

## 5. ORTHODONTICS & DENTOFACIAL ORTHOPAEDICS

### **OBJECTIVES :**

The training programme in Orthodontics is to structure and achieve the following four objectives.

### **KNOWLEDGE :**

1. The dynamic interaction of biologic processes and mechanical forces acting on the Stomatognathic system during orthodontic treatment.
2. The etiology, pathophysiology, diagnosis and treatment planning of various common Orthodontic problems.
3. Various treatment modalities in Orthodontics preventive interceptive and corrective.
4. Basic sciences relevant to the practice of Orthodontics
5. Interaction of social, cultural, economic, genetic and environmental factors and their relevance to management of oro-facial deformities
6. Factors affecting the long-range stability of orthodontic correction and their management
7. Personal hygiene and infection control, prevention of cross infection and safe disposal of hospital waste, keeping in view the high prevalence of Hepatitis and HIV and other highly contagious disease.

### **SKILLS:**

1. To obtain proper clinical history, methodical examination of the patient, perform essential diagnostic procedures, and interpret them and arrive at a reasonable diagnosis about the Dentofacial deformities.
2. To be competent to fabricate and manage the most appropriate appliance – intra or extra oral, removable or fixed, mechanical or functional, and active or passive – for the treatment of any orthodontic problem to be treated singly or as a part of multidisciplinary treatment of orofacial deformities.

### **ATTITUDES:**

1. Develop an attitude to adopt ethical principles in all aspects of Orthodontics practice.
2. Professional honesty and integrity are to be fostered.
3. Treatment care is to be delivered irrespective of the social Status, cast, creed or colleagues
4. Willingness to share the knowledge and clinical experience with professional colleagues.
5. Willingness to adopt, after a critical assessment, new methods and techniques of orthodontic management developed from time to time based on scientific research, which are in the best interest of the patient.
6. Respect patients rights and privileges, including patients right to information and right to seek a second opinion.
7. Develop attitude to seek opinion from allied medical and dental specialists as and when required

### **COMMUNICATION SKILLS:**

1. Develop adequate communication skills particularly with the patients giving them the various options available to manage a particular Dentofacial problem and to obtain a true informed consent from them for the most appropriate treatment available at that point of time.
2. Develop the ability to communicate with professional colleagues, in Orthodontics or other specialties through various media like correspondence, Internet, e-video, conference, etc. To render the best possible treatment.

## **COURSE CONTENT :**

The program outlined, addresses both the knowledge needed in Orthodontics and allied Medical specialties in its scope. A minimum of three years of formal training through a graded system of education as specifies, will equip the trainee with skill and knowledge at its completion to be able to practice basis Orthodontics and have the ability to intelligently pursue further apprenticeship towards advanced Orthodontics.

## **SPREAD OF THE CURRICULUM:**

Six months teaching to basic subjects including completion of pre-clinical exercises 2 ½ years of coverage of all the relevant topics in Orthodontics, clinical training treatment of patients and submission of dissertation. These may be divided into blocks of 6 to 8 months duration each, depending on the training policies of each institution.

### **I. APPLIED ANATOMY :**

- Prenatal growth of head:  
Stages of embryonic development, origin of head, origin of face, origin of teeth.
- Postnatal growth of head:
- Bones of skull, the oral cavity, development of chin, the hyoid bone, general growth of head, face growth.
- Bone growth:  
Origin of bone, composition of bone, units of bone structure, schedule of Ossification, mechanical properties of bone, roentgen graphic appearance of bone
- Assessment of growth and development:  
Growth prediction, growth spurts, the concept of normality and growth increments of growth, differential growth, gradient of growth, methods of gathering growth data. Theories of growth and recent advances, factors affecting physical growth.
- Muscles of mastication:  
Development of muscles, muscle change during growth, muscle function and facial development, muscle function and malocclusion
- Development of dentition and occlusion:  
Dental development periods, order of tooth eruption, chronology of permanent tooth formation, periods of occlusal development, pattern of occlusion.
- Assessment of skeletal age  
The carpal bones, carpal x –rays, cervical vertebrae

