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Intraoral Photography Recommendations for Remote Risk Assessment and Monitoring of Oral Mucosal Lesions



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ABSTRACT

Oral cancer is a global health issue with substantial morbidity and a high mortality rate mainly because of late-stage diagnosis. Cancerous lesions are often preceded by potentially malignant lesions that may be detected during routine dental examinations. Not only is the oral cavity easily accessible for screening, but the clinical risk factors of the disease are also known. However, patients may not always be able to access screening services or receive follow-up for diagnosed lesions. In these circumstances, intraoral photos are crucial for timely triage, risk assessment, and monitoring of oral lesions. Further, photos form an integral part of a patient's records, facilitate patient education and communication between health care providers, and provide important information during the referral process. To ensure that intraoral photos are of good quality and standardised there is a need to establish recommendations regarding intraoral photography in oral mucosal screening. This article recommends methods to help health professionals and patients obtain interpretable intraoral photographs. Suggestions to achieve ideal lighting, mirror placement, camera angle, and retraction have been discussed. These recommendations are adaptable to easily available smartphone or point-and-shoot cameras and may be further used to develop future teledentistry platforms.

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Introduction

Oral cancer is one of the most life-threatening conditions that dental health professionals may encounter in their practice. Globally more than 350,000 oral cancer cases and 177,000 deaths were estimated to occur in 2018.¹ Oral cancer is frequently preceded by an identifiable potentially malignant lesion that can often be detected by a simple, quick screening during a routine dental visit.²

These oral potentially malignant lesions (OPMLs) typically appear as red, white, or speckled patches in the oral cavity, termed oral leukoplakia, erythroplakia, or

erythroleukoplakia, respectively. Oral leukoplakia is the most commonly occurring OPML.³ Histopathological assessment of OPMLs show varying extents of cytological and tissue architecture changes called *dysplasia*.⁴ Currently, the presence of epithelial dysplasia is used to predict transformation to oral cancer; the risk increases with higher grades of dysplasia.⁵ Most oral cancers have a window of opportunity during which they can be detected by screening, making early diagnosis a means to significantly reduce disease mortality rate.⁶

Following the outbreak of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and coronavirus disease 2019 (COVID-19), elective and nonessential dental services were suspended in many countries to contain community spread of the virus.⁷⁻⁹ This, more than ever, highlighted the need for alternative strategies to facilitate continuity of care.¹⁰


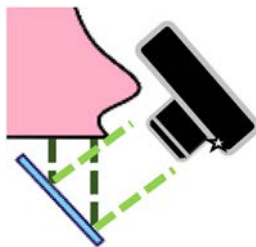








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Table 1 – A simple systematic approach to capture standardised site-specific intraoral photos.

A. Clinical Setting			
Site of Oral Lesion	Chair/Client Positioning	Mirrors	Method
<p>Hard/soft palate</p> 	Upright, with client facing clinician	Occlusal mirror 	<ul style="list-style-type: none"> Place cheek retractors Patient's tongue should be relaxed on the floor of the mouth Place mirror behind the last molar of the top arch and slant to rest equally on the lower teeth Capture two photos: (1) centring the arch and (2) centred on the lesion The palate should be on 1 vertical plane
<p>Floor of mouth</p> 	Reclined, with client facing clinician	Occlusal mirror 	<ul style="list-style-type: none"> Place cheek retractors Place mirror against patient's raised tongue, at the retromolar area of the lower arch and slant to rest equally against the top teeth The occlusal arch should be centred, with the floor of the mouth on 1 vertical plane
<p>Lingual gingiva</p> 	Upright	Lingual mirror 	<ul style="list-style-type: none"> Place cheek retractors Insert mirror obliquely above the premolars of the opposite arch For the lower lingual gingiva, use the mirror to push the tongue to 1 side and angle it to ensure the lesion is visible Zoom in to capture only the mirror image in the frame The occlusal edge of the teeth should be parallel to the floor Place camera flash further out of the mouth; you may need to hold the device upside down
<p>Buccal gingiva</p> 	Upright	Buccal mirror 	<ul style="list-style-type: none"> Place cheek retractors Patient closes halfway Insert narrow end of buccal mirror and push outwards against the buccal mucosa Zoom in to capture only the mirror image in the frame Occlusal edge of teeth should be parallel to floor Place camera flash further out of the mouth; you may need to hold the device upside down
<p>Anterior gingiva</p> 	Upright, with occlusal plane parallel to the floor	NA	<ul style="list-style-type: none"> Place cheek retractors Patient bites together loosely Occlusal plane should be parallel to floor
<p>Tongue</p> 	Upright	NA	<ul style="list-style-type: none"> Place cheek retractors Hold the patient's extruded tongue with a piece of gauze To properly expose the lesion, the client's tongue may be retracted out or rotated upwards by the clinician


