advocate

- Multisource feedback: Health Advocate multisource feedback
- Written Questions and Answers: Short-answer and essay questions for the Health Advocate Role
- Objective Structured Clinical Exam (OSCE) for the Health Advocate Role

Scholar

- Multisource Feedback: Resident as Teacher multisource feedback
- Multisource Feedback: Giving and receiving feedback
- Homework Assignment: Evidence-Informed Decision-Making
- Monitoring Form: Research Project High-Level Checklist (Appendices)
- Monitoring Form: Research Project Meeting Monitoring (Appendices)

Professional

- Direct Observation: Professionalism Incident Report (Appendices)

Quality Improvement

- Self-assessment program
- Sample of QIKAT R of QI Competencies
- Balanced Score Card (Appendices)

Clinical Requirements and Competencies

General requirements should be achieved during each training level. **The minimum (Expected)** required procedures are set forth by the SBE scientific council each year.

Competency Exercises (Mini-CEX)

The following set of competency exams is required as part of the promotion criteria:

<table>
<tr><th>R1</th><th>R2</th><th>R3</th></tr>
<tr><td>3 Cases
Moderate to High Complexity Non-surgical Root Canal Treatment
Maxillary and Mandibular Molar</td><td>3 Cases
Moderate to High Complexity Non-surgical Retreatment
Maxillary and Mandibular Molar</td><td>3 Cases
Endodontics Surgery
One of them Mandibular Molar</td></tr>
<tr><td colspan="2">Expert
✓ History and examination and radiographic imaging
✓ Endodontic Diagnosis tests
✓ Endodontic Diagnosis
✓ Endodontic treatment plan and prognosis
✓ Anesthesia and pain control
✓ Caries removal, removal of filling restoration: evaluation of restorability and site isolation
✓ Access opening
✓ Cleaning and shaping
✓ Obturation technique</td><td>Expert
✓ History and examination and radiographic imaging
✓ Endodontic surgical treatment plan and prognosis
✓ Anesthesia and pain control
✓ Flap design and management
✓ Osteotomy and curettage
✓ Root end resection, retro-preparation, and root end fillings
✓ Suture technique</td></tr>
<tr><td colspan="3">Communicator
✓ Discharge summaries are concise & completed promptly
✓ Written orders and progress notes are well organized & legible</td></tr>
<tr><td colspan="3">Leader
✓ Appropriate time management</td></tr>
<tr><td colspan="3">Professional
✓ Reflects the highest standards of excellence in clinical care and ethical conduct</td></tr>
</table>

Program and Course Evaluation

Evaluation Models

- Participant-based Evaluation: learners and tutors will be surveyed for their experience, and continuous quality improvement will be achieved by developing an improvement action plan according to the results of each resident experience survey and program survey (Appendices).

- Expert-based Evaluation: an expert will be invited to evaluate the quality of the program compared to other accredited programs and international standards.
- Goal-based Evaluation: the intended competencies achievement will be evaluated by various checklists (Appendices) at the end of each stage to assess the achievements. These checklists will be delivered to residents at the end of the "Transition to Endodontics" stage, "Foundations of Endodontics" stage, "Core of Endodontics" stage, and "Transition to Practice" stage. Any deficiency will be addressed in the following stage, utilizing the time devoted for trainee-selected topics and professional (Self-directed Learning) sessions.

Evaluation Tools

- Resident Experience Survey: this survey will be conducted after the end of the junior level written examination to evaluate the quality of the junior years and residents' learning experience.
- Program Survey: this survey will be delivered to residents after the second part exam to evaluate the whole program and their learning experience.
- Experts' Onsite Visit: experts will be invited to review the program, give their independent opinion, and establish a benchmark with other accredited programs.

SECTION V: POLICIES AND PROCEDURES

Program Entry Requirements

Please refer to the updated executive policy of SCFHS on admission and registration.
Website: www.scfhs.org.sa

Resident's Responsibilities[14]

The trainee must have high morals and values and abide by all the laws in force in the Kingdom of Saudi Arabia, including the Commission's laws, regulations, and implementation rules issued by the Executive Council for Education and Training. These include the following:

[14] https://www.scfhs.org.sa/en/MESPS/Documents/General%20Bylows%20of%20Traing%20in%20Postgraduate%20Programs.pdf

- All patients to be seen are required to **be registered in the system according to the policy of the training center**.
- Resident collects all information and data necessary; consults restorability, periodontal, and prosthodontics to make a diagnosis before conducting a brief discussion with the supervisor on the diagnosis and treatment plan. After the consent form is signed, the resident will carry out the treatment and seek an assistant if needed and/or determined by the supervisor.
- Upon completion of the treatment, the resident is responsible for arranging follow-up visits.
- Documentation and data entry need to be completed at the end of the session.
- Residents are not allowed to conduct any treatment at any time without an endodontist's supervision.
- Residents should be available for consults and treat endodontic emergencies. Do not leave the clinical floor without authorization.

- **The level of faculty supervision should be as follows (subject to change per resident performance in clinics and program director approval):**

Procedure	R1	R2	R3
Clinical examination, Diagnosis, Treatment plan, Recall, and Follow up	Close supervision	Indirect Supervision	Indirect Supervision
Nonsurgical root canal therapy (Anterior Teeth)	Close supervision	Indirect Supervision	Indirect Supervision
Nonsurgical root canal therapy (Posterior Teeth)	Close supervision	Close supervision	Indirect Supervision
Surgical endodontic therapy	Observation	Close supervision	Close supervision
Mishaps and complications	Close supervision	Close supervision	Indirect Supervision
Endodontic emergencies	Close supervision	Close supervision	Indirect Supervision

- **Close supervision**: The supervisor is physically present with the resident and patient to discuss the procedure and provide help if necessary. The resident must consult the supervisor on clinical steps to procure their approval.
- **Indirect supervision**: The supervisor is not physically present within the confines of the site of patient care but is immediately available upon request of the resident.

- If a resident disregards the dress code, the supervisor should reprimand him/her. In some cases, the supervisor may ask the resident to return home to change. This will also affect the semester/quarter evaluation.

Resident's Rights

- The trainee has the right to complain to the Secretary General against the resolution of registration termination that has been imposed against him within 30 days of receiving the notification of the resolution. The Secretary General is entitled to form a permanent or temporary committee to investigate the complaint and submit recommendations for the final resolution.

- If the violation occurred in the health facility (training center) or if one of its staff members was involved, the trainee may submit his or her complaint to the training committee and academic affairs at the same facility.
- If the violation occurred in an educational activity held by the Commission in its facilities, the trainee may submit his or her complaint to the Training Executive Administration in the Commission.
- Academic counseling and support
- Supervisor's responsibilities in consideration of residents' rights, are as follows:
  1. Be available to provide advice and assistance.
  2. Be aware of high-risk patients and provide direct supervision.
  3. Review and sign off on patients' charts.
  4. Evaluate residents' performance in the clinic.

Leave

The resident will be entitled to 28 days' annual leave, plus 10 days Eid Alfetr Holiday and 10 days Hajj Holiday, in addition to the National Day Holiday. More leaves are listed in General Bylows of Traing in Postgraduate Programs of SCFHS.

SECTION VI: LEARNING RESOURCES AND FACILITIES

Learning Resources

Required Textbooks

- Seltzer and Bender's Dental Pulp Newest Edition
- Cohen's Pathways of the Pulp, Latest edition
- Endodontics, Ingle, Latest Edition
- Littele and Falace: Dental management of medically compromised patients, latest edition
- Reader, Nusstine, Drum: Successful local anesthesia for restorative dentistry and endodontics
- Kim and Kratchman: Microsurgery in endodontics, Latest Edition

Required Journals

- Saudi Endodontic Journal
- Journal of Endodontics
- International Journal Endodontics
- Dental Traumatology
- Journal of Dental Research (Washington)
- Journal of the American Dental Association (Chicago)

Recommended Articles

The list of article citations will be approved periodically by the Scientific Council and forwarded to program directors for distribution to residents in their respective training centers. The following are the list of topics with hyperlinks to the list of articles and supplement articles (Appendices):

- Evidence-Based Endodontics/How to read a scientific article
- Teeth Morphology and Anatomy
- Canal access/instrumentation/irrigation
- Obturation
- Single vs Multiple visits and Intracanal Medicaments
- Pulpal/Periapical Pathology
- Endodontic Immunology
- Endodontic Microbiology
- Non-Surgical Root Canal Retreatment
- Restoration of Endodontically treated teeth
- Crack and Vertical Root Fractures
- Outcomes of Endodontics
- Pain Control and Odontogenic & Non-Odontogenic Pain
- Surgical Root Canal Treatment
- Dental Traumatology and Root Resorption
- Endodontic Regeneration
- Perforation/Endo Perio relation
- Endo/Orthodontics
- Oral Medicine and Drug Interactions

APPENDICES

The key competency and enabling competencies for CANMEDS roles
Advanced Pre-clinical Endodontics
Endodontic Classic Literature Review
Endodontic Contemporary Journal Club
Article Appraisal Form
Oral Case Presentation via SNAPPS
SNAPPS reference sheet
Mini-Clinical Evaluation Exercise (Mini-CEX): Non-Surgical Endodontic Therapies Form
Mini-Clinical Evaluation Exercise (Mini-CEX): Surgical Endodontic Treatment Form
Multisource Feedback Assessment Tool
Consultation Letter Rating Scale
Written questions and answers for the Communicator Role
Collaborator Role Encounter Form
Team Meeting Encounter Form
Collaborator Quotient
Leadership Reflection
Research Project High-Level Checklist
Research Project Meeting Monitoring
Professionalism Incident Report
Balanced Score Card
Resident Experience Survey
Program Survey
In-Training Evaluation Report (ITER)

The key competency and enabling competencies for CANMEDS roles

I. **Endodontic Expert:** As Endodontic Experts, endodontists integrate all of the CanMEDS roles, applying endodontic knowledge, clinical skills, and professional values in their provision of high-quality and safe patient-centered care. Endodontic Expert is the central dentist's role in the CanMEDS Framework and defines the endodontist's clinical scope of practice.
II. **Communicator:** As Communicators, endodontists form relationships with patients and their families that facilitate the gathering and sharing of essential information for effective health care.
III. **Collaborator:** As Collaborators, endodontists work effectively with other health care professionals to provide safe, high quality, patient-centered care.
IV. **Leader:** As Leaders, endodontists engage with others to contribute to a vision of a high-quality health care system and take responsibility for the delivery of excellent patient care through their activities as clinicians, administrators, scholars, or teachers.
V. **Health Advocate:** As Health Advocates, endodontists contribute their expertise and influence as they work with communities or patient populations to improve health. They work with those they serve to determine and understand needs, speak on behalf of others when required, and support the mobilization of resources to effect change.
VI. **Scholar:** As Scholars, endodontists demonstrate a lifelong commitment to excellence in practice through continuous learning and by teaching others, evaluating evidence, and contributing to scholarship.
VII. **Professional:** As Professionals, endodontists are committed to the health and well-being of individual patients and society through ethical practice, high personal standards of behavior, accountability to the profession and society dentist-led regulation, and maintenance of own health.

Endodontic Expert[15]

As Endodontic Experts, endodontists integrate all of the roles, applying endodontic knowledge, clinical skills, and professional values in their provision of high-quality and safe patient-centered care. ***The following are the key competencies and enabling competencies for this role:***

1. Practice endodontics within their defined scope of practice and expertise.
1.1 Demonstrate a commitment to high-quality patient care.
1.2 Integrate the CanMEDS Intrinsic Roles into their practice of endodontics.
1.3 Apply knowledge of the clinical and biomedical sciences relevant to endodontics.
1.4 Perform appropriately timed clinical assessments with recommendations that are presented in an organized manner.
1.5 Carry out professional duties in the face of multiple, competing demands.
1.6 Recognize and respond to the complexity, uncertainty, and ambiguity inherent in dental practice.

[15] Adopted from CanMEDS 2015 Framework http://canmeds.royalcollege.ca/guide

2. Perform a patient-centered clinical assessment and establish a treatment plan.
2.1 Prioritize issues to be addressed in a patient encounter.
2.2 Elicit history, perform a physical exam, select appropriate investigations, and interpret their results for the purpose of diagnosis and management, disease prevention, and health promotion.
2.3 Establish goals of care in collaboration with patients and their families, which may include slowing disease progression, treating symptoms. achieving a cure, improving function, and palliation.
2.4 Establish a patient-centered treatment plan.
3. Plan and perform procedures and therapies for the purpose of assessment and/or management.
3.1 Determine the most appropriate procedures and therapies.
3.2 Obtain and document informed consent, explaining the risks and benefits of and rationale for a proposed procedure or therapy.
3.3 Prioritize a procedure or therapy, taking into account clinical urgency and available resources.
3.4 Perform a procedure in a skillful and safe manner, adapting to unanticipated findings or changing clinical circumstances.
4. Establish plans for ongoing care and when appropriate, timely consultation.
4.1 Implement a patient-centered care plan that supports ongoing care, follow-up on investigations, response to treatment, and further consultation.
5. Actively contribute as an individual and as a member of a team providing care to the continuous improvement of health care quality and patient safety.
5.1 Recognize and respond to harm from health care delivery, including patient safety incidents.
5.2 Adopt strategies that promote patient safety and address human and system factors.

Communicator[16]

As Communicators, endodontists form relationships with patients and their families that facilitate the gathering and sharing of essential information for effective health care. ***The following are the key competencies and enabling competencies for this role:***

1. Establish professional therapeutic relationships with patients and their families.
1.1 Communicate using a patient-centered approach that encourages patient trust and autonomy and is characterized by empathy, respect, and compassion.
1.2 Optimize the physical environment for patient comfort, dignity, privacy, engagement, and safety.

[16] Adopted from CanMEDS 2015 Framework http://canmeds.royalcollege.ca/guide

1.3 Recognize when the values, biases, or perspectives of patients, dentists, or other health care professionals may have an impact on the quality of care, and modify the approach to the patient accordingly.
1.4 Respond to a patient's non-verbal behaviors to enhance communication.
1.5 Manage disagreements and emotionally charged conversations.
1.6 Adapt to the unique needs and preferences of each patient and to his or her clinical condition and circumstances.
2. Elicit and synthesize accurate and relevant information incorporating the perspectives of patients and their families.
2.1 Use patient-centered interviewing skills to effectively gather relevant biomedical and psychosocial information.
2.2 Provide a clear structure for and manage the flow of an entire patient encounter.
2.3 Seek and synthesize relevant information from other sources including the patient's family with the patient's consent.
3. Share health care information and plans with patients and their families.
3.1 Share information and explanations that are clear, accurate, and timely, while checking for patient and family understanding.
3.2 Disclose harmful patient safety incidents to patients and their families accurately and appropriately.
4. Engage patients and their families in developing plans that reflect the patient's health care needs and goals.
4.1 Facilitate discussions with patients and their families in a way that is respectful, non-judgmental, and culturally safe.
4.2 Assist patients and their families to identify, access, and make use of information and communication technologies to support their care and manage their health.
4.3 Use communication skills and strategies that help patients and their families make informed decisions regarding their health.
5. Document and share written and electronic information about the medical encounter to optimize clinical decision-making, patient safety, confidentiality, and privacy.
5.1 Document clinical encounters in an accurate, complete, timely, and accessible manner in compliance with regulatory and legal requirements.
5.2 Communicate effectively using a written health record, electronic dental record, or other digital technology.
5.3 Share information with patients and others in a manner that respects patient privacy and confidentiality and enhances understanding.

