Revista da Faculdade de Odontologia de Porto Alegre
V. 61, n. 2 (2020) - Artigos Originais
DOI: 10.22456/2177-0018.101545

Does clinical experience impact students' capacity to diagnose dentoalveolar disorders using intraoral radiography?

A experiência clínica influencia na capacidade de alunos para o diagnóstico de alterações dentoalveolares utilizando exames radiográficos intraorais?

Eduarda Adams Hilgert[a], Heraldo Luis Dias da Silveira[b], Mariana Boessio Vizzotto[b], Priscila Fernanda da Silveira Tiecher[b], Nádia Assein Arús[b]

ABSTRACT

Introduction: Mastery of interpretation of radiographic images is a contributing factor in correct diagnosis of conditions affecting the dentoalveolar apparatus. It is therefore essential that students' perfect these skills while studying for their degrees. Once they embark upon their professional careers outside of the university setting, it is expected that the theoretical knowledge and clinical experience accumulated during the course of their studies will have led to improved diagnostic performance. **Objective:** The objective of this study was to evaluate diagnoses made using intraoral radiographs by undergraduate students at a School of Dentistry in the South of Brazil, before and after their introduction to clinical practice. **Materials and methods:** Diagnoses made during the second (T0) and fourth (T1) years of the undergraduate course in dentistry using interproximal and periapical radiographs were analyzed. Descriptive statistics were calculated and the McNemar test was used to compare answers at T0 and T1. **Results:** Fifteen students answered questionnaires at both T0 and T1. The overall percentage of correct answers was 70.5% at T0 and 61.6% at T1, with a significant difference (p = 0.024). **Discussion:** This study highlights the need for educational strategies that improve diagnostic competence during undergraduate clinical activities, since radiographic examinations are essential in all areas of dentistry. **Conclusions:** Therefore, it was concluded that the rate of correct diagnosis of dentoalveolar disorders by intraoral radiography decreased significantly after the initial years of clinical training.

Keywords: Educational measurement. Radiology. Diagnosis.

RESUMO

Introdução: O domínio da interpretação radiográfica contribui para o correto diagnóstico de alterações do complexo dento-alveolar, e seu aprimoramento durante o período da graduação é essencial. No momento em que se inicia a carreira profissional fora da faculdade, é esperado que o conhecimento teórico adquirido, associado à experiência clínica durante a graduação, melhore a performance diagnóstica do dentista. **Objetivo:** Esse estudo objetivou avaliar diagnósticos feitos a partir de exames radiográficos intrabucais, realizados por alunos de graduação de uma faculdade de odontologia do sul do Brasil, antes e após a sua introdução na prática clínica. **Materiais e métodos:** Para tal, diagnósticos de radiografias interproximais e periapicais, feitos durantes o Segundo ano (T0) e Quarto ano (T1) do curso de graduação, foram avaliados. Uma análise descritiva foi expressa e o teste de McNemar foi realizado para comparar as respostas em T0 e T1. **Resultados:** Quinze alunos completaram os dois questionários. De uma forma geral, a porcentagem de respostas corretas em T0 foi de 70.5%, e em T1 foi de 61.6%, com uma diferença significativa entre elas (p = 0.024). **Discussão:** Este estudo salienta a necessidade de estratégias educacionais que melhorem a competência diagnóstica durante as atividades clínicas da graduação, uma vez que exames radiográficos são essenciais em todas as áreas da odontologia. **Conclusão:** Neste estudo, o correto diagnóstico de alterações dentoalveolares a partir de radiografias intraorais apresentou uma redução significativa após os primeiros anos de prática clínica.

Palavras-chave: Avaliação educacional. Radiologia. Diagnóstico.

[a] DDS, Postgraduate Program, Dental School, Federal University of Rio Grande do Sul, Porto Alegre, RS, Brazil.

[b] DDS, MSc, PhD, Department of Surgery and Orthopedics, Oral Radiology Division, Federal University of Rio Grande do Sul, Porto Alegre, RS, Brazil.

