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Comparison of General Dentistry Curriculum in Iran with Eight of the World's Top Dental Faculties

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ABSTRACT

Background and objective: *A curriculum is a general and immense outline of an educational activity. A curriculum defines teaching content, student and curriculum assessment methods, and ultimately defines the framework for each activity in the curriculum. Given the importance of training in medicine and dentistry, the purpose of this study was to compare Iran's general dentistry curriculum with eight of the world's top dental faculties.*

Methods and materials: *In descriptive-comparative research, the important components and parameters of the curriculum of the PhD in dentistry at several universities in the world were studied and compared with Iranian curriculum. The present study was conducted in two stages: The first phase included finding the best dental faculties in the world; the second phase was to identify and examine the various components of the curriculum of the PhD in Public Dentistry in Iran and the 8th highest dental faculties in the world and*

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compare them according to Loudvigsson indicators. The results of the study were reported using descriptive statistics (frequency and percentage).

Results: *All of the evaluated indicators were in the Iranian curriculum. The study of the eight top universities in the world showed that the indicators worth paying attention to, including critical thinking and scientific approach in the program, student-centered curriculum, horizontal and vertical integration, systematic education, education based on community health care system, community-based education and ethical principles, existed in all curricula of the studied colleges. The presence of a selective framework in a curriculum and early clinical exposure was only available in the educational curriculum of four universities: Toronto, UNC, Minnesota and UCLA. The focus on small group work was defined as the prevailing educational method in three Herman Ostrow, Minnesota and UCSF universities. The problem-solving learning index was only presented at two universities in Osaka and NYU.*

Conclusion: *The highest rates of Loudvigsson indicators in general dentistry curriculums of eight universities in the world were 90% and at least 72.7%, while the above indicators were 100% in the dentistry curriculum of Iran. According to the indicators of Loudvigsson, Iran's dental training program is ranked high in content.*

Keywords: curriculum, dentistry, Loudvigsson indices, top universities in the world.

INTRODUCTION

Educational curriculum is one of the main areas of education that plays a fundamental role in the desirability of manpower. A curriculum is a general and immense outline of an educational activity. The outline of a curriculum determines the teaching content of the course, indicates expectations and desires of learners, draws a teaching methodology, identifies ways to facilitate learning, clarifies student and method assessment, determines the time frame for each activity; therefore, the curriculum can be called "training agenda" (1).

Dental education is also a collection of activities that can be used both in theory and practice in dentistry departments affiliated with the Ministry of Health and Medical Education in order to teach skills in dentistry. New dental training curricula should prepare educators to gain the ability to work in a variety of fields, to adapt to changes and scientific advances after graduation; they should be able to be trained intuitively, which requires a balanced and accurate educational approach (2-4). Dent and Harden wrote: "The physician is a set of abilities but many medical science universities may train doctors whose nature of production is uncertain. Since the learning outcomes must be clearly and fully explained in the medical education curriculum, the emphasis on the goals and content of the curriculum is important in answering questions such as the following: What types of doctors will the curriculum train? What qualifications will they have? Will physicians get familiar with existed health care in the community and in hospitals? Have you been trained to promote health? Are they competent to undertake research? Are they committed to the ethics of medical science?" (5).

Most of dental schools offer new, integrated curriculums based on the system. This is very valuable in designing any new curriculum and using the experiences of other centers that have tried this way. In almost all dental programs, educational goals often include "acquiring skills to identify strengths and weaknesses, and reinforcement of student's self-study process" (6).

Sadeghirad *et al.* (7) examined the educational models of specialized doctoral courses in medical sciences of the world's top universities. According to the findings of this study, achieving a higher scientific level for the local universities and educating physicians with the necessary global standards would not be possible without changing the educational system of Iranian medi-

cal sciences in line with global changes. Also, given that in a few studies regarding the educational program, comparisons are limited to assessing the educational curriculum of Iranian universities *versus* universities in countries such as Azerbaijan, Ukraine and Armenia, and because dental faculties in these countries do not have high credibility, it seems necessary to make a comparison between the Iranian dentistry curriculum and the most up-to-date and top universities in the world (7).

