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TECHNOLOGICAL APPLICATION FOR SCREENING AND DIAGNOSIS OF ORAL LESIONS: A SUPPORT TOOL FOR THE DENTIST

APLICAÇÃO TECNOLÓGICA PARA TRIAGEM E DIAGNÓSTICO DE LESÕES BUCAIS: UMA FERRAMENTA DE APOIO AO CIRURGIÃO-DENTISTA

APLICACIÓN TECNOLÓGICA PARA LA DETECCIÓN Y EL DIAGNÓSTICO DE LESIONES ORALES: UNA HERRAMIENTA DE APOYO PARA EL ODONTÓLOGO

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ABSTRACT

The incorporation of digital technologies in dentistry has transformed the diagnosis of oral lesions, expanding access and accuracy, especially through the use of mobile applications and telediagnosis. The aim of this study was to develop a web-based application designed for screening and supporting the clinical diagnosis of these lesions, based on flowcharts and morphological criteria. The method consisted of qualitative research for building the tool, supported by artificial intelligence during its development but without performing automatic diagnosis, with the professional remaining responsible for the analysis guided by the application. The results indicate that the platform is accessible, easy to use, and compatible with multiple devices, which favors its adoption in settings with limited infrastructure. The algorithm promotes step-by-step clinical reasoning to exclude incompatible diagnoses, supporting the dentist in the initial assessment of lesions. It is concluded that the application has the potential to democratize initial diagnosis in dentistry, especially within the public health system, although clinical validation is needed to confirm its effectiveness and ensure safe use. Ethical development and the promotion of digital inclusion are essential for the implementation of this technology, which may contribute to reducing inequalities in access to qualified dental services.

KEYWORDS: Oral Diagnosis. Oral Pathology. Oral Health.

RESUMO

A incorporação das tecnologias digitais na odontologia tem transformado o diagnóstico de lesões bucais, ampliando o acesso e a precisão, sobretudo com o uso de aplicativos e telediagnóstico. O objetivo deste estudo foi desenvolver uma aplicação web-based voltada para triagem e apoio ao diagnóstico clínico dessas lesões, baseada em fluxogramas e critérios morfológicos. O método consistiu na pesquisa qualitativa para a construção da ferramenta com suporte de inteligência artificial em seu desenvolvimento, mas sem realizar diagnóstico automático, sendo o profissional responsável pela análise guiada pela aplicação. Os resultados indicam que a plataforma é acessível, de fácil uso e compatível com múltiplos dispositivos, o que favorece sua

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adoção em ambientes com infraestrutura limitada. O algoritmo promove um raciocínio clínico step-by-step para excluir diagnósticos incompatíveis, apoiando o cirurgião-dentista na avaliação inicial das lesões. Conclui-se que o aplicativo tem potencial para democratizar o diagnóstico inicial em odontologia, especialmente no sistema público, embora a validação clínica seja necessária para confirmar sua eficácia e garantir a segurança de seu uso. O desenvolvimento ético e a promoção da inclusão digital são fundamentais para a implementação desta tecnologia, que pode contribuir para reduzir as desigualdades no acesso a serviços odontológicos qualificados.

PALAVRAS-CHAVE: *Diagnóstico Bucal. Patologia Bucal. Saúde Bucal.*

RESUMEN
La incorporación de tecnologías digitales en odontología ha transformado el diagnóstico de lesiones orales, ampliando el acceso y la precisión, especialmente con el uso de aplicaciones y telediagnóstico. El objetivo de este estudio fue desarrollar una aplicación web para la detección y el apoyo al diagnóstico clínico de estas lesiones, basada en diagramas de flujo y criterios morfológicos. El método consistió en una investigación cualitativa para la construcción de la herramienta con apoyo de inteligencia artificial en su desarrollo, pero sin realizar diagnósticos automáticos, con el profesional responsable del análisis guiado por la aplicación. Los resultados indican que la plataforma es accesible, fácil de usar y compatible con múltiples dispositivos, lo que favorece su adopción en entornos con infraestructura limitada. El algoritmo promueve el razonamiento clínico paso a paso para excluir diagnósticos incompatibles, apoyando al odontólogo en la evaluación inicial de las lesiones. Se concluye que la aplicación tiene el potencial de democratizar el diagnóstico inicial en odontología, especialmente en el sistema público, aunque es necesaria la validación clínica para confirmar su efectividad y garantizar la seguridad de su uso. El desarrollo ético y la promoción de la inclusión digital son fundamentales para la implementación de esta tecnología, que puede contribuir a reducir las desigualdades en el acceso a servicios dentales cualificados.

PALABRAS CLAVE*: Diagnóstico oral. Patología oral. Salud bucal.*

INTRODUCTION

The incorporation of digital technologies into the field of dentistry has revolutionized the way professionals perform diagnoses, especially in the identification and evaluation of oral lesions. The use of devices such as smartphones combined with telediagnosis has demonstrated high accuracy, with diagnostic agreement rates close to the gold standard in clinical settings, facilitating access and communication between patients and specialists even at a distance. This democratization of diagnosis contributes to expanding the reach of dental services, enabling faster and more effective interventions (Fonseca et al., 2016).

