Review Article

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Dentistry Section

Role of Intraoral Scanners in the Detection of Dental Caries: A Review

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ABSTRACT

Dental caries is an irreversible, microbial disease of the tooth which is characterised by demineralisation and dissolution of the hard tissues. Conventional methods such as visual and tactile examination, radiography, laser or light induced fluorescence methods help in the diagnosis of dental caries, though they lack sensitivity. Being an irreversible process, it is important to detect the caries process in its incipient stages. Very recently, intraoral scanners have also found their way through to the detection and diagnosis of dental caries, particularly, the incipient lesions. Use of advanced technology for the detection of dental caries in its incipient stages has enabled a change in the paradigm to minimally invasive dentistry which focuses more on a preventive approach to caries management. The present review paper attempts to summarise the available literature on the role of intraoral scanners in caries diagnosis by performing a online search on PubMed, Embase, SCOPUS and MEDLINE databases. Only full text studies authored in English and published in peer reviewed journals between 2010 and 2022 were included in the research. Keywords and terms from both review articles and original research papers were taken. A total of 36 papers were reviewed including full texts and abstracts.

Keywords: Bitewing radiograph, Early enamel caries, Fluorescence, Near infrared radiation

INTRODUCTION

Early identification of dental caries is still one of dentistry's most difficult tasks [1]. The current protocol for the detection of dental caries relies on methods such as visual inspection, clinical and radiographic examination. These methods are known to have limited sensitivity and specificity which is a prerequisite to detect caries early on, when the tooth structure is still capable of remineralising. Recent advances in detection of caries include digital imaging, fibre optic transillumination, quantitative light/laser-induced fluorescence, tuned aperture computed tomography, ultrasound caries detector, Diagnodent [1].

The past decade saw the advent of the use of intraoral scanners in the field of dentistry and very recently its use in the detection of caries has been identified. Intraoral scanners are devices that use image sensors to acquire optical impressions of dentogingival tissues and then build point clouds using built-in scanning software [2]. A laser or Light Emitting Diode (LED) light source facilitates the capture of surface topography of the intraoral tissues by the camera of the scanner. The images are then fed into a software that filters out aberrations before being fed into the manufacturing machine [3,4].

TYPES OF INTRAORAL SCANNERS

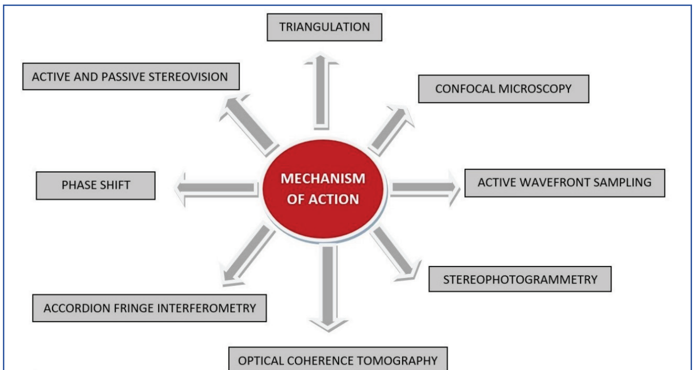
Standalone scanners: These scanners convert intraoral scanning data into 3D models, which they either store as image files or finish the design using Computer-Aided Design (CAD) software [4] [Table/Fig-1].

[Table/Fig-1]: Standalone and all-in-one scanner systems (Image Courtesy: Itero https://itero.com/our-solutions/itero- element-5d, Kazuhiko Suese).

All-in-one scanning platforms with Computer-Aided Design/ Computer-Aided Manufacturing (CAD/CAM) solutions: These scanners design the prosthetic appliances immediately from the optical impression. Hence, it is also called as 'one-day treatment' device [3] [Table/Fig-1].

MECHANISM OF ACTION

The various mechanisms of action of the intraoral scanner systems are demonstrated in [Table/Fig-2] [4-6].



[Table/Fig-2]: Mechanism of action of the intraoral scanner systems.

ROLE OF INTRAORAL SCANNERS IN CARIES DETECTION

Current methods for the diagnosis of dental caries have mainly relied on visual and tactile methods in combination with radiographic examination. However, each of these methods have a set of drawbacks which render them non ideal. With visual examination being highly subjective and technique sensitive, and exposure to ionizing radiation being an area of concern, there is a huge demand for newer imaging technologies that have an increased efficiency and accuracy for the early diagnosis of a carious lesion [7].

