

Three years Postgraduate Programme in Orthodontics: the Final Report of the Erasmus Project

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1. Introduction

In October 1989 an application was submitted to the ERASMUS Bureau of the European Cultural Foundation of the Commission of the European Communities for the joint development of a new 3-year curriculum for postgraduate education in orthodontics by the first eight persons listed above and their Universities. After the grant application was approved and funded, the first meeting took place in June 1990 in Copenhagen. At that meeting it was decided to invite M. Ronchin from Italy and colleagues from non-EEC countries, P. Rygh from Norway, S. Linder-Aronson from Sweden, O. Rönning from Finland, and J. P. Joho from Switzerland, to take part in the activities involved in developing the new curriculum. At the second meeting in Amsterdam in September 1990, it was decided to invite also M. Hegarty from Ireland and H. Droschl from Austria. The third meeting scheduled in Berlin in January 1991 had to be cancelled in view of risks associated with the Gulf War. To minimize delay in progress, the meeting planned for London at the end of May and beginning of June was extended, and matters were dealt with by mail to a greater extent than originally intended. The final meeting planned in Bled in early September had to be postponed owing to internal unrest in Yugoslavia, and was held in London on November 9 and 10, 1991. In the meantime the tragic death in August of Professor Houston, who had contributed so much to this project, called for replacement. That also applied to Professor Ronchin who had to withdraw for personal reasons. Professor J. P. Moss from the United Kingdom and Professor R. Martina from Italy were invited, and agreed to fill in the vacancies.

The main reason for initiating a common curriculum was to reduce the diversity in length, intensity, and contents of existing programmes, and to develop guidelines for countries about to embark on postgraduate education in orthodontics. Moreover, the freedom of exchange of orthodontists within the EEC countries calls for a consensus of educational standards. The Erasmus project actually has a two-fold objective: namely, to improve the quality of specialty education in the EEC countries and, thereby, the quality of patient care. At present, orthodontics has become a highly sophisticated health care service, that can provide excellent treatment

of malocclusion and facial deformity, based on the premise that this treatment is given by well educated, skilled, and experienced specialists. Therefore, adequately qualified manpower is the key to providing the best possible service to the population.

The description of the programme submitted in the application to the ERASMUS Bureau was as follows:

The joint preparation of an entire three years common curriculum within the European Community for the education in Orthodontics, based on new concepts. The programme should be founded on a description of clearly defined goals and requirements.

The new curriculum should have a common content of about 75%, leaving 25% for electives. A certain part of the programme should be suited for the exchange of students among the participating countries.

In the application, the action plan included a second year to complete the task formulated as:

Preparation of the final version of the curriculum. Agreement should be reached on goals, teaching activities, requirements, electives and exchange conditions.

This part of the action plan has been carried out already, except for the formulation of exchange conditions. It turned out to be unrealistic to define these conditions prior to establishing the common programme in various countries.

Worldwide existing information on postgraduate programmes in orthodontics was collected and evaluated prior to the development of the new curriculum. Furthermore, the directives of the Commission of the European Communities on Dental Education (1986), regarding the education of orthodontists, have been taken into account.¹

The participants listed above had the opportunity to discuss in detail the gathered information and various aspects associated with the education of orthodontists. Consensus was reached in all essential matters. The statements, conclusions and the content of the programme

¹ Advisory Committee on the training of dental practitioners report on the field of activity and training programmes for dental specialists: III/D/1374/5/84-EN.

presented in this report are supported unanimously.

2. Main objective of the programme for specialty education in orthodontics

The general objective of the programme is to educate dentists to become specialists in orthodontics with a solid and broad academic background and adequate clinical experience in different treatment methods.

The graduate should be able to:

- (1) diagnose anomalies of the dentition, facial structures, and functional conditions;
- (2) detect deviations of the development of the dentition, of facial growth, and occurrence of functional abnormalities;
- (3) formulate a treatment plan and predict its course;
- (4) evaluate psychological aspects relevant to orthodontics;
- (5) conduct interceptive orthodontic measures;
- (6) execute simple and complex treatment procedures;
- (7) act as an expert in orthodontics and related matters;
- (8) collaborate in multidisciplinary teams for treatment of compromised patients, orthodontic-surgical treatment and care of cleft palate patients;
- (9) evaluate need for orthodontic treatment;
- (10) practice orthodontics with high professional and ethical standards;
- (11) use available opportunities for improving professional skills.