Meanwhile, there is a brief overview of the phenomenon of revising the general dentistry curriculum in our country which, despite having already been revised in the headings and content of general dentistry, these cases focused more on the modification of the teaching methods and strategies of the course. On the other hand, the deputy of education center has developed a package of transformation and innovation in the education of medical sciences in line with the evolution of the health system, in which attention is paid to the country's major health needs, with focus on improving the status of universities and entry into the third millennium campus, achieving an accountable and justice-based education, using modern technologies and considering the institutionalization of professional ethics. This study is based on a responsive and justice-based learning package. ❑

METHODS AND MATERIALS

Our descriptive-comparative research, in which the important components and parameters of the curriculum of general doctoral course in Dentistry at several universities in the world were explored and compared with Iranian curriculum, was carried out in two stages.

Firstly, a search for the best dental faculties in the world (names of top schools were extracted using the Shanghai Ranking and QS World University Rankings sites from 1 to 50) yielded a list of colleges that were ranked among the top faculties in both ranking systems. The final list of faculties studied by us was based on the above list and it was prepared in any possible and purposeful form (1 to 10) according to the availability of information. It should be noted that only the universities providing a Doctor of Dental Surgery (DDS) certificate have been included in our study, while those that were providing only BS and MS were excluded; out of 50 faculties, only eight colleges met the entry criteria.

Secondly, the curriculum of general doctoral course was identified and reviewed based on: a) the general structure and length of the training course, mission and objectives of the curriculum, approach and educational strategies, the core and optional content of education, educational levels, the role of graduates; and b) Loudvigsson indexes.

At first, a checklist was prepared which included general information such as mission and objectives, total length of training, number of training sections, integration status in curriculum, design of the curriculum model (case-systematic), curriculum framework (standard-selection), prevailing training methods, the dominant assessment methods, the role of graduates, the type of graduate qualification awarded. There were also questions based on Loudvigsson indicators on critical thinking and practical approach in curriculum, student-centered curriculum, problem-solving based learning, horizontal and vertical integration in curriculum, existence of a selective framework in curriculum, consideration of small group work as the prevailing educational method, early clinical exposure, systematic education, community-based education, attention to professional principles and ethics and medical rules in the curriculum; finally, the results obtained from the review of each university were registered in a checklist. Thus, for each of the indicators, the rate (Yes-No) for the educational curriculum was provided in accordance with the rate of its achievement in the educational curriculum. Then the percentage of Loudvigsson indicators was calculated for each faculty. The results of the study were reported using descriptive statistics (frequency and percentage). ❑

RESULTS

The results of general doctoral curriculum of dentistry examination in eight world's top faculties are summarized in Tables 1 through 8.

The findings resulted from the Loudvigsson indicators are presented separately, in each university, in Table 9, in which the percentage of Loudvigsson indicators achievement in the curriculum of dental faculties was compared between each of the eight top universities and between

Toronto Dental School
Mission and objectives: • Training of dentists with preventive, diagnostic and technical knowledge • Training of dentists with the necessary knowledge in biomedical sciences and clinical skills • Basic Biomedical Sciences and Laboratory Sciences and Diagnostic Courses in the first two years of education • Curriculum for specialized and general courses based on clinical experiences • Training of international dentists
Total length of the course: four years • two additional years for students and foreign dentists (international dentists)
Number of educational sections: two sections including the DDS (Basic and Clinical) and the International Course IDAPP
DDS course: Year 1 and 2: Basic Sciences Courses and Diagnostic Courses Years 3 and 4: Patient Therapy Courses, Training for Dentistry Required Skills and Techniques The IDAPP course: six months with intensive programs for international professionals (from January to June)

TABLE 1. General dentistry curriculum of Toronto Dental School

each of them and the Faculty of Dentistry of Iran. ❑

DISCUSSION

Nowadays, after decades of great advances in medicine, and given the acknowledged role of medical education at the community level, some researchers have proposed revision and changes in the principles of medical science education and in line with that of dentistry. In this regard, extensive changes have taken place in medical education systems in developed and sometimes developing countries (8, 9). In our country, the general doctoral courses of dentistry were reviewed once in 2000 and were approved at the seventh session of the Supreme Council for Medical Planning. After that, the fourth review was conducted in 2011 in response to the needs of the community, which had been running in the dental faculties of the country until 2018 and the last review was made in August 2017. Considering the increase in the number of dental faculties from five cases before the victory of the Islamic Revolution to more than 50 cases after the victory and the concomitant increase in the number of dentists, it seems that it is time to have an assessment of the new national dental education system (8-10).

