International Journal of Dental Sciences and Research, 2018, Vol. 6, No. 4, 100-104
Available online at http://pubs.sciepub.com/ijdsr/6/4/5

DOI:10.12691/ijdsr-6-4-5

Radiographic Interpretation Skills of Clinical Dental Undergraduates Studying in Karachi, Pakistan

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Abstract Radiographs facilitate dentists to envision diseases of the teeth and neighboring tissues that cannot be visualize through a clinical oral examination. A competent authority, in Pakistan for approving and monitoring dental curricula – Pakistan Medical and Dental Council has set 5 hours for didactic and clinical teaching of oral radiology to undergraduate dental students. This study has been planned to confirm whether the undergraduate students acquire the obligatory knowledge and interpretation competency or not within the stipulated time for oral radiology teaching. **Material and Methods:** A pretested power point presentation was shown to the clinical undergraduates present on the day of the evaluation. Among the twelve slides presented, seven slides contained radiographs showing basic pathological lesions like caries, bone loss, periodontal pocket, apical radiolucency and amalgam restoration opacity & five slides showed radiographs with anatomical structures; enamel, lamina dura, PDL, mental foramen and inferior alveolar nerve. The responders were asked to answer with anonymity on provided response sheets. **Results:** A total of N=97 students took part in the study; n=43 were from third year of Bachelors of Dentistry tenure and n=54 were from the final year. Apical radiolucencies, PDL spaces, and mental foramina were the toughest to identify for most of the participants involved whereas it was considerably too easy for both groups to radiographically report caries, missing teeth, and amalgam restorations. **Conclusion:** Despite very easy interpretation skill assessment, none of the student could score 100% marks revealing some weakness in radiology teaching which could be attributed to lesser number of teaching hours allocated for oral radiology.

Keywords: *dental radiographic interpretation, credit hours for oral radiology, oral radiology teaching*

Cite This Article: Asaad Javaid Mirza, Mohsin Nazir, Zahid Akhter, Maaz Asad Javaid, and Mohammad Khalid Shafiq, "Radiographic Interpretation Skills of Clinical Dental Undergraduates Studying in Karachi, Pakistan." *International Journal of Dental Sciences and Research*, vol. 6, no. 4 (2018): 100-104. doi: 10.12691/ijdsr-6-4-5.

1. Introduction

Correct radiographic interpretation is considered an essential part of the diagnostic process of a disease as radiographs play an important role to assess the size and extent of lesions in order to develop an appropriate treatment plan [1,2]. The skill to assess and identify what is exposed by an X-ray enables a dental clinician to detect hidden lesions and conditions which cannot be recognized clinically. The meticulous knowledge of anatomy and the way these structures appear on a radiographic film is therefore, an evident requirement for the dental professionals.

Findings in a dental radiograph can be categorized as radiolucent, radiopaque or mixed density depending on their appearance when compared to the adjoining tissues. For accurate diagnosis, it is necessary that a dental clinician demonstrates adequate radiographic interpretations skills to identify all the anatomic structures which are portrayed in the radiographic images. The ability to recognize the existence of a deformity or irregularity is severely compromised if the dentist is unfamiliar with the appearances of applied anatomic structures and normal morphologic variants.

The major shortcoming of using radiography is its dependence on an individual's skills to interpret a radiograph correctly. Some previous studies done on dentists and dental students have shown apparent weaknesses in radiographic interpretation of oral lesions [3,4]. A dentist is suppose to demonstrate competency in relating patients' treatment needs with relevant structure images in view, exposing a film with a specific view ideal for the diagnosis, practicing appropriate safety measures for the patients and the clinic staff and interpreting and reporting the intraoral and extraoral radiographs including Orthopantomograph and Cephalograph.