In addition, emphasis is placed on:

- (1) biomedical sciences relevant to orthodontics;
- (2) development of a scientific attitude in an inquiring mind and stimulation of professional interest;
- (3) principles of scientific methodology;
- (4) interpretation of literature;
- (5) research activities;
- (6) oral and written presentation of clinical and research findings.

3. General conditions

1. The education of orthodontists *must* take place within universities under responsibility of appointed academic teachers in orthodontics.²
2. Candidates must be qualified as dentists.
3. The basic objective of the programme is to educate clinicians; additional education is needed for those who also want to become a teacher/researcher.
4. The programme requires full time attendance of the students.
5. Students should receive a stipend for living expenses.
6. Each student must start a minimum of 50 well documented patients.
7. Specification of the minimal number of hours students must spend is provided for the obligatory academic courses, but is not indicated in detail for the preclinical and clinical activities.
8. The core programme requires 75 per cent of the available time and must be supplemented for the remaining 25 per cent by additional activities (electives) that will vary according to the individual institution and the needs of the students. Such activities include: extension of the obligatory course work, special courses, additional clinical experience, more teaching engagements, supplementary research activities, evaluation of treatment accomplishments, as well as attending guest lectures and scientific meetings.
9. The minimal number of clinical treatment hours is 16 hours per week (not including clinical seminars and discussion of treatment plans). The minimal number of hours over the 3-year period devoted to clinical practice (including preclinical laboratory hours) is 2000.
10. The clinical staff-student ratio in supervising treatments must be at least 1:6.
11. Students must treat patients under continuous supervision of qualified orthodontists.

² *Must*: indicates an imperative or duty, mandatory; *should*: indicates highly desirable, but not mandatory; *can*: indicates freedom or liberty to follow an alternative.

12. Dental laboratory work should be limited to learning experiences.
13. Besides the theoretical and practical training in 'classical' orthodontics, students must gain experience in the treatment of patients that require a multidisciplinary approach and particularly orthognathic surgery.
14. Students must either treat cleft palate patients or be exposed to this type of treatment in clinics or centres, notwithstanding the fact that they may not necessarily treat cleft palate patients later on.
15. Mounting dental casts in an articulator is required for patients with TMJ-, surgical, and complex restorative problems.
16. Teaching of undergraduate dental students can be part of the programme, but not for more than 10 per cent of the time.
17. Students must conduct a research project (clinical, experimental, or literature research) and report their findings and conclusions in a thesis or written report.
18. Results of research and other activities undertaken in the postgraduate programme in orthodontics can be used without limitation as partial fulfilment of requirements for an advanced degree.
19. All academic theoretical courses must be concluded with an assessment of the understanding and knowledge acquired by the students.
20. At the end of the programme there must be a final examination by a committee including at least one external examiner.
21. Part of the final examination is the presentation of completed treatment records and documented results of 10 patients for evaluation, representing different malocclusions and treatment procedures, started and completed by the student (patients may still be in retention).

4. Specific conditions for specialty education in orthodontics

1. The director of the programme must be:
 - registered as a specialist in orthodontics for at least 5 years;
 - actively practising the speciality;
 - appointed for at least 80 per cent of the working week.
2. Besides the director, the equivalent of one full time position for an orthodontist must be present. When more than a total of four postgraduate students is enrolled, additional orthodontic staff are required.
3. Adequate library, laboratory, clinical, research, and administrative facilities must be available in suitable premises.
4. Sufficient non-academic staff must be available to realize an efficient conduct of the teaching programme and patient care.
5. An established connection with centres for oral and maxillofacial surgery, periodontology, and restorative dentistry is required.
6. Sufficient expertise must be available to realize the objectives of teaching *general biological and medical subjects*, and *basic orthodontic subjects*.
7. Research opportunities, statistical assistance, and computer facilities must be available.

5. Orthodontic programme: distribution of hours

It is essential that there is a correct balance in the orthodontic curriculum. The academic programme is based on a minimum of 40 weeks a year and 40 hours a week, which totals 4800 scheduled hours for 3 years.