Based on the examination of the articles, it was observed that in one study, the dental education curriculum was reviewed from the point of view of graduates of the last five year dental faculties of the country after starting work at the community level. Researchers in this study concluded that the dental education system had different levels of performance and capabilities; however, there is a sense of need for some reformations in areas such as internet education, language, research methodology, emphasis on student research activities as well as in some basic science units. The researchers also argued that, among basic science courses, two practical and theoretical dental anatomy lessons had the highest application, while practical and theoretical biochemistry had the lowest application. In terms of adequacy of the number of patients treated in the departments by students, the diag-

Osaka Dental School
Mission and objectives: • Learn various types of natural sciences, cultural and social studies • Acquiring specialized knowledge and skills • General liberal arts education in the first year of study, language and general information, seminars and health and sports topics • Teaching dental classes along with general classes
Total length of the course: six years • Basic science teaching in the second half of the first year includes general anatomy, physiology and biochemistry • Laboratory techniques begin from November to December of the third year after completing basic education and during this period, graduates study the importance of research and recognition of oral science • Diagnosing and treating education with required techniques for dentists by qualified specialists and professors in year 5 to 6
Number of educational courses: two courses consisting of 1.5 years of basic sciences and 4.5 years of professional dentistry
Exams: A standard skill and ability test includes two tests: 1. CBT Test (Computer Test): A comprehensive review of basic and clinical knowledge by computer 2. OSCE Test (Clinical Examination):
Specifications: This college is not exclusive and separate, but also with the branches of oral science.

TABLE 2. General dentistry curriculum of Osaka Dental School

nosis unit was ranked first. Also, the practical and theoretical fixed prosthetic course had the highest efficiency and community dentistry, while practical orthodontics had the lowest efficiency. However, that study was conducted eight years ago and after its completion, the curriculum was revised twice; also, it was based only on running a questionnaire for dentists in Iran, which allowed no comparability with other countries in the world. Also, in the study of Ahangari *et al.*, only the educational content was examined and no attention was paid to the other dimensions of the curriculum. In the current study, we tried to consider all these errors in methodology and data evaluation (11).

John Loudvigsson, one of the leading scholars in medical education, analyses the main features of today's societies in all fields, including that of education, and highlights the occurrence of a sudden change and, accordingly, the need for adaptation and training methods to fit the future expectations of the community with the advent of techniques and technical tools. He believes that, in order to make the changes needed to adapt education in dental care, a new approach and new knowledge equal to the logarithmic growth of today's knowledge are crucial. In this regard, Loudvigsson is also focusing on organizing knowledge sources according to the unlimited sources, and identifies appropriate educational policies for managing the proper transfer of knowledge. He believes in teaching methodology with focus on the main mechanisms of problem solving and continuous learning methods for students (12). Generally, Loudvigsson considers implementation of creativity in education as its main goal and the following factors are essential to achieve this goal:

Minnesota Dental School
Mission and objectives: • Has an educational program based on managerial, scientific, interpersonal skills • Educational methods tailored to the content of the course including traditional lectures, small group counseling, interactive tutoring teams, daily labs and clinical exercises. • Basic science courses include: macroscopic and microscopic anatomy, neurology, biochemistry, microbiology, pharmacology, physiology, pathology, oral histology, embryology and genetics. • Clinical Dentistry Courses: Oral Anatomy, Operative Dentistry, Oral Diagnosis, Pediatric Dentistry, Oral Surgery, Anesthesia, Periodontics, Oral and Radiology, Prostheses, Prosthodontics, Ethics
Total length of the course: four years
Number of educational courses: two courses including two years of basic sciences and two years of clinical sciences
Courses: • Year one: Basic science education includes human tissue training, molecular and cellular systems. Start of dental technical courses • Second year: A basic science course focusing on pathology, culminating in specialized dentistry courses for the treatment of patients • Year 3: Clinical sciences, Basic Sciences Relationship with Behavioral and Clinical Sciences in Clinical Environment, First Dental Practices • Year 4: Clinical education will be completed this year
Specifications: Agreement for the exchange of students with universities in Denmark, Norway, Germany and the Netherlands Has a worldwide reputation in the field of fluoride prevention and genetic abnormalities, periodontal disease prevention, pain control and oral cancer.

