

Distance learning course improves primary care dentists' diagnosis and self-efficacy in the management of oral lesions

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Abstract: Oral cancer represents a public health issue because of its high mortality rate, resulting mainly from diagnostic delays. Insufficient training in oral diagnosis is usually perceived by dentists. Distance learning could be used as an auxiliary tool to bridge that gap. This study evaluated the impact of a distance learning course on oral mucosal lesion diagnosis offered to public healthcare dentists. Participants of an online course answered a pretest/posttest comprising clinical images of 30 clinical cases. Participants were questioned about the diagnosis and informed their decision on the cases (referring the cases to a specialist or managing them themselves), as a parameter of perceived self-efficacy. A total of 442 dentists enrolled in the course. Their pass rate was 97%. Classification of the nature of the lesions, diagnostic hypotheses, sensitivity, and specificity improved by 13.4%, 10.0%, 13.4%, and 6.6%, respectively ($p < 0.01$, Wilcoxon test). Regarding management, there was a 16.6% reduction in the intention to refer cases, while confidence in the diagnosis of benign lesions increased by 40%. A distance learning course may be useful in continuing education actions for primary care dentists, improving their diagnostic abilities and encouraging them in the management of oral lesions. Moreover, this strategy could contribute to disseminating knowledge to remote regions, particularly among primary health care professionals.

Keywords: Education, Dental, Continuing; Education, Distance; Primary Health Care; Mouth Neoplasms; Mouth Diseases.

Introduction

Oral cancer is an important public health problem worldwide. Its mortality rate has remained high and unchanged over the past decades.¹⁻³ General dentists usually perceive gaps in their training to diagnose and manage oral lesions.⁴⁻⁶ As a result, there are currently many referrals to specialists, leading to long waiting lines in the public health system and making early diagnosis unusual.

The early detection and treatment of oral precancerous lesions and oral cancers are important components of their control. Treatment of such lesions at an early stage prevents their progression to malignancy.



It is well established that patients at initial stages require less aggressive treatments, present long-term survival, and have better quality of life when compared to those at advanced stages.⁷ Moreover, risk of death from oropharyngeal cancer is higher in public healthcare than in private healthcare because of overreferrals to specialists in the public health system of the main cities. Therefore, most cases have a delayed diagnosis and initiate treatment at advanced stages.⁸

Distance learning (DL) is an emerging educational modality with remarkable advantages, such as interactivity, flexibility in terms of time management, possibility for massive diffusion, and low cost. In the health field, studies on DL have shown its positive impact when compared to conventional lectures or nonintervention. However, studies on dental education are scarcer.⁹⁻¹¹ A study has shown that continuing education courses on oropharyngeal cancer led to improvement in some outcomes related to the subject matter, such as knowledge, performance, and confidence.¹²

In Brazil, TelessaúdeRS/UFRGS and the Open University of Brazilian National Health System (UNA-SUS), both initiatives of the Ministry of Health, have promoted DL courses,¹³⁻¹⁶ with positive evaluation by their participants.¹³ These approaches appear to be useful to target the different professions involved in primary care, addressing specific needs for continuing education.

Therefore, this study aimed to evaluate the impact of a DL course on diagnostic skills and self-efficacy of primary care dentists within the Brazilian public health system.

Methods

Study design and ethical considerations

This pretest/posttest on educational intervention was proposed in a collaborative action between the Federal University of Rio Grande do Sul and TelessaúdeRS/UFRGS, a program engaged in actions to support the public healthcare system.¹⁷ The study protocol was approved by the local Research Ethics Committee (process no. GPPG/HCPA 2018-0204).

Recruitment of the participants

Primary care dentists were invited to participate via a disclosure on the Facebook™ homepage of TelessaúdeRS/UFRGS and by e-mail. Access to the Modular Object-Oriented Dynamic Learning Environment (Moodle) platform required the participant's personal information for login to assure security by means of an authentication mechanism.

Course content and teaching methodology

The course addressed clinical examination, complementary tests, diagnostic processes, and differential diagnosis for each oral elementary lesion (ulcers, patches, erosions, pigmented lesions, and vesiculobullous lesions). The most common and relevant soft tissue lesions of the oral cavity were included. Potentially malignant disorders and oral cancer were further discussed as separate topics.