(continued)

Table 1 (Continued)

A. Clinical Setting			
Site of Oral Lesion	Chair/Client Positioning	Mirrors	Method
			<ul style="list-style-type: none"> • Ensure camera flash is placed further out of the mouth
Buccal mucosa	Upright	Mouth mirror	<ul style="list-style-type: none"> • Place cheek retractors, pulling outward on the lesion side and relaxing on the opposite side • Depress tongue as needed • The horizontal plane of the image should be parallel to the floor, and the buccal mucosa on 1 vertical plane • Ensure camera flash is placed further out of the mouth
			
Labial mucosa/lip	Upright, or semisupine position to capture the image from over head for the lower labial mucosa/lip	NA	<ul style="list-style-type: none"> • Evert the lip to image the labial mucosa, ensuring that the lesion is fully exposed and not covered by retractors or fingers
			
B. Home setting			
Site of Oral Lesion	Patient Positioning	Mirrors	Guidelines
Gums, inside of cheek, inside/outside of lip	Upright	NA	Patient, using clean fingers, pulls lips or cheeks to the side until the lesion is clearly visible.
			
Roof of mouth	Reclined with the head and chin tilted back	NA	Patient, using clean fingers, pulls the cheeks to the side until they are not blocking the lesion.
			
Floor of mouth	Chin tilted down	NA	Patient should lift the tongue to the roof of the mouth, or push back the tongue gently with a spoon.
			

(continued)

Table 1 (Continued)

A. Clinical Setting			
Site of Oral Lesion	Chair/Client Positioning	Mirrors	Method
Tongue 	Upright	NA	Patient should extend the tongue, trying to keep it parallel to the floor. Pull aside the cheek on the side of the lesion to ensure that the lesion is in clear view.

Photos are courtesy of the BC Oral Cancer Prevention Program; ethics certification and consent has been obtained for use of all images. NA = not applicable.

In British Columbia (BC), Canada, the BC Oral Cancer Prevention Program (BC OCPP) has established pathways linking health professionals to better oversee the management of oral cancer, from early dysplasia to frank carcinoma. The aim of this multidisciplinary program is to generate impact at the patient level, reducing the incidence, mortality, and morbidity of oral cancer. This is accomplished through prevention, screening, early detection, risk assessment, and management techniques. In line with this mandate, the BC Oral Cancer Prevention Program began a nonprofit community-based program, the Next Gen Oral Dysplasia Clinics, to follow-up and monitor OPMLs. The clinics receive referrals from oral health professionals across the province for patients in the community with high-risk lesions or biopsy-proven OPMLs, many of which cannot access typical referral pathways because of cost. On receipt, referrals are screened and triaged by a team of dental health professionals with expertise in this field, including the on-staff oral medicine specialist. At this stage, the provision of adequate, detailed, and accurate information in these referrals is paramount. Thus, providing intraoral (IO) photos plays a large role in helping the team better gauge the risk of the lesion, through the visualisation of colour, margins, size, texture, appearance, and site. As appointment slots are limited, this information will help ensure that patients with high-risk lesions can be prioritised and seen in a timely manner. Although there may be some degree of inter- and intraobserver variance in judging the risk of the lesion, standardised IO photo-taking techniques will help reduce this variance.¹¹ These photos also serve as an important tool for the documentation of visual changes over time and facilitate interdisciplinary collaboration.