### **II. PHYSIOLOGY:**

- **Endocrinology and its disorders**  
(Growth hormone, thyroid hormone, parathyroid hormone, ACTH) pituitary gland hormones, thyroid gland hormones, parathyroid gland hormones
- **Calcium and its metabolism**
- **Nutrition-metabolism and their disorders:** proteins, carbohydrates, fats, vitamins and minerals.
- **Muscle physiology**
- **Craniofacial Biology:** cell adhesion molecules and mechanism of adhesion
- **Bleeding disorders in orthodontics: Hemophilia**

### **III. DENTAL MATERIALS:**

- **Gypsum products:** dental plaster, dental stone and their properties, setting reaction etc.
- **Impression materials:** impression materials in general and particularly of alginate impression material.
- **Acrylics:** chemistry, composition physical properties
- **Composites:** composition types, properties setting reaction

- **Banding and bonding cements:** Zn (PO)<sub>2</sub>, zinc silicophosphate, Zinc polycarboxylate, resin cements and glass ionomer cements
- **Wrought metal alloys:** deformation, strain hardening, annealing, recovery, recrystallization, grain growth, properties of metal alloys
- **Orthodontic arch wires:** stainless steel gold, wrought cobalt chromium nickel alloys, alpha & beta titanium alloys
- **Elastics:** Latex and non-latex elastics.
- **Applied physics,** Bioengineering and metallurgy.
- **Specification and tests methods** used for materials used in Orthodontics
- **Survey of all contemporary literature and Recent advances** in above – mentioned materials.

#### **IV. GENETICS:**

- Cell structure, DNA, RNA, protein synthesis, cell division
- Chromosomal abnormalities
- Principles of orofacial genetics
- Genetics in malocclusion
- 5 Molecular basis of genetics
- Studies related to malocclusion
- Recent advances in genetics related to malocclusion
- Genetic counseling
- Bioethics and relationship to Orthodontic management of patients.

#### **V. PHYSICAL ANTHROPOLOGY:**

- Evolutionary development of dentition
- Evolutionary development of jaws.

#### **VI. PATHOLOGY:**

- Inflammation
- Necrosis

#### **VII. BIOSTATISTICS:**

- Statistical principles
  - Data collection
  - Method of presentation
  - Method of summarizing
  - Methods of analysis- different tests/errors
- Sampling and Sampling technique
- Experimental models, design and interpretation
- Development of skills for preparing clear concise and cogent scientific abstracts and publication

#### **VIII. APPLIED RESEARCH METHODOLOGY IN ORTHODONTICS:**

- Experimental design
- Animal experimental protocol
- Principles in the development, execution and interpretation of methodologies in Orthodontics
- Critical scientific appraisal of literature.

#### **IX. APPLIED PHARMACOLOGY:**

#### **X. ORTHODONTIC HISTORY:**

- Historical perspective,
- Evolution of orthodontic appliances,
- Pencil sketch history of Orthodontic peers
- History of Orthodontics in India

## **XI. CONCEPTS OF OCCLUSION AND ESTHETICS:**

- Structure and function of all anatomic components of occlusion,
- Mechanics of articulation,
- Recording of Masticatory function,
- Diagnosis of Occlusal dysfunction,
- Relationship of TMJ anatomy and pathology and related neuromuscular physiology.

## **XII. ETIOLOGY AND CLASSIFICATION OF MALOCCLUSION:**

- A comprehensive review of the local and systemic factors in the causation of malocclusion
- Various classifications of malocclusion

## **XIII. DENTOFACIAL ANOMALIES:**

- Anatomical, physiological and pathological characteristics of major groups of developmental defects of the orofacial structures.

## **XIV. CHILD AND ADULT PSYCHOLOGY:**

- Stages of child development.
- Theories of psychological development.
- Management of child in orthodontic treatment.
- Management of handicapped child.
- Motivation and psychological problems related to malocclusion / orthodontics
- Adolescent psychology
- Behavioral psychology and communication

## **XV. DIAGNOSTIC PROCEDURES AND TREATMENT PLANNING IN ORTHODONTICS**

- Emphasis on the process of data gathering, synthesis and translating it into a treatment plan
- Problem cases – analysis of cases and its management
- Adult cases, handicapped and mentally retarded cases and their special problems
- Critique of treated cases.