Assignment of the 4800 scheduled hours

1. Staff/student contact activities (± 63 per cent)

Clinical (and preclinical) practical work	2000 hrs
Pretreatment clinical conferences	230 hrs
Seminars on treatment evaluation	100 hrs
Lectures, seminars, workshops on obligatory academic courses	455 hrs
Lectures, seminars, workshops on elective theoretical subjects	150 hrs
Staff/student contact time outside regular classes for individual consultations, research guidance, manuscript preparation, etc.	115 hrs
Total	3050 hrs
2. Non-staff/student contact activities (± 37 per cent)

Analysis of records of patients to be treated	120 hrs
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Undergraduate teaching, including preparation time (10 per cent of 4800 hrs)	480 hrs
Research	100 hrs
Elective activities (including additional time for research)	1050 hrs
Total	<u>1750 hrs</u>
Combined totals	<u>4800 hrs</u>

Of the scheduled 4800 hours, 25 per cent is assigned for electives (150 + 1050 = 1200 hrs)

In addition, students are required to put in a considerable number of hours of their own time for studying. For example, for every class hour on academic subjects, on an average 2 hours studying time are required.

6. Objectives of obligatory courses for education of orthodontists³

The hours indicated in parentheses in the following sections are the minimal number of hours necessary for the average student to devote to the subject to reach the specified level of comprehension or competence. At least one-third of these hours must be spent in staff-student contact activities (lectures, seminars, workshops, etc.).

A. General biological and medical subjects

1. Growth and development of the human body (25 hrs)

Insight in:

- somatic growth and its variations;
- adolescent growth spurt and its relationship to growth of the craniofacial complex.

Familiar with:

- genetic and environmental factors that influence somatic growth;
- concept of biological age and determination of skeletal age, dental age, and stages of sexual development.

2. Anatomy of the head (35 hrs)

Knowledge of anatomical features, tissue systems, and functional anatomy essential for comprehension of:

- growth of the craniofacial skeleton;

- development of skeletal deformities;
- dentofacial orthopaedics;
- orthognathic surgical correction of facial dysmorphology and malocclusion.

3. Genetics (25 hrs)

Familiar with genetic principles essential for comprehension of:

- the development of the head;
- craniofacial malformations.

4. Embryology of the head (25 hrs)

Insight in embryology of craniofacial structures for understanding of normal growth and development of face, jaws, and teeth, teratogenesis, and development of clefts and other facial congenital malformations.

5. Cell biology (30 hrs)

Insight in cytological and histochemical aspects essential for the understanding of:

- cell metabolism under normal and abnormal conditions;
- tissue formation and proliferation;
- development of bone, cartilage, teeth, and muscle;
- facial growth;
- temporomandibular joint;
- tooth movements and reactions in tooth supporting tissues;
- dentofacial orthopaedics;
- soft tissue changes related to orthodontics;
- mechanisms of root resorption.

6. Physiology of breathing, speech, swallowing, and mastication (20 hrs)

Knowledge of oronasal aspects of different modes of breathing.

Familiar with:

- normal and abnormal speech;
- various ways of swallowing;
- the process of mastication.

7. Syndromes in which the head is involved (20 hrs)

Familiar with principles of classification of syndromes in relation to aetiology, prognosis, and reaction to orthodontic and orthognathic surgery treatment.

8. Psychology of the child, adolescent and adult (35 hrs)

Insight in:

- concepts and principles of developmental psychology;
- potential and limitation in behaviour modification;

³ Three levels of comprehension have been distinguished and are indicated by the terms: familiar with, insight in, and knowledge of. The term 'competent to' means that the procedure described can be performed without assistance.

