# **Dental School Subjects and Topics**

#### **Biomedical Foundations**

## Biochemistry

- Protein structure/function
- o Enzyme kinetics & regulation
- o DNA replication, transcription, translation
- Cell signaling pathways
- Energy metabolism (glycolysis, TCA, oxidative phosphorylation)

### Cell Biology

- Membrane structure & transport
- Cell junctions, cytoskeleton
- Organelle functions
- o Cell cycle & apoptosis

#### Genetics

- Mendelian & non-Mendelian inheritance
- Chromosomal disorders
- Gene regulation
- o Genetic testing/precision medicine

# • Developmental Biology & Embryology

- o Fertilization & gastrulation
- Neural crest migration
- o Craniofacial morphogenesis
- Tooth development

# • Histology & Microscopic Anatomy

- o Epithelial, connective, muscle, nervous tissue
- o Lymphoid & hematopoietic tissue
- o Organ systems under microscope

### Gross Anatomy

- Head & neck dissection
- Musculoskeletal system
- Cardiovascular & thoracic structures
- Abdomen & pelvis

### Physiology

- Neurophysiology (action potentials, synapses)
- Cardiovascular hemodynamics
- Pulmonary ventilation/gas exchange
- o Renal filtration & fluid balance
- o GI motility & secretion
- Endocrine hormone mechanisms

## **Immunity, Microbiology & Disease**

## Immunology

- o Innate vs adaptive immunity
- Antigen processing/presentation
- $\circ \quad \text{Antibody structure \& function} \\$
- o Cytokines, T-cell activation
- Hypersensitivity types

# Medical Microbiology

- o Bacterial pathogenesis
- o Viruses: DNA vs RNA
- o Fungal & parasitic infections
- o Microbiome & dysbiosis

# Pathology

- o Inflammation & repair
- o Neoplasia & cancer hallmarks
- o Cell injury, necrosis, apoptosis

Immune-mediated disease (autoimmunity, allergy)

## **Homeostasis & Pathophysiology**

### • Fluids/Electrolytes

- Sodium/potassium balance
- o Osmoregulation
- Acid-base disorders

## Hematology

- o RBC & WBC development
- Hemostasis & clotting cascade
- o Anemias, leukemias, coagulopathies

### Cardiovascular

- Cardiac electrophysiology
- Blood pressure regulation
- Ischemic heart disease
- Heart failure & valvular disease

### Pulmonary

- o Gas exchange mechanisms
- o Pulmonary function tests
- Obstructive vs restrictive disease

#### GI/Metabolism

- o Digestion & absorption
- Hepatic function
- Metabolic disorders

#### Endocrine

- o Thyroid, adrenal, pituitary physiology
- Diabetes mellitus
- Reproductive endocrinology

## **Practice of Medicine (Clinical Skills)**

## • Clinical Interviewing

- History of present illness
- Past/family/social history
- o Review of systems

#### Communication Skills

- Active listening
- o Empathy & cultural humility
- o Delivering difficult news

## Physical Exam

- Vital signs
- o HEENT exam
- o Cardiac, lung, abdominal exam
- Neuro exam basics

### • Clinical Reasoning

- o Problem representation
- o Differential diagnosis
- Evidence-based reasoning

### **Essentials of the Profession**

# Population Health

- o Epidemiology & biostatistics
- o Risk factors & prevention
- o Social determinants of health

## Health Policy

- o U.S. health systems overview
- o Access & disparities
- Insurance & reimbursement

#### Ethics & Professionalism

- Informed consent
- Confidentiality & HIPAA
- Conflicts of interest
- Professional conduct

### Year 2 (D2) - Preclinical Dental Sciences & Simulation

### **Dental Anatomy & Occlusion**

### Tooth Morphology

- Identification of each tooth type
- Crown and root morphology
- Anatomical landmarks (cusps, grooves, ridges, fossa)

#### Occlusion

- Centric relation vs maximum intercuspation
- Static & dynamic occlusion
- o Guidance: canine, group function