### **Cephalometrics**

- Instrumentation
- Image processing
- Tracing and analysis of errors and applications
- Radiation hygiene
- Advanced Cephalometrics techniques
- Comprehensive review of literature
- Video imaging principles and application.

## **XVII. PRACTICE MANAGEMENT IN ORTHODONTICS:**

- Economics and dynamics of solo and group practices
- Personal management
- Materials management
- Public relations
- Professional relationship
- Dental ethics and jurisprudence
- Office sterilization procedures
- Community based Orthodontics.

## **XVIII. CLINICAL ORTHODONTICS:**

### **Myofunctional Orthodontics:**

- Basic principles
- Contemporary appliances – their design and manipulation
- Case selection and evaluation of the treatment results
- Review of the current literature.

## **Dentofacial Orthopedics**

- Principles
- Biomechanics
- Appliance design and manipulation
- Review of contemporary literature

## **Cleft lip and palate rehabilitation:**

- Diagnosis and treatment planning
- Mechanotherapy
- Special growth problems of cleft cases
- Speech physiology, pathology and elements of therapy as applied to orthodontics
- Team rehabilitative procedures.

## **Biology of tooth movement:**

- Principles of tooth movement-review
- Review of contemporary literature
- Applied histophysiology of bone, periodontal ligament
- Molecular and ultra cellular consideration in tooth movement

## **Orthodontic / Orthogenetic surgery:**

- Orthodontist'role in conjoint diagnosis and treatment planning
- Pre and Post-surgical Orthodontics
- Participation in actual clinical cases, progress evaluation and post retention study
- Review of current literature

## **Ortho / Perio / Prostho inter relationship**

- Principles of interdisciplinary patient treatment
- Common problems and their management

## **Basic Principles of mechanotherapy** Includes Removable appliances and fix appliances

- Design
- Construction
- Fabrication
- Management
- Review of current literature on treatment methods and results

## **Applied preventive aspects in orthodontics**

- Caries and periodontal disease prevention
- Oral hygiene measures
- Clinical procedures

## **Interceptive Orthodontics**

- Principles
- Growth guidance
- Diagnosis and treatment planning
- Therapy emphasis on:
  - A) Dento-facial problems
  - B) Tooth material discrepancies
  - C) Minor surgery for Orthodontics

## **Retention and relapse**

- Mechanotherapy – special reference to stability of results with various procedures
- Post retention analysis
- Review of contemporary literature

## **XIX. RECENT ADVANCES LIKE:**

- Use of implants
- Lasers
- Application of F.E.M.
- Distraction Osteogenesis

## **SKILLS:**

### **II. Pre-clinical Exercises**

A general outline of the type of exercises is given here, Every institution can decide the details of exercises under each category.

- 1 General wire bending exercises to develop the manual dexterity.
- 2 Clasps, bows and springs used in the removable appliances.
- 3 Soldering and welding exercises.
- 4 Fabrication of removable habit breaking, mechanical and functional appliances, also all types of space maintainers and space regainers.
- 5 Bonwill Hawley Ideal arch preparation.
- 6 Construction of orthodontic models trimmed and polished preferably as per specifications of Tweed or A.B.O.
- 7 Cephalometric tracing and various Analyses, also superimposition methods-
- 8 Fixed appliance typhodont exercises.
  - a) Training shall be imparted in one basic technique i.e. Standard Edgewise / Begg technique or its derivative / Straight wire etc, with adequate exposure to other techniques.
  - b) Typhodont exercise
    - I. Band making
    - II. Bracket positioning and placement
    - III. Different stages in treatment appropriate to technique taught
- 9 Clinical photography
- 10 Computerized imaging
- 11 Preparation of surgical splints, and splints for TMJ problems.
- 12 Handling of equipments like vacuum forming appliances and hydro solder etc.

