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Original Article

Oral medicine education for medical students - A retrospective evaluation of the course in MacKay Medical College from 2016 to 2021

Hung-Pin Lin ^{a,b,c}, Ling-Hsia Wang ^d, Tzu-Chiang Lin ^e,
Feng-Chou Cheng ^{f,g**}, Chun-Pin Chiang ^{h,i,j*}

^a MacKay Junior College of Medicine, Nursing and Management, Taipei, Taiwan

^b Division of Oral Pathology, Department of Stomatology, MacKay Memorial Hospital, Taipei, Taiwan

^c Department of Medicine, MacKay Medical College, New Taipei City, Taiwan

^d Center for the Literature and Art, Hsin Sheng Junior College of Medical Care and Management, Taoyuan, Taiwan

^e Center for the Liberal Arts, National Kaohsiung University of Science and Technology, Kaohsiung, Taiwan

^f School of Life Science, National Taiwan Normal University, Taipei, Taiwan

^g Science Education Center, National Taiwan Normal University, Taipei, Taiwan

^h Department of Dentistry, National Taiwan University Hospital, College of Medicine, National Taiwan University, Taipei, Taiwan

ⁱ Graduate Institute of Oral Biology, School of Dentistry, National Taiwan University, Taipei, Taiwan

^j Department of Dentistry, Hualien Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, Hualien, Taiwan

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Abstract *Background/purpose:* The oral medicine education for medical students is very important and a necessary part for the comprehensive medical education. The purpose of this study was to evaluate the oral medicine course for medical students by evaluating students' perspectives and the instructor's observation.

Materials and methods: The medical students who took the compulsory course entitled "Introduction to Oral and Maxillofacial Medicine" in MacKay Medical College from 2016 to 2021 were invited to fill out the questionnaire for course satisfaction survey regarding their satisfied level with the course and their feelings about the instructors or suggestions, and the participatory

* Corresponding author. Department of Dentistry, Hualien Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, No. 707, Section 3, Chung-Yang Road, Hualien, 970, Taiwan.

** Corresponding author. School of Life Science, National Taiwan Normal University, No. 88, Sec. 4, Ting-Chou Road, Taipei 11677, Taiwan.
E-mail addresses: 894430051@ntnu.edu.tw (F.-C. Cheng), cpchiang@ntu.edu.tw (C.-P. Chiang).

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observation was performed throughout the course activities and instructor–student interactions.

Results: From 2016 to 2021, of a total of 268 medical students, 202 (75%) participated in the surveys. The results of the surveys and the instructor’s observation showed that students satisfied with the course, and the course helped them to have a basic understanding of oral medicine. Moreover, all the mean scores and the rates of respondents who answered as agree for each item were 4.22–4.92 and 85%–100%, respectively.

Conclusion: In this study, the oral medicine education for medical students contributed to an increase in students’ awareness and understanding of oral health and dentistry. Considering the reported effectiveness of the course, students’ satisfaction with the course content and teaching materials, and the instructor’s teaching, this model of providing dental and oral health knowledge for the medical students may be a good one for further use in other medical institutions.

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Introduction

The truly modern western medical system and medical education system were introduced to Taiwan in the Japanese colonial period (1895–1945). It is worth mentioning that in the Japanese colonial period, there was only a medical school for cultivating physicians. Although no dental school was set up for cultivating dentists, there was still dental education for medical students in the medical school. Established in 1899 and regarded as the first modern medical education institution in Taiwan, the Medical School of the Taiwan Government General adjusted the subject schedule in 1918, and an independent dentistry subject made its first appearance in the same year. Until the end of the Japanese colonial period, medical students in Taiwan were required to take the course of dentistry. Moreover, this tradition was continued to the College of Medicine of National Taiwan University (NTU) after the World War II. The medical students in the College of Medicine of NTU also had to take the course of “Introduction to dentistry” until 2011.^{1–3}