In this connection, the undergraduates studying in Pakistani institutions in final year of their 4-year BDS degree programs are provided 5-lecture/demonstration hour [5] training to distinguish radiographic images of anatomic structures and to differentiate them from pathological abnormalities in order to provide a good oral health examination. Enamel, lamina dura, inferior alveolar nerve, mental foramen and periodontal ligament spaces are few basic anatomic land marks which should be promptly identified by clinical dental students. Similarly fundamental pathological lesions like; caries, type of bone loss, periodontal pockets, various apical radiolucencies

and presence of restorative opacities are essential to be recognized by them. In the stipulated time for oral radiology in dental curriculum by Pakistan Medical and Dental Council (PMDC), it is not definite whether the students acquire the obligatory knowledge and interpretation competency or not. To the best of our knowledge, no study conducted in this country exists which assesses radiographic interpretation skills inculcated in undergraduate dental students. The present study therefore, was planned to evaluate the X-ray interpretation skills among clinical dental students studying in one of the dental schools in Karachi, Pakistan with a view to pinpoint needs for future alterations in curriculum of dental degree program.

2. Material and Methods

A power point presentation was meticulously prepared and pretested for content validity among junior interns who have recently started their internship. The presentation consisted of twelve very easy- to- understand slides and shown to the clinical undergraduates present on the day of the evaluation. They were explained about the objective of the study and gathered in a lecture hall. Those who were not interested to participate in the study were allowed to leave the hall before the distribution of the response sheets.

Among the twelve slides, seven slides contained dental radiographs showing basic pathological lesions like caries, bone loss, periodontal pocket, apical radiolucency and amalgam restoration opacity. Rest of the five slides showed radiographs with anatomical land marks like enamel, lamina dura, PDL space, mental foramen and inferior alveolar nerve canal. The responders were provided with response sheets with twelve spaces; one specified for each response. The responders just had to write answer in front of each specified space in two minutes and were not allowed to disclose any personal information on the response sheet in order to maintain their anonymity. The anonymity was mandatory in order to create a relax atmosphere for the respondents to answer and must not feel reprehensible in case of wrong answers. The sheets were collected by the deputed invigilators immediately after the time for last slide was over. The response sheets were checked and data of correct and incorrect responses was tabulated in the form of a table.

3. Results

A total of N=97 participants took part in the study, n=43 were from third year of their Bachelors of Dentistry tenure and n=54 were from the fourth year. The survey consisted of 5 questions about normal dental radiographic anatomical landmarks and 7 questions about easily diagnosable pathological lesions. Table 1 and Table 2 show the summarized data that was obtained in the study. A graphical representation (Figure 1) shows that it was considerably facile for both groups in the study to radiographically report caries, missing teeth, and amalgam restorations. Contrarily, apical radiolucencies, PDL spaces, and mental foramina were the toughest to identify for most of the participants involved.

Table 1. Percentage of student responses about radiographic anatomical landmarks

No.	Question Regarding	Correct Responses (%)	Incorrect Responses (%)
1	Mental foramen	27	73
2	Inf. alveolar nerve	38	62
3	Enamel	65	35
4	Lamina dura	70	30
5	PDL space	24	76

Table 2. Percentage of student responses about radiographic pathological lesions

No.	Question Regarding	Correct Responses (%)	Incorrect Responses (%)
1	Missing tooth	74	26
2	Caries	91	9
3	Apical radiolucency	23	77
4	Horizontal bone loss	72	28
5	Vertical bone loss	41	59
6	Periodontal pocket	72	28
7	Amalgam restoration	87	13

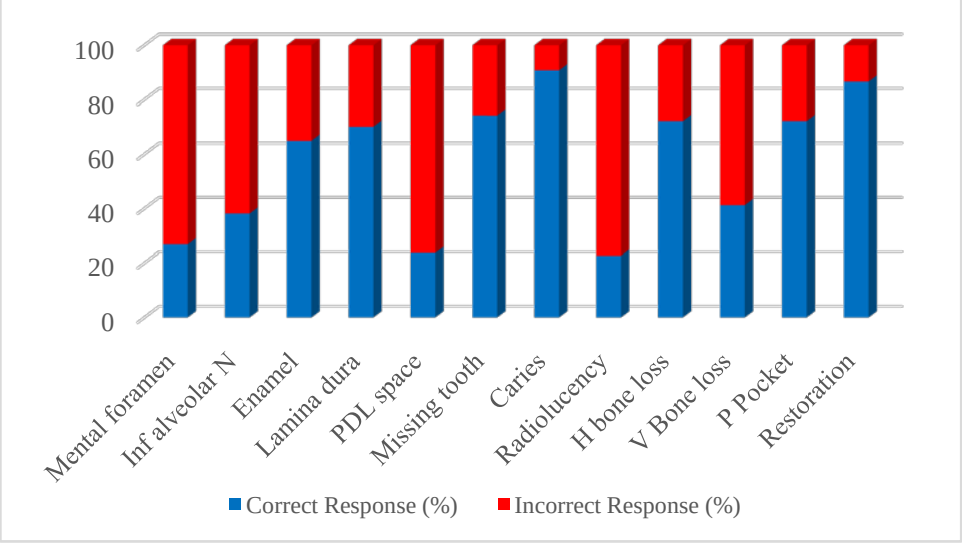

Figure 1. Percentile responses when anatomical landmarks and pathologies were in question

