ORIGINAL ARTICLE

UNDERGRADUATE IMPLANT DENTISTRY TRAINING IN SAUDI DENTAL SCHOOLS

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Background: Implant dentistry training at the undergraduate level has been introduced only recently in Saudi dental schools and there is only limited data available about it. The objective of the present study was to evaluate the current status of undergraduate dental implant education in Saudi Dental Schools. **Methods:** A two-part questionnaire-based study was conducted in Saudi university dental schools targeted towards undergraduate program directors to assess the quantity and quality of implant dentistry training being integrated into the curriculum. In addition, interns were asked to assess the degree of exposure and their satisfaction regarding implant dentistry education. **Results:** Five program directors (83.3%) and 195 interns (82.9%) responded to the questionnaires. Implant dentistry was taught to the undergraduate students in multidisciplinary departments with teaching hours ranging from 22–30 hours. Only three schools exposed students to laboratory (workshop) or clinical training. There was agreement among the program directors in respect of the didactic contents. Majority of the interns reportedly acquired knowledge regarding implant dentistry based on theoretical (96.1%), laboratory (33.5%) and/or clinical (30%) training. While 50% of the interns agreed to acquire knowledge by assisting and observing dental implant procedures, only 52.8% of the interns expressed satisfaction regarding implant dentistry training obtained during their undergraduate period. **Conclusion:** The present study revealed variability in undergraduate implant dentistry training offered at Saudi dental schools. In order to optimize this and to produce competent dentists, learning guidelines for such courses should be developed and implemented by competent authorities.

Keywords: Implant dentistry; Dental implants; Dental education; Undergraduate dentistry

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INTRODUCTION

Dental Implants (DI) are one of the most important treatment modalities to restore aesthetics and function in partially or completely edentulous patients. Dentistry has undergone a paradigm change with regard to restorative treatment options following introduction of DI.[1] In addition to their high predictability and success rates,[1] DI have resulted in increased patient satisfaction and acceptance,[2] and conservation of adjacent teeth and alveolar bone[3]. While DI treatment was primarily limited to specialists, the past decade has witnessed a change wherein general dental practitioners (GDP) have been vying to train and equip themselves with the art and science of implant dentistry.[3]

This shift in traineeship could be attributed to the evidence based predictable outcomes of DI and the readiness of GDP to undergo surgical and restorative implant training.[4] DI treatments are based on the principle of "osseointegration", a term first introduced by Branemark in 1969.[5] Although DI were reportedly used to treat edentulous patients as early as 1971,[6] it took almost two decades for implant dentistry to be included in dental school curricula worldwide[4].

In the United States of America, a pioneer in dental education and training, surveys indicate that only as low as 20% of the dental schools had implant courses in their curricula during the early 1970s.[7] Nevertheless, American dental schools have witnessed a steady increase in the percentage of dental schools offering implant courses as a part of their curriculum, from 33% in 1974 to 86% in 2005.[8] In spite of originating in Europe, implant dentistry was slow to catch up within the European dental curriculum, with only 10% of the dental schools offering DI courses prior to 1990.[4] The scenario however improved by 2000–2001, wherein almost 80% of dental schools in Europe offered implant courses. Atashrazm *et al*.[4] reported a worldwide increase in pre-doctoral implant training from less than 31% before 2000 to around 69% in 2010. These studies indicate the growing importance accorded to pre-doctoral implant dentistry training in dental school curricula.

During the 1990s, curriculum guidelines were formulated by the American Association of Dental Schools (AADS) for undergraduate training in implant dentistry.[9] These guidelines

indicated the need for undergraduate dental students to recognize indications for DI, compare DI with other alternatives and to be knowledgeable enough to seek referrals when needed.[10] According to the Association for Dental Education in Europe (ADEE) guidelines, newly graduated dental students must be qualified to identify indications and contraindications for placement of osseo-integrated DI, in addition to knowing the principles and procedures involved in them.[11] Despite internationally renowned guidelines, there is a lot of variation with regard to the didactic, laboratory and clinical aspects of undergraduate implant training.[4]

While the number of lecture hours dedicated for implant dentistry ranged from 10 to 40 hours, almost 68% of the dental schools had less than 20 lecture hours dedicated to the same. Similarly variations have been reported with regard to the involvement of students in the surgical and/or prosthodontic procedures pertaining to DI.[4] Moreover dental schools have differed in the way implant dentistry has been incorporated into the curricula, with a few of those introducing dedicated didactic and/or clinical courses and the rest of them incorporating DI related lectures within prosthodontic, oral surgical or periodontics courses.[12] In addition to the aforementioned, undergraduate DI training is reportedly challenged by the already overcrowded dental curriculum,[13] shortage of trained faculty and evidence based teaching methodologies,[14–16] and lack of resources[17].