George Leslie MacKay (1844–1901) was known as the “black-bearded barbarian” in the early days or “Dr. MacKay” during his missionary work later in Taiwan. He landed in Tamsui on March 9, 1872, and began to engage in missionary and free medical work in Taiwan.⁴ From 1872 to 2022, this year (2022) marks the 150th anniversary of MacKay’s arrival in Taiwan. Neither a physician nor a dentist, Dr. MacKay has become a classic figure in the dental history of early beginning of modern Taiwan. Along with the treatment of fever, Dr. MacKay considered dentistry as “a most important department of medical missionary work in Formosa”.⁵ According to his diary, Dr. MacKay had extracted over twenty-one thousand teeth during his time in Taiwan.⁵ Dr. MacKay was also a frontiersman in incubating western style education in Taiwan with the establishment of “Oxford College”, the first western style educational institute in North Taiwan in 1882.⁶

To commemorate Dr. MacKay, MacKay Memorial Hospital was established in Taipei in 1912. After more than 100 years of development, it has become one of the medical centers in Taiwan, consisting of four branches in Taipei, Tamsui,

Hsinchu, and Taitung, as well as one children’s hospital.⁶ In 2005, the plan to establish MacKay Medical College was approved by the Ministry of Education of Taiwan, and the recruitment of students for the Department of Medicine initiated in the year of 2009. The subject schedule of Department of Medicine sets “Introduction to Dentistry” as a compulsory subject for the medical students in their fourth academic year. This course began in 2012, unexpectedly continuing the tradition of dental education for medical students in Taiwan. In 2014, the course of “Introduction to Dentistry” was renamed as “Introduction to Oral and Maxillofacial Medicine” with some modifications of the course contents.

Education of oral medicine for medical students in MacKay Medical College has been implemented for 10 years (2012–2021). Today, only 6 out of the 13 departments of medicine of medical college or universities (at the bachelor’s level) provide courses related to dentistry or oral medicine. This study tried to analyze the survey of course satisfaction by medical students who took the course of “Introduction to Oral and Maxillofacial Medicine” in MacKay Medical College from 2016 to 2021, to understand their thoughts on oral medicine education for medical students, and to further discuss the importance of oral medicine education for medical students in today’s highly specialized medical healthcare system.

Materials and methods

Participants

The medical students who took the compulsory course entitled “Introduction to Oral and Maxillofacial Medicine” in MacKay Medical College from 2016 to 2021 were included in this study.

Teaching objectives and content

The course consists of two major parts. The first part of the course illustrated the characteristic clinical conditions that

were related to the different subspecialties of dentistry. An introduction of the frequently-used terminology in clinical dentistry and a tooth-numbering system were also included in the course content. A brief discussion of dental caries was also provided. The second part of the course focused on the common or significant pathological conditions in the oral and maxillofacial regions that medical students may encounter in their career in the near future. Videos illustrating important dental procedures, such as endodontic and periodontal treatment, were provided for students' easier understanding of the relatively complicated procedures. An emphasis was put on the clinical–pathological correlation of the diseases, especially possible oral manifestations of systemic diseases. Clinical pictures or images of selected cases were provided for a better understanding of the diseases. By doing so, the instructors expect that the medical students will have a more comprehensive consideration in the treatment of patients with oral and maxillofacial diseases.