Collaborator[17]

As Collaborators, endodontists work effectively with other health care professionals to provide safe, high quality, patient-centered care. ***The following are the key competencies and enabling competencies for this role:***

1. Work effectively with dentists and other colleagues in the health care professions.
1.1 Establish and maintain positive relationships with dentists and other colleagues in the health care professions to support relationship-centered collaborative care.
1.2 Negotiate overlapping and shared responsibilities with dentists and other colleagues in the health care professions in episodic and ongoing care.
1.3 Engage in respectful shared decision-making with dentists and other colleagues in the health care professions.
2. Work with dentists and other colleagues in the health care professions to promote understanding, manage differences, and resolve conflicts.
2.1 Show respect toward collaborators.
2.2 Implement strategies to promote understanding, manage differences, and resolve conflicts in a manner that supports a collaborative culture.
3. Hand over the care of a patient to another health care professional to facilitate continuity of safe patient care.
3.1 Determine when care should be transferred to another dentist or health care professional.
3.2 Demonstrate safe handover of care using both verbal and written communication during a patient transition to a different health care professional, setting, or stage of care.

Leader[18]

As Leaders, endodontists engage with others to contribute to a vision of a high-quality health care system and take responsibility for the delivery of excellent patient care through their activities as clinicians, administrators, scholars, or teachers. ***The following are the key competencies and enabling competencies for this role:***

1. Contribute to the improvement of health care delivery in teams, organizations, and systems.
1.1 Apply the science of quality improvement to contribute to improving systems of patient care.
1.2 Contribute to a culture that promotes patient safety.
1.3 Analyze safety incidents to enhance systems of care.
1.4 Use health informatics to improve the quality of patient care and optimize patient safety.

[17] Adopted from CanMEDS 2015 Framework http://canmeds.royalcollege.ca/guide
[18] Adopted from CanMEDS 2015 Framework http://canmeds.royalcollege.ca/guide

2. Engage in the stewardship of health care resources.
2.1 Allocate health care resources for optimal patient care.
2.2 Apply evidence and management processes to achieve cost-appropriate care.
3. Demonstrate leadership in professional practice.
3.1 Demonstrate leadership skills to enhance health care.
3.2 Facilitate change in health care to enhance services and outcomes.
4. Manage their practice and career.
4.1 Set priorities and manage time to integrate practice and personal life.
4.2 Manage career planning, finances, and health human resources in a practice.
4.3 Implement processes to ensure personal practice improvement.

Health Advocate[19]

As Health Advocates, endodontists contribute their expertise and influence as they work with communities or patient populations to improve health. They work with those they serve to determine and understand needs, speak on behalf of others when required, and support the mobilization of resources to effect change. ***The following are the key competencies and enabling competencies for this role:***

1. Respond to an individual patient's health needs by advocating with the patient within and beyond the clinical environment.
1.1 Work with patients to address the determinants of health that affect them and their access to needed health services or resources.
1.2 Work with patients and their families to increase opportunities to adopt healthy behaviors.
1.3 Incorporate disease prevention, health promotion, and health surveillance into interactions with individual patients.
2. Respond to the needs of the communities or populations they serve by advocating with them for system-level change in a socially accountable manner.
2.1 Work with a community or population to identify the determinants of health that affect them.
2.2 Improve clinical practice by applying a process of continuous quality improvement to disease prevention, health promotion, and health surveillance activities.
2.3 Contribute to a process to improve health in the community or population they serve.

[19] Adopted from CanMEDS 2015 Framework http://canmeds.royalcollege.ca/guide

Scholar[20]

As Scholars, endodontists demonstrate a lifelong commitment to excellence in practice through continuous learning and by teaching others, evaluating evidence, and contributing to scholarship. ***The following are the key competencies and enabling competencies for this role:***

1. Engage in the continuous enhancement of their professional activities through ongoing learning.
1.1 Develop, implement, monitor, and revise a personal learning plan to enhance professional practice.
1.2 Identify opportunities for learning and improvement by regularly reflecting on and assessing their performance using various internal and external data sources.
1.3 Engage in collaborative learning to continuously improve personal practice and contribute to collective improvements in practice.
2. Teach students, residents, the public, and other health care professionals.
2.1 Recognize the influence of role-modelling and the impact of the formal, informal, and hidden curriculum on learners.
2.2 Promote a safe learning environment.
2.3 Ensure patient safety is maintained when learners are involved.
2.4 Plan and deliver a learning activity.
2.5 Provide feedback to enhance learning and performance.
2.6 Assess and evaluate learners, teachers, and programs in an educationally appropriate manner.
3. Integrate best available evidence into practice.
3.1 Recognize practice uncertainty and knowledge gaps in clinical and other professional encounters and generate focused questions that can address them.
3.2 Identify, select, and navigate pre-appraised resources.
3.3 Critically evaluate the integrity, reliability, and applicability of health-related research and literature.
3.4 Integrate evidence into decision-making in their practice.
4. Contribute to the creation and dissemination of knowledge and practices applicable to health.
4.1 Demonstrate an understanding of the scientific principles of research and scholarly inquiry and the role of research evidence in health care.
4.2 Identify ethical principles for research and incorporate them into obtaining informed consent considering potential harms and benefits, and considering vulnerable populations.

[20] Adopted from CanMEDS 2015 Framework http://canmeds.royalcollege.ca/guide

4.3 Contribute to the work of a research program.
4.4 Pose questions amenable to scholarly inquiry and select appropriate methods to address them.
4.5 Summarize and communicate to professional and lay audiences including patients and their families the findings of relevant research and scholarly inquiry.

Professional[21]

As Professionals, endodontists are committed to the health and well-being of individual patients and society through ethical practice, high personal standards of behavior, accountability to the profession and society dentist-led regulation, and maintenance of personal health. ***The following are the key competencies and enabling competencies for this role:***

1. Demonstrate a commitment to patients by applying best practices and adhering to high ethical standards.
1.1 Exhibit appropriate professional behaviors and relationships in all aspects of practice, demonstrating honesty, integrity, humility, commitment, compassion, respect, altruism, respect for diversity, and maintenance of confidentiality.
1.2 Demonstrate a commitment to excellence in all aspects of practice.
1.3 Recognize and respond to ethical issues encountered in practice.
1.4 Recognize and manage conflicts of interest.
1.5 Exhibit professional behaviors in the use of technology-enabled communication.
2. Demonstrate a commitment to society by recognizing and responding to societal expectations in health care.
2.1 Demonstrate accountability to patients, society, and the profession by responding to societal expectations of endodontists.
2.2 Demonstrate a commitment to patient safety and quality improvement.
3. Demonstrate a commitment to the profession by adhering to standards and participating in clinician-led regulation.
3.1 Fulfill and adhere to the professional and ethical codes, standards of practice, and laws governing practice.
3.2 Recognize and respond to unprofessional and unethical behaviors in dentists and other colleagues in the health care professions.
3.3 Participate in peer assessment and standard-setting.
4. Demonstrate a commitment to dentist health and well-being to foster optimal patient care.
4.1 Exhibit self-awareness and manage influences on personal well-being and professional performance.

[21] Adopted from CanMEDS 2015 Framework http://canmeds.royalcollege.ca/guide

4.2 Manage personal and professional demands for a sustainable practice throughout the endodontist's life cycle.
4.3 Promote a culture that recognizes, supports, and responds effectively to colleagues in need.

ADVANCED PRE-CLINICAL ENDODONTICS

Description

This is an orientation course on the **first level (R1)** to prepare new residents for the SBE program curriculum and advanced endodontics techniques. The didactic part focuses on a systematic (step-by-step) method for providing reliable nonsurgical endodontic care. Each resident reads the textbook chapter assigned or references provided and is ready for discussion. Laboratory exercises focus on refreshing their essential clinical skills and introduce advanced endodontic technologies. The course will also focus on mastering the necessary skills and knowledge of endodontics.

The session starts using interactive teaching strategies through lectures, seminars, group discussions, and self-directed learning. Then, hands-on training is provided to ensure the development of the three phases of psychomotor skill: cognitive, development, and automated.

Objectives

1. Provide overview information about SBE programs: rules, regulations, and contents of the curriculum.
2. Provide a basic understanding of different clinical endodontic topics.
3. Provide a systematic approach to making the right endodontic diagnosis and treatment options.
4. Provide an overview of classic and current non-surgical endodontic techniques used.
5. Introduce modern endodontic instruments including but not limited to: magnification, files, irrigation systems, and obturation materials.

Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods			
Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	Knowledge		
1.1	Understands rules, regulations, and overall study plan of the SBE program.	Lecture	Survey
1.2	Review basic principles of clinical endodontics.	Lecture and homework	Written Exam
2.0	Skills		
2.1	Refresh basic principles to perform nonsurgical root canal treatment.	Lab projects on extracted or simulated molar teeth	Weekly evaluation and Discussion
2.2	Learn to use different file/obturation systems for nonsurgical root canal therapy.	Lab projects on extracted or simulated molar teeth	Weekly evaluation and Discussion
3.0	Competence		
3.1	Able to perform uncomplicated non-surgical root canal treatment in extracted or simulated molar tooth.	Lab projects on extracted or simulated molar teeth	Competency exam

Required Textbook: Cohen's Pathways of the Pulp, latest edition

Recommended topics to be covered:

1. Endodontic diagnosis
2. Access and working length
3. Cleaning and shaping the root canal
4. Rotary file systems
5. Obturation
6. History of endodontics
7. Treatment strategies and outcomes
8. Endodontic magnification tools
9. Mishaps

ENDODONTIC CLASSIC LITERATURE REVIEW

Description

This educational session comprises continuous weekly workshops for all levels of training devoted to reviewing the classical endodontic literature and discussion of research methods and strategies. The list shall be reviewed and updated every three years by the Scientific Council of Endodontics. For each topic, a series of selected articles and textbook chapters are assigned, reviewed, analyzed, abstracted, and presented to fellow residents. Throughout all levels, every effort is made to integrate the present and future status of the specialty of endodontics with a sound understanding of its historical background. The resident's recall and perspective are assessed as they relate classic and new literature to the evolving clinical practice of the endodontic specialty. Indeed, this course covers the philosophies, authors, and major works that create the endodontic specialty.

Format

Residents are given a background and authoritative information on the core of the advanced endodontic specialty. The course covers a selected review of the endodontic classic literature and topics. The evidence-based decision-making, evidence pyramid, scientific method, internal and external research variables, evaluation of the literature, and research ethics will be discussed. Residents will read assigned articles/topics each session and prepare a summary (Abstract). A discussion during seminars will highlight key points in each article and critically evaluate the evidence presented and its application in endodontic practice. Residents will have access to original articles in PDF files and present the summary utilizing Microsoft PowerPoint software. **All materials will be uploaded utilizing a cloud server to provide anytime/anywhere access.**

Objectives

1. Acquaint participants with a detailed understanding of different endodontic topics.
2. Critically review and analyze the classic endodontic literature.
3. Assess the classic materials and methods used in endodontic research.
4. Utilize data reported and use the best evidence in endodontic clinical practice.
5. Develop an understanding of the critical review process.
6. Emphasize resident learning to critically read and evaluate articles and assess their scientific and clinical contribution supporting endodontic principles and practice.

Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods			
Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Able to identify key articles in each topic.	Abstract and discussion	Weekly evaluation & Quizzes
1.2	Be familiar with classic endodontic literature and topics.	Abstract and discussion	Weekly evaluation & Quizzes

1.3	Be able to connect the art and science of endodontics.	Crash courses in selected hot topics in endodontics	Promotion, Part II exam, Trainee-Selected Topic Assessment tests.
2.0	**Skills**		
2.1	Develop an understanding of the critical review process.	Discussion	Weekly evaluation and Discussion
2.2	Be able to communicate more professionally and effectively with the endodontic community.	Discussion	Weekly evaluation and Discussion
2.3	Use references learned to apply endodontic evidence-based practice.	Discussion	Position Papers, and Case presentation defense
3.0	**Competence**		
3.1	Able to recall methodologies, results, and conclusions of classic literature articles and relate them to the evolving clinical practice of the specialty.	Lab projects on extracted or simulated molar teeth	At least two (2) quizzes throughout the academic year

Recommended topics to be covered (Recommended articles are updated through the SBE Scientific Council and available within section 6):

	Topics	Folder[22]	Contact Sessions
1	Evidence-Based Endodontics/How to read a scientific article	1	1
2	Teeth Morphology and Anatomy	1	5
3	Canal access/instrumentation/irrigation	1	10
4	Obturation	1	4
5	Pulpal/Periapical Pathology	1	4
6	Single vs. Multiple visits and Intracanal Medicaments	1	2
7	Endodontic Immunology	2	2
8	Success and Failure in Endodontics	2	5
9	Crack and Vertical Root Fractures	2	2
10	Endodontic Microbiology	2	10
11	Restoration of Endodontically treated teeth	2	3
12	Endodontic Retreatment	2	4
13	Oral Medicine and Drug Interactions	3	2
14	Odontogenic & Non-odontogenic Pain	3	3
15	Endodontic Traumatology	3	6
16	Endodontic Regeneration	3	5
17	Perforation/Endo Perio Relation	3	4
18	Endo/Orthodontic	3	2

[22] Each folder of articles is covered in one academic year.

19	Endodontic Surgery	3	6
20	Top cited Endodontic Articles	3	2
21	Selected Topics by the Scientific Council		
Total			**82**

ENDODONTIC CONTEMPORARY JOURNAL CLUB

Description

This educational session is an ongoing weekly seminar for **all training levels** devoted to an ongoing review of current, pertinent, and professional endodontic literature. It involves surveying major dental periodicals to identify essential articles, reviewing those articles, and discussing each article in an open seminar format. This course complements evidence-based decision-making, the evidence pyramid, scientific method, internal and external research variables, evaluation of the literature, and research ethics. Discussion during seminars will highlight key points in each article and critically evaluate the evidence presented and its application in endodontic practice.

Format

This educational session has a journal club format and involves surveying major dental periodicals:

International Endodontic Journal (Oxford) and *Journal of Endodontics* (Baltimore) are the main journals that will be reviewed. Other journals will also be covered such as:

- *Saudi Endodontic Journal*
- *Dental Traumatology*
- *Journal of Dental Research* (Washington)
- *Journal of the American Dental Association* (Chicago)

All clinical and systematic review articles published in *International Endodontic Journal* and *Journal of Endodontics* must be included. Residents will review those article(s), prepare a summary (Abstract), and discuss each article in an open seminar format (2–3 articles/resident/week). The Contemporary Evidenced-Based Journal Club will meet weekly. A discussion during seminars will highlight key points and critically evaluate the evidence presented and its application in endodontic practice. Residents will have access to original articles in PDF files and present a summary utilizing Microsoft PowerPoint software. All materials will be uploaded utilizing a cloud server in order to provide anytime/anywhere access.

Objectives

1. Acquaint residents with a detailed understanding of current endodontic literature.
2. Make residents competent in scientific database and library resources to obtain current information.
3. Assess the development of new materials and methods used in endodontic research.
4. Utilize data reported and compare with classic literature.
5. Develop an understanding of the critical review process.
6. Develop skills for the preparation of topic reviews in an organized and proficient manner.
7. Learn about new concepts in root canal treatment and the latest advances in technologies and biology related to endodontics.

Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods			
Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Able to be current about endodontic research	Abstract and discussion	Weekly evaluation
1.2	Familiar with classic endodontic literature and topics	Abstract and discussion	Weekly evaluation
2.0	**Skills**		
2.1	Understand the current critical review process.	Discussion	Weekly evaluation
2.2	Use a scientific database engine.	Discussion	Weekly evaluation
2.3	Practice evidence-based endodontics.	Discussion	Weekly evaluation
3.0	**Competence**		
3.1	Make endodontic decisions based on the best evidence available.	Abstract and discussion	Topic Review submission

ARTICLE APPRAISAL FORM

Classic literature (Choose the level)
(Can be submitted as a PowerPoint presentation)

Your Name:
Authors, title of article, journal, and year of publication:

Summary of Proposal (Obtained from the article's abstract) & Introduction:
Outline main ideas of the article and identify the author's purpose/objective.
Briefly outline the main ideas of the article and previous key studies related.

Materials:
Type of research
Sample: inclusion and exclusion criteria.
State experimental design and protocol.

Results:
Highlighted results: make your own table or representation.
Include key percentages and numbers cited.

Conclusion/Clinical Significance:
State author's conclusion.
State clinical scenario or previous article that prompted you to choose the given article.

Overall Article Strengths and Weaknesses:

ORAL CASE PRESENTATION VIA SNAPPS

Description

The purpose of this seminar is to provide a forum in which clinical experiences can be shared and in which discussion of clinical cases presented will benefit not only the presenter but also all participants.

Format

During this course, residents are required to present or submit **all** their cases in a comprehensive format. Treatment rendered must be justified. A unified template must be used. An online discussion forum can be utilized to discuss the clinical cases presented.

Instructions for the Learner

- Refer to the SNAPPS reference sheet provided in the appendices.
- Observe and take (non-identifying) notes on your case.
- Remember to be cautious about privacy when taking notes.
- Review with faculty as arranged or initiate a review of your presentation to obtain feedback.

S – summarize the case
N – narrow the differential
A – analyze the differential
P – probe the preceptor
P – plan management
S – select an issue for self-directed learning

Objectives

1. Present all endodontic cases treated in a comprehensive format (case report).
2. Be familiar with treatment planning options.
3. Evaluate and critique the quality of the root canal treatment scientifically and professionally.
4. Learn to debate and discuss the case in an organized and structured manner.

Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods			
Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	Knowledge		
1.1	Able to reflect on the treatment rendered	Presentation and discussion	Weekly evaluation
1.2	Develop an appreciation of different treatment options and their success	Presentation and discussion	Weekly evaluation
2.0	Skills		
2.1	Able to present endodontic cases with proper documentation and treatment plan and defend scientifically	Presentation and discussion	Weekly evaluation

2.2	Professionalism during presentation	Presentation and discussion	Weekly evaluation
3.0	Competence		
3.1	Able to build a comprehensive case portfolio	Case presentation	Case presentation evaluation and Cases Portfolio/Logbook

Resident and instructor responsibilities include:

- Resident will choose the case(s), then obtain approval from the program director before presentation.
- Resident is expected to present treatments of patients at different stages of treatment, supported by evidence, discussion of the diagnosis, treatment plan and treatment mechanics, case progress, completion, prognosis, and implemented recall. Use the format in the appendices to present the case.
- Use the CBD evaluation form attached in the appendices to rate the trainee.
- Provide constructive feedback and discuss improvement strategies with the trainee.
- Provide an overall judgment on the trainee's clinical decision-making skills.
- Presenting residents MUST submit the CBDs to the regional committee or program director in the full accreditation program one week ahead of the scheduled session.

SNAPPS REFERENCE SHEET

S – summarize the case

N – narrow the differential

A – analyze the differential

P – probe the preceptor

P – plan management

S – select an issue for self-directed learning

ORAL CASE PRESENTATION ASSESSMENT FORM

Instructions for Assessor

- Please help this learner gain insight into the comprehensive review of clinical cases by completing the form below.
- Share your assessment and feedback in a timely manner to guide the trainee's learning.
- Provide the trainee with an opportunity to discuss their approach to the case and identify strategies to improve their practice.

Checklist item	Grade			
	0 Not observed	1 Unacceptable	3 Satisfactory	4 Superior
1. Clinical case documentation ○ *Proper documentation of critical informative data:* ✓ Patient age, gender ✓ Medical history ✓ Medications prescribed ✓ Dental history ✓ Chief complaint ✓ All critical diagnostic tests, examinations, or procedures have been recorded.				
2. Diagnosis in proper sequence and tests performed				
3. Appropriate Treatment Plan ✓ Successful in declaring the various treatment options (alternative treatment plans) ✓ Prognosis				
4. Overall Quality of Treatment Rendered				
5. High standard radiographs and clinical photographs				

6. Support treatment with pertinent literature				
7. Quality of presentation ✓ Slide quality (in regard to type of fonts, no conflicting backgrounds, & absence of grammatical errors) ✓ Organization in delivering an informative presentation ✓ Effective use of figures and/or tables if required ✓ Detailed documentation of treatment steps				
8. Clinical judgment ✓ Conduct and demeanor during presentation, including response to discussion and criticism				
9. Professionalism during presentation ✓ Appropriate attire ✓ Presenter was clear and organized ✓ Used effective methods and presentation style ✓ Established good link with the audience				
10. Time management				
Overall grade				

Comments: ……

Evaluator Name	
Signature	
OVERALL COMPETENCE	

MINI-CLINICAL EVALUATION EXERCISE (MINI-CEX)
NON-SURGICAL ENDODONTIC THERAPIES

Instructions for Assessor

- Non-surgical endodontics competencies shall be assessed before the end of the first and second residency levels of junior years.
- Resident must notify the supervisor before the beginning of the session and attain approval.
- Using the form below, please help this endodontic resident gain insight into his/her skills by providing valuable confidential feedback.
- The following steps assess the CanMEDS Roles: Endodontic Expert, Communicator, Professional, Leader, Health Advocate.
- Share your assessment and feedback in a timely manner.
- The form must be signed by two instructors.
- Please return this form in a confidential sealed envelope to the attention of: Program Director.

Name:		**Residency level:**	
1. Pretreatment clinical testing and radiographic imaging			
4 Preclinical tests and radiographic imaging completed and recorded accurately. CBCT requested in advance. Optimum interpretation and planning of surgery prior to the surgery.	**3** Clinical tests and radiographic imaging completed and recorded accurately with minor discrepancies and guidance with faculty. CBCT reviewed during the procedure.	**1** Some clinical tests and radiographic images that are lacking require major guidance and intervention from the faculty.	**0** Clinical tests and radiographic images are lacking, and diagnosis and planning CANNOT be determined.
2. Endodontic diagnosis			
4 Establishes correct pulpal and periapical diagnosis with accurate interpretation of clinical tests and radiographic images.	**3** Establishes correct pulpal and periapical diagnosis with accurate interpretation but missing one clinical test and/or radiographic image.	**1** Establishes inaccurate pulpal or periapical diagnosis.	**0** Demonstrates lack of understanding of endodontic diagnosis.

3. Endodontic treatment plan and prognosis			
4	**3**	**1**	**0**
Prognosis discussed. Selects appropriate treatments based on clinical evidence and Medical/Dental history. All treatment risks identified. Informed consent obtained (signed or verbally).	As above with minor deficiency.	Prognosis of treatment outcomes unclear. Inadequate evaluation of medical and dental history despite appropriate treatment selected. Key treatment risks NOT identified.	Inappropriate treatment planning.
4. Anesthesia and pain control			
4	**3**	**1**	**0**
Thorough knowledge of technique and materials used. Profound anesthesia achieved.	Thorough knowledge of technique. Profound anesthesia achieved. Adequate patient communication.	Elements of anesthesia or pain control absent but patient care NOT compromised.	Incorrect anesthetic technique. Inadequate pain control and patient care compromised.
5. Caries removal, removal of failing restorations, evaluation of restorability and site isolation			
4	**3**	**1**	**0**
Complete removal of visible caries. Removal of failing restoration. Establishes complete structural restorability. Achieves complete isolation with dental dam.	No visible caries and failing restorations removed. Establishes significant aspects of structural restorability and achieves effective isolation with dental dam.	Caries removal compromised coronal seal (no build-up).	Gross visible caries and incomplete removal of failing restoration. Ineffective isolation.
6. Access opening			
4	**3**	**1**	**0**
Optimum outline and access form with no obstructions. All canals identified. Roof and pulp horns removed.	Slight under-extension of outline form but walls smooth. All canals identified and roof and pulp horns removed.	Crown integrity compromised by over-extension, but tooth remains restorable. All canals identified but minor roof and pulp horns remain.	Tooth is NOT restorable after access procedure or perforation. Canal(s) missed or unidentified.

7. Canal preparation technique and Cone fit			
4	**3**	**1**	**0**
Optimum canal length determination. Maintenance of canal position and integrity as demonstrated in cone fit. In REtx case, pervious canal filling completely removed with no apical extrusion. Adequate paste placed within the canal space.	Adequate canal length determination (> 1 mm short). Mild deviations of original canal shape. In REtx case, incomplete removal of GP. Acceptable placement of the root canal medicament within the canal space.	Canal length and preparation shorter than original working length. Severe deviations of original canal shape but treatable. Separated instrument that does NOT prevent canal preparation. In REtx case, incomplete removal of GP and/ or gross extrusion of Pervious GP. Inadequate placement of root canal medicament, voids.	Master cone too small or too large. Sodium hypochlorite accident. Canal perforated. Separated instrument preventing canal preparation. Massive extrusion of root canal medicament.
8. Obturation technique			
4	**3**	**1**	**0**
Achieves dense fill within 0.5–1.0 mm short of radiographic apex. None or minor over-extension of sealer. No solid core material over-extended.	Achieves dense fill within the apical two-thirds and less than 1.5 mm short of radiographic apex. Less than 1.0 mm of sealer extruded.	Apical third has slight to moderate voids. Solid core material 2.0–3.0 mm short or 1.0–2.0 mm long. More than 2.0 mm of sealer extruded.	Solid core material greater than 3 mm short or greater than 2 mm long of radiographic apex and/or significant voids throughout fill.
9. Completion of case			
4	**3**	**1**	**0**
Optimum coronal seal placed prior to permanent restoration. Optimum evidence of documentation (e.g., radiographs, clinical notes, assessment of outcomes). Evidence of comprehensive and inclusive post-operative instructions.	Effective coronal seal placed prior to permanent restoration. Thorough evidence of documentation (e.g., radiographs, clinical notes, assessment of outcomes) and evidence of post-operative instructions.	Acceptable coronal seal placed with limited longevity. Evidence of incomplete documentation. Evidence of incomplete post-operative instructions.	Poor coronal seal. Improper or no documentation. No evidence of post-operative instructions.

10. Attitude			
4	**3**	**1**	**0**
Resident consistently shows superior professionalism in dealing and communicating with patients and faculty. Communication is very good. Benefits–risks explained. Perception of patient satisfaction toward resident above 80%.	Resident shows acceptable professional behavior in most instances, but there is room for improvement. Communication does not yet address patients' concerns. Perception of patient satisfaction between 60–80%.	Resident shows minimal communication. Difficulty being understood. Questions still not addressed. Satisfaction less than 50%.	No communication. Resident did not explain procedure. Resident's actions and communication are not acceptable and always result in patient complaints.

Comments: ……

Evaluator Name	
Signature	
OVERALL COMPETENCE	

MINI-CLINICAL EVALUATION EXERCISE (MINI-CEX)
SURGICAL ENDODONTIC TREATMENT

Instructions for Assessor

- Surgical endodontics competencies shall be assessed before the end of the residency level of senior year.
- Resident must notify the supervisor before the beginning of the session and obtain their approval.
- Using the form below, please help this endodontic resident gain insight into his/her skills by providing valuable confidential feedback.
- The following steps assess the CanMEDS Roles: Endodontic Expert, Communicator, Professional, Leader, and Health Advocate.
- Share your assessment and feedback in a timely manner.
- The form must be signed by two instructors.
- Please return this form in a confidential sealed envelope to the attention of: Program Director.

Name:		**Residency level:**	
11. Pretreatment clinical testing and radiographic imaging			
4 Preclinical tests and radiographic imaging completed and recorded accurately. CBCT requested in advance. Optimum interpretation and planning of surgery prior to the surgery.	**3** Clinical tests and radiographic imaging completed and recorded accurately with minor discrepancies and guidance with faculty. CBCT reviewed during the procedure.	**1** Some clinical tests and radiographic images are lacking and require major guidance and intervention from the faculty.	**0** Clinical tests and radiographic images are lacking, and diagnosis and planning CANNOT be determined.
12. Endodontic surgical treatment plan and prognosis			
4 Prognosis discussed. Selects appropriate treatments based on clinical evidence and medical/dental history. All treatment risks identified. Informed consent obtained (signed & verbally).	**3** As above with minor deficiency.	**1** Prognosis of treatment outcomes unclear. Inadequate evaluation of medical and dental history despite appropriate treatment being selected. Key treatment risks NOT identified.	**0** Inappropriate treatment planning and lacking major steps to complete the treatment planning.

13. Anesthesia and pain control			
4 Thorough knowledge of technique and materials used. Profound anesthesia achieved. Prolonged anesthesia achieved during and after the procedure.	**3** Thorough knowledge of technique. Profound anesthesia achieved. Failed to achieve prolonged anesthesia during the procedure. May require minor guidance from faculty. Adequate patient communication.	**1** Elements of anesthesia or pain control absent. Require major guidance and intervention from the faculty to communicate with patient and manage patient pain. Overall, patient care NOT compromised.	**0** Incorrect anesthetic technique. Inadequate pain control and patient care compromised.
14. Flap design and management			
4 Establishes appropriate designing of the flap independently. Completes precise incision with minimum damage to soft tissue. Achieves complete accessibility to the surgical site with reasonable time under the magnification.	**3** Establishes appropriate designing of the flap with faculty help. Completes incision and flap elevation with minimum tearing of papilla. Completes accessibility to surgical field in acceptable time.	**1** Flap design and incision performed poorly, and in unsatisfactory time. Needs help of faculty to accomplish the step.	**0** Flap design and incision accomplished in inappropriate way or irreversible damage to the tissue resulting in major corrective action by the faculty.
15. Osteotomy and curettage			
4 Appropriate size of osteotomy. Allows optimum access to the lesion, root surface, and the use of appropriate instruments. Complete removal of granulation tissue, bleeding ceases. All tissue submitted for biopsy.	**3** Slight under-exposure of the lesion and root surface. Site requires more extension. Complete curettage is acceptable with the need for more hemostasis control. Tissue submitted for biopsy.	**1** Unable to identify lesion and/or root apex. Requires significant help from faculty to accomplish the step.	**0** Cortical plate compromised by over removal of cortical bone or irreversible damage occurs. Tissue not submitted for biopsy.

