

Undergraduate Orthodontic & Paediatric Dentistry Education in Europe—The DentEd Project

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Abstract. *As a result of a European Union funded project (DentEd), a programme of visits to dental schools throughout Europe has been underway since 1998. This report describes the philosophy behind DentEd, gives a brief description of the features of a visitation, and covers the orthodontic and paediatric dentistry teaching as reported in 26 different dental schools in 16 different countries. It is based on a report submitted to DentEd from a small working group that looked at various aspects of educational provision within the two disciplines across Europe. The value of this information to teachers within the two disciplines and to the wider dental community is briefly discussed. The report recommends the adoption of an integrated course for orthodontics and paediatric dentistry. The main objectives are that the student should be able to understand orofacial and psychosocial growth and development of the child, recognize aberrant growth and development, and manage the behaviour of the child, their straightforward preventive, restorative and occlusal needs, and to make appropriate and timely referral.*

Index words: Undergraduate Education, Europe.

Introduction

DentEd is one of approximately 40 Thematic Network Projects that are funded by the European Union's Directorate on Education and Culture. The aims of the Thematic Network Projects are to disseminate good practice, promote partnerships, and to provide a forum for debate and exchange of ideas and information. The rationale for the DentEd project centred on concerns regarding the variable standards of undergraduate dental education across Europe, the variety of assessment methods controlling entry to the profession, the level of skills and competences possessed by new graduates, and the consequent impact that the free movement of dentists within Europe might have.

At the start of the project in 1997, there were 20 schools from around Europe who agreed to take part in the project. The project finished at the end of September 2000, by which time 28 schools had been visited in 16 different countries, of whom seven are non-EU members and a further 10 schools were scheduled to be visited.

The DentEd project is based mainly on a 5-day visitation to a dental school by an international team of academics actively involved in dental undergraduate education. The visiting team consisted of a chairperson, rapporteur, and a minimum of three other people. It attempted to be representative of all dental disciplines (including basic science)

and from a range of countries, one of which should have a similar political and educational background to the country of the school hosting the visit.

The school is asked to prepare a Self-Assessment Report (SAR) that should be sent to each member of the visiting team prior to the visit. The SAR has 22 sections that cover all aspects of the dental school and course. Within each section related to the course, factual details are given, e.g. number of hours of instruction and pedagogical methods (theory, practical, laboratory), and the timing of each element within the course, followed by a list of their perceived strengths, weaknesses innovations, and best practice. This paper is based on Section 9 of the SAR—Orthodontics and Paediatric Dentistry—and summarizes the views of a working group that met in plenary session at a meeting in Stockholm in September 2000. The original report from which this paper is derived and reports from other sections may be seen on the DentEd web page (www.dented.org).

General Description

Within dental schools, Orthodontics and Paediatric Dentistry are traditionally taught by two distinct departments, despite the extensive common ground between the two. Whilst there are advantages to having two departments, it does make the concept of a holistic 'Dentistry for the Child' approach difficult to achieve. Some dental schools are now moving towards an integrated approach in both teaching

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and clinical practice, and amending the title of their course to 'Dentistry for the Child and Adolescent'. This is motivated partly by a pedagogical desire to improve the student experience, partly as a result of scarce resource and partly a tacit acceptance of the difficulty in defining the boundaries of responsibility of Paediatric Dentistry.

Two points in this section should be taken under particular consideration:

1. Orthodontics is a speciality with 3 years of postgraduate education in most European countries. The extent of undergraduate education should be directed at the orthodontic knowledge and skills expected of a general dental practitioner with specialist support. Some of these arguments have already been rehearsed (O'Brien, 1997).
2. Paediatric Dentistry is a kind of comprehensive dentistry that is focused on the growing child, and is closely connected with Orthodontics, Preventive Dentistry, Dental Public Health, Behavioural Science and Communication.

These arrangements are influenced by the local environment of organization and administration in the dental schools of the various European countries.