Teaching process and participatory observation

The course was a subject for medical students in the first semester of the fourth academic year of the Department of Medicine, MacKay Medical College, New Taipei City, Taiwan. The medical students who took the course were required to have completed the prerequisite subjects of histology and pathology, so the students might have a better understanding of the new subject. The course was a one-credit subject and was taught in the form of lectures. There were 8 topics in total and each topic was a 2-h lecture. It was taught by two of the senior attending dentists of the Department of Stomatology of MacKay Memorial Hospital, Taipei, Taiwan. One of the attending dentists, a board-certified oral pathologist and also a board-certified specialist in family dentistry, was responsible for the majority of the course content (7 out of the 8 topics), and explained the clinical specialties related to oral and maxillofacial medicine as well as common and important oral and maxillofacial diseases that the medical students may encounter in the near future. The other attending dentist, a board-certified oral surgeon, was responsible for the topic addressing on oral surgery, oral cancers, and odontogenic infections. The midterm and final examinations are multiple-choice tests. The examinations were accompanied with clinical pictures to evaluate students' understanding and recognition of oral and maxillofacial diseases. In the course design, the medical students were required to take the initiative to search for published papers (including original research, case reports, or review articles) related to one of the topics of the course of interest, and chose an article to read and wrote down their thoughts as the final report of the course. This course design helped to cultivate students' lifelong learning skills for renewal of medical knowledge and the development of critical thinking and self-reflection. The instructors participated in it and observed the medical students' perceptions of studying oral medicine from the interaction between the instructors and students in the course.

Survey tool

After the final examination, all medical students who took the course of "Introduction to Oral and Maxillofacial Medicine" were invited to fill out the questionnaire for the course satisfaction survey under the school information system. All students were invited to join in this course satisfaction survey at their free will to fill out the questionnaires without the pressure from the investigators.

A semi-structured questionnaire-based online survey was used as the survey tool to understand the overall feelings about the course of "Introduction to Oral and Maxillofacial Medicine" and instructors from the medical students. The questionnaire was designed to obligate the participants to answer all the questions and to make sure that the returned electronic survey forms were all completed. The investigated questions included (I) evaluation of the course content and teaching materials, and (II) evaluation of the instructors and the teaching. The medical students were asked to evaluate their satisfaction on a 5-point Likert scale (1: strongly disagree, 2: disagree, 3: neither disagree or agree, 4: agree, 5: strongly agree). A score equal to 4 or more demonstrated that the participants agreed with the investigated questions. The participants were suggested to complete the survey in their fresh memories. There was one open question in the final question of part II of the questionnaire. The participants could fill any suggestion and/or opinion for the open question.

Statistical analysis

All data obtained from the school information system were stored in excel files and used for statistical analysis. The differences in the mean scores (the degree of agreement) of various investigated items were compared between the medical students of different academic years by descriptive statistics.

Results

The investigated items

In addition to question 2 for the validity test and question 9 for the optional short answer about the instructor, there were seven items being investigated in the surveys of course satisfaction by the medical students from the academic year of 2016 to that of 2021 (Table 1). These investigated items all were required for multiple choice. They included part I for evaluation of the course content and teaching materials, and part II for evaluation of the instructors and the teaching. Details of the questions are listed in Table 1.

Demographic data

A total of 268 medical students took the course of "Introduction to Oral and Maxillofacial Medicine" from the academic year of 2016 to that of 2021 (Table 2). These

Table 1 Question content and question type used in the surveys of course satisfaction by the medical students from the academic year of 2016 to that of 2021.

Question content	Question type
Part I: Evaluation of the course content and teaching materials	
1. The media or teaching materials used in the course were very helpful for the learning effect.	Required, multiple choice.
2. This question is a test for validity. Please choose “strongly agree”.	Required, multiple choice for validity.
3. Overall, how were you satisfied with the course?	Required, multiple choice.
Part II: Evaluation of the instructors and the teaching	
4. The instructor had a good control of teaching time in the classroom.	Required, multiple choice.
5. The instructor explained the course materials clearly.	Required, multiple choice.
6. Teaching methods were arranged reasonably.	Required, multiple choice.
7. The instructor was enthusiastic about the course and took the class seriously.	Required, multiple choice.
8. No sexism, bias or harassment was conveyed in speech or behavior in the class.	Required, multiple choice.
9. Please write down your overall feeling about the course or suggestions for the course or instructors.	Optional, short answer.

included 47 students in the academic year of 2016, 42 in 2017, 48 in 2018, 41 in 2019, 45 in 2020, and 45 in 2021. Of these 268 medical students, 202 who filled out the questionnaires were included in this study. Thus, the overall questionnaire response rate was 75% (202/268). From 2016 to 2021, the participants (response rate) were 40 (85%), 26 (62%), 36 (75%), 31 (76%), 38 (84%), and 31 (69%), respectively (Table 2).