16. Root end resection, retropreparation, and root end fillings			
4	**3**	**1**	**0**
Optimum 3 mm of root resected with less than 10-degree bevel in satisfactory time. Visual inspection of root surface under magnification and use of dye. Radiograph image shows appropriate retro preparation and retrofilling.	Adequate root resection. Mild deviation of retro preparation. Canal surface inspected. Acceptable placement of retrofilling within reasonable time.	Root resection performed inappropriately. Took too long to do retropreparation and retrofilling. May require significant help to accomplish the step with faculty.	Over-resection of root compromised crown to root ratio. Severe deviation of retro preparation. Lack of knowledge of technique and materials to place retrofilling.
17. Suturing technique			
4	**3**	**1**	**0**
Achieves optimum repositioning of flap. Appropriate stability and placement of knots. All steps performed independently. Thorough knowledge of technique and materials used.	Accurate repositioning of flap. Thorough knowledge of technique with minimum guidance and/or intervention by faculty to successfully complete the procedure.	Needs a long time to manage the flap. Requires major guidance and/or intervention to complete all knots.	Poor management and repositioning of flap. Failed to perform single knot.
18. Completion of case			
4	**3**	**1**	**0**
Optimum RER and REF shows in the final radiograph. Optimum evidence of documentation (e.g., radiographs, clinical notes, assessment of outcomes). Evidence of comprehensive and inclusive post-operative instructions. Evidence of follow-up 2–3 days for suture removal shows optimum soft tissue healing.	Acceptable RER and REF in the final radiograph. Thorough evidence of documentation (e.g., radiographs, clinical notes, assessment of outcomes) and evidence of post-operative instructions. Acceptable soft tissue healing in the follow-ups.	Unacceptable RER and REF that require intervention in the future. Evidence of incomplete documentation. Evidence of incomplete post-operative instructions. Evidence of healing by secondary intention in the follow-up.	Poor RER and REF. Irreversible errors require additional corrective procedure. Improper or no documentation. No evidence of post-operative instructions.

19. Attitude			
4	**3**	**1**	**0**
Resident consistently shows superior professionalism in dealing and communicating with patients and faculty. Communication is very good. Benefits–risks explained. Perception of patient satisfaction toward resident above 80%.	Resident shows acceptable professional behavior in most instances, but there is room for improvement. Communication does not yet address patients' concerns. Perception of patient satisfaction between 60–80%.	Resident shows minimal communication. Difficulty in being understood. Still does not address questions. Satisfaction less than 50%.	No communication. Resident did not explain procedure. Resident's actions and communication are not acceptable and always result in patient complaints.

Comments: ……

Evaluator Name	
Signature	
OVERALL COMPETENCE	

MULTISOURCE FEEDBACK ASSESSMENT TOOL

Instructions for Assessor

- Using the form below, please help this resident physician gain insight into his/her skills by providing valuable confidential feedback.
- This information will be shared with the learner in aggregate form and for the purposes of helping him/her improve.
- Please return this form in a confidential sealed envelope to the attention of:

_____

Resident Name: _____

Training Level: _____

Indicate all that apply. I am a:

- ☐ Health professional team member
- ☐ Resident
- ☐ Dental student (including clerk)
- ☐ Faculty member
- ☐ Other, please specify _____

Degree of interaction

- ☐ Considerable interaction from this resident
- ☐ Occasional or one interaction with this resident
- ☐ Other, please specify _____

AREA OF EXPERTISE	Examples of what is done well	Examples of what needs improvement	Plans for improvement
Cognitive			
Psychomotor skills			
Visual Perceptual processing			
Metacognitive			
Non-cognitive skills			
Other:			

CONSULTATION LETTER RATING SCALE[23]

Instructions for Assessor

- Written communication competencies can be developed over time. Using the form below, please help this learner gain insight into and improve his/her written communication skills by providing valuable feedback on the consultation letter content and style.
- Circle your answer for each component of the consultation letter and for the global rating at the end.
- Use this rating scale with the letter you have reviewed as a springboard for discussion on how to improve future consultation letters.

Resident's Name: _____

Training Level: _____

Supervisor's Name: _____

Date: _____

CONTENT

1. HISTORY • Identified chief problem/reason for referral. • Described the chief complaint. • Identified relevant past history.			• Listed current medications, as appropriate. • Provided other history appropriate to presenting problem: Psychosocial history, functional history, family history, review of systems, etc.	
POOR **1** Missing relevant data.	**BORDERLINE** **2**	**ACCEPTABLE** **3** Most of relevant data present.	**GOOD** **4**	**EXCELLENT** **5** All relevant data present.

2. PHYSICAL EXAMINATION • Described physical examination findings relevant to presenting problem.				
POOR **1** Missing relevant physical exam.	**BORDERLINE** **2**	**ACCEPTABLE** **3** Most of relevant physical exam present.	**GOOD** **4**	**EXCELLENT** **5** All relevant physical exam present.

[23] *Created by S. Dojeiji, E Keely, and K. Myers.*

3. IMPRESSION AND PLAN • Provided diagnosis and/or differential diagnosis. • Provided a management plan. • Provided a rationale for the management plan (education).		• Stated whether the management plan was discussed with patient. • Stated who would be responsible for elements of the management plan and follow-up. • Answered the referring physician's questions (if present).		
POOR **1**	**BORDERLINE** **2**	**ACCEPTABLE** **3**	**GOOD** **4**	**EXCELLENT** **5**
Key issues not addressed. Did not answer referring physician's questions. No rationale for recommendation. No education provided. No indication of who will do what.		Most key issues identified and addressed. Answered referring physician's questions. Some rationale for recommendations. No education provided. Some indication of who is responsible for management plan elements and follow-up.		All key issues identified and addressed. Answered referring physician's questions. Provided rationale for recommendations made. Provided education. Clear plan for who will do what and who is responsible for follow-up. Noted what patient has told.

STYLE

4. CLARITY AND BREVITY • Words used: short (less than 3 syllables) active voice minimal medical jargon, minimal filler words/phrases no word or phrase repetition		• Length of sentences: one idea per sentence each sentence less than 3 lines long • Length of paragraphs: one topic per paragraph each paragraph less than 4–5 sentences long		
POOR **1**	**BORDERLINE** **2**	**ACCEPTABLE** **3**	**GOOD** **4**	**EXCELLENT** **5**
Wordy. Message unclear. Redundant words/phrases. Lots of jargon and fillers.		Concise. Minimal jargon and fillers. Some active tone. Some short sentences.		Concise. Clear and organized. No redundant words/phrases. No jargon and fillers. Active tone primarily. Short sentences.

Mostly passive tone. Long sentences. Long paragraphs.		Some sentences with one idea/sentence. Some short paragraphs.		One idea/sentence. Short paragraphs.

5. ORGANIZATION OF LETTER • Use of headings. • Layout visually appealing with lots of white space. • Use of bulleted or numbered lists, tables, or graphics as appropriate. • Information easy to scan.				
POOR **1** No headings. No white space. No bulleted or numbered lists. No tables. Difficult to scan.	**BORDERLINE** **2**	**ACCEPTABLE** **3** Some headings used. Some white space. Some bulleted and numbered lists. Generally easy to scan. Most key info is easy to find.	**GOOD** **4**	**EXCELLENT** **5** Headings clear and appropriate Lots of white space. Numbered and bulleted lists. Use of graphics or tables. Very easy to scan.

OVERALL RATING OF LETTER

Degree to which the letter is helpful to the referring physician.				
POOR **1** Letter not helpful. Lacking key content. Lacking style elements to make the letter easy to scan Key info hard to find.	**BORDERLINE** **2**	**ACCEPTABLE** **3** Generally helpful as key content available. Limited or no education incorporated. Some style elements incorporated. Most key information easy to find (impression and plan at a minimum).	**GOOD** **4**	**EXCELLENT** **5** Informative letter. Element of education incorporated. Key information easy to find.

Areas of strength (continue to do)	Areas for improvement (consider adding, modifying, or stopping)
1.	1.
2.	2.
3.	3.

Comments:

WRITTEN QUESTIONS AND ANSWERS FOR THE COMMUNICATOR ROLE[24]

Instructions for Learner

Answer questions on your own in the time allowed.

You have _____ minutes to answer these questions.

Name: _____

Date: _____

1. Define a minimum of six communication terms from the list below.
   - Categorization
   - Chunking
   - Common ground
   - Difficult discussion
   - Encounter
   - Non-verbal communication skills
   - Paraverbal communication
   - Patient-centered approach
   - Plain language
   - Safety net
   - Shared decision-making
   - Signposting
   - Therapeutic relationships

2. Complete the table below on verbal communication tasks. Identify the sequence, timing, and purposes of each of the communication skills tasks. **Note: one task has been prefilled as an example.**

No.	Verbal communication skills task	When it takes place in encounter	Purpose(s) (Identify a minimum of two per task)
1.			
2.			

[24] *Created for the CanMEDS Teaching and Assessment Tools Guide by S Glover Takahashi.*

3.			
4.			
5.	Building the relationship	Ongoing	• Developing a therapeutic alliance • Involving the patient
6.			

3. Complete the table below by listing some of the details you would include under each of these three parts of a written communication.

No.	Written communication skills task	Types of details to include
1.	History	
2.	Physician Exam Report (e.g., physical exam, interventions, plan, results)	
3.	Impression and Management	

4. Describe the purpose of a consult letter. List three or four things you would cover in the letter (content). List three style/structure elements that you would incorporate into your letter.

5. Identify three impacts and/or outcomes of effective communication.

ANSWER KEY—SHORT ANSWER QUESTIONS

1. **Define six of these Communicator terms**
   - **Categorization** is a type of signposting that orients the patient to specific details about how information is going to be discussed. For example, "There are three important things I want to explain. First, I want to tell you what I think is going on; second, what tests I think would be …"
   - **Chunking and checking** is an approach to giving the patient information in "pieces," then pausing to verify they understand before proceeding. This technique is used to gauge how much information to give to a patient. This approach aids in achieving a shared understanding with the patient.
   - **Common ground** provides a basis of mutual interest or agreement.
   - **Difficult discussion** refers to a patient-physician conversation related to the patient's health care preferences, needs, and values that can be challenging because of the high or intense emotion involved. The topics considered challenging or difficult vary according to the patient's preferences, needs, and values; the physician's preferences, needs, values, and comfort level; and the environmental, cultural, and health care contexts.
   - **Empathy** is a key skill in developing the physician-patient relationship. It has two parts: (1) the understanding and sensitive appreciation of another's predicament or feeling and (2) communication of that understanding back to the patient in a supportive way. This does not necessarily equate to agreeing with the patient's feelings. An example is: "I can see that your husband's memory loss has been very difficult for you to cope with." Empathy is often confused with sympathy, which is feeling pity or concern from outside of the patient's perspective.
   - **Encounter** refers to a purposeful patient-physician interaction.
   - **Non-verbal** communication skills are the skills involved in transmitting information without the use of words. They include body language (e.g., facial expressions, eye contact, gestures) and para-verbal skills (e.g., tone, pace, volume of speech), touch, space, smell, and clothing. Non-verbal communication is responsible for conveying

most of our attitudes, emotions, and affect. Non-verbal communication can override what we actually say to patients.

- **Para-verbal** communication is what you convey in the characteristics of your words through your pace, tone, pitch, rhythm, volume, articulation, and use of pauses.
- **A Patient-centered** approach is one providing care that is respectful of and responsive to individual patient preferences, needs, and values, and ensuring that patient values guide all clinical decisions.
- **Plain language** is the use of common words that are understandable by the patient. This may mean avoiding technical or medical terms unless they are carefully defined and/or described.
- **Safety net** means the set of contingency plans for the patient, which should be discussed at the end of the interview. Providing a safety net for the patient involves an explanation of what the patient should do if things do not go according to plan, telling them how they should contact you, and discussing what developments might require back-up.
- **Shared decision-making** is a communication approach where patients and their health care professionals including their physician make decisions following careful deliberation about the patient's preferences, needs, and values and with an understanding of the available options and evidence so that they can wisely choose the best action(s).
- **Signposting** is the use of bridging statements to alert patients that you are changing topics or direction in the encounter. Signposts help the patient to understand where the interview is going and why. They also help to provide structure to the interview and act as guide markers to keep you organized and patient focused. For example, "I have just finished getting a history of your stomach pain. Now I would like to do a physical exam. Is that okay?"
- **Therapeutic relationship** is the working alliance between the physician and patient. Respect (i.e., unconditional positive regard), genuineness, and empathy are correlated with good therapeutic outcomes.

2. Complete the table below about the verbal communication task. Identify the sequence, timing, and purposes of each of the communication tasks.

#	Verbal COMMUNICATION TASK	Timing	PURPOSES (2–4 per task)
1.	INITIATING THE SESSION	Beginning	• Establishing initial rapport • Identifying the reason for the visit
2.	GATHERING INFO AND PHYSICAL EXAM	Middle	• Exploration of the patient problem to discover: • Biomedical perspective (disease) • Patient perspective (illness) • Background information – context
3.	EXPLANATION and PLANNING	Middle	• Providing the correct type and level of information • Aiding accurate recall and understanding

			• Achieving a shared understanding – incorporating the patient's perspective • Planning – shared decision-making
4.	CLOSING THE SESSION	End	• Ensuring appropriate point of closure • Forward planning
5.	BUILDING THE RELATIONSHIP	Ongoing	• Developing a therapeutic alliance • Involving the patient
6.	PROVIDING STRUCTURE	Ongoing	• Making organization overt • Attending to flow

3. Complete the table below by listing some of the details you would include under each of these three parts of a written communication.

CONTENT		**Sample details**
1.	History	• Chief problem/reason for referral • Chief complaint • Relevant past history • Current medications, as appropriate • Other history appropriate to presenting problem: psychosocial history, functional history, family history, review of systems, etc.
2.	Physical Exam	• Physical examination findings relevant to presenting problem
3.	Impression and Management	• Diagnosis and/or differential diagnosis • Management plan • Rationale for the management plan (education) • Report on whether the management plan was discussed with the patient • Notes who will be responsible for elements of the management plan and follow-up • Answers the referring physician's question (if present)

4. Describe the purpose of a consult letter. List three or four items you would cover in the letter (content). List three style/structure elements that you would incorporate into your letter.

Written Communication	**PURPOSE**	**CONTENT**	**STYLE**
CONSULT LETTER	Communicates findings and opinions to the referring physician.	**Referring physicians want:** • the consultant's impressions (dx and answer to the referring question)	**Language** • Simple language • No abbreviations, acronyms

		• management plan (who will do what and when) • medication changes • rationale for recommendations • who is providing ongoing care • guidance and education (articles, advice, guidelines) **Consultants want:** • a record of the history and physical exam • a context that enables interpretation of investigations • proof the consultation actually occurred • a clear question	• Short words (less than three syllables) • Active vs. passive voice ("I saw Ms. X …" vs. "Ms. X was seen …" **Visual display** • Organized • Bullet points • Short sentences (one idea per sentence) • Short paragraphs (four to five sentences) • Section headings • Graphics • Right amount of information • Edited (Plan, Dictate, Edit)

5. Identify three impacts/outcomes of effective communication.

No.	Impacts/outcomes of effective communication
1.	Increased accuracy, which improves patient understanding, recall, and compliance, and increases efficiency for patients and physicians
2.	Improved outcomes of care (physiological and psychological)
3.	Heightened perceptions by patients that they are supported by their physicians and improved relationships between patients and caregivers, resulting in higher satisfaction for patients and physicians
4.	Reduced rates of adverse events/medical errors
5.	Better protection against complaints and malpractice claims

COLLABORATOR ROLE ENCOUNTER FORM

Instructions for Assessor

- Collaborator competencies can be developed over time. By completing the form below, it will help the learner to gain insight into his/her skills.
- Share your assessment and feedback in a timely manner.