The course was learner-centered, comprising 50 hours distributed into 10 units for 3 months. Problem-based learning (PBL) was used as teaching methodology, as the flow of reading materials and video classes followed the specialist's step-by-step diagnostic reasoning, avoiding the content-centered approach usually adopted in textbooks. The learning objects were released weekly (1 unit per week) and structured based on the flipped classroom model.¹⁸ The participants had to access the reading material, and then watch a video class in which the tutors presented the diagnostic reasoning flow for each oral elementary lesion according to their clinical characteristics. An artificial environment (virtual learning object) to practice the diagnosis of oral lesions was also available for white and ulcerative lesions, where the participants could train their diagnostic abilities through the evaluation of a panel of cases, activating or not clinical data and a summary of the main differential diagnoses. For each case, feedback justifying the right answer was available. Finally, a five-question single-choice quiz was answered at the end of each unit and to reinforce the main topics of each subject. The questions focused on the steps required for the diagnostic process and/or the evaluation of photos, as performed in the pretest/posttest. For each answer, there was feedback with explanations about the corresponding topic. The learning objects are displayed in Table 1.

Evaluation strategy

At the end of each unit, the participants took an online quiz consisting of five single-choice questions to stimulate knowledge retention. Furthermore, a pretest/posttest, taken before and after the completion of the course, was used to evaluate the impact of the course on the participants' diagnostic abilities. The tests required the students to assess 30 clinical cases, based exclusively on photos of oral lesions, without any clinical data. The cases were obtained from the University's collection. Each case remained available for 30 seconds.¹⁹ Three questions were asked about each case: a) classification of the nature of lesions as benign, potentially malignant, or malignant; b) diagnostic hypotheses: a single-choice question with four options of differential diagnoses; c) decision-making: a single-choice question on the participant's decision about a similar case in a real-life situation, having to choose to: 1) refer the patient to a specialist; 2) make the diagnosis, but refer the case to a specialist for management, or 3) diagnose and manage the case. Questions 1 and 2 were a parameter for diagnostic ability, and question 3 indicated self-efficacy in dealing with oral lesions. Self-efficacy is defined as a person's belief about their own ability to address a certain issue. Assuming that the majority of benign lesions could be managed by general dentists in the primary health care setting, a low number of referrals to specialists may represent the participants' self-perceived competence, also known as self-efficacy.²⁰

Figure 1 summarizes the evaluation strategy used in the course.

The test was available as an online questionnaire and comprehended the most common and relevant cases in the daily practice of a general dentist and was available on the same online platform. The included lesions are shown in Table 2. The pass rate was achieved with a minimum score of 70% of correct answers in the quizzes and in the posttest, each representing 50% of the final grade. Pass rate was assessed by the percentage of participants who started the course and met the above-mentioned requirements. The impact of the course was assessed by comparing performance in the pretest and posttest, taken shortly after completion of the course.

Statistical analysis

Classification of the nature of lesions and diagnostic hypotheses were analyzed based on the percentage of correct answers. For sensitivity and specificity analyses, malignant and potentially malignant disorders were considered positive cases for requiring urgent management. The Shapiro-Wilk test revealed a non-normal distribution; Wilcoxon test was used to compare the pretest and posttest. The p-value was set at 5%. Analyses were conducted on GraphPad Prism 6.1.

Results

The sample consisted of 442 primary care dentists working in the public health system. The mean

Table 1. Course's learning objects.

Item	Description	Duration/Length
Reading material (PDF file)	A text based on the diagnostic reasoning of the oral medicine specialist accompanied by representative images of each lesion, tables, and decision trees.	Mean: 20 pages per unit Range: 9–37 pages
Video class	Short videos to reinforce the main topics related to the diagnostic reasoning regarding the subject of each module.	Mean: 10min06s Range: 1 min 36s –25min37s Total: 4h42min46s
Virtual learning environment	Active learning object based on a panel of clinical cases whereby the participant could simulate the diagnostic challenge. Available for two units (white and ulcerative lesions).	Two panels of clinical cases to practice oral diagnosis available for the unit on white lesions (13 cases) and the unit on oral ulcers (17 cases). Free navigation (no time determined)
Quiz	A test with five simple-choice questions applied at the end of each unit.	Estimated time: - 25 minutes per unit