Furthermore, advances in artificial intelligence (AI) have expanded the role of technologies in supporting dental surgeons. AI may enable detailed analysis of images and clinical data, providing more accurate and personalized diagnoses for various oral conditions,

ranging from dental caries to potentially malignant lesions. These automated tools may also increase the efficiency of care by reducing errors and the time spent analyzing information, benefiting both professionals and patients (Kharche; Mathur; Mehta, 2024; Patil et al., 2022).

The use of modern dental technologies, such as cone beam computed tomography (CBCT), intraoral scanners, and digital diagnostic software, has improved the accuracy and speed of diagnoses in dentistry. CBCT is a widely used tool for obtaining detailed three-dimensional images of the maxillofacial region, which are essential for clinical planning and accurate diagnosis, reducing errors and facilitating more effective interventions (Araújo et al., 2019).

Despite technological advances in the diagnosis of oral lesions, complementary examinations such as imaging tests and biopsies are not always readily available to all patients, especially within the Brazilian public health system (SUS). Delays in performing these examinations may postpone diagnostic confirmation and, consequently, the initiation of treatment, which may worsen the prognosis of lesions, particularly in cases of malignant neoplasms. This situation highlights the critical importance of an accurate and effective clinical diagnosis performed by the dental surgeon during the initial evaluation phase in order to accelerate screening and appropriate referral, minimizing the harm caused by delays in care (Le Campion et al., 2016; Rieger; Volpato; Bavaresco, 2025; Soares et al., n.d.).

The aim of this study is to develop a technological application to support screening and facilitate the diagnosis of oral lesions, providing a practical and accessible tool for dental surgeons. The proposed application seeks to integrate functionalities that enable image capture, secure data storage, and support for the preliminary analysis of lesions, contributing to the agility and reliability of the diagnostic process, with the potential to improve dental care in different clinical contexts.

MATERIALS AND METHODS

This study is characterized as a methodological development research study with a qualitative approach, aimed at constructing a technological application for the screening and diagnosis of oral lesions. To achieve this, an internal diagnostic support flowchart was developed based on a review of the specialized literature.

The construction of the flowchart was grounded in a literature review in the fields of Oral Pathology and Stomatology, using the following well-established references: **Neville BW et al**., *Oral and Maxillofacial Pathology* (5th edition) (Neville, 2016), and **Regezi JA et al**., *Oral Pathology: Clinical-Pathologic Correlations* (7th edition) (Regezi, 2017). Initially, oral lesions were categorized into six main morphological groups according to classifications established in the literature: macules, plaques, nodules, bullae, ulcers, and erosions.

The researchers themselves were responsible for developing the technological application, with support from the "v0.dev" platform, which uses artificial intelligence for application development. At this stage, the application's characteristics and incorporated resources were defined, including data collection, accessibility, and the built-in features of the application.

The developed platform is characterized by its web-based architecture, ensuring universal accessibility through hosting in an online environment. This technological approach provides a significant operational advantage by enabling multiplatform access through computers, mobile devices, and any equipment with internet connectivity.

The web-based implementation eliminates conventional technological barriers, as it does not require the installation of specific software or high-performance hardware. The solution maintains full functionality even on devices with modest technical specifications or outdated operating systems, requiring only an internet connection.

This development strategy substantially expands the potential reach of the tool among healthcare professionals, overcoming geographical and socioeconomic limitations.

RESULTS

The application can be accessed from any device through the following link: https://www.diagnosticobucal.online/. To ensure ease of use, the application's homepage was designed in a simplified manner, containing a menu with buttons to start the diagnostic process, instructions on how to use the application, and an "About" section (Figure 1).

Figure 1. Home page of the "Oral Lesion Diagnosis" application"