Observation process

All the topics in the course of “Introduction to Oral and Maxillofacial Medicine” were given by lectures in the physical classroom except the first topic of the course in the academic year of 2021, which was carried out online due to the COVID-19 pandemic. As a one-credit subject, we divided the course into 8 classes of 2-h lecture for one topic. In addition, there were a midterm and a final examination, each of which took 1 h. Thus, the course had a total of 18 h in a semester, which met the requirements of the medical school. In 2016, the final report was free to submit as a bonus option, but not mandatory. After 2017, it became a necessary assignment for all medical students who took the course.

The 8 topics of the course were: 1) Clinical specialties in clinical dentistry and a brief introduction of the course oral and maxillofacial medicine, 2) Pulp and periapical lesions, 3) Periodontal diseases, 4) Oral potentially malignant disorders, 5) Oral surgery, oral cancer, and odontogenic infections, 6) Non-odontogenic infection of oral and

maxillofacial region, 7) Developmental defects in head and neck region, and 8) Odontogenic cysts and odontogenic tumors.

We found that the medical students expressed their interests in the overview of the specialties in clinical dentistry, the tooth numbering system, basic dental examination technique, and frequently used terms related to clinical dentistry during the classroom activity. The above-mentioned content may assist in their career, especially in cases of interprofessional consultations. Subsequent selective topics might be challenges for students. After all, all medical students had never been exposed to professional courses in stomatology before this. We found the topics of odontogenesis and histology of teeth were omitted in the courses of embryology and histology. We provided additional explanations of the basic information on odontogenesis and oral histology. The provided information assisted in a better understanding of pathogenesis of pulp/periapical disease, periodontal disease, as well as odontogenic tumors and cysts. Both the midterm and final examinations were multiple-choice tests, and the test was accompanied with clinical pictures (mainly clinical photographs of oral precancerous lesions). Most students were able to get good grades in midterm and final examinations, indicating that they are indeed capable of taking the course and gaining clinical diagnostic ability for related oral and maxillofacial diseases from the course. From the final report for the academic paper reading by the medical students, taking the semester of 2021 as an example, we found that top three topics selected by the students were

Table 2 Summary of the surveys of course satisfaction by the medical students from the academic year of 2016 to that of 2021.

Academic year	2016	2017	2018	2019	2020	2021
Total number of medical students who took the course	47	42	48	41	45	45
Number of respondents (response rate)	40 (85%)	26 (62%)	36 (75%)	31 (76%)	38 (84%)	31 (69%)
Part I	Mean score (number and rate of respondents who answered as agree)					
Question 1	4.58 (38, 95%)	4.38 (23, 88%)	4.28 (32, 89%)	4.71 (30, 97%)	4.74 (37, 97%)	4.68 (30, 97%)
Question 3	4.60 (39, 98%)	4.38 (22, 85%)	4.22 (31, 86%)	4.71 (30, 97%)	4.84 (38, 100%)	4.71 (30, 97%)
Mean score of part I	4.59	4.38	4.25	4.71	4.79	4.69
Part II	Mean score (number and rate of respondents who answered as agree)					
Question 4	4.60 (39, 98%)	4.62 (25, 96%)	4.42 (33, 92%)	4.84 (31, 100%)	4.89 (38, 100%)	4.74 (31, 100%)
Question 5	4.65 (39, 98%)	4.46 (24, 92%)	4.39 (33, 92%)	4.81 (30, 97%)	4.89 (38, 100%)	4.74 (31, 100%)
Question 6	4.60 (39, 98%)	4.42 (23, 88%)	4.28 (32, 89%)	4.77 (30, 97%)	4.84 (38, 100%)	4.77 (31, 100%)
Question 7	4.63 (39, 98%)	4.50 (24, 92%)	4.47 (34, 94%)	4.84 (31, 100%)	4.87 (38, 100%)	4.77 (31, 100%)
Question 8	4.65 (39, 98%)	4.65 (26, 100%)	4.47 (33, 92%)	4.87 (31, 100%)	4.92 (38, 100%)	4.77 (31, 100%)
Mean score of part II	4.63	4.53	4.41	4.83	4.88	4.76
Question 9 (answered optionally)	Number of respondents who answered the question 9					
	5	2	3	3	1	2