The current treatment concept in restorative dentistry mainly focuses on the early detection and diagnosis of caries in order to prevent and avoid an extensive intervention.

Near Infrared Imaging (NIRI) is a useful diagnostic tool for early detection of caries. The scanners based on NIRI use a light having a wavelength of 850 nm in the electromagnetic spectrum which on penetration and interaction with the tooth forms images which are based on the optical properties of the tooth due to the scattering, absorption and transmission of dental tissues in near infrared radiation wavelength [7-9]. Various studies carried out previously demonstrate NIRI and bitewing radiography to have reproducible results [10-12]. However, NIRI would serve to be further advantageous over bitewing radiography in terms of the use of non ionizing radiation.

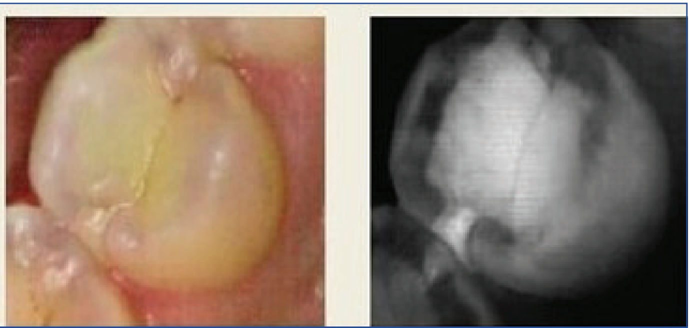
The scanner systems capable of caries detection work on the principle of confocal laser scanning microscopy which is based on the concept of preserving and gathering the in-focus reflected light from the specimen and discarding the off-focus light [13].

Further, imaging technologies utilising this principle employ different sources of light for caries detection.

Near Infrared Transillumination Technology

The iTero Element 5D scanner [Table/Fig-3a], and Planmeca Emerald S scanner [Table/Fig-3c] utilises this technology wherein sound enamel which is transparent to near-infrared radiation due to the limited scattering of light, appears as a dark area by allowing the light to pass through it entirely, whereas sound dentin, due to its orientation of the dentinal tubules, appears bright in a NIRI image due to enhanced scattering of light [14,15]. The iTero Element 5D produces a 3D model, 2D colour photographs, and NIRI images mapped to the 3D model after scanning the area of interest using an optical, non contact mode. However, in early enamel lesions, demineralised enamel would contain gaps that scatter light substantially in the near infrared region. The difference between optical properties of sound enamel, demineralised enamel and the contrast between sound enamel and demineralised enamel, illuminated with near infrared range light with wavelength of 480 nm, which is high, resulting in enamel lesions looking bright [16,17] [Table/Fig-4].

[Table/Fig-3]: a) iTero Element 5D scanner; b) 3Shape TRIOS 4 scanner; c) Planmeca Emerald S scanner.



[Table/Fig-4]: Radiographic detection of incipient caries using nearinfrared radiation. (Image courtesy: Itero https: //itero.com/our-solutions/itero-element-5d, CAD/CAM Solutions Brochure, Planmeca).

Fluorescence Technology

Certain other caries detection scanner systems such as the 3Shape TRIOS 4 [Table/Fig-3b] utilise blue-violet light (415 nm) in contrast to near infrared range light (480 nm), which receive and detect fluorescence signals remitted from dental hard tissues. Such systems rest on a concept similar to the reliable quantitative light-induced fluorescence, allowing higher specificity and sensitivity in results compared to clinical visual examination and radiographic methods and are in fact seen to be comparable to histological assessment of caries detection [18,19]. Michou S et al., found only minor differences between in-vitro and in-vivo diagnostic performances of IOS devices, and concluded different approaches can be investigated for possible optimisation of the IOS devices in caries diagnosis [18].

When blue-violet light is illuminated onto a sound tooth surface, a portion of it is absorbed by fluorophores in the enamel and dentin and re-emitted at a longer wavelength as green fluorescent light. However, presence of demineralisation in the tooth causes the intensity of the green fluorescence to reduce and so the carious lesion appears dark on the fluorescent images [18,19].