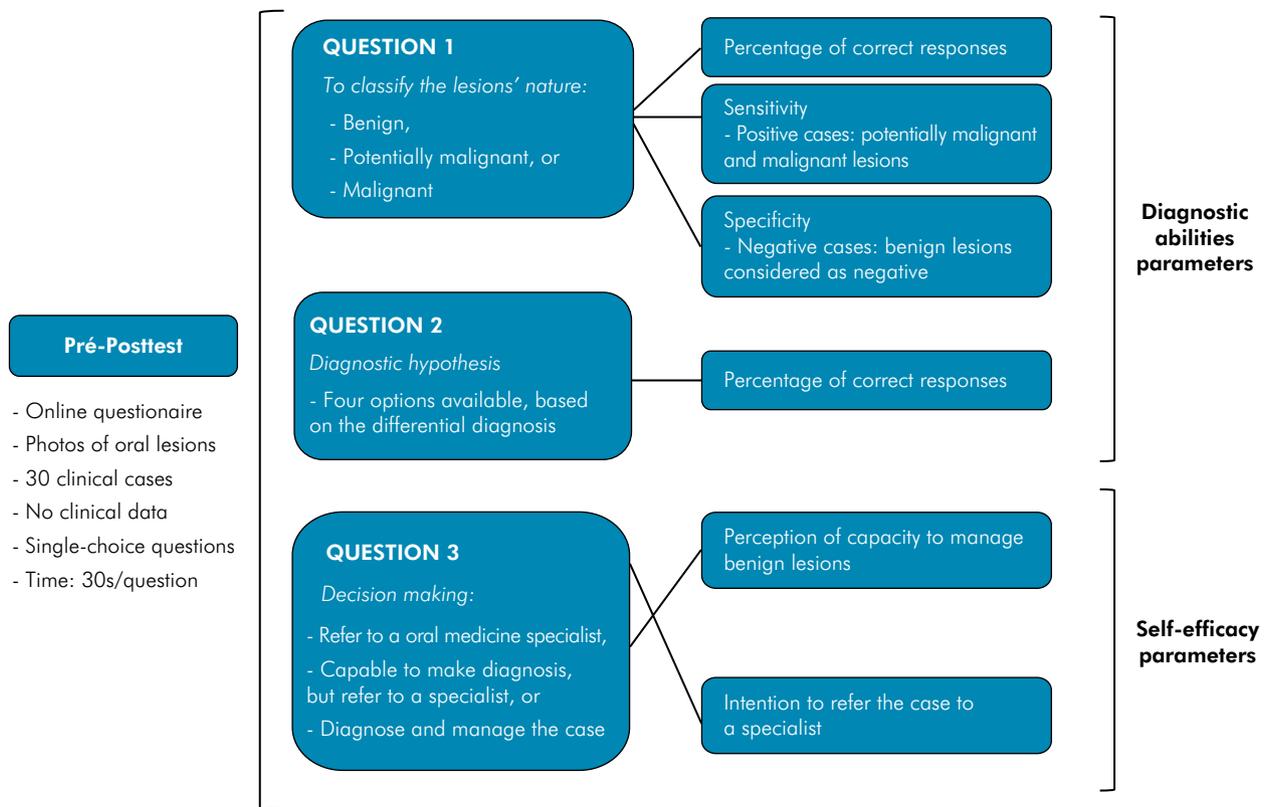


Figure 1. Evaluation strategy to assess the impact of distance learning course on the diagnostic abilities of the participants.

age of the participants was 35 years (SD = 9.4), and a female predominance was observed (71%). The most prevalent regions were the Northwest and the South, representing 73% of the total sample. The pass rate was 97% (n = 429). Table 3 summarizes the sample characteristics.

Regarding performance, the course showed a positive impact for all evaluated parameters (Figures 2 and 3). A 13.4% increase was observed in the posttest for the correct classification of lesions, while sensitivity and specificity increased by 13.4% and 6.6%, respectively. Diagnostic hypotheses also improved by 10%. Regarding self-efficacy, there was a 16.6% reduction in participants' intent to refer cases to oral medicine specialists, while confidence to manage benign lesions increased by 40%.

Figure 2 also shows that the performance of participants varied considerably. Despite that, 85.5% (n = 378) increased the percentage of right answers and this difference was at least 20% for

Table 2. Distribution of oral mucosal lesions included in the diagnostic ability test (n = 30).

Nature of lesions	n	%
Benign		
Candidiasis	2	10.0
Frictional keratosis	2	6.7
Inflammatory hyperplasia	2	6.7
Traumatic ulcer	2	6.7
Geographic tongue	2	6.7
Pyogenic granuloma	1	3.3
Smoker's palate	1	3.3
Mucocele	1	3.3
Recurrent aphthous stomatitis	1	3.3
Paracoccidioidomycosis	1	3.3
Potentially malignant		
Leukoplakia	4	13.3
Lichen planus	3	10.0
Actinic cheilitis	2	6.7
Malignant		
Squamous cell carcinoma	6	20.0
Total	30	100.0

33.5% (n = 148) of them. In relation to the diagnostic hypotheses, better scores were obtained for 71.3 % (n = 315) of the participants.

Table 3. Sample characteristics.