Agência financiadora: CNPq - PIBIC/CAPES

Autora de correspondência: Mariana Boessio Vizzotto - E-mail: mariana.vizzotto@ufrgs.br

Data de envio: 01/04/2020 | **Data de aceite:** 09/06/2020

Introduction

Oral and maxillofacial radiology encompasses radiographic physics and techniques, radiation biology and safety, imaging sciences and, most importantly, the interpretation of images to render or contribute to diagnosis[1]. Imaging exams are an essential tool to complement clinical examination of the patient and provide information for developing the treatment plan, benefitting both patient and dentist. Following conclusion of their undergraduate dentistry degrees, students are expected to be able to perform and appropriately interpret the most common radiographic examinations used in daily clinical practice[2]. Therefore, students in the advanced stages of training should be able to readily interpret radiographic examinations[3]. Clinical practice is performed through spending time training in the clinical setting and regularly updating expertise. This knowledge is accumulated unintentionally and is as essential as learning acquired from books and articles[4]. According to the American Dental Association[5], radiographic examinations should be evaluated in conjunction with the patient's clinical history, signs, and symptoms to arrive at an appropriate diagnosis. Dentists are not required to take a postgraduate course to achieve this, because they should have acquired adequate practical knowledge during their university studies and through continuing education.

The purpose of this study was to compare radiographic reports of dental conditions made by students at different periods in their undergraduate course. Changes were evaluated before and after they had had experience in clinical settings.

Materials and methods

The study was approved by the research committee (no. 2.395.084) and the local university ethics committee (no. 71643117.2.0000.5347) at the Universidade Federal de Rio Grande do Sul. All students enrolled on the second year of the undergraduate dentistry course in 2015 were invited to voluntarily take part in the first phase of analysis of radiographic images (T0). The T1 assessment was conducted in 2017, during the students' fourth year, and students who had taken part at T0 were invited to participate at T1, once more on a voluntary basis. Students who agreed to participate signed informed consent before answering the questionnaires at T0 and T1. In the T1 phase, students were blinded and interpreted the same radiographic images as at T0. Sixty-one questionnaires were completed in the T0 phase and fifteen questionnaires were filled out in the T1 phase.

The questionnaires were created by requesting two oral and maxillofacial (OMF) radiologists (N.A.A and H.L.D.S) to select twenty intraoral radiographs, four bitewings and sixteen periapical radiographs, showing crown, root, and periodontal disorders (Figure 1A). All of the radiographs were from the Oral Radiology Service's imaging dataset. The images selected were printed on a laser impression film (DryView Laser Imaging Film, Carestream, USA).

The questionnaire contained seventy-five questions, as follows: fifty questions were about crown disorders (covering twelve different disorders), sixteen were about root disorders, and nine were about periodontal disorders (covering nine and four different disorders, respectively) (Figure 1B). The dental students were instructed to interpret the images using an X-ray viewer with controlled light and a magnifying glass. After T0 and T1, the questionnaires were checked against the gold standard answers determined by the two experts in oral maxillofacial radiology.

A descriptive analysis of the results was performed, expressing results as percentages and absolute values. Subsequently, the McNemar test was used to detect differences between

T0 and T1 answers. IBM SPSS Statistics software version 20.0 (SPSS, Chicago, IL, USA) was used for data analysis. The significance level was set at 5%.

