# Contents


## 1. Introduction 1

**Introduction to Orthodontics 1**

• *Definitions 1* • *Orthodontist 2*

**History of Orthodontics 4**

• *Orthodontics in India 5* • *Evolution of Orthodontic Appliances 5*

## 2. Growth and Development 9

**General Principles and Concepts 9**

• *Definitions 9* • *Factors Affecting Physical Growth 10* • *Concepts of Growth 11* • *Types of Growth Data 17* • *Methods of Gathering Growth Data 18* • *Methods of Studying Growth 19* • *Mechanism of Bone Growth 20* • *Osteogenesis (Mechanism of Bone Formation) 20* • *Theories of Growth 23*

**Prenatal Growth and Development 28**

• *Period of Ovum 28* • *Period of Embryo 28* • *Prenatal Development of Maxilla 32* • *Development of Palate 32* • *Development of Maxillary Sinus 33* • *Development of Tongue 33* • *Prenatal Development of Mandible 34* • *Meckel's Cartilage 34* • *Endochondral Bone Formation 35* • *Prenatal Growth of Temporomandibular joint 35*

**Postnatal Growth and Development 35**

• *Neonatal Skeleton 36* • *Postnatal Growth of the Cranial Vault 36* • *Postnatal Growth of the Cranial Base 36* • *Postnatal Growth of Maxilla 38* • *Postnatal Growth of Mandible 40* • *Mandibular Rotation 42* • *Postnatal Growth of TMJ 43 Summary of Facial Growth Changes 44*

**Development of Dentition and Occlusion 44**

*• Bud Stage 45 • Cap Stage 45 • Bell Stage 45 • Periods of Occlusal Development 46 • Predental Period 46 • Deciduous Dentition Period 48 • Mixed Dentition Period 50 • Permanent Dentition Period 53*

**Functional Development 57**

*• Normal Milestones of Development 58 • Puberty and Adolescence 59 • Mastication 59 • Deglutition 60 • Respiration 62 • Speech 64 • Trajectories of Force 65 • Wolff's Law of Transformation of Bone 66*

**Psychological Development 66**

*• Psychology (Study of Psyche) 67 • Theories of Psychological Development 67 • Behavior in Orthodontics 72 • Behavior Development 73 • Behavior Management 73 • Basic Approaches to Child Management in Orthodontics 77 • Ephebodontics 77*

**Clinical Importance of Growth and Development in Orthodontics 78**

*• Infancy and Early Childhood 78 • Juvenile Period 79 • Adolescent Growth 79 • Clinical Implications of Regional Development 79*

**3. OCCLUSION AND MALOCCLUSION 83**

**Occlusion 83**

*• Terminology 83 • Types of Cusps 84 • Arrangement of Teeth in Humans 84 • Imaginary Occlusal Planes and Curves 84 • Centric Relation and Centric Occlusion 85 • Centric Contacts 85 • Eccentric Occlusion 86 • Disclusion 86 • Angle's Concept of Normal Occlusion 87 • Begg's Concept of Normal Occlusion (Attritional Occlusion) 88 • Roth's Concept of Functional Occlusion 88 • Andrews Six Keys to Normal Occlusion 89*

**Classification of Malocclusion 90**

*• Malocclusion 90 • Classification 90 • Types of Malocclusion 91 • Systems of Classification 93*

**Epidemiology of Malocclusion 101**

*Applications of Epidemiological-Principles 101 • Study Designs 102 • Bias in Research 104 • Statistics Measurement of Data 106 • Hypothesis Testing 106*

**Indices of Malocclusion 109**

*• Index 109*

**Anthropology 117**

*• Anthropology and Orthodontics 120 • Early Primates 121*

**4. ETIOLOGY 127**

**Etiology of Malocclusion 127**

*• Classification of Etiologic Factors in Malocclusion 127 • Etiology for Specific Types of Malocclusion 133*

**Habits 135**

• *Definition 135 • Classification of Habits 135 • Thumb Sucking and Finger Sucking 137 • Tongue Thrusting Habit 142 • Mouth-breathing 147 • Lip Biting and Lip Sucking 151 • Bruxism 151 • Finger Nail Biting 153 • Tongue Sucking 154 • Pillowing Habits 154*