Name:			PGY:		
Inter/Intra professional communication					
1	2	3	4	5	n/a
Borders on rude. Authoritarian or differential in approach. Overly passive. Debates or is dismissive of feedback.		Respectful, clear, and timely communication. Responsive to others' requests and feedback.		Skillfully works with others to coordinate patient's care.	
Collaboration with patient/family					
1	2	3	4	5	n/a
Does not inform patient/family of plans. Does not elicit patient/family perspective. Provides misinformation.		Recognizes when to organize patient. Recognizes when to organize patient/family meetings. Encourages shared decision-making. Provides clear patient information and patient/family meetings. Shared decision-making. Provides clear patient information.		Independently coordinates and leads patient/family meetings. Confidently negotiates and manages patient/family differences.	

Discharge planning					
1	2	3	4	5	n/a
Passive. No initiative. Lacks awareness of appropriate team and community resources.		Actively seeks out appropriate resources and consults with patient/team/community resources. Formulates a d/c plan.		Independently facilitates and coordinates a comprehensive discharge plan, including follow-up. Delegate(s) responsibility.	

Team meeting					
1	2	3	4	5	n/a
Consistently late or absent. Behavior disruptive or non-contributory to team process.		Actively participates and contributes. Reliably performs assigned tasks. Able to co-chair or co-lead meetings.		Independently able to facilitate and coordinate meetings and follow-up. Actively moves meeting forward. Builds consensus, resolves differences, and provides direction.	
Management of difference and conflict					
1	2	3	4	5	n/a
Argumentative. Lacks awareness of own personal contributions to difference or conflict. Debates feedback. Does not listen.		Identifies and manages differences constructively. Listens to understand and for common ground. Demonstrates a willingness to act upon feedback.		Proactively assists in subverting and resolving conflict with other team/family members. Recognizes own role in contributing to differences and acts professionally to resolve them.	

Handover					
1	2	3	4	5	n/a
Disorganized or incomplete handover. Not attentive in giving and receiving patient information. Does not clarify. Not efficient or effective in teamwork.		Provides needed patient information. Competent approach or use of structured tool. Understands role of team members and competently collaborates in handover.		Attentive in giving and receiving patient info. Uses structured approach/tools with ease and efficiency. Is attentive to and enables effective team handover assisting if/as needed.	

OVERALL EVALUATION				
1	2	3	4	5
Unsatisfactory		Solid performance		Superior
Below the minimally acceptable level for a trainee at specified training level.		Demonstrates a solid ability to perform competently. Does what is expected at the specified training level.		Significantly exceeds the benchmark for competence at the specified training level.

Describe STRENGTHS	Actions or areas for improvement

Comments:

TEAM MEETING ENCOUNTER FORM

Instructions for Assessor

- Collaborator competencies can be developed over time. By completing the form below, it will help the learner to gain insight into his/her skills.
- Share your assessment and feedback in a timely manner

Name: _____

Level of Evaluation is PGY: _____

DATE: _____

Evaluator: _____

Participation in team meetings					
1	2	3	4	5	n/a
Consistently late or absent. Disruptive to process. Disrespectful to roles of others. Unprepared.		Reliably performs assigned tasks. Respects roles and opinions of others. Listens to understand and for common ground.		Behaviors consistently move meeting forward. Facilitates mutual accountability for shared decisions. Builds consensus, manages differences, and resolves conflict.	

Communication in team meetings					
1	2	3	4	5	n/a
Does not listen respectfully. Verbal and non-verbal communication is disruptive to process.		Clearly and directly communicates. Uses reflective listening. Acknowledges and responds to others' questions, concerns, and contributions.		Skillfully recognizes and manages communication challenges. Maintains and coordinates necessary communication outside of meeting.	
Leadership skills in team meetings					
1	2	3	4	5	n/a
Consistently avoids or declines leadership responsibilities. Cannot follow others.		Values difference. Builds on others' opinions. Supports consensus-building efforts. Encourages multiple viewpoints.		Flexible approach and situationally aware. Respectfully delegates and shares power. Demonstrates followership when issue is better led by another.	
Management of difference and conflict in team meetings					
1	2	3	4	5	n/a
Argumentative. Lacks awareness of own personal contributions to difference or conflict. Debates feedback.		Identifies and manages differences constructively. Listens to understand, and for common ground. Demonstrates a willingness to act upon feedback.		Proactively assists in subverting and resolving conflict with team members regardless of context.	

OVERALL PERFORMANCE IN TEAM MEETINGS				
1	2	3	4	5
Unsatisfactory		Solid performance		Superior
Below the minimally acceptable level for a trainee at specified training level.		Demonstrates a solid ability to perform competently. Does what is expected at the specified training level.		Significantly exceeds the benchmark for competence at the specified training level.

Describe STRENGTHS	Actions or areas for improvement

Comments:

COLLABORATOR QUOTIENT[25]

Instructions for learners

- The purpose of this exercise is to help you reflect on your impact on group dynamics in a recent situation or clinical setting.
- Thoughtful reflection can lead to improvement.
- Focus is not on the "correct" score, but on identifying ways to improve your "collaboration quotient."

Be prepared to discuss at the next meeting.

Insert your name: _____

Describe your role/responsibilities in this location:

Describe the Rotation/Site/Organization: (include details about when, where, how long, and type of service)

[25] *Created for the CanMEDS Teaching and Assessment Tools Guide by S Glover Takahashi.*

Collaborator Quotient: Calculate your personal "score"

Do you…	0 No or rarely	1 Occasionally or sometimes	2 Often or mostly	3 Always	Notes or examples
genuinely appreciate the role and contribution of others?					
demonstrate a respectful approach, even when things are not going well or not going as you wish?					
introduce yourself to people?					
clarify if you do not understand what is being said?					
develop positive, trusting relationships?					
work to be aware of the difference between your own/others' "intention" and "impact"; work to ensure that the impact of your behavior on others is aligned with your intentions?					
apologize with ease and sincerity?					
use both your preferred style to work in teams and flexibly use other styles if they are better suited to the situation?					

ask for feedback regularly?					
say please and thank you?					
YOUR TOTAL					

Areas for improvement
Area(s) for improvement over the next three to four weeks:

What will improvement look like?

LEADERSHIP REFLECTION[26]

Instructions for Learner

- Observe, reflect, and take (non-identifying) notes on your Leader Role activities in day-to-day practice.
- Remember to be cautious about confidentiality when taking notes.
- Review with faculty as arranged or initiate a review of your case reports to obtain feedback.

NAME: _____

LEVEL: _____

DATE OF LEADERSHIP ACTIVITY: _____

DATES OF PREVIOUS LEADERSHIP REFLECTION REPORTS:
•
•

CURRENT REPORTING PERIOD: FROM _____ TO _____

REFLECTION REPORT REVIEW MEETING

DATE: _____

REVIEWER: _____

COMMENTS FROM REVIEWER

REVIEW OF PAST PRIORITIES LEADERSHIP COMPETENCIES (if applicable)
☐ Not applicable
☐ PAST REPORTING PERIOD: FROM _____TO _____

[26] *Created for the CanMEDS Teaching and Assessment Tools Guide by M Chan and S Glover Takahashi.*

No.	**Leadership area** (e.g., leadership skills, managing self, engaging others, QI, stewardship, patient safety)	**Past goal including timeframe**	**Identified metrics or criteria for success**	**Notes on progress, outcomes, completion**
1.				
2.				
3.				

SUMMARY OF CURRENT/NEW PRIORITIES FOR IMPROVEMENT OF LEADERSHIP COMPETENCIES

☐ APPLIES TO PERIOD: FROM TO

No.	**Leadership area** (e.g., leadership skills, managing self, engaging others, QI, stewardship, patient safety)	**Goal(s) including timeframe**	**Metrics or criteria for success**	**Key next steps, resources, supports for success**
1.				
2.				
3.				

Other notes:

RESEARCH PROJECT HIGH-LEVEL CHECKLIST

Instructions for Assessor

- Meet with your learner for a one-on-one teaching session to assess their progress on these high-level steps of a research project.
- Be prepared to walk the learner through the steps if needed.
- Revisit this checklist with the learner on a regular basis (e.g., quarterly) to explore and support their progress.

Checklist items	Complete	Not yet complete	Comments
1. Meet with your program director or departmental research coordinator as soon as possible.			
2. Look for resources that introduce the basic concepts of research methodology and critical appraisal.			
3. Find a research supervisor.			
4. Pose a focused and specific research question.			
5. Develop a research outline.			
6. Meet with methodological (especially biostatistical) specialists with particular expertise in your area of study.			
7. Develop a research protocol.			
8. As applicable, obtain institutional and research ethics approval.			
9. Seek necessary funding.			
10. If you are conducting a clinical trial, ensure that it is registered with ClinicalTrials.gov.			
11. Collect and analyze the data.			
12. Present your findings.			
13. Prepare and submit a manuscript describing the study and its results to a suitable journal.			
14. If your manuscript is accepted, revise it according to the editor and reviewer's comments.			
15. Celebrate and thank your coauthors and supervisor.			

RESEARCH PROJECT MEETING MONITORING

Instructions for Teacher

- Meet with your learner for a one-on-one teaching session to review the high-level steps to prepare for a research meeting.
- Be prepared to walk the learner through the steps if needed.
- After your initial meeting with the learner, revisit this checklist with them on a regular basis (e.g., quarterly) to explore and support their progress.

Questions to prepare a learner for discussion at a research meeting

1. Has a timeline been developed for the research study that includes additional time (at least 25%) for inevitable delays? (Refer to teaching tool T8.)
2. What strategies have been implemented to deal with unexpected challenges, suggestions for useful research resources at your institution, and time management?
3. Have the Program Director and Research Director and research personnel in your department been consulted to learn more about the available resources to help you with your research project at your institution?

Summary checklist for review at a research meeting

- ☐ Pre-study
- ☐ Develop protocol
- ☐ Consult with statistician (if applicable)
- ☐ Develop study procedures (i.e., data collection form, mechanisms for tracking progress, etc.)
- ☐ Identify potential sources of funds
- ☐ Develop study timetable (plan for delays)
- ☐ Ethics submission and approval

Approval date _____

- ☐ Determine roles and responsibilities of study team
- ☐ Determine method(s) and timing of routine study related communications (e.g., bi-weekly updates)

Start-up

- ☐ Hire and train study staff (if applicable)
- ☐ Establish research account (if applicable)

Account number _____

- ☐ Develop and initiate monitoring

Ongoing

Routinely monitor:

- ☐ Recruitment of study participants/response rate for surveys
- ☐ Adherence to protocol
- ☐ Data quality
- ☐ Consistency of clinical and laboratory procedures and/or assessments by multiple assessors

- ☐ Confidentiality
- ☐ Study budget
- ☐ Other

Maintain relevant correspondence with Research Ethics

Board regarding:

- ☐ Request for annual approval
- ☐ Amendments to protocol and/or consent forms
- ☐ Reports of serious adverse events
- ☐ Study closure

Schedule routine meetings and/or contact with preceptor and study team.

Post-study

- ☐ Complete follow-up for participants (i.e., communicate study results).
- ☐ Perform data analysis (with statistician if applicable).
- ☐ Review study documentation with preceptor.
- ☐ Archive all study documents as per institutions' requirements.

PROFESSIONALISM INCIDENT REPORT

RESIDENT Name: _____

Postgraduate year (PGY): _____

Program: _____

Date & time: _____

1. **Type:** ☐ Critical event ☐ Concerned event/situation ☐ Clinic

2. **Reporter/evaluator:**
   - ☐ Health professional team member (i.e., incl. co-resident) that has worked closely with this resident
   - ☐ Health professional (i.e., incl. co-resident) that has had some interaction with this resident
   - ☐ Resident supervisor that has worked closely with this resident
   - ☐ Resident supervisor that has had some interactions with this resident
   - ☐ Others, please describe: _____

3. **Contact name, follow-up phone, and email**: _____

   _____

4. **SETTING: *Workplace***
   - ☐ Patient Present ☐ Patient Not Present
   - ☐ Ward ☐ Clinic
   - ☐ OR ☐ ER
   - ☐ Other: _____

   Non-Workplace
   "Structured Teaching" Informal/unstructured Teaching
   - ☐ Other: _____

5. **Brief overview of incident or concern:**

6. **Type of incident or concern:**

A. *Professional Ethics*
   - ☐ behaved in a dishonest manner
   - ☐ used illicit substances OR alcohol, non-prescription or prescription drugs in a manner that compromises ability to contribute to patient care
   - ☐ misrepresented self, others, or members of the team to others
   - ☐ breached patient confidentiality

- ☐ acted in disregard for patient welfare (e.g., willfully reports incomplete or inaccurate patient information)
- ☐ took credit for the work of others
- ☐ misused equipment, biohazardous materials, or other scientific specimens

B. *Reliability and Responsibility*
- ☐ consistently arrives late to scheduled events or assignments
- ☐ has unexcused/unexplained absences
- ☐ fails to notify appropriate staff of absences in a timely manner
- ☐ does not respond to communications (e-mail, pages, phone calls, etc.) in a timely or professional manner. Please specify frequency and duration(s) of delay(s).
- ☐ fails to complete required or assigned tasks
- ☐ requires constant, repeated reminders from staff/faculty to complete required or assigned tasks

C. *Professional Relationships & Responsibilities*
- ☐ has inappropriate demeanor or disruptive behavior (raises voice, disrespects authority, rude, condescending, etc.)
- ☐ inappropriate appearance (dirty white coat, wrinkled clothes, un-bathed, etc.) in the classroom or in the health care setting
- ☐ fails to accept responsibility for own errors
- ☐ fails to recognize limitations and seek help
- ☐ does not accept constructive feedback
- ☐ does not incorporate feedback to modify behavior
- ☐ engages in relationships with patients or any other member of the health care team, which are disruptive to learning and patient care
- ☐ acts disrespectfully toward others
- ☐ engages in disruptive behavior in class or with health care team (situational dependent)

D. *Patient, Faculty, Resident, Administrative Staff, and Other Team Member Interactions*
- ☐ is unable to establish rapport
- ☐ is not sensitive to patient needs
- ☐ is disrespectful of diversity or race, gender, religion, sexual orientation, age, disability, or socio-economic status
- ☐ struggles with establishing and maintaining appropriate boundaries in work and learning situations
- ☐ contributes to an atmosphere that is not conducive to learning
- ☐ relates poorly to other learners in the learning environment
- ☐ relates poorly to staff in the learning environment
- ☐ relates poorly to faculty in the learning environment

E. *OTHER*
- ☐ _____
- ☐ _____
- ☐ _____

7. **Immediate Action Taken**
   - ☐ spoke to patient(s)
   - ☐ spoke to learner(s)
   - ☐ spoke to supervisor(s)
   - ☐ contacted supervisor via email
   - ☐ called police or hospital security
   - ☐ documented in patient record
   - ☐ OTHER: _____

Brief summary of action taken:

8. **Next Steps**
   - ☐ Yes, please contact me for further discussion.
   - ☐ Contact me at your discretion.
   - ☐ OTHER:

BALANCED SCORE CARD

Balanced Score Card ***This tool is to be used after completion of the QI project.***						
Title of project: **Team members:**						
Rating system: 0 = no 1 = some attempt was made but does not meet the requirements 2 = met some requirements but substantial improvement is required 3 = good (can use some improvement) 4 = very good (only minimal improvement required) 5 = excellent (no improvement needed)						
Please circle appropriate number for each question.						
1. Have the residents worked effectively as a team?	0	1	2	3	4	5
2. Do the project findings indicate a patient focus?	0	1	2	3	4	5
3. Do the project findings indicate knowledge of process?	0	1	2	3	4	5
4. Do the project findings incorporate PDSA/small tests of change?	0	1	2	3	4	5
5. How would you rate the aim statement (including use of appropriate methodology to identify causes of the problem)?	0	1	2	3	4	5
6. How would you rate the measurement/collection/use of data? (0 = no actual data)	0	1	2	3	4	5
7. Has the team engaged stakeholders in planning, executing, and evaluating the change?	0	1	2	3	4	5
8. How would you rate the change suggested/achieved? (0 = no change suggested)	0	1	2	3	4	5
9. Do the three elements (aim, measure, change) bear some relationship to each other?	0	1	2	3	4	5
Comments:						
Total Score						**/45**

RESIDENT EXPERIENCE SURVEY

An online survey needs to be developed to promote transparency and enable continuous quality improvement. This survey will have five domains with sub-items.