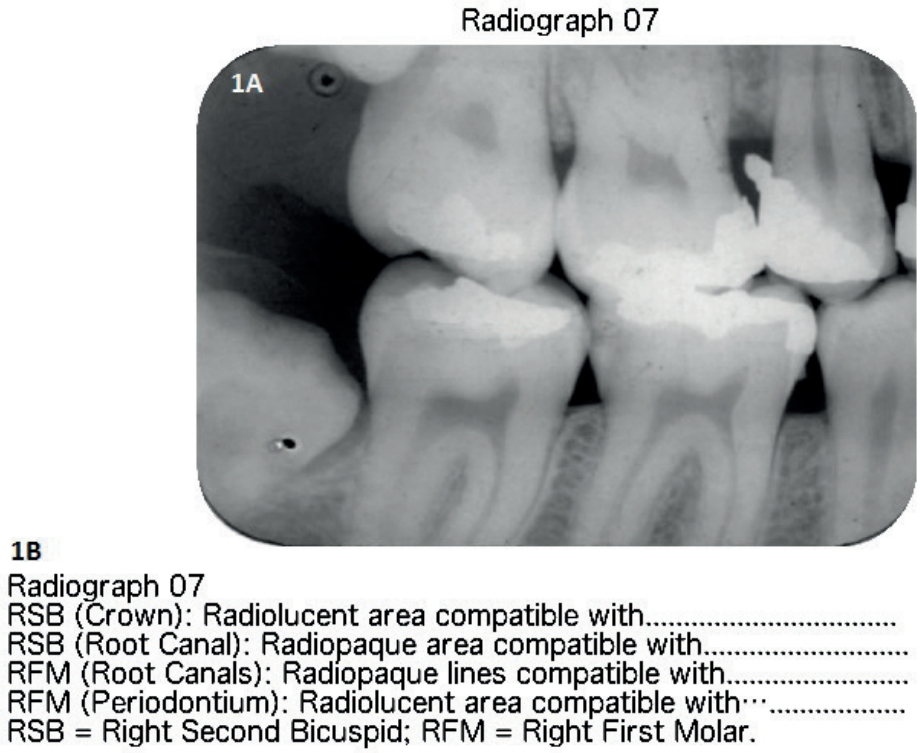

Figure 1A: An example of the intraoral radiographs analyzed in the study.
Figure 1B: Questions linked to the example radiograph.

Results

The McNemar test was used to assess differences in diagnostic performance from T0 to T1 (p=0.024). When performance was calculated separately for each region evaluated, assessing periodontal, root, and crown disorders, values were also lower at T0, with statistical significance (p=0.003, p=0.033, and p=0.000 respectively) (Table 1).

For crown disorders, dental students had a 33.2% rate of errors at T0 and a 41.37% rate at T1. The most common errors were related to differentiating fillings and prosthetic materials, identifying cervical adaptation failures, and caries lesions associated with fillings and dental prosthetics. The error rate for cervical incongruity of fillings, dental prostheses, and caries lesions was 16.46% at T0 (41 answers) and 9.58% (30 answers) at T1. The remaining errors at T0 and T1 were related to proximal overlap, dental calculus, identification of filling and/or prosthetic materials, and dental attrition.

The error rate for questions about root disorders was 25.41% at T0 and 32.5% at T1. The incorrect answers were mostly related to detection of vertical root fractures and identification of external root reabsorption. Together, these types of error accounted for 36.06% (22 answers) of the total errors at T0 and 23.08% (18 answers) at T1. Other mistakes detected were related to identification of hypercementosis, gutta-percha material, and root perforation.

A total of 16.29% of the questions on periodontal changes were incorrectly answered at T0 and 30.37% of answers were incorrect at T1. Errors were related to vertical and horizontal bone reabsorptions, misidentification of periapical lesions, and overfilling of endodontic material. At T0, 51.54% (twelve answers) of questions related to identification of periapical lesions were answered incorrectly and at T1 34.21% (13 answers) of answers were incorrect.

At T0, 0.71% of questions were unanswered. These questions were related to the crown (six questions) and root regions (two questions) and were left unanswered by one student. At T1, 0.8% of the questions were not answered, by two students. Overall, 29.51% of all questions were answered incorrectly at T0, while this value had increased to 38.40% at T1. This shows that the students found interpretation of radiographic images more difficult at T1.

Table 1: Comparison of correct and incorrect answers at T0 and T1 and the results of the McNemar Test.

Crown Disorders		**T1**		
		incorrect diagnosis	*correct diagnosis*	
T0	*incorrect diagnosis*	156	93	
	correct diagnosis	157	344	McNemar Test; p=0.000
Root Disorders		**T1**		
		incorrect diagnosis	*correct diagnosis*	
T0	*incorrect diagnosis*	41	20	
	correct diagnosis	37	142	McNemar Test; p=0.033
Periodontal Disorders		**T1**		
		incorrect diagnosis	*correct diagnosis*	
T0	*incorrect diagnosis*	12	10	
	correct diagnosis	29	84	McNemar Test; p=0.003

Discussion

In the dentistry course, oral and maxillofacial radiology is a full-fledged academic discipline on a par with all of the other disciplines. The oral and maxillofacial radiology department should participate in all phases of the university's missions, including teaching, patient care, research and scholarship, and service[1]. Radiographic examination is usually performed to support clinical analysis and to guide treatment planning. It often demands adequate theoretical knowledge of radiographic techniques, anatomy, and dental disorders.

The Dentistry course at the Universidade Federal de Rio Grande do Sul is a five-year program and students take a course in oral radiology during their second year. This course provides a radiological overview of the full range of techniques and of anatomy and then covers dentomaxillofacial disorders. In the third year, students start their clinical classes and during the fifth year they should have achieved the ability to conduct the complete patient examination, to plan treatment, and to provide treatment. The combination of radiographic images and theoretical content (subject matter) is covered by Ausubel's theory of meaningful learning, based on the idea that an individual's existing cognitive structure (organization, stability, and clarity of knowledge on a particular subject) is the principal factor influencing learning and retention of meaningful new subjects[6].