**Nutrition in Orthodontics 154**

• *Effect of Nutritional Status on Tooth Movement and Tissue Response to Appliances 154 • Dietary Counseling for Plaque Control and General Health in the Orthodontic Patient 156 • Nutritional Considerations in the Orthognathic Surgical Patient 156 • Nutritional Factors in the Etiology of Craniofacial Anomalies 157*

**Genetics in Orthodontics 158**

• *History 159 • Molecular Basis of Inheritance 159 • Genetics in Orthodontic Perspective 161*

**5. ORTHODONTIC DIAGNOSIS 166**

**Orthodontic Diagnosis 166**

• *Esthetics in Orthodontics 166 • Golden Section 167*

**Diagnostic Aids in Orthodontics 171**

• *Essential Diagnostic Aids 171 • Supplemental Diagnostic Aids 172 • Case History 172 • Clinical and General Examinations 173 • Functional Examination 180 • Orthodontic Study Models 185 • Total Dentition Space Analysis 193 • Inference to Deficits and Decisions 195 • Radiographs Used In Orthodontic Diagnosis 196 Cephalometrics 198 • Facial Photographs 218*

**Computers in Orthodontics 236**

• *Characteristics of a Computer 237 • Uses of Computer in Orthodontics 238*

**Sterilization in Orthodontics 243**

• *Sterilization 243*

**6. ORTHODONTIC TREATMENT PLANNING 246**

**General Factors in Orthodontic Treatment Planning 246**

• *Setting-up Goals 246 • Enlisting the Treatment Objectives 246 • Age Factor in Orthodontics 249 • Treatment and Age 250 • Tooth Movement and Age 251 • Young Versus Adult Patients 251 • Phases of Orthodontic Treatment 252 • Limitations in Orthodontics 253*

**Methods of Gaining Space 253**

• *Proximal stripping (Reproximization, Slenderization, Disking and Proximal Slicing) 254 • Expansion 255 • Types of Appliances Used 257 • Slow Expansion 260*

• *Extractions in Orthodontics 262* • *Distalization 267* • *Uprighting of Molars 269* • *Derotation of Posterior Teeth 269* • *Proclination of Anterior Teeth 269*

**Treatment Planning in Class I Malocclusion 269**

• *Clinical Features of Class I Malocclusion 269* • *Midline Diastema 272* • *Crossbite 275* • *Impacted Teeth 281*

**Treatment Planning in Class II Malocclusion 284**

• *Class II Division 1 Malocclusion 285* • *Class II Division 2 Malocclusion 287*

**Treatment Planning in Class III Malocclusion 288**

• *Clinical Features of Class III Malocclusion 288* • *Skeletal Features of Class III Malocclusion 289*

**Drugs Used in Orthodontics 290**

• *Prophylactic Antibiotics for Prevention of Infective Endocarditis 290*

**7. BIOMECHANICS 298**

**Mechanics of Tooth Movement 298**

• *Newton's Laws of Motion 298* • *Types of Tooth Movements 299* • *Types of Force 301*

**Biology of Tooth Movement 302**

• *Physiologic Tooth Movement 302* • *Tooth Mobility 305* • *Histology of Tooth Movement 305* • *Optimum Orthodontic Force 306* • *Hyalinization 307* • *Theories of Tooth Movement 308* • *Phases of Tooth Movement 309* • *Biochemical Reaction to Orthodontic Tooth Movement 310* • *Bone Resorption 311* • *Bone Deposition 311*

**Anchorage in Orthodontics 314**

• *Definition (Graber) 314* • *Classification 314* • *Sources of Anchorage 315* • *Implants as Anchorage in Orthodontics 320* • *Anchorage Loss 325*

**8. PREVENTIVE AND INTERCEPTIVE ORTHODONTICS 326**

**Preventive Orthodontics 326**

• *Definition 326* • *Caries Control 327* • *Oral Habits Check-up and Educating Patients and Parents 328* • *Space Maintainers 328*

**Interceptive Orthodontics 333**

• *Definition 333* • *Serial Extractions 334* • *Developing Anterior Crossbite Correction 337* • *Preorthodontic Trainers 340* • *Clinical Management 341* • *Muscle Exercises 341*