General Organizational Structure

The number of departments in the schools varies from 4 to 20. Orthodontics is a distinct department in the majority of schools and is joined with Paediatric Dentistry as a single department only in four schools. Public Dental Health and/or Prevention is integrated with Paediatric Dentistry in two schools, and in two other schools Orthodontics and Paediatric Dentistry are together with Dental Public Health as one department. In three German schools Paediatric Dentistry is part of the Department of Operative Dentistry. This is a historical anomaly that is gradually disappearing.

The European Orthodontic Society (EOS) and the European Federation of Orthodontic Specialists Associations (EFOSA) declare within the ERASMUS-programme, for specialist practice, postgraduate education should be compulsory and should have a minimum duration of 3 years. Orthodontics is a recognized specialty in all the European countries that have been visited, although the duration of postgraduate education varies. All countries apart from Germany and the UK have a 3-year training programme that is university based. In the UK, to become a hospital consultant a further two years of training after basic speciality training are necessary. The '3 + 2' training programme is linked to an academic orthodontic unit (although the '2' may not be in the same institution as the basic '3'). In Germany, the training programme requires a year to be spent in an academic institution, and a further 2 years in a recognized specialist practice or continuation at the university.

This arrangement has relevance because, in countries with postgraduate education, undergraduate education is directed at basic knowledge with priority given to growth, development, and diagnosis, but in countries without postgraduate education the student will require additional skills and knowledge in treatment.

Nevertheless, in all countries, the generalist treats 20–50

per cent of the orthodontic cases (Schneider *et al.*, 1998). Therefore, additional to the points above, topics such as (interceptive) orthodontic prevention and treatment of simple malocclusions should be included in the undergraduate educational programme.

The timing of undergraduate entry to clinics to treat child patients varies considerably between schools and between the two disciplines (Tables 1, 2). Similarly, the number of hours in the curriculum varies between orthodontics and paediatric dentistry, as does the balance between the theoretical and clinical elements of the course. In a small number of schools students have no personal practical orthodontic experience and learn by observation at the chairside. In schools where paediatric dentistry is part of operative dentistry, the quality and quantity of experience of dentistry for children is variable.

Amongst staff within dental teaching institutions, it is well recognized that the clinical material available for student practice is heavily influenced by the catchment area in which the school is located, and also by the referral pattern of general dental practitioners (GDPs). This latter can give the undergraduate a distorted view of the challenges presented by the 'average' child patient because the easy/simple cases are handled by the GDP, and those that are more challenging (usually behaviour management problems for paediatric dentistry patients, and complex orthodontic problems) are referred for specialist care. Shortage of staff in the relevant departments and suitable patients frequently results in undergraduates having to learn management techniques on the most challenging cases.

Orthodontics

The primary aims in most schools are that the graduate should be able to understand and recognize normal and abnormal craniofacial growth, eruption pattern, and occlusal development, should evaluate the need of treatment, and assess the proper time for treatment or referral for treatment. They should be able to undertake the treatment of common types of malocclusion such as simple Class II division 1 and crossbite at an early stage with the help of the supervisor.

The objectives of lessons, seminars, and the practical training in the majority of schools are the following:

- (1) differential diagnosis of normal and abnormal craniofacial and occlusal development;
- (2) significance of disturbances in function, occlusal development and tooth eruption;
- (3) clinical examination including radiography (including cephalometric radiography);
- (4) diagnosis of models and measurement methods;
- (5) orthodontic treatment need, and appropriate timing of provision;
- (6) advice for patients about risk and benefit with and without treatment, duration of treatment and retention, prognosis for stability;
- (7) biological and biomechanical principles of tooth movement and tissue regeneration;
- (8) orthodontic treatment methods and appliances for different malocclusions;
- (9) interdisciplinary planning and treatment for special

- handicapping malocclusions and developmental disturbances such as cleft lip and palate;
- (10) interdisciplinary treatment planning for adults (pre-surgery, pre-prosthetic/restorative);
 - (11) timely and appropriate onward referral for cases beyond their competence.