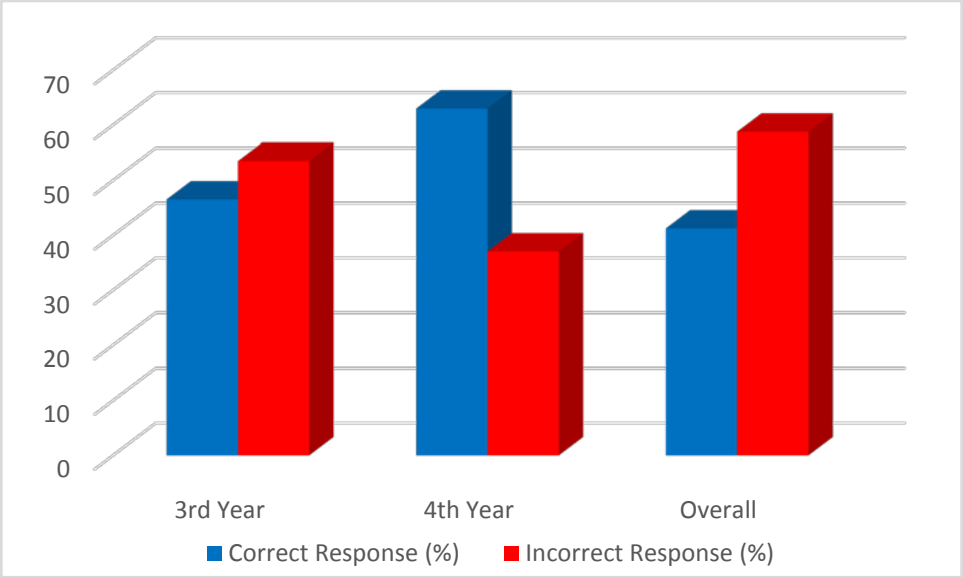

Figure 2. Graphical representation of the results obtained for the vertical bone loss question

Within the anatomical assessment of the survey, 41.9% third years and 94.4% fourth year students correctly identified the lamina dura respectively. Chi square tests for lamina dura identification revealed $\chi 2(1) = 32.24$, $p = 0.000$ between the groups. This was closely followed by significant results for enamel identification too. PDL space was the least reported landmark followed closely by the statistically significant results for the mental foramen and the inferior alveolar nerve.

When pathological diagnosis and assessment were under review, the results showed missing teeth, caries, periodontal pockets and amalgam restorations were easy for both groups to point out. However, Chi square tests for apical radiolucencies showed $\chi 2(1) = 10.86$, $p = 0.001$ between the groups. Only 7% of the third year students and about 35% of the fourth years correctly reported the apical radiolucencies. Although, overall bone loss was pointed out by both groups relatively and statistically similarly, vertical bone loss was not as easily determined as horizontal bone loss. In fact, vertical bone loss was identified by more third year students than the fourth year ones (37%). Figure 2 shows a bar chart of the descriptive results obtained in the study for vertical bone loss identification.

4. Statistical Analysis

All data collected was statistically analyzed using Statistical Package for the Social Sciences (SPSS) software version 20 (IBM Corporation, Armonk, New York, USA). The results were expressed in means and percentages, p-value ≤0.050 was considered significant. The significance was tested by Chi square tests.