**9. ORTHODONTIC APPLIANCES 344**

• *Classification of Orthodontic Appliances 344* • *Ideal Requirements of an Orthodontic Appliance 345*

**Removable Appliances 345**

*• Indications for Removable Appliances 345 • Advantages of Removable Appliances 345 • Disadvantages of Removable Appliances 346 • Components of Removable Appliances 346*

**Fixed Appliances 364**

*• Advantages of Fixed Appliances 364 • Disadvantages of Fixed Appliances 365 • Banding 366 • Bonding 367 • Components of Fixed Orthodontic Appliances 368 I. Active Components 369 • II. Passive Components 372 • Fixed Appliance Techniques 375 • Oral Hygiene in Fixed Appliance Treatment 379*

**10. DENTOFACIAL ORTHOPEDICS 382**

**Orthopedic Appliances 382**

*• Basis for Orthopedic Appliances 382 • Biomechanical Consideration 383 • Headgear 384 • Protraction Face Mask Therapy 388 • Factors Governing Variability in Clinical Response 389 • Chin Cup Therapy 390*

**Functional Appliances 390**

*• Definition 391 • Classification of Functional Appliances 391 • Advantages of Functional Appliances 393 • Limitations of Functional Appliances 393 • Action of Functional Appliances 394 • Visual Treatment Objective 395 • Vestibular Screen (Oral Screen) 395 • Activator 397 • Management of the Appliance 400 • Wunderer's Modification 401 • The Reduced Activator or Cybernator of Schmuth 402 • Propulsor 402 • Karwetzky Modification 402 • Herren's Modification of the Activator 402 • Function Regulator (Frankel Appliance) 403 • Bionator 407 • Twin Block Appliance 408 • Herbst Appliance 409*

**11. RETENTION AND RELAPSE 412**

**Retention 412**

*• Schools of Retention 412 • Theorems of Retention 412 • Raleigh Williams Six Keys for Retention 414 • Theories of Retention 414 • Methods of Retention: Retainers 415 Relapse 421 • Failures in Orthodontics 423*

**12. SURGICAL ORTHODONTICS 429**

**Minor Surgical Procedures 429**

*• Extractions 429 • Surgical Exposure of Impacted Teeth 430 • Frenectomy 431 • Pericision (Circumferential Supracrestal Fibrotomy or CSF Procedure) 431 • Corticotomy 432 • Orthodontic Implants 432*

**Orthognathic Surgery 433**

*• Etiology of Dentofacial Deformities 433 • Orthognathic Surgery 434 • Presurgical Orthodontics 436 • Maxillary 437 • Mandibular Surgeries 440*

**Distraction Osteogenesis 442**

• *Definition 442* • *Historical Perspective 442* • *Indications 443* • *Advantages 443* • *Disadvantages 443* • *Preoperative Clinical Examination 444* • *Growth and Stability after Distraction 446*

**13. MULTIDISCIPLINARY ORTHODONTICS 448**

**Adult Orthodontics 448**

• *Reasons for Increase in Adult Patients 448* • *Biomechanical Considerations 450* • *Diagnosis and Adult Orthodontics 451* • *Treatment Aspects in Adult Orthodontics 452*

**Orthodontics in Multispecialty Approach 455**

• *Multispecialty Orthodontic Treatment 455* • *Orthodontic-periodontic Interrelationship 457*

**Orthodontic Management of TMJ and Occlusal Disorders 462**

• *Biomechanics 463* • *Temporomandibular Joint Pathology 464* • *Signs and Symptoms of TMJ Disorders 465* • *Orthopedic Dysfunction 466* • *Diagnosis 468 Management 469*

**Orthodontic Management of Cleft Lip and Palate 472**

• *Incidence 472* • *Embryological Background 473* • *Family Counseling 480*

**Orthodontic Management of Craniofacial Syndromes 480**

• *Orthodontic Management of Cleidocranial Dysplasia 480* • *Orthodontic Management of Obstructive Sleep Apnea Syndrome 482* • *Orthodontic and Temporomandibular Joint Considerations in Treatment of Patients with Ehlers-Danlos Syndrome 483*