Implant dentistry in Saudi universities has been introduced to the undergraduate dental curriculum only recently. However, the presence of integrated DI training to undergraduate students, the quantity and quality of such training and the extent of exposure to didactic, laboratory and/or clinical aspects of implant dentistry have not been documented well in the literature. Aljohani and Alghamdi[18] reported the extent of student exposure to oral implantology based on a single institution study from King Abdulaziz University in Saudi Arabia. While a well-structured undergraduate DI course may be the need of the hour, it is imperative to evaluate the level of incorporation of implant dentistry in the existing curricula. Such information would be an important tool not only to assess the national dental curriculum with respect to DI, but also to improve it to match international standards and ultimately produce a competent dentist with knowledge and skills in implant dentistry. Therefore, the objective of the present study was to evaluate the current status of undergraduate dental implant education in Saudi Universities.

MATERIAL AND METHODS

During the academic year 2012–2013 there were 16 private and public dental schools in the Kingdom of Saudi Arabia. Among which only 6 dental schools with graduated students were enlisted for participation in the study. This included 5 dental schools affiliated to public universities (King Saud University, King Abdulaziz University, King Khalid University, Dammam University and Al-Qassim University) and one private dental school (Riyadh College of Dentistry). The sampling frame included all the undergraduate implant dentistry program directors and the interns in the above mentioned Saudi dental schools, without any specific inclusion or exclusion criteria. Calculating the sample size for the given sampling frame, using 95% confidence level (α=0.05), 5% confidence interval and a statistical power of 0.85, a study sample of at least 5 program directors and 166 interns was required to achieve a statistically valid result (Epi Info 7, CDC, Atlanta, U.S.A.).

Following ethical approval and institutional review by the College of Dentistry Research Center, King Saud University, Riyadh, Saudi Arabia (Ref. No. IR 0029, dated 03/09/2013), a questionnaire-based study pertaining to undergraduate implant dentistry training was conducted in two parts in the participating institutions. The first part was targeted towards the program directors, comprising 28 questions assessing the quantity and quality of undergraduate implant training integrated into the curriculum. The second part was targeted towards dental interns, comprising 10 questions to evaluate the degree of exposure and satisfaction regarding implant dentistry training in their respective schools.

All the questionnaires were designed based on previously reported studies and the questions were assessed for reliability and validity by 3 independent observers prior to distribution. The two parts of the questionnaire were distributed to all participating dental schools and responses were collected using a convenience random sampling technique. For institutions in Riyadh, hard copy questionnaires were distributed in person and responses were collected in the same way too. Questionnaires for dental schools outside Riyadh were sent electronically and the respondents were requested to send their feedback through e-mail. Collected data were tabulated using MS-Excel (Microsoft Corporation, U.S.A.) spreadsheet. Descriptive statistical analyses were performed using SPSS Version 18 (IBM Statistics, U.S.A.).

RESULTS

The first part of the questionnaire was responded to by implant dentistry program directors from all the participating institutions except the dental school in Dammam University, thereby yielding a response rate of 83.3% (5 out of 6 schools). Based on the academic records of the participating dental schools, there were a total of 375 dental interns enrolled in all the six institutions together. Although questionnaires were sent to all the interns, only 235 dental interns consented to participate in the second part of the study, among which, 195 interns responded (82.9%). Owing to incompleteness of response data, 15 questionnaires had to be omitted leading to a final sample size of 180 (response rate 76.6%).

Based on collected data, it was found that implant dentistry was taught to the undergraduate students not as a dedicated course, but as sessions in multidisciplinary departments, namely oral surgery, periodontics and prosthodontics. Wherein, the hours assigned for implant dentistry related topics ranged from 22 to 30 hours. Although didactic sessions were offered in all the schools, only three out of the five schools exposed the students to laboratory (workshop) or clinical training. While implant dentistry programs were incorporated to the dental school curriculum as early as 2003 in one school, it was introduced in 2007 in three schools and only in 2012 in one of the schools. With regard to the study year during which implant courses were introduced to the students, it varied between 2nd year (1 school), 3rd year (3 schools) and 5th year (1 school). There was agreement among the program directors in respect of the didactic contents, which comprised of introduction to implant dentistry, diagnosis and treatment planning. In addition, three schools provided lectures pertaining to clinical procedures, maintenance and evaluation in their courses. Similarly, the program directors expressed consensus about the textbook for their courses (Contemporary Implant Dentistry by Carl. E. Misch[19], with it being a mandatory requirement in 3 dental schools.