5. Discussion

A radiographic analysis is a difficult process which needs the use of certain algorithms in interpreting the obtained images and the knowledge to evaluate different findings to reach an appropriate diagnosis. The result of the study shows that more than 62% of the respondents could not give correct answer about the inferior alveolar nerve, mental foramen and PDL space. Correct responses regarding identification of radiographic images of enamel and lamina dura were also very disheartening. On the contrary, similar study done on Saudi dental undergraduates at Qassim University reveals that the responding students performed better in recognizing radiographic land marks related to anatomy of head and neck [6]. The logical reason behind better performance by Saudi students may be the number of study courses taught and credit hours (teaching and clinical) allocated for oral radiology in their curriculum [7]. Curricula followed in Pakistani institutions of dentistry despondently fall short of number of radiology courses including a course in radiographic anatomy.

Regarding apical pathology, merely 35% of the final year students could report accurately whereas correct answers from 3rd year students were almost ignorable. This finding is similar to findings of a study where the respondents were practicing dental graduates [8]. In another study discouraging results achieved from dental students in this regard were improved by applying special teaching methodology [9]. One more study reported low values of accuracy of radiographic diagnosis of proximal caries among dentists and emphasized the inevitability of improving training in radiographic interpretation skills for caries detection [10]. According to authors of a Brazilian study, dentists' imprecise performance in Oral Radiology has been related to inadequate training at an undergraduate level of dental education. The study also concludes that dentists' radiographic skills don't change significantly comparing the undergraduate years [11] which means a student continue practicing same routine in radiological interpretation what he/she has learnt as an undergraduate.

In this study the smallest amount of knowledge expected from clinical undergraduates regarding radiographic interpretation was included and complicated queries and intricate X-ray images were not included. Despite that, none of the students could achieve maximum marks which reflect certain weaknesses in the interpretation skills of the students. Had questions regarding knowledge about radiation physics, safety precautions and radiographic

angulations and malignant lesions been included in the study, the scenario might have been even worse.

The below expectation performance by the respondents of this study may well be attributed to teaching of oral radiology in the institution .The most important problem with the undergraduate radiology education is the number of allocated credit hours to the subject. According to approved curriculum from PMDC only five hours of lecturing and demonstration are required to be taught as a part of Operative Dentistry during final year of Bachelor's degree program. Another five hours are allocated for cephalometric analysis to be taught by orthodontic department. Though clinical studies commence in third year of dental education, but no time span is allotted for teaching oral radiology to third year students. Despite individual efforts by Periodontology department - a clinical subject taught in this year, the real number of hours still remains insufficient for adequate teaching of a radiology course. In European countries and USA, dental schools offer several oral radiology courses to their undergraduates during preclinical and clinical stage of education [12,13]. They cover principles and biology of radiation, hygiene and safety measures, radiographic quality assurance, the application and theory of properly exposing, processing, mounting and interpretation of radiographs including identification of normal anatomic landmarks and pathologic lesions.

In Pakistan, Oral and maxillofacial radiology is neither a recognized specialty nor universities offer any post graduate higher learning program in this field. Most of the oral radiology teaching is imparted by either medically qualified radiologists or subject specialists in other disciplines of dentistry. A similar situation existed in Belgium few years ago but authors were optimistic about the positive change in the situation as Dentomaxillofacail radiologists qualified from some UK based university were recruited for teaching radiology to dental undergraduates [14].

Unlike their medical counterparts, dental practitioners have to use X-ray equipment by themselves in their clinics on regular bases. They are exposed to the radiations and may be at danger to adversely suffer from the hazards if not trained to take necessary precautionary measures. It necessitates for the students to have thorough knowledge of an X-ray unit suitable for their day-to-day practice. Along with conventional X-raying which involve dark room and chemical processing, contemporarily, digital sensors have been introduced to save time and avoid an assistant's exertion.

A dental practitioner should also be well versed with cephalography for interception of orthodontic dentofacial ailments. Currently, Cone beam imaging (CBCT) is a 3-dimensional imaging technique which overcomes the limitations of conventional X-rays and has been found very useful for use in endodontics and oral Implantology [15,16]. Induction of courses in undergraduate dental curriculum comprising of comprehensive knowledge about use of present-day technology is need of the hour to augment diagnostic skills of future dentists.

It is time for curriculum monitoring authorities in PMDC and various universities offering degree programs in dentistry to bring required amendments in the oral radiology teaching and clinical training hours.