**Orthodontic Management of Medically Compromised Patients 484**

• *Management of Physically Handicapped Child 484* • *Management of Orthodontic Patients with a History of Rheumatic Fever or Congenital Heart Disease 485* • *Orthodontic Management of Patients with Bleeding Disorders 486* • *Orthodontic Management of Patients with Hematologic Malignancies 487* • *Orthodontic Management of Patients with Endocrine Disorders 488* • *Orthodontic Management of Patients with Diabetes 489* • *Orthodontic Management of Patients with Cystic Fibrosis 491* • *Orthodontic Management of Patients with Juvenile Rheumatoid Arthritis 491* • *Orthodontic Management of Patients with Renal Failure 492*

**Forensic Orthodontics 493**

• *Forensic Dentistry 493* • *Role of Orthodontist 494* • *Dermatoglyphics 495*

**14. COMMUNITY ORTHODONTICS 496**

**Orthodontic Practice 496**

• *Ideal Orthodontic Services 496* • *Typical Orthodontic Practice Organization 496* • *Orthodontic Work Environment 499*

**Medicolegal Considerations in Orthodontics 504**

• *Legal Precedents 504*

**15. MATERIALS USED IN ORTHODONTICS 507**

**Orthodontic Materials 507**

• *Classification of Orthodontic Appliance Materials 507* • *Orthodontic Arch Wire Materials 509* • *Bracket and Attachment Materials 517* • *Bonding Materials 518* • *TEGDMA 520* • *Orthodontic Cements 520* • *Sealants and Adhesion Promoters 524* • *Conditioning and Crystal Growth Systems 525* • *Elastics and Elastomerics 526* • *Magnets in Orthodontics 526* • *Soldering and Welding 528* • *Other Dental Materials 534*

**Acrylic Materials 542**

• *Ideal Requirements for Dental Resin 542* • *Acrylic Resins 542*

**Finishing and Polishing Materials 545**

• *Commonly used Abrasives 545*

**Implant Materials in Orthodontics 546**

• *History 546* • *Metals and Alloys 546* • *Other Metals and Alloys 547* • *Endosteal and Subperiosteal Implants 548*

**Orthodontic Instruments 549**

• *Adam's Pliers (Universal Pliers) 549* • *Arch-forming Pliers (Arch-contouring Pliers, De la Rossa Pliers) 549* • *Band Burnisher (Beaver-tail Burnisher) 549* • *Band-contouring Pliers 550* • *Band Pusher (Mershon Band Pusher) 550* • *Band-Removing (Debanding) Pliers, Anterior 550* • *Band-Removing (Debanding) Pliers, Posterior 550* • *Band Seater (Band Biter) 551* • *Bird-beak (No. 139) Pliers 551* • *Bracket-positioning Instrument (Bracket-height Gauge, Boone's Gauge) 551* • *Bracket-removing Pliers (Debonding Pliers) 552* • *Conversion Instrument 552 Coon Ligature-tying Pliers 552* • *Distal-end Cutter 552* • *Elastic Separator Pliers (Separator Pliers) 553* • *Facebow-adjusting Pliers 553* • *Hard Wire Cutter 553* • *Hemostat (Mosquito Pliers) 553* • *Howes Utility Pliers 554* • *Ligature Director (Pitchfork Instrument, Tie in Tucker) 554* • *Light-wire Pliers 554* • *Mathieu-style Ligature-tying Pliers 555* • *Parallel-action Pliers with Cutter (Sargent's heavy-duty Pliers) 555* • *Pin and Ligature Wire Cutter 555* • *Serrated Band Plugger (Serrated Amalgam Plugger) 556* • *Steiner Ligature-tying Pliers 556* • *Torquing Key 556* • *Triple-beaked Pliers (Three Prong Pliers, Three Jaw Pliers, Clasp-adjusting Pliers) 556* • *Turret 557* • *Tweed Arch-adjusting (No. 142) Pliers 557* • *Tweed Loop-forming Pliers (Omega Pliers, Optical Pliers) 557* • *Weingart Utility Pliers 558*

*Bibliography* 559

*Index* 561