

Education Status of Oral Genetics at the Fourth Military Medical University and other Chinese Dental Schools

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Objective: To investigate the current state of genetics education at the Fourth Military Medical University (FMMU) and compare it with other dental schools of China.

Methods: Detailed information about the history and current education status of Oral Genetics in the FMMU were collected and questionnaires were completed to acquire the feedback of twenty-seven students on the course. In the other thirty-five dental schools including the capitals of twenty-five provinces and four municipalities in China, information about the oral genetic course were collected by a telephone survey. The contents of survey included whether or not the Oral Genetic course is offered and some basic information about the curriculum (such as the content, hours, teachers' background and teaching methods).

Results: Among a total of thirty-six dental schools investigated, six of them (16.7%) offered the Oral Genetic course or related lectures/seminars. The length and contents of the curriculum vary among these schools. The FMMU offered the oral genetic curriculum both to undergraduates and graduated students. Their teachers had a broad range of backgrounds, such as dentistry, biology, genetics, and biochemistry. The students considered the Oral Genetics course to be helpful for their future professional careers.

Conclusion: Genetic education in dentistry in China is still at a preliminary stage. More effort must be paid to spread the knowledge of Oral Genetics in China. In addition, domestic and international communications and networks for Oral Genetics should be set up in the near future.

Key words: dentistry, education, genetics, oral inherited diseases, China
Chin J Dent Res 2016;19(4):225–229; doi: 10.3290/j.cjdr.a37147

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This work was supported in part by grants from the National Natural Science Foundation of China (No. 81470728).

There are about one-third of genetic disorders or developmental anomalies affecting craniofacial regions and teeth, and more than 700 distinct craniofacial syndromes have been described¹. Knowledge about the above genetic disorders and dental care for the patients with genetic conditions have been introduced in the dental education process over the past decades^{2,3}. Nowadays, genetic education has been listed as one elementary part of the dental education system of the United States and other countries although it takes several decades for dental professionals to realise the importance of knowledge and skills in dental genetics⁴.

In the United States, dental health professionals began to realise the importance of genetic factors in oral diseases in the late 1980s and more attention has been given to dental genetics since the early 2000s. In the beginning, the National Coalition for Health Professional Education in Genetics (NCHPEG) advocated "Genetics, Disease and Dentistry" to help dental

health professionals incorporate genetic concepts into practice⁵. Behnke et al carried out a survey in 264 dental hygiene programs and found that none of them attended a genetics course for the entry of the program, or a required genetics course within their curricula⁶. Among the fifty-four dental schools surveyed, only one requires a genetics course before admission, and six have the genetic course in the dental curriculum⁶. Generally, the genetics education offered to undergraduate dental students is not standardised, and the content varies considerably among schools^{7,8}. To some extent, the dense curriculum in dental education hinders schools from establishing one or more courses dedicated to genetics^{7,9,10}.

The variety of genetic education in dentistry from school to school has been realised in the past^{11,12}. There are different medical or dental education systems among China, the US or other European countries¹³⁻¹⁸. Although the number of reported genetic diseases from Chinese dental professionals has gradually increased over the past several decades¹⁹, little is known about the current education status regarding oral or craniofacial genetics in Chinese dental schools. Therefore, in this study, we will introduce the current education state of Oral Genetics in the Fourth Military Medical University (FMMU) and compare it with the other thirty-five Chinese dental schools.

Materials and methods

The first part of the data collection and analysis covered the following items of Oral Genetics at the FMMU: history, time, duration, students' background, teachers' background, contents of course, teaching methods, etc.

The second part of the survey included a short questionnaire to understand student attitudes to Oral Genetics curriculum at the FMMU. The questionnaire consisted of six questions and used the Likert scale (1 = strongly disagree to 5 = strongly agree). Twenty-seven students took about 10 min to complete the questionnaire anonymously at the end of the Oral Genetics course and this was taken as primary data.

In order to compare the education status of Oral Genetics with other Chinese dental schools, telephone surveys were performed in the departments or the office of the educational administration of thirty-five dental schools, in the capitals of twenty-five provinces and four municipalities directly under the Central Government of China, which covers the majority of large and medium scale dental schools in China. The questions in the survey were as follows: 1) Is the Oral Genetics course offered? 2) Which department is

responsible for the Oral Genetics course? 3) What are the main contents of the Oral Genetics course? 4) How many students take the course each semester?