However, there are no established guidelines regarding IO photography in oral mucosal screening. As a result, photos are often not included in referrals sent to the clinic or are of poor quality and noninterpretable. Over a span of 20 years, our clinical team has been optimising methods for photographing and assessing OPMLs in the Next Gen Oral Dysplasia Clinics. We propose a set of recommendations to help health professionals obtain interpretable, good quality IO photographs. For patients who may not be able to access this service, we also present the possibility of using IO photography for continued follow-up of diagnosed low-grade dysplasia, through photos taken by patients themselves.

Specific aims

1. To describe how IO photography can be used in remote triaging of high-risk oral lesions and continued follow-up of diagnosed low-grade dysplasia.
2. To establish recommendations for obtaining good quality photos in the clinical setting.
3. To establish recommendations for obtaining good quality photos in the home setting.

Discussion

Oral mucosal screening

Screening refers to the “early detection of disease by testing or checking for disease in people who do not show any symptoms.”¹² Oral mucosal screening is a multistep process starting with documentation of medical history and modifiable risk factors (duration and amount of tobacco, alcohol, or other habits).¹³ Following this, a thorough clinical examination of extraoral and IO structures is conducted. The extraoral examination involves inspection and palpation of the head and neck region for swelling, asymmetries, or palpable lymph nodes. IO examination involves a systematic approach to examine all the mucosal surfaces for presence of nonhealing ulcers and red or white patches.¹⁴ Along with lesion recording, IO photographs also play an important role in the documentation and the referral process.

Documentation and referral process

Asymptomatic oral lesions are most often detected by frontline dental professionals, such as dentists and dental hygienists.¹⁵ Patients are then referred to specialists such as oral medicine and pathology, ear nose and throat specialists, oral surgeons, or dermatologists for follow-up. Referral forms should contain detailed lesion descriptions including site, duration, dimensions, colour, margins, and appearance. Additional information regarding previous history of cancer, previous biopsies done, family history of head and neck cancer, and specifics on tobacco and alcohol use are also valuable. IO photographs should accompany every referral because they provide essential visual information

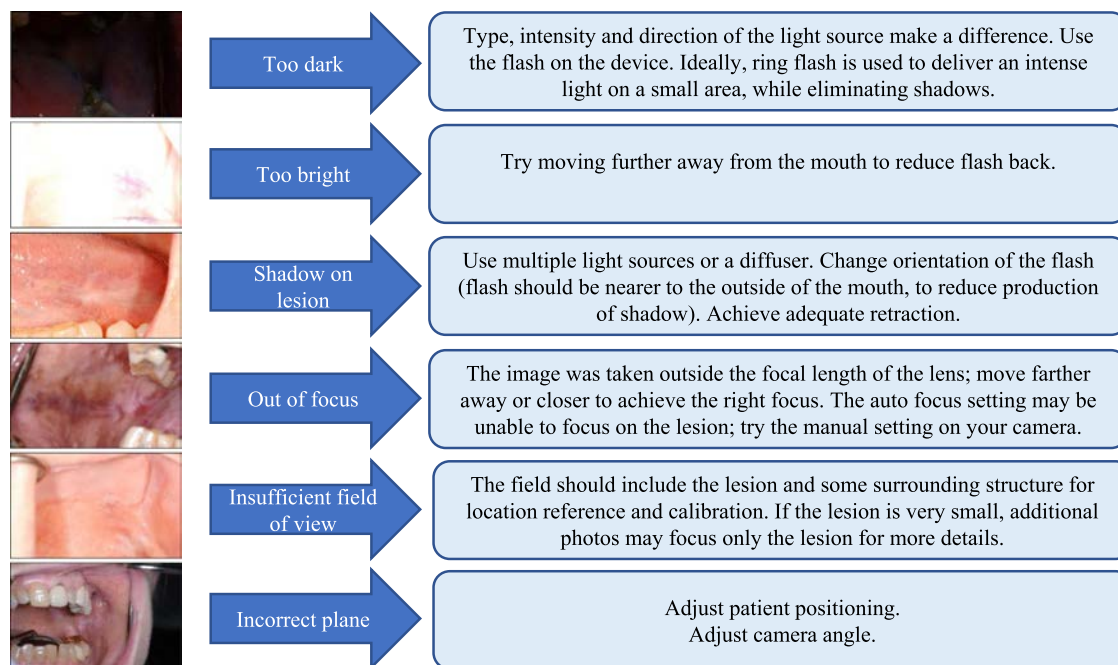


Fig. 1 – Common issues encountered when capturing intraoral photographs and solutions.

to help triage high-risk patients. However, guidelines are needed to obtain standardised, good quality oral soft tissue photographs.