By collecting all of the colour information available on the 3D model and assessing any differences in colour signal intensity on the tooth surface, as well as fluorescence variations correlating to sound and demineralised tooth structure, four algorithms identifying red green fluorescence signals (Rfluo, Gfluo) were devised for the intraoral scanner systems - ALG1, ALG2, ALG3 and ALG4 [18,19]. The first three algorithms incorporate the fluorescent information i.e. (ALG1, ALG2, ALG3) while the last one, ALG4 is based on sound tooth colour information. For initial enamel caries, ALG1 and ALG4 were seen to be most accurate (0.70,0.69) and sensitive (0.74,0.71) whereas for caries extending into the outer and middle third of dentin, ALG3 and ALG4 were seen to be most accurate (0.87,0.86) and specific (0.88,0.86) [19].

Intraoral scanner systems have also utilised scoring systems that incorporated the red green fluorescent components on illuminated tooth surfaces into mathematical functions that help quantify the fluorescent signal [19].

f1 - Defined the ratio of red to green fluorescence at the examination sites and allowed quantification of severity of carious lesion.

f2 - The absolute green fluorescence measured at the examination site.

f3 - Defined the ratio of green fluorescence at the examination site and sound tooth surface and allowed quantification of demineralisation of the hard tissues.

f4 - Defined as the ratio of total red to green fluorescence at the examination site to the sound tooth surface.

Assessment of the specificity, sensitivity and accuracy of these functions, using histological evidence as a reference revealed highest collective specificity and sensitivity with f2, f3, and f4 while lowest was seen for f1 [19]. Early detection of a carious lesion allows for preventive steps to be taken. To improve caries diagnosis, researchers have created better and newer approaches with more advanced and sensitive methods over time. [Table/Fig-5] includes various studies comparing intraoral scanners with other methods for incipient caries detection [10,14,20-29].

Advantages and Disadvantages

The recent development of intraoral scanners as an aid for the detection of dental caries serve to be advantageous in early detection and intervention of incipient carious lesion and documentation for long-term follow-up. Also, they help in reducing chairside time and allow easier communication with the patient. However, its limitations can be described in terms of higher equipment costs, the need for a clear, isolated field and difficulty in the detection of caries around the restorative margins.

CURRENT CHALLENGES AND FUTURE PERSPECTIVES

Increasing adoption of dental technologies such as intraoral scanners for diagnosis and treatment planning have seemed to help both, dentists and patients alike in terms of treatment experiences. However, there is limited evidence on their efficiency in caries detection in patients. This could, in part, be due to its high cost, making it uneconomical for a clinical setup. There are various in-vitro and in-vivo studies that have proven intraoral scanners sensitive to detect initial caries which were corelatable with histological findings and have been accepted by standard caries research organisations such as European Organisation for Caries Research (ORCA), though not as gold standard or substitute but as an adjunct diagnostic aid [30].