oral cancers, oral precancers, and periodontal diseases. A focus on the issues of oral cancers and precancers could be explained by the fact that these relevant diseases are likely to be encountered in their future practice. The discussion on periodontal diseases included the relation to systemic factors or diseases (dietary factors, diabetes, autoimmune diseases, and Papillon-Lefevre syndrome). It was worth mention that three out of the 45 students explored the oral manifestations of COVID-19. This was exactly the goal that the course originally set.

It was also important to highlight the informal talk or interaction outside the class between the instructor and the medical students during these years. A number of students expressed their awareness of the oral/dental lesions or normal anatomical variants in the oral and maxillofacial regions that they were unfamiliar with prior to the enrollment of the class. Several students expressed more understanding of the dental procedures, especially the endodontic and periodontal treatments that they or their family members had received. The explanation of the correct use of dental brush and dental floss also helped the students with more confidence in maintaining oral hygiene and assisting their patients in doing correct oral hygiene procedures.

The scores of course satisfaction in the surveys from 2016 to 2021

There were two investigated items for evaluation of the course content and teaching materials and five investigated items for evaluation of the instructors and the teaching (Table 1). The degree of agreement for each item was very high, and all the mean scores and the rates of respondents who answered as agree for each item were 4.22–4.92 and

85%–100%, respectively. Among them, the mean scores for evaluation of the course content and teaching materials were 4.25–4.79, and those for evaluation of the instructors and the teaching were 4.41–4.88 (Table 2). In overall, the mean scores of various investigated items were highest in 2020, and those were lowest in 2018. On the other hand, the mean scores for evaluation of the instructors and the teaching all were higher than those for evaluation of the course content and teaching materials from 2016 to 2021 (Table 2). However, the mean scores of various investigated items were all greater than 4, demonstrating that all medical students from 2016 to 2021 agreed and were satisfied with all investigated items.

Open question

From 2016 to 2021, there was a total of 16 respondents who answered the open question (Table 2). Some respondents wrote more than one opinion and thus there were a total of 29 opinions (Table 3). The free comments for the open question from the medical students could be summarized as follows: 1) Positive emotions towards the instructors: such as thanks to the teacher, affirmation of the teacher's teaching (enthusiasm for teaching and explained the materials clearly), and enjoying the class; 2) Suggestions for the course content and teaching materials: such as providing the file of teaching slides before the class, providing a simplified version of the teaching materials, hoping to focus on differential diagnosis of oral diseases that were common or easily misdiagnosed in the clinic, as well as to avoid detailed information of epidemiology and pathology; 3) Feelings about the class assignment: positive feeling for enhancing the ability to read English articles; 4) Feelings and suggestions about difficulties in

Table 3 The overall feelings about the instructors, the course content, the teaching materials, the class assignment, and the examinations or suggestions for question 9.

	Responses for question 9 from the medical students	Number of opinion (frequency)
1	Positive emotions towards the instructors	12 (41.4%)
2	Suggestions for the course content and teaching materials	11 (37.9%)
3	Feelings about the class assignment	1 (3.5%)
4	Feelings and suggestions about difficulties in examinations	5 (17.2%)
Total number of opinions		29 (100.0%)

examinations: such as feelings for more difficulties in the final examination, and suggestions for the examination contents (hope to focus mainly on oral diseases that medical students may encounter in their future clinical practices).