The nature of practical training varies. In some schools, students treat their own orthodontic patients in a separate or comprehensive practical training in dentistry for children and adolescents. In the other schools, students learn diagnostic procedures in seminars and assist the supervisor during treatment, without gaining personal experience in the day-to-day management of an orthodontic case. This may well reflect the challenging nature of cases referred to the department.

Paediatric Dentistry

Paediatric Dentistry is an independent department in 14 schools. It is a sub-specialty of Operative Dentistry in three schools, and linked to either behavioural science or preventive dentistry in a further three schools. The number of hours is about a third that of Orthodontics (Table 2). The primary aims of the paediatric dentistry curriculum are to prepare the student for the management and general pre-

TABLE 2 Paediatric dentistry

Dental school	Clinical teaching	Non-clinical teaching	First patient contact
1	50	60	VIII-IX semester
2	100	40	VIII-X semester
3*	113	117	VI semester
4	88	49	IX semester
5	45	40	II semester
6*	470		VI-VII semester
7	60	40	VIII-IX semester
8	65	55	VII semester
9*	50	100	IX-X semester
10	120	60	VIII semester
11	30	69	VIII semester
12*	205	155	VI semester
13*	160	52	VIII semester
14	15	30	IX-X semester
15	1575	15	VIII-XII semester
16	282	169	VI semester
17	130	6	VIII semester
18	83	48	IX-X semester
19	100	55	IX-X semester
20	250	300	VIII semester
21	270	150	VIII semester
22	120	96	V-IX semester
23	160	80	IX-X semester
24	96	40	VIII-IX semester
25	80	27	VIII semester
26**	60	108	VI-X semester

TABLE 1 Orthodontics

Dental school	Clinical teaching	Non-clinical teaching	First patient contact
1	40	75	VIII semester
2	200	100	IX-X semester
3*	117	113	VI semester
4	106	112	V-VI semesters & IX-X semesters
5	360	120	VIII semester
6*	470		VI-VII semester
7	60	40	VIII-IX semester
8	18	127	VIII semester
9*	72	156	VIII-X semester
10	40	75	IX-X semester
11	46	101	VIII semester
12*	245	140	VI semester
13*	160	52	VIII semester
14	26	78	IX-X semester
15	120	21	X-XI semester
16	132	76	VI semester
17	95	6	VIII semester
18	120	75	IX-X semester
19	20	211	IX-X semester
20	250	130	IX semester
21	60	100	VIII semester
22	48	68	VII-VIII semester
23	1540	76	IX semester
24	80	40	IX-X semester
25	96	34	VIII semester
26	180	102	VII semester

Key

Clinical teaching: number of hours on clinics, either treating patients or observing treatment.

Non-clinical teaching: number of hours of seminars and lectures, wire bending exercises, cephalometric tracing, and treatment planning exercises.

First patient contact: semester in which the students have their first contact with orthodontic patients.

The schools with * have an integrated course, and hours refer to Orthodontics and Paediatric Dentistry time.

Key

Clinical teaching: number of hours on clinics, either treating patients or observing treatment.

Non-clinical teaching: number of hours of seminars and lectures, treatment planning exercises.

First patient contact: semester in which the students have their first contact with paedodontic patients.

The schools with * have an integrated course, and hours refer to Orthodontic and Paediatric Dentistry time; those with ** have an integrated course, and hours refer to Paediatric Dentistry and Preventive Dentistry I-IV semester.

ventive and restorative dental care of infants, children and adolescents, and to assess the appropriate time of referral of a child for specialist care.