TABLE 3. General dentistry curriculum of Minnesota Dental School

1. Paying attention to critical thinking and scientific approach in the curriculum
2. Student-centered curriculum
3. Learning based on problem solving
4. Horizontal and vertical integration in the curriculum
5. The existence of selective framework in the curriculum
6. Paying attention to work in a small group as the dominant educational method
7. Early clinical exposure
8. Systematic training
9. Education based on community health care system (community-based education).
10. Considering the principles of professionalism, ethics and dental rules in the curriculum (12).

According to the latest changes in the curriculum of general doctoral course of dentistry, this study was conducted to compare the curriculum of the doctoral program in dentistry in Iran with the programs of eight dental faculties from different countries of the world with the indicators of Ludvigsson's study and the different fields and dimensions of their general medical dentistry curriculum; comparing them with the general dentistry curriculum of the country would provide useful information about the status and

UCLA Dental School
Mission and objectives: • Training dentists with preventive, diagnostic and technical knowledge • Training dentists with the necessary knowledge in biomedical sciences and clinical skills • Training dentists as a leader in their specialty • Pre-dentistry courses for those suspected of continuing education • Basic Biomedical Sciences and Laboratory Sciences in the first two years of education • Curriculum for specialized and general courses based on clinical experiences • Training international dentists
Total length of the course: four years /two extra years for foreign students and dentists (international dentists)
Number of educational sections: two sections including DDS and PPID sections
Courses: Teaching students in two 4-year (DDS) and 2-year (PPID) courses

TABLE 4. General dentistry curriculum, UCLA Dental School

New York University School of Dentistry (NYU)
Mission and objectives: • Training dentists with the knowledge and skills necessary to diagnose, manage and prevent diseases, abnormalities • Curriculum include biomedical sciences, behavioural sciences and clinical sciences and public health issues • Developed educational processes and dental ethics education • Encouraging students to create models for professional commitment to welfare in the entire world This training program includes: 1. Promote decisions that reflect the latest knowledge in biomedical and clinical sciences 2. Emphasis on the integration of biomedical, behavioural and clinical sciences throughout the curriculum 3. Encourage and motivate lifelong learning as a core value in professional life 4. Creating the highest ethical and professional standards 5. Meritocracy 6. Increased appreciation of multiculturalism and pluralism as a cultural diversity in the United States and effective in health behaviours 7. Comprehensive patient-centered care-changing system complement
Total length of the course: four years
Number of educational sections: containing the DDS section

TABLE 5. General dentistry curriculum, New York Dental School

North Carolina Dental School, University of North Carolina (UNC)
Mission and objectives: • Considering a variety of students with diverse backgrounds and experiences for dentistry by the Admissions Committee • Selection of strong applicants in terms of education and dentistry The goals and expectations of the faculty of dentistry of their applicants: • Satisfactory academic ability (completion of the pre-dentistry and acceptance of a dental exam (DAT) • Having sufficient psychological skills in performing dental technical tasks • A commitment to helping others and participating in additional and voluntary work Having a pre-dentistry curriculum that increases your social awareness • The individual's potential for self-reliance on learning (self-study of applicants) • Contacting applicants and dentists with each other and talking to them
Total length of the course: four years
Number of educational sections: containing the DDS section
Specifications: The country's largest dental training center.

TABLE 6. General Dentistry Curriculum, North Carolina Dental School

UCSF Dental School
Mission and objectives: • Balancing in terms of clinical, research and social services • Covering a wide range of science, art and technology in modern dentistry • Leading graduates to psychological and clinical skills • Based on four main areas including physical evaluation of patients, protecting people from oral disorders, diagnosis and treatment
Total length of course: four years/two years later • Years 1 and 2: include biomedical courses, basic dental sciences, and patient care courses, preventive and restorative dentistry. • Years 3 and 4: Lessons associated with treating patients
Number of educational sections: including DDS and IDP sections
Specifications: The country's largest dental training center

TABLE 7. General dentistry curriculum, UCSF Dental School

shortcomings of the program and its implementation.

According to our findings, the differential study of the general doctoral curriculum of each university indicated that:

• At UCLA, nine cases (81.8%) of the indicators were positive and two negative. In the educational curriculum of this university, there were no learning indicators based on problem solving and no attention was paid to small group work as a dominant teaching technique.