Discussion

Considering the case in the United States, the separation of medicine and dentistry was initiated as a historical root and was substantiated with legislation, education, and insurance.⁷ Although the medical system included two separate professions, dentistry and medicine, the medical education system in Taiwan in the Japanese colonial period had only one medical school for cultivating physicians. There was no dental school for cultivating dentists in that period of time. Under the special circumstances of colonial rule, the medical education at that time also covered dentistry. Although the dental education for medical students at that time was not designed to train real dentists, it still became a channel for physicians to become dental practitioners.^{1–3} For the medical students of Taipei Imperial University, in the four-year courses of medical education, the medical students had to study dentistry courses equivalent to 6.66 credits in their senior academic year. In addition, dentistry was one of the nine clinical practice subjects for the medical students.⁸ Based on the courses and clinical practice related to dentistry provided for medical students, some of the medical graduates seemed to become physicians with a more comprehensive understanding of dental science in the Japanese colonial period.^{1–3}

After the World War II, medical education in Taiwan moved towards the same development path like the western medical education. Thus, the medical education and dental education were completely separated. Although NTU inherited the tradition of the medical school in the Japanese colonial period, medical students of NTU just needed to study one credit of dentistry until 2011.^{2,3} In a national survey of 88 medical schools in the United States, only 9 (10.2%) of 88 medical schools did not offer the oral

health curriculum for the medical students.⁹ In addition, providing oral health education for the medical students has nothing to do with the presence or absence of a dental school or a dental residency program in the medical schools. Therefore, oral health education has historically been lacking in the medical school curricula.^{10,11} However, the separation of dental education from medical education has serious negative implications in terms of healthcare delivery.¹² Hence, in the United States, there are the criticism of a “mouthless” medical education and the requests to bring the mouth back into the body for the medical education.¹³ The physicians can play a role in preventing oral diseases, but they usually lack enough knowledge for doing the right action. It is important to expose medical students to the patients with both oral and systemic diseases throughout the entire curriculum. The oral medicine education for the medical students can help to provide the future healthcare professions with the tools to serve the oral health needs and treat oral diseases of our patient population and further the general public.¹⁴

In the United States, it was considered as a serious problem that 10.2% of medical schools do not offer the oral health curriculum.⁹ According to the 2021 schedules announced on the websites by various medical schools in Taiwan for their medical students, 6 (46.2%) of the 13 medical colleges/universities did not offer the oral health curriculum. Among the 8 medical colleges with a dental school, 3 (37.5%) did not offer the oral health curriculum. Apparently, the problem of lacking adequate oral health education for medical students is relatively serious in Taiwan in comparison to that in the US.

The Dr. MacKay’s missionary work and medical work in Taiwan started in 1872.⁴ From the Japanese colonial period in Taiwan to today, the MacKay’s medical work has had developed into a relatively large medical system consisting of a medical center with four branch hospitals and one children’s hospital, one junior college (MacKay Junior College of Medicine, Nursing and Management), and one medical college (MacKay Medical College). Although the MacKay Medical College does not have a dental school, the medical students are required to study one credit of dentistry, and this was implemented for the first time in 2012. It not only inherited the tradition of providing dental education for medical students in the Japanese colonial period, but also became one of the very few medical colleges without a dental school but could still provide the dental education for the medical students in Taiwan. The instructors of our oral medicine course were both dentists, mainly an oral pathologist and another oral surgeon. In addition to a brief introduction to the various specialties in clinical dentistry, the course contents included mainly the introduction of oral and maxillofacial diseases and the teaching of diagnoses and treatments of these oral and maxillofacial diseases, which further helped the medical students to have a complete idea for managing patients with these oral and maxillofacial diseases properly in their future practice.