Teaching aids used for the undergraduate implant dentistry training reportedly ranged from pre-recorded video demonstrations (2 schools) to internet resources, workshops and seminars (3 schools). While, 2 schools reported training the students with the aid of partially dentate DENTOFORM models, only one school reported the use of manikins. Regarding the implant system used for training, the popularly used systems were "NOBEL BIOCARE" (used exclusively in 3 schools) and "3i implant system". Among the 3 dental schools which offered clinical implant dentistry training to their students, the faculty to student ratio during training sessions ranged from a ratio of 1:6 to 1:1. While students in these schools were allowed to select cases for dental implants, diagnose them and plan treatment, surgical implant training was provided either in the form of "assisting surgical procedures done by specialists" (2 schools) or "performing surgeries under the guidance of a specialist" (1 school). Students were allowed to perform prosthodontic implant restorative procedures under guidance, but with limitations pertaining to the nature and type of rehabilitation involved. This varied between implant restorations involving "single tooth in the esthetic zone" (1 school), "single tooth in the bicuspid region" (2 schools), "single molar tooth" (2 schools), "simple 2–4 units fixed partial denture" (1 school) and "implant overdenture abutments in the mandible" (1 school). Although none of the schools required their students to perform implant-related laboratory procedures, one school had in place a mandatory requirement for implant cases to be done by undergraduate students either in the 4th or the 5th year.

The average numbers of implant procedures per school, done by undergraduate students in the academic year 2012–2013 ranged from 50–100 (4 schools) to 100–200 (1 school). Majority of the reported implant procedures involved placement of implant supported crowns (80%) or mandibular overdenture implant abutments (20%). The participating program directors reported no barriers towards including implant dentistry in the undergraduate dental curriculum except for one program director, who reported "limited demand due to financial constraints of the patients" as a potential barrier. Similarly, except for one program director, there was a consensus among the remaining program directors regarding the need for changes in the quantity of implant dentistry education offered to undergraduate Saudi dental students in terms of theoretical, laboratory and clinical training. Personal opinions of the program directors regarding competence level of students in relation to implant dentistry upon graduation are summarized in table-1.

Majority of the dental interns reportedly acquired knowledge regarding implant dentistry based on theoretical (96.1%) training, followed by laboratory (33.5%) and clinical (30%) training. Nearly 50% of the dental interns agreed to have acquired knowledge about implant dentistry only by assisting and observing surgical and

prosthodontic dental implant procedures. (Table-2). Surprisingly, only 52.8% (n=95) of the dental interns surveyed expressed satisfaction with regard to implant dentistry training obtained during their undergraduate period and the remaining interns were either not sure (22.2%, n=40) or were not-satisfied (25%, n=45). Only 51.2% of the interns (n=92) reported performing dental implant procedures as a student, among which only 10 interns (5.6%) had performed surgical implant procedures. (Table-3). While the interns reportedly performed 112 implant prosthetic restorations, majority of them involved a single non-esthetic restoration (63.4%, n=71), followed by mandibular overdenture abutments (28.6%, n=32), and single esthetic restoration (8.0%, n=9). Several reasons were considered by the interns as barriers for dental implant treatment to patients. They were mainly related to cost (73.3%, n=136) and duration (42.2%, n=76) of treatment, followed by patient unavailability (20%, n=36) and shortage of trained faculty (6.7%, n=12). Similarly, the interns expressed their consensus regarding increased future requirements for undergraduate implant dentistry training, especially in the clinical (75.6%, n=136) and laboratory (68.3%, n=123) scenarios, in addition to lectures (35%, n=63).

Table-1: Opinions of implant dentistry course program directors regarding competence level of undergraduate students upon graduation. (n=5)

Question	Agree	Disagree	Not sure
The ability to surgically place implants does belong to the regular undergraduate curriculum	4	1	0
Surgical skills within implant dentistry can be acquired after attending a short continuous education course	2	2	1
Implant surgery should be performed only by specialists	1	4	0
The ability to prosthetically restore dental implants does belong to the regular undergraduate dental curriculum	3	2	0
Implant prosthetic restorative skills can be acquired after attending a short continuous education course	4	0	1
Implant prosthetic restorations should be provided only by specialists	0	4	1

Table-2: Dental interns' educational training in implant dentistry. (n=180)

Type of educational training	Frequency (%)
Theoretical / Lectures	173 (96.1)
Laboratory	60 (33.5)
Clinical	54 (30)
Surgical assisting	57 (31.7)
Prosthodontic assisting	34 (18.9)
Surgical observation	64 (35.6)
Prosthodontic observation	33 (18.3)

Table-3: Numbers of implant cases done by dental interns' during undergraduate period. (n=180)

Numbers of cases	Surgical part Frequency (%)	Prosthodontic part Frequency (%)
1–3 cases	9 (5%)	66 (36.6%)
4– 6 cases	1 (0.6%)	18 (10%)
> 7 cases	-	4 (2.2%)
NIL	170 (94.5%)	92 (51.2%)