The objectives of lessons, seminars and practical training are the following:

- (1) diagnosis and treatment planning during craniofacial and occlusal development and dental eruption ;
- (2) recognition and management of dental anomalies (e.g. amelogenesis or dentinogenesis imperfecta);
- (3) prevention for caries and periodontal diseases;
- (4) behavioural science, premedication, pain control and patient management;
- (5) restoration, endodontics and prosthetics in primary and premature permanent teeth;
- (6) traumatology, diagnosis, and first steps of treatment;
- (7) timely and appropriate onward referral for cases beyond their competence.

Important Regional Differences and Potential Consequences

There exists a difference in philosophical approach to dental undergraduate courses, with mainly 'western' schools

favouring an odontological approach, whereas many 'eastern' schools retain a stomatological approach. There are a number of schools that are in a transitional phase towards odontology. In general, the stomatological approach leaves less time in the course for the clinical dental disciplines and this must have some impact on the clinical competence of new graduates from different schools throughout the area of 'Europe'.

The resource allocated to the Dental Course by different universities will impact on the overall quality of graduate. However, there is some evidence in the reports provided that Orthodontics suffers from a shortage of staff because, contrary to many other dental disciplines, staff have both undergraduate and postgraduate educational duties to fulfil. Also, where Paediatric Dentistry is a sub-specialty of Operative Dentistry, whilst there may be no lack of resource, the message that children are just small adults is unhelpful.

The small resource allocated by governments (usually former Soviet Union countries) to higher education, and dentistry in particular is also a substantial handicap leading to lack of funds for crucial things such as books, journals, computers, and clinical consumables, as well as refurbishment of clinics. This impacts on the overall quality of teaching environment and will inhibit the development of modern adult educational methods such as problem-based learning. In addition, the lack of funds to support staff activities and travel leads to prolongation of professional isolation with its consequent impact on staff morale, and their continued professional education and development.

Yet another problem faced by small countries with limited resources available is the availability of up-to-date information in the native language. Any dental course within 'Europe' today needs a staff and student body who are capable of understanding written English and preferably also spoken English.

A positive aspect of the regional differences is the knowledge that the majority of graduates will not move out of the country in which they live and train, and the training programme will have prepared them for practice within that country. The converse, that undergraduate training programmes should equip students to work in any 'European' country is unsustainable, although the DentEd drive to bring about some harmonization of courses is to be recommended. Furthermore, the parochialism that inevitably follows professional isolation will be a major contributor to the stagnation of ideas and techniques to the detriment of undergraduate courses.

Integration

Experience shows that the only real way to bring about a properly integrated course is for the departments to be merged, or for there to be one head of department who is prepared to delegate authority and responsibility to the different sections.

If integration is accompanied by a merging of departments, whilst sending correct messages to the students about Dentistry for the Child, there can be repercussions. A reduction of departments within a school may weaken the overall position of the Dean within the university. It automatically reduces the opportunities for individuals to

become a head of department, affecting promotion pathways. The sensitivities of staff in the combined department must be addressed, so that the affiliation of the head of department is not perceived to favour one or other specialty.

The major advantage of integration is the subliminal message of holistic care of the child. Other advantages are:

- (1) the reduction of duplication of information to students, thus releasing staff and student time, and providing the opportunity to create a seamless programme of instruction;
- (2) economies of scale for the institution.

Another distinct and important issue is the extent of orthodontic instruction at undergraduate level. This is influenced by a range of issues.

In those countries in which orthodontics is considered the province of the specialist, undergraduate instruction should be essentially the teaching of recognition of normal and abnormal craniofacial and occlusal development, and timely and appropriate referral. The limited amount of time within the curriculum available to orthodontics will restrict all but a cursory exposure to fixed appliances (which are recognized as the means of production of high quality orthodontic results; Richmond *et al.*, 1993). Indeed, undergraduates should not be encouraged to consider themselves competent to use such a powerful tool as a fixed appliance. Furthermore, many would argue that only the most able students can approach competence in the management of removable appliances.

A final part of the equation lies in the staff resource available. Low staff numbers will inevitably impact upon the quality and quantity of orthodontic instruction. This may affect staff morale that, in turn, can have a malign influence on students' perceptions of the specialty.