Variable	n	%
Age (years)		
Mean	35.3	
SD	6.3	
Sex		
Male	127	28.7
Female	315	71.3
Region		
Northwest	164	37.1
South	159	36.0
Southwest	101	22.9
Midwest	12	2.7
North	6	1.4

Discussion

Low accuracy and low self-efficacy have been key points in the diagnosis of oral cancer worldwide. This study aimed to evaluate whether a DL course on oral medicine could improve the performance of dentists in a diagnostic test, as well as their self-efficacy as primary care professionals in relation to oral lesions. To the best of our knowledge, this is the first study to evaluate a large-scale DL course for dentists and its potential impact on the behavior of these professionals, regarding oral cancer diagnosis, in a national public health system.

There were positive impacts on all evaluated parameters, demonstrating the usefulness of this DL course. Our findings corroborate those described in the literature, showing that, in general, DL courses produce knowledge improvement among health professionals in several specialties.²¹⁻²³ In dentistry, there exists a lack of evidence on the impact of continuing education courses on knowledge gain

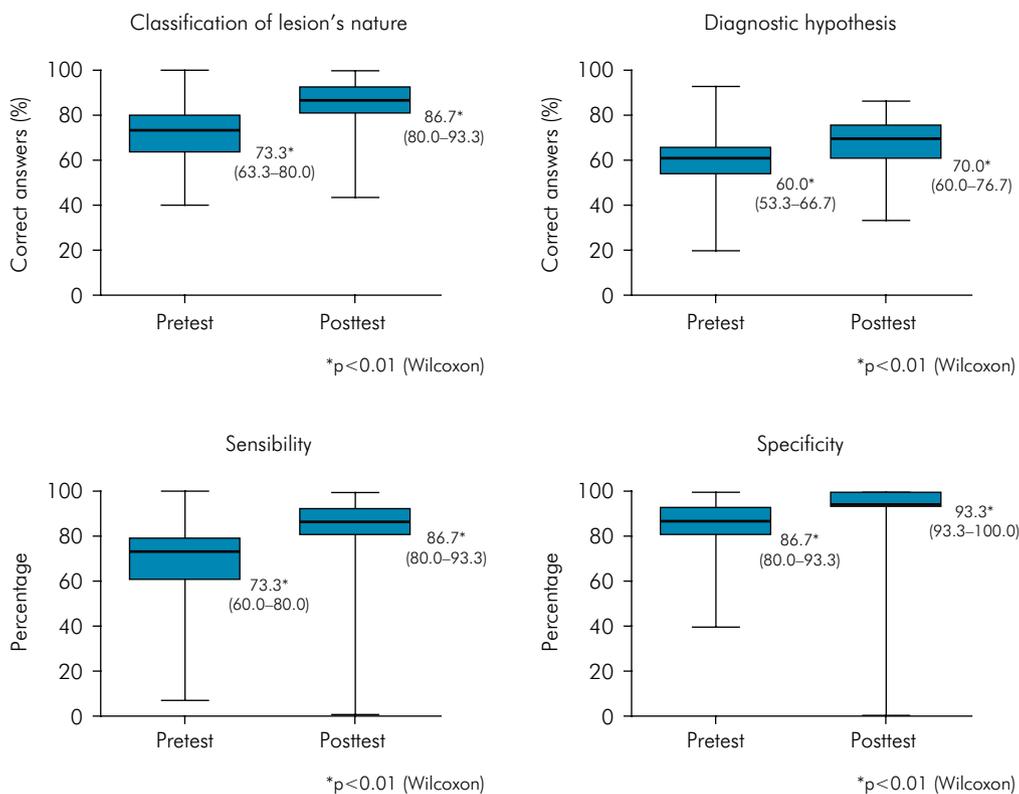


Figure 2. Participants' diagnostic skills in pretest and posttest evaluation.

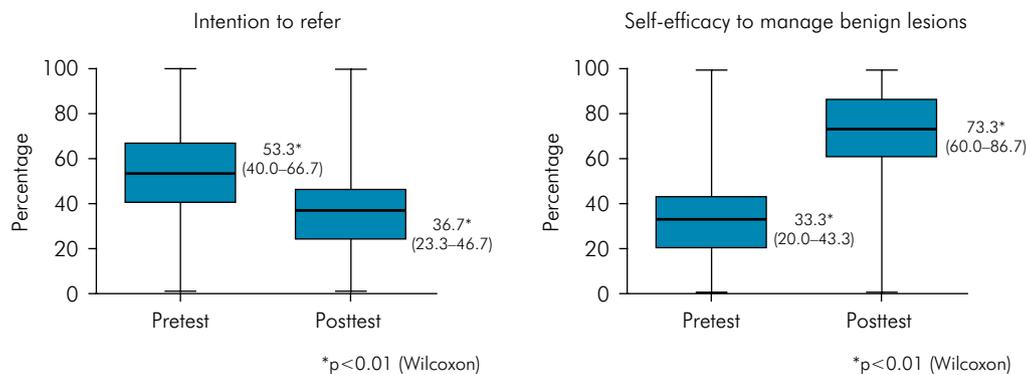


Figure 3. Participants' self-efficacy in pretest and posttest evaluation.