DISCUSSION

The number of dental schools worldwide teaching implant dentistry as a part of the undergraduate curriculum has increased markedly.[4] The present study was aimed towards undergraduate implant dentistry training in Saudi Arabian dental schools. While implant dentistry was introduced to the students at the undergraduate level, in all the dental schools surveyed in the present study, there were wide variations ranging from course design and delivery, timing of course delivery to the course structure. Although undergraduate implant dentistry training in Saudi dental schools were introduced only between 2003 and 2007, during the same time nearly 97% of dental schools in the U.S.A. and Canada were offering similar courses.[12]

Moreover, the implant dentistry training sessions in the surveyed dental schools were often incorporated through multi-disciplinary dental courses. On an average, 26 didactic hours (range 22–30 hours) were dedicated for implant related sessions in the surveyed schools. This was comparable to what has been reported previously from western dental schools, wherein the undergraduate dental implant training sessions ranged from 20 to 36 hours.[20–22]

Among the dental schools surveyed in the present study, implant dentistry was taught mainly in the form of theoretical lectures with a few short pre-clinical training sessions and assisting specialists during implant procedures. Only 1 out of the 5 schools had a mandatory requirement for implant cases to be done either in the 4th or the 5th year and 3 out of the 5 schools allowed their students to perform prosthodontic restorations of dental implants, mainly in the non-esthetic dental zone.

Nevertheless, laboratory training related to dental implants was not given much importance in any of the surveyed dental schools, except for one school wherein pre-clinical workshops were conducted for the students. Only 52% of the surveyed dental interns had performed dental implant cases during their undergraduate period. Although the cases predominantly involved single

non-esthetic tooth restorations, the interns expressed satisfaction with regard to the undergraduate implant dentistry training which they acquired and the procedures which they performed. Cost and duration of dental implant treatment and paucity of trained faculty were reported as barriers for offering dental implant treatment to patients, according to the interns.

All the above-mentioned findings from the present study were in coherence with previously reported studies which proclaimed the need for greater clinical and laboratory training in implant dentistry for undergraduate students.[4,8,10,12,20,23] Based on a survey of freshly graduated dentists, Maalhagh-Fard *et al*.[10] reported that, the dental graduates were inclined to offer dental implant restorations, provided they were exposed to implant dentistry training in their undergraduate curricula. Based on a similar survey from Saudi Arabia in 2009, Aljohani and Alghamdi[18] reported the need for well-structured pre-doctoral dental implant courses in Saudi dental schools. Although such courses have not been introduced formally, the last decade has witnessed greater incorporation of implant dentistry related training in all the 5 of the 6 dental schools surveyed in this study. This paradigm shift was also evident from the opinions of the implant course program directors, who felt that freshly graduated dentists were competent of performing surgical and prosthodontic implant procedures in simple cases. Nevertheless, the program directors and interns felt the need for dedicated implant dentistry courses covering theoretical, clinical and laboratory training to make dentists competent in handling advanced dental implant procedures.

Being a cross sectional survey, the present study might not reflect the ongoing curriculum development efforts in different dental schools in Saudi Arabia. Moreover, the present study surveyed program directors and interns from only 6 out of 16 dental schools, in order to garner responses from graduated dentists. While a more comprehensive survey involving all dental schools and clinical students might give a better insight into the existing curriculum, the present study has definitely exposed shortcomings in the existing curricula of established dental schools with regard to implant dentistry. The greatest of them being the absence of clear curriculum guidelines established by a suitable governing body and the variability in teaching modalities employed in different schools. In addition, Saudi universities have to address the issue of providing a favorable faculty to student ratio for implant dentistry training as this is a prevalent issue in dental schools worldwide.[14]

CONCLUSION

The present study revealed great variability in implant dentistry education within undergraduate curricula at various Saudi dental schools. Differences were found in relation to the course content, ratio of faculty to students, training hours, implant systems used and exposure to laboratory and clinical training. None of the schools had a dedicated implant dentistry course; rather there was an inclination towards integrating the same through multiple courses in most dental schools. In order to optimize Saudi undergraduate implant dentistry education and to produce dentists competent in implant restorations, learning guidelines for such courses should be developed and implemented by competent authorities.

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AUTHORS' CONTRIBUTION

MAK: Research design and concept, defining intellectual content, literature review, formulation of research methodology, data acquisition, statistical analysis, reporting of findings, and manuscript preparation, editing, and review. SR: Research design and concept, defining intellectual content, literature review, formulation of research methodology, data acquisition, statistical analysis, reporting of findings, and manuscript preparation, editing, and review. MA: Data acquisition, statistical analysis, reporting of findings, and manuscript preparation, editing and review. AA: Data acquisition, statistical analysis, reporting of findings, and manuscript preparation, editing and review. HA: Data acquisition, statistical analysis, reporting of findings, and manuscript preparation, editing and review.

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