## • Temporomandibular Joint (TMJ)

- Anatomy & function
- Muscles of mastication
- Mandibular movement patterns

# **Oral Biology**

## Oral Histology

- o Enamel, dentin, cementum
- Pulp tissue
- o Periodontal ligament, alveolar bone
- Oral mucosa subtypes (masticatory, lining, specialized)

# • Embryology & Development

- o Tooth germ development (bud, cap, bell stages)
- o Amelogenesis & dentinogenesis

Craniofacial development & genetic regulation

# Oral Physiology

- Saliva composition & functions
- o Taste perception
- o Pain pathways in oral tissues

#### Craniofacial Genetics

- o Genetic syndromes affecting craniofacial growth
- Orofacial clefts
- Molecular signaling in tooth development

## **Oral Microbiology & Pathology**

## Microbiology

- Oral flora & biofilms
- o Cariogenic bacteria (S. mutans, Lactobacilli)
- Periodontal pathogens
- Host-microbe interactions

#### Caries Process

- Demineralization & remineralization
- Risk assessment tools
- Caries prevention models

# Oral Pathology

- o Benign & malignant lesions
- Cysts of the jaws
- o Oral potentially malignant disorders (leukoplakia, erythroplakia)
- o Oral manifestations of systemic disease

# **Oral & Maxillofacial Radiology**

# • Radiographic Principles

o X-ray physics, exposure, ALARA principles

Radiographic anatomy (maxilla/mandible)

## Imaging Techniques

- o Intraoral: bitewing, periapical, occlusal
- o Extraoral: panoramic, cephalometric

#### CBCT Fundamentals

- Field of view selection
- o 3D anatomy interpretation

## Radiation Safety

- Dose minimization strategies
- Protective equipment

#### **Preclinical Simulation & Skills**

## Operative Dentistry

- Instrumentation
- Class I–V preparations (amalgam, composite)
- o Adhesive protocols
- o Finishing & polishing

# • Cariology & Prevention

- Sealant application
- $\circ \quad \text{Topical fluoride therapy} \\$
- Non-invasive caries management

#### Fixed Prosthodontics

- o Crown preparations (PFM, all-ceramic, full cast)
- Provisional restorations
- o Impression techniques & digital scanning
- CAD/CAM workflows

#### Removable Prosthodontics

- Complete denture design
- RPD components & framework design
- Jaw relation records
- Try-in & insertion protocols

### Periodontology (Preclinical)

- Periodontal instrumentation
- Scaling & root planing on typodonts
- Periodontal charting
- Intro to surgical concepts

## • Endodontics (Preclinical)

- o Access cavity design
- Working length determination
- Canal instrumentation & obturation
- Endo microbiology & irrigation

## Orthodontics (Intro)

- Growth & development of craniofacial complex
- o Cephalometric tracing basics
- Malocclusion classification
- Space analysis

## • Pediatric Dentistry (Foundations)

- Primary tooth morphology
- Behavior guidance techniques
- Pulp therapy in primary teeth
- Stainless steel crowns

## • Oral Surgery & Local Anesthesia

- Pharmacology of anesthetics
- o Injection techniques (infiltration, block)
- Principles of exodontia
- o Medical emergencies in dental settings

#### Infection Control

- Sterilization & disinfection
- PPE protocols
- OSHA standards
- Needle/sharps safety

## **Evidence-Based Dentistry**

## Critical Appraisal

- Study design (RCTs, cohort, case-control)
- Levels of evidence
- o Bias & confounding

## • Biostatistics for Dentistry

- o Descriptive statistics
- o p-values & confidence intervals
- Sensitivity/specificity
- o Systematic reviews & meta-analyses

## • Clinical Application

- o PICO question framing
- o Integrating literature into treatment planning

# **Treatment Planning & Patient Management**

## • Risk-Based Planning

- Caries risk
- Periodontal risk
- Medical comorbidities

## • Comprehensive Planning

- Sequencing of care
- o Interdisciplinary considerations

### • Patient Communication

Informed consent

- Shared decision-making
- Motivational interviewing

# Year 3 (D3) - Clinical Immersion & Specialty Rotations

## **Comprehensive Care (Longitudinal Clinic)**

## Diagnosis

- Patient history & risk assessment
- Clinical exam (extraoral, intraoral, occlusal, periodontal)
- Radiographic interpretation