Paediatric Dentistry

The main differences are in the department structure. In the small number of schools where they work together with the Orthodontic Department, all teaching is directed at the same age group of patients. This focus at a developmental stage is more suitable for comprehensive treatment of the growing child. Links with Dental Public Health and Prevention are found in a small number of schools. This concept helps to broaden the intellectual base of the specialty, but the risk that these linked disciplines are seen as entirely the province of dentistry for children can lead to difficulty.

In a minority of schools, Paediatric Dentistry is linked to a well structured Behavioural Science course that prepares the student for the varying levels of psychosocial development that they will encounter in their child patients.

Best Practice and Innovations

The following list gives the examples of Best Practice that were offered by the different schools in their SAR. There has been some editorial activity to eliminate duplication and to simplify the list for ease of reading. The list is divided into Orthodontics and Paediatric Dentistry. The innovations are more generic in nature and are not divided by discipline.

Orthodontics

- (1) diagnosis of malocclusions using clinical data and study models;
- (2) students have practical training with patients;
- (3) students assist in the daily treatment of patients and do some small treatment procedures by themselves [impressions, slicing (disking of approximal surfaces of teeth), ligation of wires, replacement and repair of fixed appliance components];
- (4) students diagnose malocclusions in children on the paediatric course and in adults on comprehensive dentistry courses;
- (5) students are able to participate in the planning of Orthognathic surgery cases, and follow these through the surgical and post-surgical phase;
- (6) students are able to participate in the planning of combined orthodontic/restorative dentistry cases;
- (7) students take part in epidemiological investigations of children in schools, and record caries and malocclusions in different age groups.

Paediatric Dentistry

1. Practical training in a special course for comprehensive dentistry for children, that includes psychology, behavioural management, pain control, and sedation.
2. Integrated course for Orthodontics and Paediatric dentistry.
3. Four-handed dentistry, either with chairside assistance from dental nurses (where resources permit) or with fellow students, either from the same year or as part of a mentoring process with junior students acting as assistant.
4. Integration of students in Public Dental Health, annual investigation of school children.
5. Delivery of short lectures about prevention and first aid in cases of tooth injuries prepared by students for kindergarten and school children.
6. Treatment of children and adolescents with special needs, appropriate to the skills of the undergraduate and the cooperation of the patient.
7. Students take part in epidemiological investigations of children in schools and record caries and malocclusions in different age groups.
8. Outreach clinical training programme providing access to less challenging child patients.

Innovations

PBL. Integrated cases of Orthodontics, Paediatric Dentistry, Oral Surgery, Restorative Dentistry, Behavioural Science, Preventive Dentistry, and General Dentistry.

Integrated course for Orthodontics and Paediatric Dentistry.

Lessons by students in kindergarten and schools on Dental Health.

Screening of schoolchildren for dental disease observed by students.

Competence as an assessment method.

Reflective log book for clinical practice.

Individual learning goals agreed between tutor and student.

Extra-mural (outreach) clinical experience in a primary care and Dental Public Health environment.

Mentoring by senior students and use of postgraduate students for undergraduate instruction.

Electronic capture of clinical data.

Video used as a teaching tool.

Pro-active discussion in protected time prior to the start of a clinical session of cases to be treated.

Hot review of cases treated during the session, i.e. protected time discussion at the end of a clinic of things that have gone well, things that have not gone well (and how they were handled), and unusual or interesting cases seen.

Conscious sedation ± general anaesthesia for management of the anxious child.

Special needs children treated by undergraduates.

Teamworking. This may be with dental nurses, hygienists, therapists, and dental technicians as part of the immediate dental team, but expanding to include wider teams such as those found in the interdisciplinary care within dentistry, and broader still in the management of children with cleft lip and palate.

Recommendations

The recommendations that follow are culled from the details of courses given within the schools' SAR, and from the Best Practices and Innovations.

