Intraoral ultrasound to measure tumor thickness and depth of invasion in oral cancer: Narrative review

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AIM

Oral Squamous Cell Carcinoma (OSCC) tends to invade the surrounding tissue and to metastasize to the regional neck lymph nodes (local metastasis), while its incidence of haematogenous metastasis (distant metastesis) is infrequent and late. For this reason, the surgical treatment of the primary tumor cannot be considered complete without the neck evaluation.

Regarding the TNM staging system, neck dissection is recommended in T3, T4 lesions and/or with also preoperative positive neck involvement. Instead, the management of patients with early stage OSCC, with clinical negative lymph nodes involvement, is still controversial. "Wait and See" approach has been shown to be accompanied by a high percentage of occult metastases after the surgical treatment. The neck dissection proved to be an overtreatment in 70% of patients without OSCC at the clinical and radiographical level. The presence of occult metastasis to the cervical lymph nodes can lead to a reduction in the probability of disease control and shortens the survival of patients. Occult metastasis may occur in up to 40% of patients but the rate is found to be higher in tumors of the tongue and floor of the mouth. The exact depth of cut-off point, in which it would be advisable to decide to treat the neck, is still in doubt. In fact, Pentenero M. et al., in a review demonstrate that the depth of cut-off point varies from 2 mm to 8 mm[1]. A precise preoperative assessment of the Tumor Thickness (TT) and Depth Of Invasion (DOI) would provide useful information for targeting patients in need to elective treatment of the neck. To measure the TT and DOI, several diagnostic techniques are available such as Magnetic Resonance Imaging (MRI), Computed Tomography (CT) and Ultrasonography (US). The limitation in the use of MRI and CT is the difficulty to differentiate tumors with thickness

less than 5 mm from the surrounding tissues. Recently, the development of US technology with the introduction of intraoral small probes, similar size of a tooth brush, allows the direct evaluation of tumor. In addition, US has several advantages such as being harmless, radiation free, widely available, easy-to-use, non-invasive, low cost, and unaffected by metal artefacts such as dental restorations. Disadvantages of US include difficulty in imaging intra-bony structures and its dependence on a skilled operator.

The aim is to discuss the state of knowledge of the accuracy of intraoral Ultrasound (US) in determining TT and DOI in OSCC. The literature evaluation will be carried out based on expert opinion.

MATERIALS AND METHODS

A search was performed using PubMed (MEDLINE), Embase and Cochrane databases, for original articles published from June 1990 to February 2018. The following keywords were used in combining more keywords: "ultrasound, ultrasonography, sonography, intraoral, oral cancer, oral tongue carcinoma" and the Boolean operators "AND" and "OR". Titles and abstracts were screened to determine relevance to our topic. Articles were selected when (1) the studied population consisted of patients with OSCC; and (2) preoperative or intraoperative measurement of tumor thickness or tumor depth was performed by intraoral US; and (3) when these measurements were compared with histopathological data. It is excluded from this search: articles not published in English, case reports, letters to the editor and/or no-human studies.

RESULTS

15 articles, that analyzed 565 patients, were selected. All the reviewed articles used the intraoral US in the OSCC diagnosis and management. The intraoral US probes operated on frequencies ranging from 5 to 17 MHz. Most tumors were OSCC of the tongue (n = 410 tumors); the remaining tumors were situated in floor of the mouth (n = 15, 4%); buccal mucosa (n = 13, 3%); gingiva (n = 1, < 1%); lip (n = 1, < 1%) and not specified (n = 22, 6%). Most of the included patients in the studies were suffering from early-stage tumors. The correlation between intraoral US and histopathological thickness measurements in tongue tumors was high in these studies.

DISCUSSION

TT or DOI are two parameters that are widely used and studied. It has been reported their possible ability to predict occult nodal metastasis. The two terms are used interchangeably in many articles, including some of those analyzed in this review. Therefore, it is important to highlight the difference between them. TT is the distance measured from the tumor surface to the deepest invasion point, while DOI is defined as the distance from the adjacent epithelial surface to the deepest invasion point of the tumor. The increase of DOI and of the microvascular proliferation caused by neoplastic growth might determine proximity of the tumor to blood vessels and lymphatics, and facilitate the prediction of the tumor's ability to metastasize.

The usage of intraoral US for pre- or intraoperative TT measurements in patients with early-stage tumors in almost all the studies can be explained due to its significant and beneficial impact on the surgical resection and treatment plan decision for this kind of patients[2]. The probe of US can be applied in two modalities in direct contact or in non-contact technique. Almost all the studies use direct contact with a careful manner avoiding the distortion of the surrounding structures. Few studies used the non-contact technique by filling the mouth with saline and measure the TT without touching the tumor. Overestimation and underestimation of US of TT measures are reported in many studies. These may highlight many factors to be considered for future studies such as the occurred shrinkage of the specimen after surgical resection, the time interval between the US measures and the surgical procedure, and the use of wide range of intraoral US transducer. The application of intraoral US in almost all the articles is focused on OSCC on the tongue[3]. Thus, performing more studies on other subsites is a must to achieve a reliable conclusion.

Intraoral US seems to be a reliable tool in determining preoperatively the TT and DOI in early-stage that may help for more precise decision and selection of cases for elective neck treatment without the risk of under-treatment. Further studies are needed to investigate if intraoral US has the same accuracy for other subsites in the oral cavity and if it can reduce the need of surgical resections or adjunctive treatments (radio- or chemotherapy) with subsequent improvement of the quality of the life of the patients.

Keywords: tumor thickness, Oral Squamous Cell Carcinoma (OSCC), ultrasonograph, Oral Cancer (OC), intraoral ultrasound

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