## Treatment Planning

- o Sequencing of multidisciplinary care
- Risk/benefit analysis
- o Patient-centered planning

### • Preventive Care

- Oral hygiene instruction
- Nutritional counseling
- o Preventive agents (sealants, fluoride, antimicrobials)

#### Maintenance

- Recall intervals
- o Periodic reassessment
- o Long-term monitoring

## **Restorative Dentistry**

#### Direct Restorations

- Composite techniques (anterior/posterior)
- o Amalgam restorations
- Esthetic considerations

#### Indirect Restorations

o Inlays/onlays

- Crown and bridge
- Shade selection & esthetics

### Occlusal Rehabilitation

- Management of wear & attrition
- Equilibration
- o Restoring vertical dimension

## Periodontology

### Non-Surgical Therapy

- Scaling & root planing
- Local antimicrobials
- Maintenance programs

## • Surgical Therapy (Introduction)

- Flap design & suturing
- Osseous recontouring
- o Guided tissue regeneration
- Periodontal plastic surgery basics

## • Risk Management

- o Smoking & systemic disease
- o Risk-based recall intervals

#### **Endodontics**

## Diagnosis

- o Pulp vitality testing
- o Periapical diagnosis

# Root Canal Therapy

- o Single-rooted vs multi-rooted techniques
- Working length determination

### Obturation methods

## • Management of Complications

- o Instrument separation
- Ledge formation
- Retreatment strategies

#### **Prosthodontics**

#### Fixed Prosthodontics

- o Multi-unit bridge preparation
- Post & core restorations
- Provisionalization

### Removable Prosthodontics

- o RPD delivery & adjustments
- o Complete denture fabrication
- o Immediate dentures

## Implant Prosthodontics

- o Prosthetically driven planning
- Abutment selection
- o Impression & delivery of implant crowns

# **Oral & Maxillofacial Surgery**

# Surgical Exodontia

- Flap reflection
- Bone removal
- Sectioning of teeth

# Minor Oral Surgery

Biopsy techniques

Management of cysts & benign lesions

## Medical Emergencies

- Airway management
- o Syncope, allergic reactions
- Emergency pharmacology

## • Sedation (Observation)

- o Nitrous oxide monitoring
- IV sedation protocols (exposure, not full training)

#### **Oral Medicine & TMD**

#### Orofacial Pain

- Differential diagnosis (dental vs non-dental)
- Neuropathic pain
- TMD management (splints, PT, pharmacotherapy)

### Oral Lesions

- Aphthous ulcers
- Candidiasis
- o Lichen planus

# • Systemic Disease & Oral Health

- Diabetes & periodontitis
- o Immunosuppression & oral manifestations
- Cancer therapy complications (mucositis, xerostomia)

#### **Orthodontics**

## Diagnosis

- o Cephalometric interpretation
- Cast analysis

# • Treatment Planning

- o Interceptive orthodontics
- Limited orthodontic treatment

## • Adjunctive Orthodontics

- o Pre-prosthetic orthodontics
- o Alignment for restorative cases

## **Pediatric Dentistry**

#### Behavior Guidance

- Tell-show-do
- Nitrous oxide sedation
- Protective stabilization (last resort)

## • Restorative in Primary Teeth

- o Glass ionomer, composite, amalgam
- Stainless steel crowns

## Pulp Therapy

Pulpotomy, pulpectomy

## • Trauma Management

- Luxation injuries
- o Avulsions & reimplantation protocols

## • Special Needs Care

- o Children with developmental disabilities
- o Medically complex pediatric patients

# **Geriatric & Special Care Dentistry**

#### Medical Considerations

- Polypharmacy
- Xerostomia & hyposalivation

Cognitive impairment (Alzheimer's, dementia)