Proposed IO photography recommendations

IO photography can often seem challenging to dental professionals because it requires a complex armamentarium including a digital single-lens reflex (DSLR) camera, lens, and external flash. However, by following simple methods, IO pictures of sufficient quality can also be obtained using readily available point-and-shoot or smartphone cameras. IO cameras are also commonly used in dental offices by clinicians; though these can be suitable to obtain images of single teeth, using them for IO lesion photography is not recommended. IO cameras often capture a narrow dimension of the area of interest, resulting in magnified but blurry image without any adjacent structures to act as reference. It is best to include surrounding oral structures to give information about the orientation, size, and site of the lesion. Cheek retractors and gauze can help retract tissue and ensure that the lesion is completely visible, and mouth mirrors can provide visualisation of inaccessible areas. Air blown with a triplex syringe can be used to control fogging. Photos using oral cancer screening adjunct tools, such as fluorescence visualisation (FV) and toluidine blue (TB), will provide additional information but are not required. [Table 1A](#) describes simple steps to capture site specific IO images, with corresponding examples of mirror and camera placement techniques. [Figure 1](#) provides troubleshooting to common issues faced. Storage of patient IO photos in the dental office and sharing with other clinicians should be done in accordance with the policies and legislations of jurisdictional regulatory authorities.

Recommendations for patients

Patients previously under the care of a dental professional for regular monitoring of their oral lesions may feel anxious that their condition is not being followed due to restrictions of in-person consultations as a result of COVID-19. These patients are likely familiar with the location of their lesion and how to monitor for changes at home. We propose that patients send in photos of their lesion for virtual assessment by an oral medicine specialist through a secure cloud sharing application. To capture ideal images, patients should find a location with adequate lighting. If available, light-emitting diode (LED) lights or camping headlamps may provide additional illumination. Patients may need to enlist the help of another individual to manage the camera or to provide proper retraction. Clean hands can be used to pull the cheeks or tongue to ensure that the lesion is clearly visible. However, the photo should not be fully zoomed into the lesion; it is important to include some surrounding structure to provide information on the orientation, site, and size of the lesion. [Table 1B](#) provides site specific recommendations for the capture of IO photos in the home setting, where access to specialised cameras, tools, and equipment are limited. The knowledge of the patient and accessibility of the lesion site would be limiting factors to the taking of IO photos at home. In future, clinicians should demonstrate and educate patients on how to conduct self-examinations to monitor their lesions and to take IO photos as needed.

Conclusion

IO photography can play a key role in maintaining continuity of care for patients with potentially malignant oral lesions or

other oral lesions, not only in the face of COVID-19 but also in preparation for future infectious disease outbreaks or threats. The current shift away from in-person services creates an opportunity to develop platforms and guidelines for digitised routes of care provision. Today's technology enables instant easy capture and sharing of digitised images with smartphone cameras that are widely available. The creation of guidelines for the capture of IO lesion photos will standardise the quality and interpretability of IO images. This will allow for the improvement of clinical care, enable knowledge sharing among professionals and researchers, and open the potential for remote oral mucosal screening programs. Many exciting initiatives are on the horizon; the management structure and patient pool at the Next Gen clinics will allow for the development and testing of a teledentistry platform consisting of an interdisciplinary team of pathologists, oral medicine specialists, and dental professionals. This platform can then be extrapolated to include future workshops to train dental professionals, physicians, and other health care workers in remote areas to take good quality IO photos and further facilitate future remote screening. As technology and global circumstances continue to evolve, paradigm shifts are needed not only to adapt in the face of changing conditions but also to advance the quality of care.

Author contributions

Iris Lin and Madhurima Datta share coauthorship.

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Conflict of interest

None disclosed.

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