In this study, students misdiagnosed 29.5% of conditions at T0 and failed to detect 38.40% at T1. This finding shows that the final performance was inferior to the initial performance and contradicts our hypothesis that improvement in the students' diagnostic ability would be observed after they had accumulated clinical experience. Tavakoli et al.[7] evaluated final year dental students' abilities and skill at identifying the presence and depth of proximal caries using dental bitewing radiographs. The dental students' performance was not satisfactory, with a 0.28 Kappa coefficient for the agreement between students' responses and gold standards. In contrast, a study conducted at Manchester University compared diagnoses made by fifty students on the fourth and fifth years of the dental course with diagnoses made by two OMF radiologists. The OMF radiologists obtained better results, showing that clinical experience may influence the ability to diagnose periapical changes on radiographs[8].

Some students had difficulty with differentiation of fillings and prosthetic materials. We believe that these results were not entirely relevant because this distinction should be based on clinical observations, which is a limitation of the present study. Furthermore, this study reports on the experience at our dental course, so the results cannot be generalized. During the last year of the dental degree course, some specific classes are proposed to improve complex imaging exams. Despite this, it can be seen from this study that the students may not feel fully capable of interpreting even the most common disorders radiographically. One explanation for this discrepancy could be the lack of an orderly systematic procedure for radiographic analysis, or even the fact that some students develop a particular interest in just one area of the profession at a very early stage and narrow their focus to that area, which can ultimately undermine the level of care provided to patients.

The findings of this study can guide teachers to encourage their students to conduct a more systematic analysis of imaging exams, enabling them to relate analysis to clinical concerns and reinforcing an entirely radiographic interpretation. Busanello et al.[9] evaluated a digital learning object (DLO), developed to improve skills for diagnosing radiographic dental changes and showed that students who used the DLO performed better than those who used conventional methods[9]. From a similar perspective, Santos et al.[10] claims that e-learning is at least as effective as traditional learning methods for oral radiology and that students have positive attitudes to e-learning. Therefore, implementation of active learning in an oral radiology course could contribute to better teaching and learning practices.

Conclusion

The results of this study showed that exposure to clinical training did not improve the number of correct radiographic diagnoses of dental and periodontal disorders made by dental students. Furthermore, the study highlights the need for educational strategies to improve students' diagnostic competence, since radiographs are essential in all areas of dentistry.

References

1. Kantor ML, Beideman RW, Benn DK, Geist JR, Hollender LG, Ludlow JB, et al. Characteristics of an oral and maxillofacial radiology department: report of the ad hoc Department Characteristics Committee of the American Academy of Oral and Maxillofacial Radiology. Oral Surg Oral Med Oral Pathol Oral Radiol Endodontology. 1997 Dec;84(6):708–12.
2. Vuchkova J, Maybury T, Farah CS. Digital interactive learning of oral radiographic anatomy. Eur J Dent Educ. 2012 Feb;16(1):79–87.

3. Mileman PA, Hout WBVD, Sanderink GCH. Looking for caries...? Teachers evaluate a program to improve caries diagnosis from radiographs. Eur J Dent Educ. 2004 Feb;8(1):35–42.
4. Fasoli A, Lucchelli S, Fasoli R. The role of clinical "experience" in diagnostic performance. Med Decis Making. 1998 Apr-Jun;18(2):163-67.
5. The American Dental Association Council on Scientific Affairs. Dental radiographic examinations: recommendations for patient selection and limiting radiation exposure. Washington DC; 2012.
6. Ausubel DP. The acquisition and retention of knowledge: a cognitive view. Boston: Kluwer Academic Publishers; 2000.
7. Tavakoli E, Davari A, Javadi ZS, Targhi MG. Ability of dental students in detection of proximal caries. Shahid Beheshti Univ Dent J. 2015;33(3):220–4.
8. Patel N, Rushton VE, Macfarlane TV, Horner K. The influence of viewing conditions on radiological diagnosis of periapical inflammation. Br Dent J. 2000 July;189(1):40–2.
9. Busanello FH, da Silveira PF, Liedke GS, Arús NA, Vizzotto MB, Silveira HED, et al. Evaluation of a digital learning object (DLO) to support the learning process in radiographic dental diagnosis. Eur J Dent Educ. 2015 Nov;19(4):222–8.
10. Santos GN, Leite AF, Figueiredo PT, Pimentel NM, Flores-Mir C, de Melo NS, et al. Effectiveness of e-learning in oral radiology education: a systematic review. J Dent Educ. 2016 Sep;80(9):1126-39.