## • Prosthetic Challenges

- Atrophic ridges
- Retention issues

### Access & Accommodation

- Wheelchair-bound patients
- Home care strategies

## **Oral & Maxillofacial Radiology**

## Advanced Imaging

- CBCT interpretation
- o 3D visualization of pathology

## • Case-Based Diagnostics

- Impactions
- Jaw pathology
- Sinus involvement

# **Emergency & Urgent Care**

## • Triage

- o Acute pain & swelling
- Dental trauma

## Immediate Management

- Incision & drainage
- Temporary restorations
- o Antibiotic stewardship

# **Community-Based Dentistry**

#### Public Health Rotations

- Federally qualified health centers (FQHCs)
- School-based sealant programs

### Health Equity

- Barriers to care
- o Cultural competence

## **Practice Management & Ethics**

#### Business Basics

- Insurance & reimbursement
- Billing & coding

### • Risk Management

- o Documentation & informed consent
- HIPAA & compliance

#### Professionalism

- o Ethical decision-making
- Conflict resolution

# Quality Improvement

- Outcome tracking
- Patient satisfaction

# Year 4 (D4) – Advanced Clinical Practice, Electives & Capstone

# **Advanced Comprehensive Care (Primary Focus)**

# • Interdisciplinary Case Management

Full-mouth rehabilitation

- Coordination across prosthodontics, perio, ortho, oral surgery
- o Complex treatment planning with systemic conditions

## • Esthetic Dentistry

- Smile design principles
- Veneers (ceramic/composite)
- Whitening protocols
- o Esthetic integration with implants and prosthodontics

### • Complex Restorative

- Management of failed restorations
- o Bonding to compromised substrates
- Post and core systems

## **Implant Dentistry (Restorative Focus)**

## Digital Planning

- o CBCT-guided implant planning
- Surgical guide design

# Prosthetic Components

Abutment types (stock vs custom)

Screw-retained vs cement-retained

#### Restorative Protocols

- o Implant-level vs abutment-level impressions
- o Single-tooth implant restorations
- o Multi-unit implant prostheses

#### Maintenance

- o Peri-implantitis prevention
- Long-term follow-up

## **Specialty Selectives/Electives**

### Endodontics (Advanced)

- Retreatment protocols
- Microscope-assisted endo
- Surgical endodontics (apicoectomy principles)

### Periodontology (Advanced)

- o Implant site development
- Mucogingival surgery
- o Guided tissue/bone regeneration

### • Prosthodontics (Advanced)

- Esthetic zone fixed cases
  Full-arch prostheses
- Maxillofacial prosthetics exposure

#### Oral Medicine

- Management of medically complex patients
- Long-term oral disease surveillance

### Orthodontics

- Clear aligner therapy basics
- o Pre-prosthetic orthodontic planning

# Pediatric Dentistry

- Advanced trauma cases
- Complex special needs care
- Hospital dentistry observation

# **Case Conferences & Interdisciplinary Seminars**

# • Treatment Planning Rounds

- Case presentations across specialties
- o Faculty critique and peer learning

# • Interdisciplinary Collaboration

- o Integration with MDs and other healthcare professionals
- Managing dental-medical comorbidities

### • Ethics & Professionalism

- Ethical dilemmas in advanced cases
- o Equity in access to specialty care

### **Community-Based Externships**

## Service Learning

- Rotations in community health centers
- Underserved population focus

## • Public Health Dentistry

- Oral health promotion
- School-based programs
- o Integration with local/state health systems

## Global/International Electives (optional)

- Short-term service projects
- o Comparative public health systems

## Oral & Maxillofacial Radiology (Advanced)

# • Complex Diagnostics

- o TMJ imaging
- o Pathologic lesion interpretation
- o Airway analysis with CBCT

# • Treatment Planning Integration

- o Radiology in implant planning
- Multispecialty collaboration

#### **Practice Readiness & Transition**

## • Business of Dentistry

- Private practice vs academic vs public health models
- Financial management
- Insurance systems

## • Risk & Compliance

- o Jurisprudence and licensure law
- Record-keeping best practices

## • Leadership & Management

- Team leadership
- o Delegation and dental auxiliary supervision

## Quality & Safety

- o Continuous quality improvement
- o Infection control audits

## **Scholarly Project / Research Requirement**

## Capstone Research

- o Literature review and project design
- o Data collection & analysis
- o Manuscript or poster preparation

#### Dissemination

- o Presentation at HSDM Research Day
- o External conference participation

# Mentorship

- o Faculty-led supervision
- o Interdisciplinary research opportunities