- aspects of patient motivation and assessment of co-operation;
 - psychological aspects of puberty and adolescence;
 - impact of facial appearance on self-esteem;
 - psychological aspects of orthognathic surgery.
9. Biostatistics (45 hrs)
Insight in statistical methodology.
Familiar with:
- commonly used statistical methods;
 - data processing procedures.
- Competent to:
- understand and evaluate statistical aspects in current literature;
 - evaluate validity of statistical methodology and interpretation of findings in clinical and research papers relevant to orthodontics and related subjects.
10. Epidemiology (10 hrs)
Familiar with:
- principles of epidemiologic surveys;
 - research designs;
 - sample composition and requirements for control groups;
 - data analysis and critical interpretation of findings.
11. Research methodology (35 hrs)
Familiar with:
- philosophy of science;
 - ethical aspects of research on animals and humans.
- Insight in various methods of research design.
- Competent to:
- perform an analytical review of bio-medical research and clinical research papers;
 - write a protocol for a research project;
 - interpret own research findings;
 - evaluate validity of conclusions in research papers;
 - present research findings in oral and written form.
- B. Basic orthodontic subjects*
1. Development of the dentition (normal and abnormal) (60 hrs)
Knowledge of:
- the development of normal occlusion from birth to adulthood;
 - variations in this development;
 - abnormalities in number, size, form, and position of teeth;
 - genetic and environmental factors relevant to the development of the dentition;
 - developmental patterns of different malocclusions, also with consideration of severity;
 - effect of agenesis and supernumerary teeth and as well as (premature) loss or extraction of deciduous and permanent teeth on the development of the dentition;
- Competent to recognize and identify a given situation of the dentition in terms of:
- normality or abnormality;
 - developmental stage attained;
 - future development;
 - possibilities for interceptive measures to improve the ultimate situation.
2. Facial growth (normal and abnormal) (50 hrs)
Insight in growth of cartilage, bone, and muscle.
Knowledge of:
- growth sites in the craniofacial skeleton;
 - post-natal growth changes in the craniofacial region, including soft tissues;
 - variation in the function of components within the craniofacial region relevant to facial growth;
 - individual variation in facial configuration;
 - influence of environmental factors on facial growth.
3. Physiology and pathophysiology of the stomatognathic system (35 hrs)
Knowledge of:
- normal and abnormal functional occlusion of the dentition;
 - normal and abnormal behaviour of soft tissue structures;
 - normal and abnormal functioning of the temporomandibular joint;
 - diagnostic procedures regarding the temporomandibular joint;
 - treatment procedures of temporomandibular joint disorders.
4. Aspects of tooth movements and dentofacial orthopaedics (35 hrs)
Knowledge of:
- process of tooth eruption and spontaneous tooth movement;

- effect of different types of force application on cells and tissues;
 - influence of force systems and force magnitude;
 - post-treatment changes;
 - cellular aspects of endochondral growth in the nasal septum, condyles and epiphyses, and bone growth at sutures and bone surfaces;
 - effect of dentofacial orthopaedic measures on tissue systems;
 - relationship between adaptability of tissues and results of dentofacial orthopaedic measures.
5. Radiology and other imaging techniques (30 hrs)
 Knowledge of abnormalities and pathological conditions that can be diagnosed on radiographs.
 Insight in methods and risks involved in making radiographs for orthodontic purposes.
 Familiar with digital radiographic and other imaging techniques.
6. Cephalometrics (including tracings) (45 hrs)
 Competent to:
- identify relevant anatomical structures on cephalograms;
 - describe the morphology of the head on basis of cephalograms;
 - make tracings of cephalograms in norma lateralis and frontalis that include essential contours;
 - perform several cephalometric diagnostic analyses on tracings.
- Knowledge of limitations of cephalograms and their analyses.
7. Orthodontic materials (25 hrs)
 Insight in property and composition of orthodontic materials.
 Knowledge of:
- parameters for selection of correct material for various orthodontic procedures;
 - proper handling and application of orthodontic materials.
8. Orthodontic biomechanics (35 hrs)
 Competent to:
- understand basic principles of statics and mechanics of materials;
 - relate principles of mechanics to clinical and research problems;
 - solve problems related to force resultants and force equivalents;
- estimate forces produced by different orthodontic appliances;
 - estimate forces produced by dentofacial orthopaedic devices.
- C. *General orthodontic subjects*
1. Aetiology (25 hrs)
 Insight in genetic and environmental factors that influence post-natal development of the dentition and facial growth.
 Knowledge of unfavourable influence of environmental factors and their interception.
2. Diagnostic procedures (15 hrs)
 Competent to:
- obtain a relevant patient history;
 - perform a thorough clinical examination;
 - determine habitual occlusion, evaluate functional occlusion, and different jaw relationships of patients;
 - evaluate influence of functional components of soft tissues on dentofacial morphology;
 - take high quality impressions of the dentition with a maximal reproduction of alveolar processes;
 - make face bow registrations and mount dental casts in an articulator;
 - take good extra-oral and intra-oral photographs;
 - take good radiographs necessary for orthodontic purposes.
3. Orthodontic diagnostic assessment, treatment objectives, and treatment planning (60 hrs)
 Competent to:
- arrive at a tentative diagnostic assessment and classification on the basis of a cursory examination of a patient;
 - provide advice after a cursory examination concerning feasibility of treatment, need for more detailed analysis and treatment planning, or consultation of other specialists for further evaluation and treatment;
 - arrive at a proper diagnostic assessment on the basis of anamnestic data, patient examination, dental casts, photographs, radiographs, cephalograms, and other relevant data;
 - predict the likely effect on growth and development of face and dentition if no therapy is implemented;