### **First Year**

1. Basic Pre-clinical Exercise Work for the MDS Students:  
First 6 Months

### **NON-APPLIANCE EXERCISES**

All the following exercises should be done with 0.7 or 0.8 mm wire

<b>Sl. No.</b>	<b>Exercise</b>	<b>No.</b>
1	Straightening of 6" & 8" long wire	1 each
2	Square	1
3	Rectangle	1
4	Triangle of 2" side	1
5	Circle of 2" side	1
6	Bending of 5U's	1
7	Bending of 5v's	1

### **2. CLASPS**

<b>Sl.No.</b>	<b>Exercise</b>	<b>No.</b>
1	$\frac{3}{4}$ Clasps	2
2	Full clasps	2
3	Triangular clasps	2
4	Adam's clasp-upper molar	2
5	Adam's clasp- lower molar	2
6	Adam's clasp- Pre-molar	2

7	Adam's clasp- incisor	2
8	Modification of Adam's-with Helix	2
9	Modification of Adam's- with distal extension	2
10	Modification of Adam's- with soldered tube	2
11	Duyzing clasps on Molars	2
12	South end clasp	1

### 3. LABIAL BOWS

SI.No.	Exercise	No.
1	Short labial bow (upper & lower)	1
2	Long labial bow (upper & lower)	1
3	Robert's retractor	1
4	High labial bow-with apron spring's	1
5	Mill's labial bow	1
6	Reverse loop labial bow	1
7	Retention labial bow soldered to Adam's clasp	1
8	Retention labial bow extending distal to second molar	1
9	Fitted labial bow	1
10	Split high labial bow	1

### 4. SPRINGS

SI. No.	Exercise	No.
1	Finger spring-mesial movement	2
2	Finger spring-distal movement	2
3	Double cantilever spring	2
4	Flapper spring	2
5	Coffin spring	2
6	T spring	2

### 5. CANINE RETRACTORS

SI. No.	Exercise	No.
1	U loop canine retractor	2 PAIRS
2	Helical canine retractor	2 PAIRS
3	Palatal canine retractor	2 PAIRS
4	Self- supporting canine retractor	2 PAIRS
5	Self-supporting canine retractor	2 PAIRS

### 6. APPLIANCES

SI.No.	Exercise
1	Hawley's retention appliance with anterior bite plane
2	Upper Hawley's appliance with posterior bite plane
3	Upper expansion appliance with coffin spring
4	Upper expansion appliance with coffin spring
5	Upper expansion appliance with expansion screw
6	Habit breaking appliance with tongue crib
7	Oral screen and double oral screen
8	Lip bumper
9	Splint for Bruxism
10	Catalans appliance
11	Activator
12	Bionator
13	Frankel-Fr 2 appliance
14	Twin block

15	Lingual arch
16	TPA
17	Quad helix
18	Bihelix
19	Utility arches
20	Pendulum appliance

### 7. Soldering exercises

Sl.No.	Exercise	No.
1	Star	1
2	Comb	1
3	Christmas tree	1
4	Soldering buccal tube on molar bands	1

### 8. Welding exercises

Sl.No.	Exercise
1	Pinching and welding of molar, premolar, canine and Incisor bands
2	Welding of buccal tubes and brackets on molar bands and incisor bands

### 9. Impression of upper and lower arches in alginate

### 10. Study model preparation

### 11. Model analysis

Sl. No.	Exercise
1	Impression of upper and lower dental arches
2	PREPARATION OF STUDY MODEL-1 And all the permanent dentition analyses to be done.
3	PREPARATION OF STUDY MODEL – 2 And all the permanent dentition analyses to be done.
4	PREPARATION OF STUDY MODEL – 3 And all the mixed dentition analyses to be done.