• At UCSF University, eight cases (72.7%) had positive responses and three cases (27.3%)

Herman Ostrow School of Dentistry
Mission and objectives: • Has a learning-centered environment • Supporting students to solve patient challenges in collaborative groups Encourage experts to learn evidence-based strategies, critical thinking, and problem solving • Committed to teaching dentistry with the necessary knowledge in biomedical sciences, flexible behavior and clinical skills. • Preparing students for clinical, educational, general health planning and research • Learning problem solving skills • Ability to access appropriate data and educational resources independently • Integration of basic science and clinical knowledge of dentistry • Ability to do group work effectively
Total length of the course: four years
Number of educational courses: five quarterly sections including 88 units, 76 dental health units and 12 general courses
Courses: Teaching students in two 4-year courses (DDS)
Specifications: Graduates of this university can continue their education in public health, mathematics or biology. The university also offers a new route for educated dentists who can complete a bachelor's degree program of their choice at the same time as a dentistry course

TABLE 8. General dentistry curriculum, Herman Ostrow School of Dentistry

negative responses. In the educational curriculum of this university, learning indicators were not defined on the basis of problem solving; the presence of selective framework in the educational curriculum and early clinical exposure was not defined.

• At Minnesota University, 10 cases (90.9%) of the indicators were defined and one case (9.1%) was not defined. The learning-based index based on the problem solving in the educational curriculum of this university was also not defined.

• At UNC, eight cases (72.7%) of the indicators were positive and three negative. Three unclear points in the educational curriculum at this university were learning outcomes based on problem solving, attention to small group work as a prevailing educational method and early clinical exposure.

• At NYU, three indicators (27.3%) were not defined and eight (72.7%) were defined. Uncertain indicators in the educational curriculum in this university were a selective framework in the curriculum, focusing on small group work as a prevailing educational method and early clinical exposure.

• At Toronto University, nine cases (81.8%), similarly to UCLA campus, had positive responses and two cases (18.2%) negative responses. There were no indicators of learning based on problem solving and no attention was paid to small group work as a dominant educational technique in educational curriculum.

• At Herman Ostrow University, nine cases (81.8%) of the indicators were defined and two (18.2%) were not defined. In this university, the learning index based on the problem solving and the existence of the selective framework in the curriculum was not defined in the educational curriculum.

• At the University of Osaka, similarly to the University of NYU, three cases (27.3%) were not defined and eight cases (72.7%) were

Index	UCLA	UCSF	Minnesota	UNC	NYU	Toronto	Herman Ostrow	Osaka	IRAN	Total
Student-centered educational program	✓	✓	✓	✓	✓	✓	✓	✓	✓	100%
Learning based on problem solving	✓	✓	✓	✓	✓	✓	✓	✓	✓	100%
Horizontal and vertical integration	---	---	---	---	✓	---	---	✓	✓	33%
The existence of the selective framework in the curriculum	✓	✓	✓	✓	✓	✓	✓	✓	✓	100%
Pay attention to small group work, as the dominant teaching method	✓	---	✓	✓	---	✓	---	---	✓	55%
Early clinical presentation	---	✓	✓	---	---	---	✓	---	✓	44%
Systematic training	✓	---	✓	---	---	✓	✓	---	✓	55%
Community based education	✓	✓	✓	✓	✓	✓	✓	✓	✓	100%
Attention to ethics	✓	✓	✓	✓	✓	✓	✓	✓	✓	100%
The degree of realization of the whole index (effectiveness)	✓	✓	✓	✓	✓	✓	✓	✓	✓	100%
	9 (81.8%)	8 (72.7%)	10 (90.9%)	8 (72.7%)	8 (72.7%)	9 (81.8%)	9 (81.8%)	8 (72.7%)	100%	

TABLE 9. Definition of Loudvigsson indices in Iranian Dental Schools and eight top universities of the world

defined. Uncertain indicators in the educational curriculum in this university were a selective framework in the curriculum, focusing on small group work as a prevailing educational method and early clinical exposure.