in various fields of dentistry,²⁴⁻²⁷ and the impact of these courses on primary health care has not been verified.²⁸

After the course, significant improvement was observed in participants' ability to correctly detect potentially malignant and malignant lesions with sensitivity increasing from 73.3% to 86.7%, showing an advance in participant's ability to identify suspicious lesions that required urgent management. This initiative may contribute to improve early diagnosis of oral cancer, because the participants appear to be encouraged to face the challenge of diagnosing oral lesions in their daily practice,^{1,2,12} assuming most dentists consider their training in oral diagnosis to be insufficient during undergraduate education.^{4-6,29,30}

Improvement in participants' self-efficacy was also observed, represented by higher confidence in treating benign lesions and less intention to refer cases to a specialist. Presumably, after the course, the participants felt more familiar with the topics covered, and that influenced the perception of their own competence in the management of oral lesions. This trend corroborates the findings of previous studies that have demonstrated health professionals report greater confidence in patient management regarding the topic addressed after the completion of DL courses.^{23,31-33} In the field of dermatology, an effective decrease was observed in referrals to specialists and reconsultations with primary care professionals in the year following the completion of a DL course on cancer diagnosis and management.²² Moreover, a significant decrease in

participants' intention to refer the cases represents a major achievement for our course. Similar findings in terms of knowledge on oropharyngeal cancer have been previously observed when a face-to-face course was offered to dentists.¹²

Our findings suggest this strategy could reduce referral waiting lines in public healthcare services by avoiding unnecessary referrals to oral medicine specialized services. Cost-effective strategies to reduce waiting time are urgently needed in many countries that struggle with long waiting lists for several medical specialties. This course represents a successful experience in oral diagnosis, raising the possibility of its use in different medical specialties. Moreover, the course reached participants from all regions of Brazil, reinforcing that DL may reach remote localities. These continuing education actions could be implemented regularly via government policies aimed at reducing healthcare burden.

The blended approach has yielded superior results for knowledge gain when compared to isolated methodologies.^{27,34-36} In medical education, PBL has become the preferred instructional methodology and curriculum approach to enhance self-regulation learning skills.²⁰ Through the PBL methodological configuration used in this course, a change in the current teaching paradigm is supported: students play a central role, being active and responsible for their own learning, moving away from the teacher-centered model in which the teacher is the knowledge holder.³⁷ Recent data from a review of the literature have shown a positive effect on students' perceived preparedness and confidence to practice dentistry in

case and problem-based approaches, suggesting that this teaching approach could improve students' ability to apply their knowledge in the clinical setting.³⁸

The quizzes at the end of each module enabled gradual self-assessment of acquired knowledge, considering that continuous feedback on comprehension for each topic allows making adjustments whenever necessary.³⁵ Particularly, in healthcare, the use of virtual technologies provides students with the opportunity to learn in an environment where they can make mistakes prior to actual contact with patients.³³ In addition, due to its inherent schedule flexibility, it is an effective alternative for professionals with limited time.³¹

Although this course achieved remarkable results, some limitations should be considered. The efficiency of DL courses is usually measured by participants' knowledge gain through tests. These methodologies do not consider confounding factors such as level of motivation, prior knowledge or the methodology used. Thus, there is no concrete evidence that any improvements observed for these variables will result

in effective behavioral changes in clinical practice, and ultimately, a better outcome for patients.^{1,39} There are limitations of DL itself concerning technical problems.²⁶ Moreover, online teaching material does not equate with actual contact with a patient. Finally, the application of a posttest immediately after course completion probably overestimated its impact, given that the participants had had contact with the instructional material recently. However, opting for an assessment much later, ideal for assessing knowledge retention, could have a high non-response rate.

Conclusion

The present findings support that DL courses may be useful strategies for continuing education actions on diagnosis of oral mucosal lesions. This modality could be a promising resource to bridge the knowledge gaps of health workers, in the perspective of continuing education, improving the quality of healthcare.

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