1. Quality educational tools:
   a) Lecture/Workshop — Yes ☐ No ☐
   b) Oral Case Presentation Seminar — Yes ☐ No ☐
   c) Literature Review Club — Yes ☐ No ☐

2. Completed clinical procedures:
   a) NS-RCT — Yes ☐ No ☐
   b) NS-RCT Retx — Yes ☐ No ☐
   c) Apicoectomy — Yes ☐ No ☐
   d) Regeneration — Yes ☐ No ☐

3. Preferred methods and techniques utilized during training:
   a) Visualization — Yes ☐ No ☐
   b) Instrumentation — Yes ☐ No ☐
   c) Obturation — Yes ☐ No ☐

4. Effectiveness and efficiency of program management team:
   a) Time management — Yes ☐ No ☐
   b) Coordination — Yes ☐ No ☐
   c) Supervision — Yes ☐ No ☐
   d) Transparency — Yes ☐ No ☐
   e) Support — Yes ☐ No ☐

5. Sufficiency and suitability of physical facilities, equipment, and supplies:
   a) Classrooms — Yes ☐ No ☐
   b) Dental lab — Yes ☐ No ☐
   c) Equipment — Yes ☐ No ☐
   d) Dental materials — Yes ☐ No ☐
   e) Dental auxiliaries — Yes ☐ No ☐

PROGRAM SURVEY[27]

Instruction to Residents:

Based on your experience in the program thus far, please answer all questions. Please be frank. The purpose of this questionnaire is not to assess your knowledge or abilities, but to find out more about the program. If you expect to receive specific training and/or experiences but have not met yet, please indicate this in the comment section at the end of each question.

You will have an opportunity to discuss your answers privately with the program director. Please bring the completed questionnaire with you and return it directly to the program director office.

NOTE: Kindly answer all the questions based on your experience in the program by circling YES or NO or completing the blanks as appropriate. The space provided after each question is for your comments.

[27] *Adopted from the American Dental Association (ADA).*

Date_____

INSTITUTIONAL AND PROGRAM EFFECTIVENESS

Do you have the same privileges and responsibilities given to residents in other professional education programs at this institution? YES NO

Comments: _____

_____

Based on your knowledge of the program, have overall goals and objectives been developed? YES NO

Comments: _____

_____

a. Endodontics YES NO
b. Resident education YES NO
c. Patient education YES NO
d. Community service YES NO

Comments: _____

_____

Have you been given the opportunity to evaluate if the program has met its stated goals and objectives? YES NO

Comments: _____

_____

EDUCATIONAL PROGRAM CURRICULUM

Have goals and objectives OR competency and proficiency statements been developed for each area of resident training? YES NO

Comments: _____

_____

Do the goals and objectives OR competency and proficiency statements describe the intended outcomes of the resident's education? YES NO

Comments: _____

_____

Has your instruction and training included providing comprehensive multidisciplinary oral health care? YES NO

Comments: _____

_____

Do you think your instruction and training have been at a skill and level beyond that of dental school? YES NO

Comments: _____

_____

Have you received didactic and clinical training to prepare you to act as an endodontist in the following areas?

1) Providing emergency and multidisciplinary comprehensive oral health care YES NO
2) Obtaining informed consent YES NO
3) Functioning effectively within interdisciplinary health care teams including consultation and referral YES NO
4) Providing patient-focused care that is coordinated by the general practitioner YES NO
5) Directing health promotion and disease prevention activities YES NO
6) Using advanced dental treatment modalities as defined by the program YES NO

Comments: _____

_____

Have you received didactic and clinical training in the following areas?

1) Assessing, diagnosing, and planning for the provision of multidisciplinary oral health care for a wide variety of patients, including patients with special needs YES NO
2) Managing the delivery of patient-focused oral health care YES NO

Comments: _____

_____

Have you received didactic, clinical training, and experience in the following areas?

a) Endodontic therapy	YES	NO
b) Immunocompromised and special needs patients	YES	NO
c) Evaluation and treatment of dental emergencies	YES	NO
d) Pain and anxiety control utilizing behavioral and pharmacological techniques	YES	NO

Comments: _____

_____

Have you received training in the management of the following areas?

a) Medical emergencies	YES	NO
b) Dental implants	YES	NO
c) Oral mucosal diseases	YES	NO
d) Temporomandibular disorder and orofacial pain	YES	NO
e) Occlusal disorders	YES	NO

When assigned to an off-service rotation or one in an affiliated institution or extramural facility, the following have occurred:	YES	NO
a. Objectives developed in conjunction with the rotation director have been distributed to the faculty.	YES	NO
b. Supervision by faculty who are familiar with the objectives	YES	NO
c. Evaluation by faculty	YES	NO

Comments: _____

_____

Have you been given assignments that require critical review of relevant scientific literature?	YES	NO

Comments: _____

_____

Do you think the instruction received in the principles of practice management is adequate?	YES	NO

Comments: _____

_____

Do you think you have gained the experience necessary to evaluate and manage dental emergencies, including trauma to dentoalveolar structures and acute oral pathological conditions? YES NO

Comments: _____

_____

Have you received formal coaching in physical evaluation and medical risk assessment, including:

_____ taking, recording, and interpreting a complete medical history;

_____ understanding the indications and interpretations of laboratory studies and other techniques used in the diagnosis of oral and systemic diseases;

_____ understanding the relationship between oral health care and systemic diseases;

_____ interpreting the physical evaluation performed by a physician with an understanding of how it impacts on proposed dental treatment.

Comments: _____

_____

Program Length

Do you feel the goals and objectives OR competency and proficiency statements of the senior year of resident training are at a higher level thanthose of the junior year of the program? YES NO

Comments: _____

_____

Evaluation

How often are you evaluated on your progress toward achieving the program's written goals and objectives? Frequency _____

Comments: _____

_____

Following each evaluation, are you given an opportunity to discuss it with the program director or faculty? YES NO

Comments: _____

_____

FACULTY AND STAFF

Does the faculty have collective competence in endodontics? YES NO

Comments: _____

_____

In your opinion, do endodontists have a significant role in program development and instruction? YES NO

Comments: _____

_____

Are you given the opportunity to evaluate the performance of faculty members annually? YES NO

Comments: _____

_____

Approximately what percent of time is a faculty member present in the dental clinic for consultation, supervision, and active teaching when residents are treating patients in scheduled clinic sessions? _____%

Comments: _____

_____

Are allied dental personnel and clerical staff available to ensure residents receive training and experience in the use of modern concepts of oral health care delivery and to ensure efficient administration of the program? YES NO

Comments: _____

_____

Do residents and teaching staff regularly perform the tasks of dental assistants, laboratory technicians, or clerical personnel? YES NO

Comments: _____

_____

EDUCATIONAL SUPPORT SERVICES

Are the facilities and resources adequate and appropriately maintained to support the goals and objectives of the program? YES NO

Comments: _____

_____

Are you aware of specific written due process policies and procedures for adjudication of academic and disciplinary complaints? YES NO

Comments: _____

_____

Were you encouraged to be immunized against and/or tested for infectious diseases such as mumps, measles, rubella, and hepatitis B prior to contact with patients and/or infectious objects or materials? YES NO

Comments: _____

_____

PATIENT CARE SERVICES

Have you had adequate patient experiences to allow you to achieve the program's stated goals and objectives OR competencies and proficiencies of resident training? YES NO

Comments: _____

_____

Have you been involved in a structured system of continuous quality improvement for patient care? YES NO

Comments: _____

_____

Prior to providing direct patient care, were you required to be certified in basic life support procedures including cardiopulmonary resuscitation? YES NO

Comments: _____

_____

Have you been provided with the institution's policies on radiation hygiene and protection, ionizing radiation, hazardous materials, and blood-borne and infectious diseases? YES NO

Comments: _____

_____

Does the program have policies that ensure that the confidentiality of information pertaining to the health status of each individual is strictly maintained? YES NO

Comments: _____

_____

In your opinion, what are the strengths of the program?

In your opinion, what are the weaknesses of the program?

Would you recommend this program to graduating dental students? YES NO

Comments: _____

_____

How have you most benefited by completing this program? YES NO

Comments: _____

_____

Thank you

IN-TRAINING EVALUATION REPORT (ITER)

Instructions for Assessor

- Using the form below, please help this endodontic resident gain insight into his/her skills by providing valuable confidential feedback.
- The form must be completed in electronic format on the One 45 portal, with signatures of at least two clinical supervisors, within two weeks before the end of each rotation.
- The ITERs should be completed every three months covering nine training months per year.
- This information will be shared with the learner in aggregate form and for the purposes of helping him/her improve by the program director, as necessary.

Checklist item	Grade			
	0 Fail	1 Borderline	3 Acceptable	4 Exceed expectation
Endodontic Expert				
***History & Dental Examination:** 1. Obtain dental history, perform dental examination and diagnostic endodontic assessment, and provide an interpretation of the radiographs in a comprehensive, accurate, & concise manner with all relevant details.				
***Endodontic Diagnostic Tests:** 2. Used in a cost-effective manner & understands limitation & predictive value.				
***Endodontic Diagnosis:** 3. Able to formulate appropriate differential diagnosis.				
***Endodontic Treatment Plan:** 4. Able to analyze, integrate, and formulate effective management strategies.				
***Medical Knowledge:** 5. Broad clinical & basic knowledge of a wide variety of medical problems and develops a plan of secondary prevention.				
***Emergency Management:** 6. Able to identify and respond appropriately to urgent cases.				

***Evidence-based Practice/Critical Appraisal Skills:** 7. Aware of the role of evidence in clinical decision-making.				
8. Able to apply relevant information in problem solving.				
*9. Demonstrates knowledge of medications used, mechanisms of action, clinically relevant pharmacokinetics, indications, contraindications, and adverse effects.				
10. Demonstrates in-depth guidelines and clinical training to achieve proficiency in high impact procedures in endodontics.				
***Procedural Skills:** 10. Performs diagnostic & therapeutic procedures in skillful and safe manner; understands indications, limitations, & complications.				
Endodontic Communicator				
1. Communicates effectively with patients and their families using patient-centered approach, and with health care providers.				
2. Able to maintain clear, accurate, & appropriate records.				
3. Written orders and progress notes are well organized & legible.				
4. Discloses harmful patient safety incidents to patients and their families accurately and appropriately.				
5. Discharge summaries are concise & completed promptly.				

Endodontic Collaborator				
1. Works effectively in a team environment with dentists and other colleagues in the health care profession to promote understanding, manage difference, and resolve conflicts.				
2. Hands over the care of a patient to another health care professional to facilitate continuity of safe patient care.				
Endodontic Leader				
1. Serves in administration and leadership roles as appropriate.				
2. Appropriate & efficient use of health care resources.				
3. Demonstrates time management and sets priorities.				
Endodontic Health Advocate				
1. Able to identify the psychosocial, economic, environmental, & biological factors that influence the health of patients and society.				
2. Offers advocacy on behalf of patients at practice and general population levels.				
3. Incorporates disease prevention and health promotion and education resources.				
Endodontic Scholar				
1. Attends and contributes to rounds, seminars, and other learning events.				
2. Accepts and acts on constructive feedback.				
3. Contributes to the education of patients, junior residents, dental staff, and students.				

4. Contributes to scientific research.				
5. Plans and delivers a learning activity				
Endodontic Professional				
1. Delivers the highest quality of care with integrity & compassion.				
2. Recognizes limitations and seeks advice and consultations when necessary.				
3. Reflects the highest standards of excellence in clinical care and ethical conduct.				

Evidence-Based Endodontics/How to read a scientific article

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Teeth Morphology and Anatomy

Classification System

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Anterior Teeth

4. Kerekes K, Tronstad L. Morphometric observations on root canals of human anterior teeth. J Endod. 1977 Jan;3(1):24–9.
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8. Bellizzi R, Hartwell G. Clinical investigation of in vivo endodontically treated mandibular anterior teeth. J Endod. 1983 Jun;9(6):246–8.
9. Mauger MJ, Schindler WG, Walker WA. An evaluation of canal morphology at different levels or root resection in mandibular incisors. J Endod. 1998;24:607–9.
10. Al-Fouzan KS, AlManee A, Jan J, Al-Rejaie M. Incidence of two canals in extracted mandibular incisors teeth of Saudi Arabian samples. Saudi Endod J. 2012;2:65–9.

Maxillary & Mandibular Premolars

11. Bellizzi R, Hartwell GR. Radiographic evaluation of root canal anatomy of in vivo endodontically treated maxillary premolars. J Endod. 1985;11:37–9.
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Maxillary & Mandibular Molars

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Radix Entomolaris & Paramolaris

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CANAL ACCESS/INSTRUMENTATION/IRRIGATION

Canal access/instrumentation/irrigation

Canal Access

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Orifice Enlargement and Preflaring

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Instrumentation Techniques and their Effect

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OBTURATION

Obturation

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SINGLE VS MULTIPLE VISITS AND INTRACANAL MEDICAMENTS

Single vs Multiple Visits and Intracanal Medicaments

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Endodontic Immunology

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New Trends

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Endodontic Microbiology

1. **Part I. Basic microbiology related to endodontics** (Refer to pathways of the pulp)
   - **1.1 Concepts**
     - **The following concepts need to be discussed and defined:**
       - **a.** Define Apical Periodontitis.
       - **b.** What is the ultimate goal of the endodontic treatment?
       - **c.** Define Biofilm, Commensal, Infection, Opportunistic infection, Pathogen, Parasite, Saprophyte, Genotype, Phenotype, and Virulence.
       - **d.** Define Prokaryotes and Eukaryotes.
       - **e.** Classification of microorganisms:
         - **i.** According to morphology or shape (Cocci, Bacilli, Spiral forms, Pleomorphic; give example).
         - **ii.** According to cell wall (Gram positive and negative).
         - **iii.** According to oxygen tolerance (Obligate anaerobes, Micoaerobic, Facultative anaerobes).
         - **iv.** Sub-classification of Black Pigmented Bacteriods.