An oral cavity is a demanding region for radiological diagnosis that contains glandular structures, soft tissues and osseous structures present in close propinquity for which a perfect knowledge of radiological anatomy, radiological appearance of pathology and channel of disease spread is mandatory. Radiographic images of the oral cavity are often obstructed by existence of intracoronal, extracoronal restorations and other fixed oral appliances. Keeping the radiologic exigency of this area in view many USA, UK and Sweden based universities have started offering a master's program in oral radiology to dental graduates as they are better familiar with the prostheses present intraorally compared to medical graduates.

College of Physicians and Surgeons of Pakistan and the universities which possess approved post graduate dental education programs should include oral and maxillofacial radiology as a separate specialized entity to bring it at par with the western countries. It will not only enhance the oral radiology services in the country but also create an opportunity for dental graduates to opt for specializing in radiology.

The study was conducted among graduates studying in same dental school which is obviously a limitation. More studies with questions having higher difficulty level including various schools across the country are recommended. Difference of radiological learning by students should also be assessed between students who are if any; taught by Oral Radiologists and who are taught by medical radiologists or non-radiologists.

6. Conclusion

Knowledge combined with pertinent teaching instructions and practical training is important in the development of competent radiograph interpretation skills and to improve the existing situation, there is a call for revision of the radiology curriculum and allocation of suitable number of credit hours for undergraduate dentistry programs.

References

[1] Wenzel A. A review of dentists' use of digital radiography and caries diagnosis with digital systems Dento maxillo fac Radiol. 2006; 35(5): 307-314.

[2] White SC, Pharaoh MJ. Oral Radiology Principles and Interpretation 5th Ed. 2009. p.12-25, 55-59.

[3] Lopez-Jornet P, Camacho-Alonso F, Molina-Minano F. Knowledge and attitudes about oral cancer among dentists in Spain. J Eval Clin Practice. 2010; 16: 129-133.

[4] Taheri JB, Moshfeghi M, Anbari F, Namazi Z, Bakhtiari S. Knowledge, Opinions and Practice of Last Year Dentistry Students of Shahid Beheshti University Regarding Diagnosis and Differentiation of Malignant Lesions. Res. J. Med. Sci. 2010; 4 (3): 238-242.

[5] PMDC Curriculum of BDS available at http://www.pmdc.org.pk/LinkClick.aspx?fileticket=06HF%2Blta1uc%3D accessed on 8.4.18.

[6] Abdullah A, Abdullah A. Evaluation of Undergraduate Dental Student Radiographic Interpretation. Int J Dent Med Res 2014; 1(4): 1-5

[7] Qassim Uni curriculum available at http://www.qudent.org/e-learning/course/index.php?categoryid=102 accessed on 5.4.18.

[8] Sherwood IA. Pre-operative diagnostic radiograph interpretation by general dental practitioners for root canal treatment. Dentomaxillofac Radiol. 2012; 41(1):43-54

[9] Naik Z, Umarani M. One Minute Preceptor- a teaching-learning model for oral radiographic interpretation skill. J Contemp Med Edu. 2015; 3(2): 72-76.

[10] Estay J, Bersezio C, Arias R, Fernández E, Oliveira OB Jr, Ferrarezi de Andrade M, Núñez CC. Effect of Clinical Experience on Accuracy and Reliability of Radiographic Caries Detection. Int. J. Odontostomat 2017; 11(3): 347-352.

[11] de Azevedo-Vaz SL, Karla de Faria V, Karla Rovaris K, Naiara de Paula F, Neto FH. A survey on dental undergraduates' knowledge of oral radiology. Braz. J. Oral Sci. 2013; 12(2): 109-113.

[12] DDS curriculum available at www.dentistry.umn.edu/sites/dentistry.umn.edu/files/dds_2016_year_by_year.pdf accessed on 9.4.18.

[13] Houstan unicurriculum: available at https://dentistry.uth.edu/students/docs/dds-course-list17-18.pdf accessed on 5.4.18.

[14] Aps JKM. Flemish general dental practitioners' knowledge of dental radiology. Dentomaxillofac Radiol. 2010; 39(2): 113-118.

[15] Durack C, Patel S. Cone beam computed tomography in endodontics. Braz. Dent. J. 2012; 23(3): 179-191.

[16] Gupta J, Ali SP. Cone beam computed tomography in oral implants. Natl J Maxillofac Surg. 2013 4(1): 2-6.