Source: Image obtained by the authors, 2026

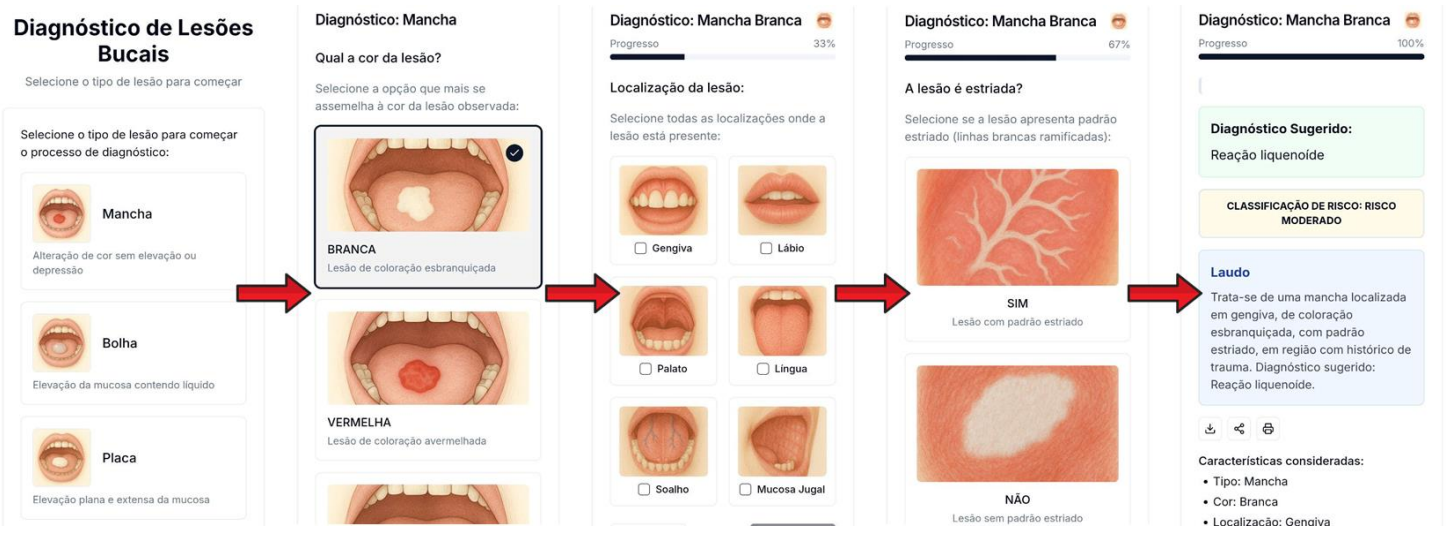
The implemented diagnostic algorithm is based on a sequential clinical investigation approach through the presentation of stratified questions to the user. The process begins with the morphological characterization of the lesion and progresses to the systematic analysis of fundamental clinical parameters established in the specialized literature.

The evaluation criteria include chromatic characteristics (coloration), metric dimensions, macroscopic surface aspects, anatomical location, duration of evolution, and relevant associated factors. Each variable constitutes a decision node within the flowchart, allowing the progressive refinement of the differential diagnosis.

The sequence of questioning follows well-established principles of oral semiology, prioritizing parameters with greater discriminatory value. With each response provided, the algorithm excludes incompatible nosological entities, progressively converging toward a set of plausible differential diagnoses.

This step-by-step approach reproduces specialized clinical reasoning, simulating the mental process of diagnostic exclusion and confirmation based on objective clinical evidence (Figure 2).

Figure 2. *Step-by-step* approach leading to the diagnosis of oral lesions in the digital application



Source: Image obtained by the authors, 2026

DISCUSSION

The incorporation of digital technologies in dentistry has expanded the possibilities for screening and supporting clinical diagnosis, especially for oral lesions, through the use of applications that facilitate the organization and systematic analysis of clinical data. These tools provide important support for dental surgeons, particularly in contexts with limited access to specialists, without replacing human evaluation, which is aligned with the purpose of the application developed in this study (Lau et al., 2024; Ribeiro et al., 2020).

Although the application was developed with the support of artificial intelligence during its creation process, the diagnosis provided results from the professional's interaction with an algorithm based on clinical evidence and decision-making flowcharts. This distinguishes the tool from systems that perform autonomous AI-based diagnoses, positioning it as an educational and supportive resource for clinical practice (Ribeiro et al., 2020; Wuthstrack et al., 2024).

The choice of a web-based platform allows broad accessibility, which is especially important in the Brazilian context, where socioeconomic variations and technological infrastructure limitations restrict access to more complex tools. Studies on dental smartphone applications in Brazil highlight the need for validated and user-friendly solutions, reinforcing the relevance of the approach adopted in the developed application (Faria et al., 2018).

Although the application represents an advance in clinical support, it is essential that its performance be validated in real clinical scenarios through comparisons between the suggested diagnostic hypotheses and confirmatory results, such as biopsies. This validation is crucial to ensure safety and effectiveness before large-scale adoption (Li et al., 2024).

Ethics in the development and use of digital applications in dentistry involves ensuring that the tool complements, rather than replaces, human clinical judgment. Transparency regarding the application's functioning and the protection of patient data are essential for the responsible use of these technologies (Rokhshad et al., 2023).

Finally, the importance of public policies that promote digital inclusion and the development of accessible technologies to reduce inequalities in access to oral healthcare in Brazil should be emphasized. The advancement of these initiatives may significantly contribute to promoting equity in healthcare, as demonstrated by analyses of barriers and inequalities within the Brazilian Unified Health System (SUS) (Freire et al., 2021).

CONSIDERATIONS

This study developed a web-based application for the screening and support of oral lesion diagnosis, offering an accessible tool grounded in clinical criteria that enhances the initial evaluation performed by dental surgeons, especially in contexts with limited access to diagnostic resources. The application does not perform automatic AI-based diagnosis but instead serves as a structured support tool for clinical reasoning, standing out for its ease of use and potential to democratize dental care. However, future clinical validation is necessary to confirm its effectiveness and safety.

Addressing socially marginalized populations as a public issue requires more than marginal adjustments to employability programs. It demands rethinking the relationship between income, urban environments, technology, and care at local, metropolitan, and national levels. The path adopted in the coming years will determine whether artificial intelligence will be remembered as a tool that intensified the management of exclusion or as an opportunity to renegotiate, with collective courage, the role of work and non-work in the construction of fairer cities.

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