Results

Current Education Status of Oral Genetics at the FMMU

Professor Xiaohong Duan from the Department of Oral Biology began to give two lectures about oral genetic knowledge (5 h in total) to the undergraduates during her Oral Biology class in 2007, and then she offered a 20-hour Oral Genetic course to the undergraduates as an elective course in the fall of 2010. Since the fall of 2013, a 40-hour Oral Genetics course was offered to the dental postgraduate students. The teachers involved in the course were from different backgrounds including medical genetics, molecular genetics or dentistry.

The 40-hour course covered the majority of dental, oral and craniofacial genetic diseases involving teeth (enamel, dentin, cementum, root and periodontal tissues), salivary glands, bone tissues, soft tissues, nerve tissues, etc (Table 1). The polygenic factors in some oral diseases such as cleft lip and palate, oral mucosa diseases, oral cancer and periodontal diseases were also included in the course. Several new techniques, such as exome analysis, whole genome sequencing, whole genome re-sequencing, whole transcriptome sequencing and the single nucleotide polymorphism (SNP) chip were also introduced. The students also learnt how to perform genetic consulting, draw pedigree diagrams, design primers and perform Polymerase Chain Reaction (PCR), and use several software systems (such as Sequencher and DNA star). In addition, in order to improve the students' abilities to use web-based resources of genetics, a 2-hour class was assigned for online database learning, such as Online Mendelian Inheritance in Man (OMIM), a NCBI-related website. The Oral Rare Diseases and Genetic Diseases (ORDGD) Network (<http://kqycb.fmmu.edu.cn/index.asp>) was also recommended as a specific oral genetics website.

Case-based learning is quite important in medical and dental education^{20,21}. Usually, some representative hereditary cases will be introduced, which will include when and how the patient presented at the hospital, what the patient's complaints were, which clinical diagnosis was given, how to make the differential diagnosis, which molecular diagnosis was performed, and what clinical treatment was taken. Some published case reports or clinical research data were chosen for the discussion²².

Table 1 Course content of Oral Genetics for postgraduates at the FMMU.

Contents	Theory hours	Practical hours
Basic concept of medical genetics	2	-
Introduction of oral genetics	2	-
Genetic diseases of the enamel	2	-
Genetic diseases of dentin	2	-
Tooth agenesis	2	-
Genetic diseases of periodontal tissues	2	-
Genetic diseases of craniofacial bones	4	-
Genetic diseases of salivary glands and craniofacial nervous tissues	2	-
Genetic diseases of facial skin/ oral mucosa	2	-
Oral polygenetic diseases	2	-
Syndromes and chromosomal diseases of the head	2	-
Case discussion		4
Genetic consulting and pedigree diagram drawing		2
PCR and sequencing analysis		2
Bioinformatics and online databases		2
Quiz	2	

Table 2 Student feedback regarding the Oral Genetics curriculum.

Item	1 n (%)	2 n (%)	3 n (%)	4 n (%)	5 n (%)
I heard about some oral hereditary diseases before taking the Oral Genetics course	11(30%)	19(51%)	7(19%)	0	0
I am interested in oral hereditary disease before taking the Oral Genetics course	8(22%)	14(38%)	12(32%)	3(8%)	0
I am interested in oral hereditary disease after taking the Oral Genetics course	1(3%)	3(8%)	7(19%)	12(32%)	14(38%)
It is important to have an Oral Genetics course in professional dental education	0	0	14(38%)	19(51%)	4(11%)
It is important to have an Oral Genetics course in dental clinical work	1(3%)	0	10(27%)	9(24%)	17(46%)
It is necessary to offer Oral Genetics	0	0	0	21(57%)	16(43%)

n = number of responses to each question. Note: Items ranked on Likert scale in which 1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree.

The FMMU has a clinic for Oral Rare Diseases and Genetic Diseases, the first unique clinic for oral inherited diseases in China. The clinic has admitted many different types of genetic diseases since 2011, which has become the major recourse of the Biobank of Oral Rare Diseases and Genetic Diseases in the FMMU. The whole Clinic and Biobank is open for the students to visit during their clinical probation.

Feedback regarding the Oral Genetics Course

In total twenty-seven students in one representative class at the FMMU took the survey. The students considered that the Oral Genetics course was helpful for their professional education (100%) and clinical work (97%). They agreed that it was necessary to offer Oral Genetics when teaching Oral Medicine. Most of the students (81%) never heard about oral genetic diseases before they took the class (Table 2).