### 12. Cephalometrics

Sl. No.	Exercise
1	Lateral cephalogram to be traced in five different colors and super imposed to see the accuracy of tracing
2	Steiner's analysis
3	Down's analysis
4	Tweed analysis
5	Rickett's analysis
6	Burrstone analysis
7	Rakosi's analysis
8	Mc Namara analysis
9	Bjork analysis
10	Coben's analysis
11	Harvold's analysis
12	Soft tissue analysis- Holdaway and Burstone

### 13. Basics of clinical photography including Digital photography

### 14. Light wire bending exercises for the Begg technique

Sl. No.	Exercise
1	Wire bending technique on 0.016' wire circle "Z" Omega
2	Bonwill-hawley diagram
3	Making a standard arch wire
4	Inter maxillary hooks- Boot leg and Inter Maxillary type



5	Upper and Lower arch wire
6	Bending a double back arch wire
7	Bayonet bends (vertical and horizontal offsets)
8	Stage-III arch wire
9	Torquing auxiliary (upper)
10	Reverse Torquing (lower)
11	Up righting spring

### 15. Typhodont exercises: (Begg or P.E.A. method)

Sl. No.	Exercise
1	Teeth setting in class-II division I malocclusion with maxillary anterior proclination and mandibular anterior crowding
2	Band pinching, welding brackets and buccal tubes to the bands
3	Stage- I
4	Stage- II
5	Pre stage – III
6	Stage- III

### CLINICAL WORK:

Once the basic pre- clinical work is completed the students can take up clinical cases and the clinical training is for the two and half years.

**Each postgraduate student should start with a minimum of 50 cases of his/ her own. Additionally he/ she should handle a minimum of 20 transferred cases.**

The type of cases can be as follows:

- i. Removable active appliances- 5 cases
- ii. Class- I malocclusion with Crowding
- iii. Class-I malocclusion with bi- maxillary protrusion
- iv. Class-II division- 1
- v. Class-II division- 2
- vi. class\_ III (Orthopedic, surgical, Orthodontic cases)
- vii. Inter disciplinary cases
- viii. Removable functional appliance cases like activator, Bionator, functional regulator, twin block and new developments
- ix. Fixed functional appliances – Herbst appliance, jasper jumper etc – 5 cases
- x. Dento-facial orthopedic appliances like head gears, rapid maxillary expansion niti expander etc., - 5 cases
- xi. Appliance for arch development such as molar distalization –m 5 cases
- xii. Fixed mechano therapy cases (Begg, PEA, Tip edge, Edgewise)  
Retention procedures of above treated cases.

### Other work to be done during FIRST YEAR

1. **Seminars:** One seminar per week to be conducted in the department. A minimum of five seminars should be presented by each student each year
2. **Journal club:** One journal club per week to re conducted in the department. A minimum of five seminars should be presented by each student each year.
3. **Protocol for dissertation to be submitted on or before the end of six months from the date of admission.**
4. **under graduate classes:** Around 4-5 classes should be handled by each post – graduate student
5. **Field survey:** To be conducted and submit the report.
6. **Inter-departmental meetings:** should be held once in a month.
7. **Case discussions**
8. **Field visits: To attend dental camps and to educate the masses**
9. **basic subjects classes**
10. **Internal assessment or Term paper**

## **Second Year:**

The clinical taken up should be followed under the guidance. More case discussions and cases to be taken up. Other routine work as follows.

1. **Seminars:** One Seminar per week to be conducted in the department. Each student should present a minimum of five seminars each year.
2. **Journal club:** One Journal club per week to be conducted in the department. Each student should present a minimum of five seminars each year.
3. **Library assignment to be submitted on or before the end of six months.**
4. **Undergraduate classes;** each post- graduate student should handle Around 4-5 classes.
5. **Inter- departmental meetings:** should be held once in a month
6. *Case discussions*
7. **Field visits: To attend dental camps and to educate the masses.**
8. **Internal assessment or term paper.**
9. **Dissertation work:** On getting the approval from the university work for the dissertation to be started.