Also, the rate of realization of each index in the universities has been calculated. All of the evaluated indicators were present in the Iranian curriculum. Indicators of attention to critical thinking and the scientific approach to curriculum, student-centered curriculum, horizontal and vertical integration, systematic education, community-based education, and ethical considerations in the curriculum of all universities were defined. The existence of a selective framework in the Early Clinical Education and Exposure Program was only available in the educational curriculum of four universities of Toronto, UNC, Minnesota and UCLA. The focus was on small group work as prevailing educational methods were in three universities: Herman Ostrow, Minnesota and UCSF. The problem-solving learning index was only presented at two universities: Osaka and NYU.

General dentistry curriculum has been integrated into all studied faculties of Iran in particular, and in most of them, vertical integration between basic and clinical sciences has occurred. In using effective new teaching methods, turning teaching from lecture methods into other effective methods, including PBL or discussion in small groups as the dominant teaching method, in most colleges, especially in Iranian dental faculties, medicine is included in the curriculum; but in practice, the teaching method in most Iranian dental faculties is lecture and discussion in large groups, which is more prevalent in the basic sciences courses.

One of the important indicators in any general dentistry educational curriculum is the early clinical exposure of students. Exploring the general dentistry curriculum in the top universities of the world and those of Iran indicated that in most of cases, students received one day training weekly or a defined period during their educa-

tion to attend the health and environment system either from the first weeks or at most after one year. In contrast, in Iranian faculties of dentistry, the curriculum has been developed, enabling students to attend clinical courses after the pre-clinic courses.

The curriculum framework is selective and flexible in the current curriculum of the country, which offers 35 optional units for dental students. Unfortunately, it pays no attention to its implementation and operation.

In the studied universities, the maximum realization of the mentioned indicators is 90% and the minimum 72.7%. While the aforementioned indices in the dentistry curriculum of Iran are 100% fully met, which indicates the high efficiency and ability of the educational curriculum developed in Iran's dentistry in comparison to other pre-graduate and higher education institutions. But the fact that Iranian graduates' results and efficiency are far lower in terms of science and skills compared to graduates of these eight universities reveals problems in the implementation of curriculum, which have to be solved, as well as barriers to non-implementation, which need to be identified.

In this regard, a study conducted by Darhazadeh *et al.* reviewed the general dentistry curriculum based on the viewpoints of beneficiaries as well as the weaknesses, strengths and proposed solutions from the stakeholders' perspective and in accordance with the main components of the curriculum, including assessment, objectives, educational strategies, content, educational resources, educational environment, learning activities of students, implementation and evaluation (9). The authors concluded that, generally speaking, from a stakeholder point of view, revision of the curriculum was beneficial, but abrupt change without justifying the stakeholder and the lack of suitable hardware and software platforms to run cause failure in the implementation of the curriculum (9).

It seems that the stakeholders' dissatisfaction with the general dental curriculum has recently been revised due to the hasty implementation of the curriculum, the lack of infrastructure for its implementation and the attainment of idealistic goals of the curriculum. Therefore, a review with a comprehensive assessment of the curriculum stakeholders and its pilot implementation, as well as providing the platforms and justifying the beneficiaries for the development and success of the curriculum is recommended (9, 11).

According to the present study and other reports, it can be said that in order to harmonize educational systems with academic and global processes, a World Dental Foundation is required to license and standardize dental teaching systems around the world. The activities of this foundation and the institutions of dental education lead to the training of qualified people from all over the world to study and apply to the dental faculties of each country. It should be noted that such persons should be selected from all countries, under the supervision of the World Health Organization, and should start work self-monitoring.

Developing a set of globally recognized educational standards for the training of dental students and the use of international standard terminology to facilitate proper and equal curriculum can lead to the design of standard dental curriculums; in turn, this alignment has the desired results, such as improving oral health worldwide, reducing the cost of dental services from developing and less developed countries to developed countries, increasing the benefits of standard dental services for all segments of the population, and providing job security and income will be appropriate for dentists across all countries. ❑

CONCLUSION

The maximum rate of achievement of Loudvigsson indicators in dental education curricula of eight universities is 90% and at least 72.7%, while the above indicators are 100% in the dentistry curriculum of Iran. However, comparing Iranian graduates' efficiency with regard to their knowledge and skills *versus* that of graduates of these eight of the world's top dental faculties, there is a need for reform in the implementation of the curriculum and also for identification of barriers to non-implementation. ❑

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