Comparison with thirty-five dental schools in China

The telephone investigations were completed in 32 of 35 (91.4%) schools and these surveys were taken to be effective data. Only five of the schools (14.3%) offered the Oral Genetics course, or related lectures and seminars. At the School of Stomatology, Wuhan University, Professor Zhuan Bian's group offered an 18-hour optional course of "Molecular Biology of Oral Hereditary Diseases" to postgraduates from 2004 to 2008. A 36-hour course "Oral Genetics" has replaced the old version and has become an obligatory postgraduate course since 2009. At the Capital Medical University, a 12-hour Oral Genetics course has been offered to both 5-year and 7-year programme dental students by research fellow Ying Hu since 2009. Other schools presenting lectures and seminars include dental schools in Peking University, Tongji University and Sichuan University. Most teachers are professionals in oral medicine and the content of courses or lectures differ from school to school. The numbers of students taking the oral genetic course in every semester vary from 20 to 40 in three dental schools (Wuhan University, Capital Medical University and the FMMU), and there are about 200 students per year taking the Oral Genetics course in China.

Discussion

Nowadays, most Chinese dental students learn medical genetics during their basic medical education. The first genetic courses were developed in the early 1920s at the National Southeast University in China. Medical genetics education has gradually become a compulsory course in most Chinese medical universities or colleges since the 1980s²³.

However, the research and education on oral genetics has fallen behind medical genetics in China. Before the late 1990s, because of the lower incidence of oral hereditary diseases, such as 1/700 to 1/14000 in amelogenesis and 1/6000 to 1/8000 in dentinogenesis imperfecta²⁴, most dental professionals paid little attention to the clinical treatment or research of oral hereditary diseases, let alone genetic education.

In 2001, two Chinese groups published their genetic research about dentinogenesis imperfecta in *Nature Genetics*^{25,26}. Moreover, with the growing knowledge and development of techniques in medical genetics, more clinical genetic cases affecting oral or craniofacial regions have been found. More dental professionals began to realise the importance of genetics in oral medicine. According to the search results from the China National Knowledge Infrastructure (CNKI), using the

key words 'genetic' and 'dental' or 'oral', more than 400 articles could be found since 2001. The publication types of these articles were diverse, including case reports, research articles and reviews.

Compared with the growing attention given to clinical work and research of Oral Genetics, the delivery of Oral Genetics education fell far behind. In our study, fewer Chinese dental schools were found to offer related courses, lectures or seminars. Most students in the survey never heard about oral genetic diseases before they took the class. According to a report by the National Ministry of Health of China in 2012, there is one dental clinician for every 11,000 people, and there are about 130,000 dental clinicians in China, lower than the world average²⁷. Among the 36 dental schools investigated, only one sixth (6/36) offered the course of Oral Genetics, or related lectures and seminars, and about 200 students per year took the Oral Genetics course in China. Thus the current education of Oral Genetics is far beyond the needs of the professional dental education in China.

A weak teaching team might also contribute to a delay in the delivery of Oral Genetics education in China. At the FMMU and other universities, only a few teachers took a full time job for Oral Genetic education. Most teachers were invited to offer Oral Genetics because part of their research or clinical experience was related to genetics. In addition, the lack of reference books or text books on the Oral genetic course might also hinder the development of related education. Two schools used the first Chinese text book *Oral Genetics* (in Chinese) written by Dr Xiaohong Duan and Gorlin's *Syndromes of the Head and Neck* (5th), as major reference books^{28,29}. Other schools chose several published case reports or articles. Therefore, in order to let more dental students benefit from Oral Genetics education, more professionally trained teachers and reference books regarding Oral Genetics are needed.

One encouraging phenomena was the establishment of the ORDGD Network and the Clinic of Oral Rare Diseases and Genetic Diseases at the School of Stomatology, FMMU. The network and clinic provided a platform for the students, teachers and researchers to learn and communicate in the future.

In summary, although some dental schools including the FMMU offer the Oral Genetic course or related lectures, dental genetic education in China is underdeveloped. More effort must be made to spread the knowledge of Oral Genetics in China, in order to let more dental students benefit from learning about Oral Genetics. More domestic or international workshops must also be developed to share information about genetics education in dentistry.

Conflicts of interest

The authors reported no conflicts of interest related to this study.

Author contribution

Dr Yan Li ZHANG for conducting the whole survey and writing the manuscript; Dr Chang Ning WANG and Zhi Peng FAN for conducting the survey in their schools and providing the information about their course; Dr Yang JIAO for the manuscript revision; Dr Xiao Hong DUAN for the research design, writing, revision and final approval of the manuscript.

(Received May 04, 2016; accepted Aug 11, 2016)

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