These are features of the orthodontic and paediatric dentistry curricula that the working group felt should be included or excluded from the undergraduate course. Those for inclusion were considered to have the potential for enhancing the student learning experience, whereas those for exclusion were considered to have little relevance in a modern undergraduate dental course.

Orthodontics

1. The course should be integrated with Paediatric Dentistry (and the disciplines linked to paediatric dentistry), and be linked to Operative Dentistry and Oral Surgery, as well as the obvious links with Preclinical disciplines.
2. To enable a better understanding of intellectual, psychological, social and physical growth, and development, students should have early clinical contact with patients whom they can follow throughout the duration of the course.
3. The course should concentrate on understanding normal and aberrant growth and development, and developing skills in appropriate occlusal management and referral.
4. Students should have clinical time devoted to fitting and adjustment of simple appliances.
5. There should be no laboratory skills course for construction of appliances, although the generic psychomotor skills that such a course can impart should not be undervalued.
6. Students should have skills in recognizing good and poor quality technical work.
7. Students should be skilled in adjustment of the wire components of removable appliances.

8. Postgraduate orthodontic students should be used to assist teaching staff.

Paediatric Dentistry

1. Paediatric Dentistry is a specialty in its own right, not a sub-specialty of Restorative Dentistry.
2. It must be integrated with orthodontics, restorative dentistry and oral surgery, as well as the pre-clinical disciplines. It also should have an alliance with dental public health, behavioural science, communication skills, anxiety control, and prevention, but these topics must also continue into the adult sphere.
3. There must be clearly defined boundaries for the speciality, e.g. upper age limit would be at the discretion of the Paediatric Dentistry department, taking cognisance of the mental, dental, and skeletal maturity of the patient, and having regard to medico-legal aspects of consent and the facilities of the respective clinics. There should be a phantom head course for procedures specific to Paediatric Dentistry. There should be a specific children's clinic.
4. Students must have early clinical contact and progress from simple to complex psychomotor tasks on child patients. These skills should include behaviour management, preventive counselling and treatment, and restorative care for primary and young permanent teeth. This will mean adoption of a team/mentoring approach to clinical work, and using more senior students or postgraduate students to assist with teaching, as well as the use of ancillary dental personnel where appropriate.
5. Students should hold and maintain a reflective logbook, and agree their individual learning goals with their tutors.
6. Students in their final year should regularly work in a primary care environment outside the Dental School, and should be supervised by dentists whose treatment practice includes children.
7. Assessment should be through a Competency scheme.

Conclusions

In broad terms, there is not a great deal of disharmony in the approach of different dental schools to the teaching of Orthodontics and Paediatric Dentistry.

All aim to ensure that students understand general and orofacial growth and development of the child, are able to recognize malocclusion, and to manage occlusal development. Paediatric Dentistry aims, in addition, to ensure that graduates have the necessary child management skills, together with appropriate restorative skills for primary teeth and traumatized immature permanent teeth. Both disciplines also include appropriate and timely referral skills.

The amount of theoretical and clinical time available to the two disciplines varies considerably, as does the timing of first exposure to child patients.

There are manpower problems in some schools that curtail the amount of student contact time and also, presumably, influence the amount of research that may be performed.

Some schools have to overcome problems of the unavailability of dental textbooks, and other important literature and sources of information in their native language.

There is a wide variety of pedagogical approach from stomatologically-based courses to odontological courses. There are varying degrees of penetration of Problem Based Learning ranging from none at all to total use of PBL throughout the entire course. Use of competence as an assessment method is limited. There is a minority of schools where Orthodontics and Paediatric Dentistry are fully integrated.

The recommendations given above are designed to complement the common elements already described. Whilst it is accepted that the undergraduate course should prepare the student to be able to safely and competently undertake those procedures that the GDP will perform, it must be remembered that the practice profile of the GDP will alter with increasing postgraduate experience. Hence, the 'typical' GDP work pattern is difficult to define.

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