- define objectives of treatment with due consideration of alternatives;
 - define a treatment plan for various types of orthodontic and dentofacial abnormalities, including strategy of treatment and retention, therapeutic measures, timing and sequence of their application, prognosis, and estimated treatment and retention time.
4. Growth and treatment analysis (35 hrs)
Knowledge of:
- potential and limitation of different methods of longitudinal cephalometric assessment;
 - limitation of analyses of growth and treatment changes;
 - validity and limitation of growth prediction including computerized prediction.
- Competent to:
- perform growth analyses based on serial cephalograms;
 - detect treatment changes by analysis of tracings obtained at critical stages of treatment.
5. Long-term effect of orthodontic treatment (30 hrs)
Knowledge of:
- relapse associated with different anomalies and treatment procedures;
 - changes that can take place during retention period;
 - changes that can occur after retention has been terminated.
- Competent to predict the probable long-term effect of orthodontic treatment in individual patients.
6. Iatrogenic effects of orthodontic treatment (30 hrs)
Knowledge of:
- risk involved in different treatment and retention procedures;
 - influence of various conditions and age ranges on iatrogenic effects;
 - possible influence of treatment on temporomandibular joints;
 - effect of different types of treatment on periodontal tissues in the long run;
 - factors involved in root resorption;
 - possible influence of treatment on facial expressivity;
 - possible influence of treatment on dento-facial appearance and aesthetics.
7. Epidemiology in orthodontic research (35 hrs)
Insight in:
- basic principles of epidemiology;
 - prevalence and incidence of orthodontic anomalies;
 - validity of indices in estimating need for treatment;
 - models to determine the demand for treatment;
 - influence of society on demand for treatment;
 - aspects involved in subjective need for treatment;
 - role played by orthodontists in demand for treatment;
 - factors involved in estimating objective need.
8. Orthodontic literature (120 hrs)
Familiar with various orthodontic journals.
Competent to:
- detect essentials in current literature (taught in specific literature review sessions);
 - present concise and analytic literature reviews.
- D. Orthodontic techniques*
1. Removable appliances (30 hrs)
Knowledge of:
- indication, design, and use of removable appliances;
 - potential and limitation of removable appliances.
- Competent to construct and repair removable appliances.
2. Functional appliances (40 hrs)
Knowledge of:
- indication, design, and use of functional appliances;
 - potential and limitation of functional appliances.
- Familiar with different varieties, designs, and constructions of functional appliances.
Competent to construct and repair functional appliances.
3. Extra-oral appliances⁴ (25 hrs)
Knowledge of:
- indication, design, and use of various

⁴ A major part of the section is covered in B.4.: Aspects of tooth movements and dentofacial orthopaedics.

types of headgears, facial masks, chin-caps, and combined extra-oral/functional appliances;

- potential and limitation of these appliances.

4. Partial fixed appliances (25 hrs)

Knowledge of:

- indication and application of partial fixed appliances (e.g. lingual, palatal, and vestibular arches, rapid maxillary expansion devices, and partially banded/bonded dental arches);
- potential and limitation of different approaches in partial fixed appliance therapy.