   - **1.2 The following article needs to be discussed/summarized:**

1. Siqueira JF Jr, Rôças IN. Diversity of endodontic microbiota revisited. J Dent Res. 2009 Nov;88(11):969–81.

1.3 Methods for microbial identification (Pathways of the pulp, Endodontic topic articles)

- **1.1 Histology—Discuss the following articles:**

2. Ramachandran Nair PN. Light and electron microscopic studies of root canal flora and periapical lesions. J Endod. 1987 Jan;13(1):29–39.
3. Trope M, Rosenberg E, Tronstad L. Darkfield microscopic spirochete count in the differentiation of endodontic and periodontal abscesses. J Endod. 1992 Feb;18(2):82–6.
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1.4 Culture: Discuss advantages and disadvantages. Then discuss the following articles:

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6. Noda M, Inoue S, Komatsu H. A comparison of methods for detecting bacteria in root canal exudate. J Endod. 1999 Mar;25(3):187–9.
7. Peters LB, Wesselink PR, Buijs JF, van Winkelhoff AJ. Viable bacteria in root dentinal tubules of teeth with apical periodontitis. J Endod. 2001 Feb;27(2):76–81.

1.5 Molecular Methods: Discuss advantages and disadvantages. Then discuss the following articles:

8. Siqueira JF Jr, Rôças IN, Souto R, de Uzeda M, Colombo AP. Checkerboard DNA-DNA hybridization analysis of endodontic infections. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2000 Jun;89(6):744–8.
9. Rolph HJ, Lennon A, Riggio MP, Saunders WP, MacKenzie D, Coldero L, Bagg J. Molecular identification of microorganisms from endodontic infections. J Clin Microbiol. 2001 Sep;39(9):3282–9.
10. Siqueira JF Jr, Rôças IN. Exploiting molecular methods to explore endodontic infections: part 1—current molecular technologies for microbiological diagnosis. J Endod. 2005 Jun;31(6):411–23.
11. Sedgley C, Buck G, Appelbe O. Prevalence of Enterococcus faecalis at multiple oral sites in endodontic patients using culture and PCR. J Endod. 2006 Feb;32(2):104–9.
12. Young G, Turner S, Davies JK, Sundqvist G, Figdor D. Bacterial DNA persists for extended periods after cell death. J Endod. 2007 Dec;33(12):1417–20.

Part 2. Routes of Root Canal Infection: How do microorganisms reach the root canal system? (Refer to pathways of the pulp)

2.1. Caries

13. Hahn CL, Falkler WA Jr, Minah GE. Microbiological studies of carious dentine from human teeth with irreversible pulpitis. Arch Oral Biol. 1991;36(2):147–53.
14. Martin FE, Nadkarni MA, Jacques NA, Hunter N. Quantitative microbiological study of human carious dentine by culture and real-time PCR: association of anaerobes with histopathological changes in chronic pulpitis. J Clin Microbiol. 2002 May;40(5):1698–704.

2.2. Coronal Leakage

15. Hommez GM, Verhelst R, Claeys G, Vaneechoutte M, De Moor RJ. Investigation of the effect of the coronal restoration quality on the composition of the root canal microflora in teeth with apical periodontitis by means of T-RFLP analysis. Int Endod J. 2004 Dec;37(12):819–27.
16. Ricucci D, Bergenholtz D. Bacterial status in root-filled teeth exposed to the oral environment by loss of restoration and fracture or caries—a histobacteriological study of treated cases. Int Endod J. 2002;36:787–802.

2.3. Periodontium

17. Langeland K, Rodriques H, Dowden W. Periodontal disease, bacteria, and pulpal histopathology. Oral Surg Oral Med Oral Pathol. 1974;37:257–70.
18. Tanner AC, Visconti RA, Holdeman LV, Sundqvist G, Socransky SS. Similarity of Wolinella recta strains isolated from periodontal pockets and root canals. J Endod. 1982 Jul;8(7):294–300.
19. Kerekes K, Olsen I. Similarities in the microfloras of root canals and deep periodontal pockets. Endod Dent Traumatol. 1990 Feb;6(1):1–5.

2.4. Anachoresis: Define Anachoresis and bacteremia. Discuss the following articles:

20. Robinson HBG, Boling LR. An anachoretic effect in pulpitis. I. Bacteriological studies. JADA, Feb 1941, 28;268–82. (Abstract only)

21. Gier RE, Mitchell DF. Anachoretic effect of pulpitis. J Dent Res. 1968 Jul-Aug;47(4):564–70.

22. Tziafas D. Experimental bacterial anachoresis in dog dental pulps capped with calcium hydroxide. J Endod. 1989 Dec;15(12):591–5.

23. Delivanis PD, Snowden RB, Doyle RJ. Localization of blood-borne bacteria in instrumented unfilled root canals. Oral Surg Oral Med Oral Pathol. 1981 Oct;52(4):430–2.

24. Delivanis PD, Fan VS. The localization of blood-borne bacteria in instrumented unfilled and overinstrumented canals. J Endod. 1984 Nov;10(11):521–4.

2.5 Can endodontic microorganisms enter systemic circulation?..... Yes

25. Eisenbud L. Subacute bacterial endocarditis precipitated by non-surgical dental procedures (Report of two cases). Oral Surg Oral Med Oral Pathol. 1962;15:624–7.

26. Baumgartner JC, Heggers JP, Harrison JW. The incidence of bacteremias related to endodontic procedures (I. Nonsurgical endodontics). J Endod. 1976;2:135–40.

27. Baumgartner JC, Heggers JP, Harrison JW. Incidence of bacteremias related to endodontic procedures (II Surgical endodontics). J Endod. 1977;3:399–402.

Part 3. Virulence Factors (Refer to Endodontic topic article *Salient virulence factors* by Olson & Dahlen + Pathways of the pulp)

1.1. Variable host-microorganisms in the root canal: 1. Able to colonize, 2. Able to evade host, 3. Able to cause tissue destruction, 4. Able to adopt conditions (pH, Redox, nutrients, adhere to dentin).
(Most information can be found in *Salient virulence factors* by Olson & Dahlen, 2004)—2 slides.

1.2. Virulence of microorganisms by forming biofilms (Endo Topic by Svensater & Bergenholtz, 2004 + Pathways of the pulp)

3.3 Discuss/overview of biofilm, then discuss the following articles:

28. Chávez de Paz LE, Bergenholtz G, Dahlén G, Svensäter G. Response to alkaline stress by root canal bacteria in biofilms. Int Endod J. 2007 May;40(5):344–55.

29. Ricucci D, Siqueira JF Jr. Biofilms and apical periodontitis: study of prevalence and association with clinical and histopathologic findings. J Endod. 2010 Aug;36(8):1277–88.

a. **Virulence of microorganisms by invasion of dentinal tubules** (Refer to *Invasion of dentinal tubules by root canal bacteria* by Love, 2004)—3 slides

1.3. Virulence of microorganisms by coaggregation and gene transfer (31–37 >> Put a table at the end to show coaggregation.)

30. Khemaleelakul S, Baumgartner JC, Pruksakom S. Autoaggregation and coaggregation of bacteria associated with acute endodontic infections. J Endod. 2006 Apr;32(4):312–8.
31. Johnson EM, Flannagan SE, Sedgley CM. Coaggregation interactions between oral and endodontic Enterococcus faecalis and bacterial species isolated from persistent apical periodontitis. J Endod. 2006 Oct;32(10):946–50.
32. Sedgley CM, Lee EH, Martin MJ, Flannagan SE. Antibiotic resistance gene transfer between Streptococcus gordonii and Enterococcus faecalis in root canals of teeth ex vivo. J Endod. 2008 May;34(5):570–4.
33. Sundqvist GK, Eckerbom MI, Larsson AP, Sjögren UT. Capacity of anaerobic bacteria from necrotic dental pulps to induce purulent infections. Infect Immun. 1979 Aug;25(2):685–93.
34. Sundqvist G. Associations between microbial species in dental root canal infections. Oral Microbiol Immunol. 1992 Oct;7(5):257–62.
35. Siqueira JF Jr, Rôças IN, Oliveira JC, Santos KR. Molecular detection of black-pigmented bacteria in infections of endodontic origin. J Endod. 2001 Sep;27(9):563–6.
36. Peters LB, Wesselink PR, van Winkelhoff AJ. Combinations of bacterial species in endodontic infections. Int Endod J. 2002 Aug;35(8):698–702.

b. **Virulence of microorganisms by Endotoxin** (37–43 already covered in Immunology topic, please copy and paste. Reference 44 needs to be discussed.)

37. Schein B, Schilder H. Endotoxin content in endodontically involved teeth. J Endod. 1975;1:19–21.
38. Dahlen G, Bergenholtz G. Endotoxic activity in teeth with necrotic pulps. J Dent Res. 1980;59:1033–40.
39. Pitts DL, Williams BL, Morton TH. Investigation of the role of endotoxin in periapical inflammation. J Endod. 1982;8:10–18.
40. Schonfeld SE, Greening AB, Glick DH, Frank AL, Simon JH, Herles SM. Endotoxic activity in periapical lesions. Oral Surg Oral Med Oral Pathol. 1982;53:82–7.
41. Horiba N, Maekawa Y, Abe Y, Ito M, Matsumoto H, Nakamura H. Correlations between endotoxin and clinical symptoms or radiolucent areas in infected root canals. Oral Surg Oral Med Oral Pathol. 1991;71:492–5.
42. Khabbaz MG, Anastasiadis PL, Sykaras SN. Determination of endotoxins in the vital pulp of human carious teeth: association with pulpal pain. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2001;91:587–93.
43. Gomes BP, Endo MS, Martinho FC. Comparison of endotoxin levels found in primary and secondary endodontic infections. J Endod. 2012 Aug;38(8):1082–6.

c. **Virulence factors by Enterococcus faecalis**

44. Kayaoglu G1, Ørstavik D. Virulence factors of Enterococcus faecalis: relationship to endodontic disease. Crit Rev Oral Biol Med. 2004 Sep 1;15(5):308–20 (Please discuss in detail.)

Part 4. Microorganisms in Primary Endodontic Infections

4.1. Can microorganisms cause Apical Periodontitis? Yes, according to animal studies:

45. Kakehashi S, Stanley HR, Fitzgerald RJ. The effects of surgical exposures of dental pulps in germ-free and conventional laboratory rats. Oral Surg Oral Med Oral Pathol. 1965 Sep;20:340–9. (Use articles in top 40.)

46. Möller AJ, Fabricius L, Dahlén G, Ohman AE, Heyden G. Influence on periapical tissues of indigenous oral bacteria and necrotic pulp tissue in monkeys. Scand J Dent Res. 1981 Dec;89(6):475–84.

47. Fabricius L, Dahlén G, Holm SE, Möller AJ. Influence of combinations of oral bacteria on periapical tissues of monkeys. Scand J Dent Res. 1982 Jun;90(3):200–6.

4.2. Microorganisms in necrotic human pulp

First, discuss the following article with emphasis on microorganisms in primary endodontic infection (no need to discuss previously covered).

48. Siqueira JF Jr, Rôças IN. Diversity of endodontic microbiota revisited. J Dent Res. 2009 Nov;88(11):969–81.

4.3. Human studies on the presence of microorganisms in necrotic pulp

49. Bergenholtz G. Microorganisms from necrotic pulp of traumatized teeth. Odontol Revy. 1974;25(4):347–58.

50. Sundqvist G. Bacteriological studies of traumatized teeth. UMEA Dissertation.

51. Gomes BP, Pinheiro ET, Gadê-Neto CR, Sousa EL, Ferraz CC, Zaia AA, Teixeira FB, Souza-Filho FJ. Microbiological examination of infected dental root canals. Oral Microbiol Immunol. 2004 Apr;19(2):71–6.

4.4. Specific microorganisms retrieved from necrotic pulp

4.4.1. Bacteria

52. Baumgartner JC, Falkler WA. Bacteria in the apical 5 mm of infected root canals. J Endod. 1991;17:380–3.

53. Dougherty WJ, Bae KS, Watkins BJ, Baumgartner JC. Black-pigmented bacteria in coronal and apical segments of infected root canals. J Endod. 1998;24:356–8.

54. Siqueira JF Jr, Rôças IN, Alves FR, Silva MG. Bacteria in the apical root canal of teeth with primary apical periodontitis. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2009 May;107(5):721–6.

55. Sundqvist G, Johansson E, Sjogren U. Prevalence of black-pigmented Bacteroides species in root canal infections. J Endod. 1989;15:13–19.

56. Bae KS, Baumgartner JC, Shearer TR, David LL. Occurrence of Prevotella nigrescens and Prevotella intermedia in infections of endodontic origin. J Endod. 1997 Oct;23(10):620–3.

57. Gomes BP, Pinheiro ET, Gadê-Neto CR, Sousa EL, Ferraz CC, Zaia AA, Teixeira FB, Souza-Filho FJ. Microbiological examination of infected dental root canals. Oral Microbiol Immunol. 2004 Apr;19(2):71–6. (Covered previously)

58. Rôças IN, Siqueira JF Jr, Santos KR, Coelho AM. "Red complex" (Bacteroides forsythus, Porphyromonas gingivalis, and Treponema denticola) in endodontic infections: a molecular approach. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2001 Apr;91(4):468–71.

59. Gomes BP, Montagner F, Jacinto RC, Zaia AA, Ferraz CC, Souza-Filho FJ. Polymerase chain reaction of Porphyromonas gingivalis, Treponema denticola, and Tannerella forsythia in primary endodontic infections. J Endod. 2007 Sep;33(9):1049–52.
60. Baumgartner JC, Khemaleelakul SU, Xia T. Identification of spirochetes (treponemes) in endodontic infections. J Endod. 2003 Dec;29(12):794–7.

4.4.2. Fungal

61. Baumgartner JC, Watts CM, Xia T. Occurrence of Candida albicans in infections of endodontic origin. J Endod. 2000 Dec;26(12):695–8.
62. Egan MW, Spratt DA, Ng YL, Lam JM, Moles DR, Gulabivala K. Prevalence of yeasts in saliva and root canals of teeth associated with apical periodontitis. Int Endod J. 2002 Apr;35(4):321–9.

4.4.3. Viruses

63. Sabeti M, Simon JH, Slots J. Cytomegalovirus and Epstein-Barr virus active infection in periapical lesions of teeth with intact crowns. J Endod. 2003;29:321–3.
64. Slots J, Sabeti M, Simon JH. Herpesvirusus in periapical pathosis: an etiopathogenic relationship? Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2003;96:327–31.
65. Sabeti M, Simon JH, Slots J. Cytomegalovirus and Epstein-Barr virus are associated with symptomatic periapical pathosis. Oral Microbiol Immunol. 2003;18:327–8.
66. Sabeti M, Slots J. Herpesviral-bacterial coinfection in periapical pathosis. J Endod. 2004;30:69–72.
67. Li H, Chen V, Chen Y, Baumgartner JC, Machida CA. Herpesviruses in endodontic pathoses: association of Epstein-Barr virus with irreversible pulpitis and apical periodontitis. J Endod. 2009 Jan;35(1):23–9.

4.5. Transmissible Spongiform Encephalopathies and Prions

68. Blanquet-Grossard F, Sazdovitch V, Jean A, Deslys JP, Dormont D, Hauw JJ, Marion D, Brown P, Cesbron JY. Prion protein is not detectable in dental pulp from patients with Creutzfeldt-Jakob disease. J Dent Res. 2000 Feb;79(2):700.
69. Azarpazhooh A, Fillery ED. Prion disease: the implications for dentistry. J Endod. 2008 Oct;34(10):1158–66.

4.6. Association between specific microorganisms and symptoms
There is an association.

70. Haapasalo M, Ranta H, Ranta K, Shah H. Black-pigmented Bacteroides spp. in human apical periodontitis. Infect Immun. 1986 Jul;53(1):149–53.
71. Gomes BP, Lilley JD, Drucker DB. Associations of endodontic symptoms and signs with particular combinations of specific bacteria. Int Endod J. 1996 Mar;29(2):69–75.
72. Sakamoto M, Rôças IN, Siqueira JF Jr, Benno Y. Molecular analysis of bacteria in asymptomatic and symptomatic endodontic infections. Oral Microbiol Immunol. 2006 Apr;21(2):112–22.