## **Third Year:**

The clinical cases taken up should be followed under the guidance. More cases discussions and cases to be taken up. Other routine work as follows:

1. **Seminars:** One seminar per week to be conducted in the department. Each student should present a minimum of five seminars each year.
2. **Journal club:** One Journal club per week to be conducted in the department. A minimum of five seminars should be presented by each student each year.
3. **Under graduate classes:** each post – graduate student, should handle Around 4-5 classes.
4. **Inter- departmental meetings:** Should be held once in a month.
5. **The completed dissertation should be submitted six months before the final examination**
6. **Case discussions**
7. **Field visits:** To attend dental comps and to educate the masses.
8. Finishing and presenting the cases taken up.
9. **Preparation of finished cases and presenting the cases** (to be presented for the examination)
10. **Mock examination**

## **DISSERTATION:**

- a. The protocol for dissertation should be submitted on or before the end of six months from the date of admission as per calendar of events to the Registrar, Rajiv Gandhi University of Health Sciences, Karnataka, through proper channel.
- b. The completed dissertation should be submitted 6 months before the final examination as per calendar of events to the Registrar (Evaluation), Rajiv Gandhi University of Health Sciences, Karnataka, through proper channel.
- c. The Dissertation should not be just a repetition of a previously undertaken study but it should try to explore some new aspects.
- d. Approval of dissertation is essential before a candidate appears for the University examination.

## **MONITORING LEARNING PROGRESS:**

It is essential to monitor the learning progress of each candidate through continuous appraisal and regular assessment. It not only helps teachers to evaluate students, but also students to evaluate themselves. The monitoring be done by the staff of the department based on participation of students in various teaching / learning activities. It may be structured and assessment be done using checklists that assess various aspects. Checklists are given in Section IV.

## **SCHEMES OF EXAMINATION:**

### **A. Theory : 300 Marks**

Written examination shall consist of four question papers each of three hours duration. Total marks for each paper will be 100. Paper I, II and III shall consist of two long questions carrying 20 marks each and 6 short essay questions each carrying 10 marks. Paper IV will be on Essay. Questions on recent advances may be asked in any or all the papers. Distribution of topics for each paper will be as follows:\*

**Paper-I:** Applied Basic Sciences: Applied anatomy, Physiology, Dental Materials, Genetics, Pathology, Physical Anthropology, Applied Research methodology, Bio-Statistics and Applied Pharmacology.

**Paper-II:** Orthodontic History, Concepts of occlusion and esthetics, Child and Adult Psychology, Etiology and classification of malocclusion, Dentofacial Anomalies, Diagnostic procedures and treatment planning in Orthodontics, Practice management in Orthodontics

**Paper-III:** Clinical Orthodontics

**Paper-IV:** Essay

*\* The topics assigned to the different papers are generally evaluated under those sections. However a strict division of the subject may not be possible and some overlapping of topics is inevitable. Students should be prepared to answer overlapping topics.*

### **B. Practical / Clinical Examination : 200 Marks**

#### **Exercise No: 1 Functional Case : 50 Marks**

Selection of case for functional appliance and recording of construction bite. Fabrication and delivery of the appliance the next day.

#### **Exercise No: 2 Multiband exercise : 50 Marks**

1. III stage with auxiliary springs  
OR

2. Bonding of SWA brackets and construction of suitable arch wire.

#### **Exercise No. 3 Display of records of the treated cases (minimum of 5 cases)**

**5 cases \*15 marks = 75 Marks**

#### **Exercise No: 4 long case discussions: 25 Marks**

<b>NO</b>	<b>Exercise</b>	<b>Marks allotted</b>	<b>Approximate Time</b>
1	Functional appliance	50	1 hour 1 hour
2	III stage mechanics / Bonding and arch wire fabrication	50	1 hr 30 min
3	Display of case records (a minimum of 5 cases to be presented with all the cases)	75	1 hour
4	Long cases	25	2 hours

**C. Viva Voce: 100 Marks**

*i. Viva- Voce examination : 80 marks*

All examiners will conduct viva- voce conjointly on candidate's comprehension, analytical approach, expression, interpretation of data and communication skills. It includes all components of course contents. It includes presentation and discussion on dissertation also.

*ii. Pedagogy Exercise: 20 marks*

A topic be given to each candidate in the beginning of clinical examination. He/ She is asked to make a presentation on the topic for 8-10 minutes.