5. Fixed appliances (60 hrs)

Insight in:

- indication and application of fixed appliances;
- different concepts and treatment approaches in design and biomechanical principles of fixed appliance therapy;
- potential and limitation of different appliance systems.

Knowledge of at least one type of full fixed appliance.

6. Retention appliances (15 hrs)

Knowledge of:

- indication and contra-indication, design, and use of retention appliances;
- potential and limitation of retention appliances;
- the most appropriate duration of retention.

E. Multidisciplinary treatment procedures

1. Cleft palate treatment (20 hrs)

Insight in:

- multidisciplinary approaches in the treatment of cleft palate patients;
- indication, timing, and application of multidisciplinary treatment of cleft palate patients;
- specific aspects of orthodontic treatment in cleft palate patients.

2. Orthodontic-surgical treatment (20 hrs)

Knowledge of:

- indication and application of combined orthodontic-surgical treatments;
- specific aspects of orthodontic treatment in patients requiring orthognathic surgery.

3. Orthodontic-periodontal treatment (20 hrs)

Knowledge of:

- indication and contra-indication of orthodontic treatment in periodontally compromised dentitions;
- specific aspects of orthodontic treatment in periodontally compromised dentitions;
- contribution of orthodontic treatment to the periodontal condition of patients.

4. Orthodontic-restorative treatment (10 hrs)

Knowledge of:

- indication and application of combined orthodontic-restorative treatment;
- specific aspects of orthodontic treatment in combined orthodontic-restorative patient care.

F. Specific treatment procedures

1. Guiding the development of occlusion⁵ (10 hrs)

Knowledge of indication and contra-indication of interceptive measures.

2. Adult orthodontics (15 hrs)

Knowledge of:

- indication and specific aspects of orthodontic treatment of adults;
- treatment of adult patients in collaboration with general dental practitioners.

3. Craniomandibular dysfunction (40 hrs)

Familiar with:

- aetiology of craniomandibular dysfunction;
- general measures to improve craniomandibular dysfunction;
- various therapeutic procedures.

Knowledge of:

- indication and contra-indication for orthodontic treatment in patients with craniomandibular dysfunction;
- possible implications of orthodontic treatment in the presence of craniomandibular dysfunction;
- appropriate orthodontic procedures contributing to the treatment of patients with craniomandibular dysfunction by a team of specialists.

⁵ A major part of this subject is incorporated in B.I.: Development of the dentition.

G. Management of health and safety

1. Management of oral health (15 hrs)

Insight in specific aetiological features encountered in orthodontic practice regarding development of dental caries, periodontal problems, and soft tissue lesions.

Knowledge of:

- procedures to detect a high risk of developing dental caries in patients;
- procedures to detect a high risk of developing periodontal problems in patients.

Competent to instruct patients to maintain optimal oral hygiene as a preventive measure for gingival and dental lesions.

2. Health and safety conditions in an orthodontic practice (5 hrs)

Knowledge of:

- prevention of cross-infection;
- methods of sterilization of instruments;
- management of high risk patients;
- control of substances hazardous to health for patients and personnel.

H. Practice management, administration, and ethics

1. Office management (15 hrs)

Insight in:

- design of an orthodontic practise;
- equipment and instruments needed in an orthodontic practise;
- recruitment and selection of auxiliary personnel;
- training and quality control of auxiliary personnel;

- financing and administration of an orthodontic practise;
- public relationships.

2. Use of computers⁶ (10 hrs)

Familiar with utilization of computers in clinical orthodontics and patient management.

3. Ergonomy (5 hrs)

Knowledge of:

- optimal position of patient, orthodontist, chair-side assistant, and placement of instruments to conduct specific clinical tasks;
- most efficient sequence to perform specific clinical procedures.

4. Legislation (10 hrs)

Insight in:

- rules and laws that apply to an orthodontic practise;
- responsibilities and services vulnerable to malpractice law suits;
- different insurance coverages required;
- procedures to follow when a law suit arises.

5. Professional ethics (5 hrs)

Knowledge of:

- behaviour and conduct expected of an orthodontist as health care provider;
- ethical standards that apply to relationships with personal, patients, and colleagues.

⁶ Students should preferably have a personal computer that operates on a compatible base with those in the teaching institution.