LETTER to the EDITOR

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Revolutionizing Oral Cancer Screening: New Approaches and Emerging Technologies

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Dear Editor

Oral cancer , including Malignant neoplasms of lip, oral cavity and pharynx (C00-C16) makes up around 3% of all cancer cases worldwide, with over 3.5 million new diagnoses annually and substantial mortality and morbidity (WHO, 2022). This risk increases with age, particularly affecting people over the age of 50. When discovered in its early stages, oral cancer has a favorable prognosis, leading to higher survival rates and quality of life. However, in the early stages, there are frequently no visible signs, or the signs mimic benign illnesses, thus preventing prompt medical attention (Warnakulasuriya and Kerr, 2021). While advances in treatment have increased survival rates, early detection remains crucial for improving outcomes and lowering the impact of oral cancer on patients' health and well-being. The goal of oral cancer screening is to identify apparently healthy individuals with atypical oral findings.

Oral screening methods

For decades, a range of oral screening methods have been employed for oral cancer screening. The most common oral cancer screening method is clinical examination, which comprises a visual assessment of the oral cavity and probing of oral tissues for abnormalities. It is inexpensive and can be conducted in primary care settings by skilled healthcare practitioners. Subramanian et al., (2009) discovered it to be extremely cost-effective, with an incremental cost of $835 per life-year saved for all participants and 156 for patients at high risk. Clinical examination, Brush cytology, Chemiluminescence , Toluidine blue are the most common traditional method for oral cancer diagnosis, nevertheless, has limitations, including difficulties in recognizing benign lesions, limited specificity, and the inability to recognize early tumors and dysplasia. (Alsarraf et al., 2018; Kim et al., 2021; Moffa et al., 2021).

All of these technologies have advantages and problems; regrettably, these methods have less practical applicability in community particularly hard-to-reach areas, since patients with late stages of oral cancer are still being detected. Taking into account these factors, there is a need for creating novel technologies for early detection of oral cancer through screening.

Emerging technologies in Oral cancer screening

Artificial intelligence (AI) is increasingly revolutionizing cancer diagnosis through image analysis, image and biopsy based classification of precancerous lesion and cancer risk prediction particularly deep convolutional neural networks (CNNs) . The use of AI in disease screening may also lead to better diagnosis owing to its speedy workflow and higher accuracy over conventional screening approaches. Jubair et al., (2022) showed that utilizing the EfficientNet-B0 transfer model, are highly sensitive (84.5%), accurate (85%), and have good specificity (86.7%) in identifying potentially cancerous cells in the tongue. These findings outperform general dental practitioners' (75%) and are comparable to the diagnostic accuracy of specialists (90%). Similarly, Sunny et al., (2019) investigated the potential of a tele-cytology platform for screening oral cancer by creating an artificial neural network-based risk categorization model. The study's findings demonstrated the platform's clinical effectiveness, with excellent specificity and sensitivity to oral cancer screening. This exemplifies how telemedicine and AI can improve the usability and precision of screening programs, making them more effective and reliable.

Bioimpedance is another potential early detection method which can be used in community settings. , It can be described as the way how living tissue reacts to an external electrical impulse. Resistance (opposition to electricity) and capacitance (the resistance of the cell membrane) are two components of bioimpedance. Cell membranes have a high bioimpedance under low-frequency settings, which restricts the current to constrained extracellular routes and raises the bioimpedance. The bioimpedance is lower in oral cancer tissue because of its larger pathways and smaller cell volume, which provide a direct conduit for the current. In brief, it indicates cell health, which varies between individuals. Due to its quick results, low cost, and low skill requirement, bioimpedance has become a more successful screening technique. his makes it appropriate for adoption at the grassroots level in nations with limited resources, lowering patient worry, enhancing compliance, enabling immediate outcomes, and providing portability. It can deal with the challenges involved in running nationwide screening programs in underdeveloped nations (Gupta et al., 2023). A novel MobileNet-based dual-modality technique for oral cancer screening was introduced by Song et al., (2021). It delivers good accuracy while making optimal use of constrained computational resources and physical space on mobile device platforms. With lower memory needs and computational expenses

than traditional deep CNN models, the MobileNet-based technique stands out for its effectiveness.

Furthermore, saliva-based biomarkers have grown in popularity as a practical and economical approach for early oral cancer screening. Saliva is simple to collect, takes little time, and doesn't require complicated equipment or a lot of expertise. Several salivary biomarkers have shown high specificity (91%) and sensitivity (91%) in diagnosing oral cancer, including mRNAs and salivary transcriptomes (e.g., Interleukin-8, IL-1B, salivary actin, and myosin). These salivary biomarkers work well together as a screening tool to improve the accuracy and early detection of precancerous and cancerous lesions in the mouth. To be used in clinical settings, however, several issues including the standardization of saliva samples and processing procedures as well as differences in the quantities of putative salivary biomarkers must be resolved. Additionally, Larger cohort studies are also required to strengthen the reliability of these novel systems, especially in contexts with limited resources (Kaur et al., 2018).

In conclusion, Novel oral cancer screening techniques are being developed using cutting-edge developments in artificial intelligence, bioimpedance, and saliva-based biomarkers. They not only provide greater accessibility and accuracy but also have enormous promise for reducing healthcare inequities, particularly in places with limited resources. Nevertheless, to further confirm and improve these novel approaches in the pursuit of more successful oral cancer screening and early diagnosis, continued research, standardization initiatives, and larger-scale studies are crucial.

Author Contribution Statement

ST is the guarantor of the study. ST, AM and VM conceived and designed it. ST wrote the first draft, and all contributed to subsequent drafts and the final paper.

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Conflict of Interest

The authors have no conflict of interest to declare.

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