Authors name of the study	Place of study	Aim of the study	Sensitivity	Specificity	Conclusion
Shimada Y et al., (2020) [10]	Japan	Evaluated the diagnostic accuracy of 3D imaging of intensity-based non polarised Optical Coherence Tomography (OCT) for the diagnosis of posterior proximal caries in molars.	Enamel demineralisation 0.89/0.73 Enamel caries: 0.87/0.59 Dentin caries: 0.85/0.45	Enamel demineralisation 0.73/0.62 Enamel caries: 0.86/0.87 Dentin caries: 0.97/0.91	Optical coherence tomography can be a safer option for the diagnosis of proximal caries in posterior teeth that can be applied to the patients without X-ray exposure.
Lederer A et al., (2018) [20]	Germany	Developed an in-vitro model for the validation of Near-Infrared (NIR) transillumination for proximal caries detection, to enhance Near-Infrared light Transillumination (NIRT) with High Dynamic Range Imaging (NIRT-HDRI).	NIRT Enamel: 0.57 Dentin: 0.82 NIRT-HDRI Enamel: 0.62 Dentin: 0.71	NIRT Enamel: 0.93 Dentin: 0.98 NIRT-HDRI Enamel: 0.92 Dentin: 0.99	Both methods seem to be well suited for proximal caries detection. Distinguishing between demineralised enamel and dentin lesions seems to be a specific problem for NIRT and cannot be balanced using HDRI.
Lederer A et al., (2019) [21]	Germany	To assess the in-vitro validity of Near Infrared Refection (NIRR) for detecting proximal caries compared to Bitewing Radiography (BWR).	NIRR Enamel: 0.13 Dentin: 0.55 BWR Enamel: 0.31 Dentin: 0.55	NIRR Enamel: 0.95 Dentin: 0.98 BWR Enamel: 0.94 Dentin: 1.00	The NIRR and BWR was found to be reproducible methods with comparable diagnostic accuracy.
Kühnisch J et al., (2016) [22]	Germany	Investigated the diagnostic accuracy of NILT as a novel X-ray-free method for proximal caries detection	0.99	0.99	The diagnostic accuracy of NILT achieved the same level as bite-wings for the detection of proximal dentin caries.
Heck K et al., (2021) [23]	Germany	Evaluated the diagnostic potential of near-infrared reflection at 780 nm for early proximal caries detection on the occlusal, buccal and oral surfaces of molars and premolars.	NIRR 0.63 BWR 0.26	NIRR 0.69 BWR 1.00	The NIRR 780 nm is not suitable for reliable detection of early proximal caries, even with the application of an ideal setup and optimised in-vitro conditions.
Litzenburger F et al., (2022) [24]	Germany	Analysed potential of early proximal caries detection using 3D range data of teeth consisting of Near-Infrared Refection (NIRR) images at 850 nm.	NIRR 0.47 BWR 0.27	NIRR 0.75 BWR 1.00	The NIRR achieved diagnostic results comparable to BWR. Trilateral NIRR assessments overestimated presence of proximal caries, revealing stronger sensitivity for initial caries detection than BWR.
Stratigaki E et al., (2020) [25]	Switz-erland	Validated a NILT device for the detection of proximal caries lesions and compared to Bitewing Radiography (BWR).	NILT Enamel: 1 Dentine: 1 BWR Enamel: 0.73 Dentine: 0.81	NILT Enamel: 0.41 Dentine: 0.98 BWR Enamel: 0.88 Dentine: 1	The NILT seems to be a valuable diagnostic tool for dentinal caries detection. However, there exists an uncertainty in detection of enamel caries. Useful in cases of growing children and pregnant women and for monitoring of primary carious lesions.
Haak R et al., (2002) [26]	Germany	To examine the validity of proximal caries detection supported by different optical magnifications.	Without magnifying aid 0.55 Prism loupe 0.52 Microscope 0.49	Without magnifying aid 0.83 Prism loupe 0.81 Microscope 0.82	Only moderate validity of caries detection was achieved with visual inspection of proximal sites. The use of a prism loupe or a surgical microscope does not improve the ability to detect proximal carious lesions.
Yoon HI et al., (2017) [27]	Korea	Evaluated in-vitro the validity of Quantitative Light-induced Fluorescence-Digital (QLF-D) and laser fluorescence (DIAGNOdent) for assessing proximal caries.	0.78	0.86	The NIRR and BWR was found to be reproducible methods with comparable diagnostic accuracy.
Melo M et al., (2017) [28]	Spain	Evaluated clinically the ability of Near-Infrared Light-Transillumination (NILT) for proximal dentinal caries detection compared to Direct Digital-Radiography (DDR)	NILT 0.98 DDR 1.00		The NILT showed sensitivity similar to that of DDR and higher correlation than DDR for approximal dentinal caries detection and hence may be used to monitor the progression of caries without exposing the patient to ionizing radiation, particularly for pregnant women. The combination of NILT and DDR represents an increase in the diagnosis of approximal lesions.
Dundar A et al., (2020) [29]	Turkey	Compared the diagnostic performance of NILT (DIAGNOcam) device with other methods including visual examination (ICDAS), Bitewing Radiography (BW), an LED-based device and laser fluorescence device.	NILT 0.99 LED 0.94 VE 0.64 LF pen 0.81 BW 0.86	NILT 0.94 LED 0.80 VE 1 LF pen 0.85 BW 0.95	The NILT showed the best performance in detecting proximal dentinal caries.
Schlenz MA et al., (2022) [14]	Germany	Investigated new caries diagnostic tools, including three intraoral scanners, and compared them to established diagnostic methods in primary and permanent teeth.	Occlusal VE 0.660 BWR 0.592 Diagnocam: 0.921 TRIOS 4: 0.806 iTero Element 5D: 0.759 Planmeca Emerald S: 0.963 Proximal VE 0.227 BWR 0.591 Diagnocam 0.818 TRIOS 4 0.545 iTero Element 5D 0.545 Planmeca Emerald S 0.727	Occlusal VE 0.991 BWR 0.730 Diagnocam 0.626 TRIOS 4 0.704 iTero Element 5D 0.670 Planmeca Emerald S 0.774 Proximal VE 0.750 BWR 1.000 Diagnocam 0.712 TRIOS 4 0.738 iTero Element 5D 0.6900 Planmeca Emerald S 0.900	For proximal carious lesions, BWR is non substitutable, however, Planmeca Emerald S showed better results than radiography.