73. Sabeti M, Simon JH, Slots J. Cytomegalovirus and Epstein-Barr virus are associated with symptomatic periapical pathosis. Oral Microbiol Immunol. 2003;18:327–8. (Discussed previously, cut and paste).

There is NO association.

74. Baumgartner JC, Watkins BJ, Bae KS, Xia T. Association of black-pigmented bacteria with endodontic infections. J Endod. 1999 Jun;25(6):413–5.
75. Rôças IN, Siqueira JF Jr, Santos KR, Coelho AM. "Red complex" (Bacteroides forsythus, Porphyromonas gingivalis, and Treponema denticola) in endodontic infections: a molecular approach. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2001 Apr;91(4):468–71. (Covered, cut and paste.)

4.7 Microorganisms in unsuccessful endodontic treatment (Secondary)

76. Gomes BP, Pinheiro ET, Gadê-Neto CR, Sousa EL, Ferraz CC, Zaia AA, Teixeira FB, Souza-Filho FJ. Microbiological examination of infected dental root canals. Oral Microbiol Immunol. 2004 Apr;19(2):71–6. (Covered previously >> Develop a table of comparison.)
77. Molander A, Reit C, Dahlen G, Kvist T. Microbiological status of root-filled teeth with apical periodontitis. Int Endod J. 1998;31:1–7.
78. Sundqvist G, Figdor D, Persson S, Sjogren U. Microbiologic analysis of teeth with failed endodontic treatment and the outcome of conservative re-treatment. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 1998;85:86–93.
79. Hancock HH, Sigurdsson A, Trope M, Moiseiwitsch J. Bacteria isolated after unsuccessful endodontic treatment in a North American population. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2001;91:579–86.
80. Pinheiro ET, Gomes BP, Ferraz CC, Sousa EL, Teixeira FB, Souza-Filho FJ. Microorganisms from canals of root-filled teeth with periapical lesions. Int Endod J. 2003;36:1–11.
81. Rocas IN, Siqueira JF, Santos KR. Association of Enterococcus faecalis with different forms of periradicular diseases. J Endod. 2004;30:315–20.
82. Sedgley C, Nagel A, Dahlén G, Reit C, Molander A. Real-time quantitative polymerase chain reaction and culture analyses of Enterococcus faecalis in root canals. J Endod. 2006 Mar;32(3):173–7.
83. Kaufman B, Spangberg L, Barry J, Fouad AF. Enterococcus Spp. in endodontically treated teeth with and without periradicular lesions. J Endod. 2005;31:851–6.
84. Stuart CH, Schwartz SA, Beeson TJ, Owatz CB. Enterococcus faecalis: its role in root canal treatment failure and current concepts in retreatment. J Endod. 2006;32:93–8.

4.8 Effect of endodontic treatment on microorganisms—Discuss the following articles:

85. Haapasalo M, Endal U, Zandi H, Coil JM. Eradication of endodontic infection by instrumentation and irrigation solutions. Endod Topics 2005;10:77–102.
86. Fedorowicz Z, Nasser M, Sequeira-Byron P, de Souza RF, Carter B, Heft M. Irrigants for non-surgical root canal treatment in mature permanent teeth. Cochrane Database Syst Rev. 2012 Sep 12;9.

4.8.1. Sodium hypochlorite (Present MSDS)
Can you cite articles to support the usage of NaOCL?
For disinfection

87. Cvek M, Nord CE, Hollender L. Antimicrobial effect of root canal débridement in teeth with immature root. A clinical and microbiologic study. Odontol Revy. 1976;27(1):1–10.
88. Cvek M, Hollender L, Nord CE. Treatment of non-vital permanent incisors with calcium hydroxide. VI. A clinical, microbiological and radiological evaluation of treatment in one sitting of teeth with mature or immature root. Odontol Revy. 1976;27(2):93–108.
89. Byström A, Sundqvist G. Bacteriologic evaluation of the efficacy of mechanical root canal instrumentation in endodontic therapy. Scand J Dent Res. 1981 Aug;89(4):321–8.
90. Byström A, Sundqvist G. Bacteriologic evaluation of the effect of 0.5 percent sodium hypochlorite in endodontic therapy. Oral Surg Oral Med Oral Pathol. 1983 Mar;55(3):307–12.
91. Bystrom A, Sundqvist G. The antibacterial action of sodium hypochlorite and EDTA in 60 cases of endodontic therapy. Int Endod J. 1985 Jan;18(1):35–40.
92. Shuping GB, Orstavik D, Sigurdsson A, Trope M. Reduction of intracanal bacteria using nickel-titanium rotary instrumentation and various medications. J Endod. 2000 Dec;26(12):751–5.
93. Martinho FC, Gomes BP. Quantification of endotoxins and cultivable bacteria in root canal infection before and after chemomechanical preparation with 2.5% sodium hypochlorite. J Endod. 2008 Mar;34(3):268–72.

For tissue dissolving (all articles were covered in the canal access, cleaning, and shaping topic)

94. Senia ES, Marshall FJ, Rosen S. The solvent action of sodium hypochlorite on pulp tissue of extracted teeth. Oral Surg Oral Med Oral Pathol 1971;31:96–103.
95. Hand RE, Smith ML, Harrison JW. Analysis of the effect of dilution on the necrotic tissue dissolution property of sodium hypochlorite. J Endod 1978;4:60–4.
96. Rosenfeld EF, James GA, Burch BS. Vital pulp tissue response to sodium hypochlorite. J Endod 1978;4:140–6.
97. Harrison JW, Hand RE. The effect of dilution and organic matter on the antibacterial property of 5.25% sodium hypochlorite. J Endod 1981;7:128–32.
98. Harrison JW, Svec TA, Baumgartner JC. Analysis of clinical toxicity of endodontic irrigants. J Endod. 1978;4:6–11.
99. Johnson BR, Remeikis NA. Effective shelf-life of prepared sodium hypochlorite solution. J Endod. 1993;19:40–3.
100. Stojicic S, Zivkovic S, Qian W, Zhang H, Haapasalo M. Tissue dissolution by sodium hypochlorite: effect of concentration, temperature, agitation, and surfactant. J Endod. 2010 Sep;36(9):1558–62.
101. Jungbluth H, Peters C, Peters O, Sener B, Zehnder M. Physicochemical and pulp tissue dissolution properties of some household bleach brands compared with a dental sodium hypochlorite solution. J Endod. 2012 Mar;38(3):372–5.

4.8.2 Can you cite articles to support the usage of Chlorohexidine?

102. Jeansonne MJ, White RR. A comparison of 2.0% chlorhexidine gluconate and 5.25% sodium hypochlorite as antimicrobial endodontic irrigants. J Endod. 1994 Jun;20(6):276–8.

103. Wang CS, Arnold RR, Trope M, Teixeira FB. Clinical efficiency of 2% chlorhexidine gel in reducing intracanal bacteria. J Endod. 2007 Nov;33(11): 1283–9.

104. Zamany A, Safavi K, Spångberg LS. The effect of chlorhexidine as an endodontic disinfectant. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2003 Nov;96(5):578–81.

105. Ringel AM, Patterson SS, Newton CW, Miller CH, Mulhern JM. In vivo evaluation of chlorhexidine gluconate solution and sodium hypochlorite solution as root canal irrigants. J Endod. 1982 May;8(5):200–4.

106. Siqueira JF Jr, Rôças IN, Paiva SS, Guimarães-Pinto T, Magalhães KM, Lima KC. Bacteriologic investigation of the effects of sodium hypochlorite and chlorhexidine during the endodontic treatment of teeth with apical periodontitis. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2007 Jul;104(1):122–30.

4.8.3 Can you cite articles discussing the usage of MTAD?

107. Torabinejad M, Khademi AA, Babagoli J, Cho Y, Johnson WB, Bozhilov K, Kim J, Shabahang S. A new solution for the removal of the smear layer. J Endod. 2003 Mar;29(3):170–5.

108. Newberry BM, Shabahang S, Johnson N, Aprecio RM, Torabinejad M. The antimicrobial effect of biopure MTAD on eight strains of Enterococcus faecalis: an in vitro investigation. J Endod. 2007 Nov;33(11):1352–4.

109. Kho P, Baumgartner JC. A comparison of the antimicrobial efficacy of NaOCl/Biopure MTAD versus NaOCl/EDTA against Enterococcus faecalis. J Endod. 2006 Jul;32(7):652–5.

110. Johal S, Baumgartner JC, Marshall JG. Comparison of the antimicrobial efficacy of 1.3% NaOCl/BioPure MTAD to 5.25% NaOCl/15% EDTA for root canal irrigation. J Endod. 2007 Jan;33(1):48–51.

111. Malkhassian G, Manzur AJ, Legner M, Fillery ED, Manek S, Basrani BR, Friedman S. Antibacterial efficacy of MTAD final rinse and two percent chlorhexidine gel medication in teeth with apical periodontitis: a randomized double-blinded clinical trial. J Endod. 2009 Nov;35(11):1483–90.

4.9 Rationale for using sonic, ultrasonic, and other delivery systems

112. Martin H. Ultrasonic disinfection of the root canal. Oral Surg Oral Med Oral Pathol. 1976;42:92–9.

113. Sjögren U, Sundqvist G. Bacteriologic evaluation of ultrasonic root canal instrumentation. Oral Surg Oral Med Oral Pathol. 1987 Mar;63(3):366–70.

114. Haidet J, Reader A, Beck M, Meyers W. An in vivo comparison of the step-back technique versus a step-back/ultrasonic technique in human mandibular molars. J Endod. 1989;15:195–9.

115. Gutarts R, Nusstein J, Reader A, Beck M. In vivo debridement efficacy of ultrasonic irrigation following hand-rotary instrumentation in human mandibular molars. J Endod. 2005;31:166–70.

116. Burleson A, Nusstein J, Reader A, Beck M. The in vivo evaluation of hand/rotary/ultrasound instrumentation in necrotic, human mandibular molars. J Endod. 2007 Jul;33(7):782–7.
117. Beus C, Safavi K, Stratton J, Kaufman B. Comparison of the effect of two endodontic irrigation protocols on the elimination of bacteria from root canal system: a prospective, randomized clinical trial. J Endod. 2012 Nov;38(11): 1479–83.
118. Nielson BA, Baumgartner JC. Comparison of the EndoVac system to needle irrigation of root canals. J Endod 2007;33:611–5.
119. Siu C, Baumgartner JC. Comparison of the debridement efficacy of the EndoVac irrigation system and conventional needle root canal irrigation in vivo. J Endod. 2010 Nov;36(11):1782–5.
120. Huffaker SK, Safavi K, Spangberg LS, Kaufman B. Influence of a passive sonic irrigation system on the elimination of bacteria from root canal systems: a clinical study. J Endod. 2010 Aug;36(8):1315–8.
121. Pawar R, Alqaied A, Safavi K, Boyko J, Kaufman B. Influence of an apical negative pressure irrigation system on bacterial elimination during endodontic therapy: a prospective randomized clinical study. J Endod. 2012 Sep;38(9): 1177–81.

4.10 Do irrigants reach the apical third?
122. Chow TW. Mechanical effectiveness of root canal irrigation. J Endod. 1983 Nov;9(11):475–9.
123. Card SJ, Sigurdsson A, Orstavik D, Trope M. The effectiveness of increased apical enlargement in reducing intracanal bacteria. J Endod. 2002 Nov;28(11):779–83.
124. Nair PN, Henry S, Cano V, Vera J. Microbial status of apical root canal system of human mandibular first molars with primary apical periodontitis after "one-visit" endodontic treatment. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2005 Feb;99(2):231–52.
125. Munoz HR, Camacho-Cuadra K. In vivo efficacy of three different endodontic irrigation systems for irrigant delivery to working length of mesial canals of mandibular molars. J Endod. 2012 Apr;38(4):445–8.
126. Vinothkumar TS, Kavitha S, Lakshminarayanan L, Gomathi NS, Kumar V. Influence of irrigating needle-tip designs in removing bacteria inoculated into instrumented root canals measured using single-tube luminometer. J Endod. 2007 Jun;33(6):746–8.

4.11 Summary of Irrigation Delivery Systems
127. Gu LS, Kim JR, Ling J, Choi KK, Pashley DH, Tay FR. Review of contemporary irrigant agitation techniques and devices. J Endod. 2009 Jun;35(6):791–804.

4.12 Laser in Endodontics
128. Fransson H, Larsson KM, Wolf E. Efficacy of lasers as an adjunct to chemo-mechanical disinfection of infected root canals: a systematic review. Int Endod J. 2013 Apr;46(4):296–307.

4.13 Effect of Ca(OH)2 on endodontic microorganisms

129. Sjögren U, Figdor D, Spångberg L, Sundqvist G. The antimicrobial effect of calcium hydroxide as a short-term intracanal dressing. Int Endod J. 1991 May;24(3):119–25.

130. Shuping GB, Orstavik D, Sigurdsson A, Trope M. Reduction of intracanal bacteria using nickel-titanium rotary instrumentation and various medications. J Endod. 2000 Dec;26(12):751–5.

131. Peters LB, van Winkelhoff AJ, Buijs JF, Wesselink PR. Effects of instrumentation, irrigation and dressing with calcium hydroxide on infection in pulpless teeth with periapical bone lesions. Int Endod J. 2002 Jan;35(1):13–21.

132. Parashos P, Messer H. Antibacterial efficacy of calcium hydroxide intracanal dressing: a systematic review and meta-analysis. Int Endod J. 2007 Jan;40(1): 2–10.

4.14 Susceptibility of bacteria to antibiotics

133. Grossman L. The making of an antibiotic. Endod Dent Traumatol. 1987 Jun;3(3):91–4.

134. Baumgartner JC, Xia T. Antibiotic susceptibility of bacteria associated with endodontic abscesses. J Endod. 2003 Jan;29(1):44–7.

135. Gomes BP, Jacinto RC, Montagner F, Sousa EL, Ferraz CC. Analysis of the antimicrobial susceptibility of anaerobic bacteria isolated from endodontic infections in Brazil during a period of nine years. J Endod. 2011 Aug;37(8): 1058–62.

Part 5. Case Management of:

1.1. RCT on a tooth that was left open to oral micro flora

136. Weine FS, Healey HJ, Theiss EP. Endodontic emergency dilemma: leave tooth open or keep it closed? Oral Surg Oral Med Oral Pathol. 1975;40:531–6.

137. August DS. Managing the abscessed tooth: instrument and close? J Endod. 1977;3:316–19.

138. August DS. Managing the abscessed open tooth: instrument and close—part 2. J Endod. 1982;8:364–6.

139. Bence R, Meyers RD, Knoff RV. Evaluation of 5,000 endodontic treatments: incidence of the opened tooth. Oral Surg Oral Med Oral Pathol. 1980;49:82–4.

Part 6. Microorganisms in Periapical Lesions

140. Walton RE, Ardjmand K. Histological evaluation of the presence of bacteria in induced periapical lesions in monkeys. J Endod. 1992;18:216–217.

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Management of Immature Teeth: Apexification with Ca (OH)2

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Perforation/Endo Perio relation

Perforation

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Oral Medicine and Drug Interactions

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