Regarding the dental education for medical students, it is not suitable to put an emphasis on the detailed technique procedures of various clinical specialties in dentistry. On the contrary, the course content of oral medicine should focus mainly on assisting medical students in the

understanding and diagnoses of oral and maxillofacial diseases, as well as getting familiar with the oral manifestations of systemic diseases. In fact, the clinical manifestations in the oral and maxillofacial region may be the initial warning of a systemic disease. The recognition of a specific symptom/sign may lead to the early and prompt diagnosis with further treatment of an underlying disease. It is also important to set the background for communication between the specialties of medicine and dentistry. Explaining the subspecialties of clinical dentistry may provide the guide of proper referral. Introduction of the dental notations and frequently used terms will improve the understanding the dental records in cases of consultation. We think that this course design is a good teaching model and is suitable for the experienced oral pathologists to teach this special oral medicine course for the medical students.

A study of the impact of incorporating oral health education into the medical curriculum demonstrated that medical students are interested in the oral health curriculum.¹² That study concluded that oral health courses in the medical curriculum helped to increase awareness and understanding of oral health by medical students. Because the healthcare of patients involves multidisciplinary and interprofessional environments with a wide array of healthcare providers, curricular directions for medical students should explore a medical education model that incorporates oral health education. To the best of our knowledge, our study is the first one focusing on the dental or oral medicine education for medical students in Taiwan. According to the medical students' course satisfaction surveys, a majority of the medical students were consistently satisfied with the course content and teaching materials, as well as the instructors' teaching. In addition, according to instructor's observations at the classroom and the feedback from the medical students, students generally found that the dental course was interesting and expressed that the oral medicine course helped them to understand oral and maxillofacial diseases. Three out of the 29 responses mentioned that the final examination was more difficult. After all, the medical students have none of previous experiences of studying dentistry. However, the medical students were capable of taking dental courses and passed the examination with good grades. In fact, the benefits of studying dentistry by medical students are not only for medical education, but also for medical students to gain a more comprehensive understanding of dentistry and oral and maxillofacial diseases, and this knowledge is very helpful for the future medical practice. In addition, the dental and oral health knowledge can also enhance the concepts of dental and oral health for medical students themselves and let them to have positive attitudes toward personal oral care and prevention of oral and maxillofacial diseases.¹⁵

Through the course of "Introduction to Oral and Maxillofacial Medicine", we hope that medical students can learn about the connotation of various clinical dental specialties from the course, and hope that they will become physicians with a comprehensive understanding of dentistry and oral and maxillofacial diseases in the future. In order to provide complete medical care to the patients, the cooperation of experts of various medical fields including dentistry is often required. Communication and

cooperation are based on mutual understanding, and the course can provide knowledge that bridges oral health to total body health. However, it is indeed a big challenge to achieve such a great goal just by learning this one-credit oral medicine course. Medical students who become physicians after graduation from medical schools may not take courses of oral medicine, but they will certainly encounter patients with oral and maxillofacial diseases in their future professional careers. How to distinguish the odontogenic diseases from non-odontogenic diseases and the oral manifestations of systemic diseases from oral signs and symptoms purely originating from the diseases of oral structures, as well as how to make proper arrangements and treatments for patients with oral and maxillofacial diseases are important issues that cannot be ignored. If medical students or physicians can have a preliminary understanding of stomatology, they can make appropriate judgments at the first time when they encounter patients with oral and maxillofacial diseases in their professional careers. Therefore, the dental and oral health education for the medical students is beneficial for both physicians and their patients.

We suggest that both medical and dental educations should include learning the knowledge of the body and the oral cavity, and medical education focuses mainly on the learning of the body and the dental education focuses predominantly on the learning of the oral cavity. The future directions for this specific oral medicine course for medical students involve developing the oral health topics throughout the curriculum and further measuring the experience and effectiveness of learning these oral health topics. This project can have a major impact on the patients' healthcare outcomes, because medical professionals who are aware of the link between oral and systemic health and pay attention to the societal and biological consequences of poor oral health can provide a higher level of body and oral health care to the patients.

Declaration of competing interest

The authors have no conflicts of interest relevant to this article.

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