[Table/Fig-5]: Various studies comparing intraoral scanners with other methods of incipient caries detection [10,14,20-29].

Over the years, dentistry has undergone tremendous transformation from traditional, invasive methods to unconventional, reliable, minimalistic methods for caries detection. Increasing demand for highly sensitive methods of caries detection through intraoral scanners would not only allow a shift in the caries management protocol to conservative restorative procedures, but could also motivate dentists and patients to adopt caries preventive measures, owing to their high sensitivity.

CONCLUSION(S)

By addressing one of the most challenging aspects of preventive dentistry, intraoral scanners have helped significantly in the diagnosis of incipient dental caries, enabling patients to avail preventive treatments. It also makes for a better medical experience by reducing patient discomfort, risks of cross infection and clinician's chairside time. High adoption of intraoral scanners would be a huge step in the evolution of dental diagnosis, serving as efficient adjuncts to the conventional diagnostic aids.

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REFERENCES

[1] Baltacioglu IH, Orhan K. Comparison of diagnostic methods for early interproximal caries detection with near-infrared light transillumination: an in-vivo study. BMC Oral Health. 2017;17(1):130.
[2] Mangano F, Gandolfi A, Luongo G, Logozzo S. Intraoral scanners in dentistry: A review of the current literature. BMC Oral Health. 2017;17(1):149.
[3] Suese K. Progress in digital dentistry: The practical use of intraoral scanners. Dent Mater J. 2020;39(1):52-56.
[4] Atieh MA, Ritter AV, Ko CC, Duqum I. Accuracy evaluation of intraoral optical impressions: A clinical study using a reference appliance. J Prosthet Dent. 2017;118(3):400-05.
[5] Coutinho CA, Hegde D, Shetty S, Iyer R, Priya A. Intraoral scanners: A narrative review. Journal of Research in Dentistry. 2020;8(1):01-09.
[6] Richert R, Goujat A, Venet L, Viguie G, Viennot S et al. Intraoral Scanner Technologies: A Review to Make a Successful Impression. J Healthc Eng. 2017;12:01-09.
[7] Abdelaziz M, Krejci I. DIAGNOcam- a Near Infrared Digital Imaging Transillumination (NIDIT) technology. Int J Esthet Dent. 2015;10(1):158-65.
[8] Schwendicke F, Elhennawy K, Paris S, Friebertshäuser P, Krois J. Deep learning for caries lesion detection in near-infrared light transillumination images: A pilot study. J Dent. 2020;92:103260.
[9] Near infrared imaging (NIRI) technology in dentistry - iTero Element 5D. iTero Global Education, 1-15. Align Technology, Inc; 2019. Available from: https://storagy-itero-production-us.s3.amazonaws.com/download/en/iTero-Element-5D-Clinical-Guide.pdf
[10] Shimada Y, Burrow MF, Araki K, Zhou Y, Hosaka K, Sadr A, et al. 3D imaging of proximal caries in posterior teeth using optical coherence tomography. Sci Rep. 2020;10(1):15754.
[11] De Zutter M, Vandenbulcke JD, Van Acker JWG, Martens LC. In-vivo correlation of near-infrared transillumination and visual inspection with bitewing radiography for the detection of interproximal caries in permanent and primary teeth. Eur Arch Paediatr Dent. 2020;21(4):509-18.
[12] Ozkan G, Guzel KGU. Clinical evaluation of near-infrared light transillumination in approximal dentin caries detection. Lasers Med Sci. 2017;32(6):1417-22.
[13] Hwang HHM, Chou CW, Chen YJ, Yao CCJ. An overview of digital intraoral scanners: Past, present and future-from an orthodontic perspective. Taiwan J Orthod. 2020;30:148-62.
[14] Schlenz MA, Schupp B, Schmidt A, Wöstmann B, Baresel I, et al. New Caries Diagnostic Tools in Intraoral Scanners: A Comparative In Vitro Study to Established Methods in Permanent and Primary Teeth. Sensors (Basel). 2022;22(6):2156.
[15] Fried D, Glena RE, Featherstone JD, Seka W. Nature of light scattering in dental enamel and dentin at visible and near-infrared wavelengths. Appl Opt. 1995;34(7):1278-85.
[16] Pham TH, Nguyen KT, Thi PA, Thi MN, Thi MH. Design and manufacture of a device using transillumination and scattering near-infrared techniques for detecting dental lesions. Kalpa Publications in Engineering. 2020;14(3):42-48.
[17] Pham TH, Le PD, Ta TK. Attempting near-infrared transillumination imaging with simple instrumentation for studying dental lesions. Vietnam Journal of Science, Technology and Engineering. 2019;61(2):42-46.
[18] Michou S, Lambach MS, Ntovas P, Benetti AR, Bakhshandeh A, et al. Automated caries detection in-vivo using a 3D intraoral scanner. Sci Rep. 2021;11(1):21276.
[19] Michou S, Benetti AR, Vannahme C, Hermannsson PG, Bakhshandeh A, et al. Development of a Fluorescence-Based Caries Scoring System for an Intraoral Scanner: An in vitro Study. Caries Res. 2020;54(4):324-35.
[20] Lederer A, Kunzelmann KH, Hickel R, Litzenburger F. Transillumination and HDR Imaging for Proximal Caries Detection. J Dent Res. 2018;97(7):844-49.
[21] Lederer A, Kunzelmann KH, Heck K, Hickel R, Sochtig F. In-vitro validation of near-infrared reflection for proximal caries detection. Eur J Oral Sci. 2019;127:515-22
[22] Kühnisch J, Söchtig F, Pitchika V, Laubender R, Neuhaus KW, Lussi A, et al. In-vivo validation of near-infrared light transillumination for interproximal dentin caries detection. Clin Oral Investig. 2016;20(4):821-29.
[23] Heck K, Litzenburger F, Geitl T, Kunzelmann KH. Near-infrared reflection at 780 nm for detection of early proximal caries in posterior permanent teeth in vitro. Dentomaxillofac Radiol. 2021;50(6):20210005.
[24] Litzenburger F, Heck K, Kaisarly D, Kunzelmann KH. Diagnostic validity of early proximal caries detection using near-infrared imaging technology on 3D range data of posterior teeth. Clin Oral Investig. 2022;26(1):543-53.
[25] Stratigaki E, Jost FN, Kühnisch J, Litzenburger F, Lussi A, et al. Clinical validation of near-infrared light transillumination for early proximal caries detection using a composite reference standard. J Dent. 2020;103:100025.
[26] Haak R, Wicht MJ, Hellmich M, Gossmann A, Noack MJ. The validity of proximal caries detection using magnifying visual aids. Caries Res. 2002;36(4):249-55.
[27] Yoon HI, Yoo MJ, Park EJ. Detection of proximal caries using quantitative light-induced fluorescence-digital and laser fluorescence: a comparative study. J Adv Prosthodont. 2017;9(6):432-38.
[28] Melo M, Pascual A, Camps I, Ata-Ali F, Ata-Ali J. Combined Near-Infrarred Light Transillumination and Direct Digital Radiography Increases Diagnostic In Approximal Caries. Sci Rep. 2019;9(1):14224.
[29] Dündar A, Çiftçi ME, İşman Ö, Aktan AM. In-vivo performance of near-infrared light transillumination for dentine proximal caries detection in permanent teeth. Saudi Dent J. 2020;32(4):187-93.
[30] Ntovas P, Michou S, Rahiotis C, Kakaboura A. Caries detection using intraoral scanner under in vivo and in vitro conditions [abstract]. In: Proceedings of the 67th congress of European Organisation for Caries Research (ORCA). 2020;9-11: Abstract 178. P.443.

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