

# Recent Advancements in Imaging of Oral Cancer

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## Abstract

In oral fissure, “squamous cell carcinoma (SCC) “is the commonest oral carcinomas which comprises (90-95%). After the 5<sup>th</sup> decade of age, male predilection is double as compared to females. (40%)of OSCC are confined to the dorsal or ventral surface of the tongue,(thirty percent)on the floor of the oral fissure. “OSCC” regularly distresses maxillary and mandibular attached gingiva, buccal mucosa, retro-molar and palatal region. In 5 years’ survival percentage series from 20% {OSCC in the floor of the mouth} to 60% {OSCC in alveolus portion of jawbone} depicting poor prognosis. Although it is tough but it is required to do imaging studies to understand the results at the initial phases of the disease. Various modalities include {conventional plain film radiography, panoramic radiograph, cone beam computed tomography, Perfusion computed tomography, Magnetic resonance imaging–(diffusion-weighted MRI, dynamic contrast-enhanced MRI), ultrasonography, single-photon emission computed tomography}, fusion techniques such as (ECT/CT, CT/MRI, PET/CT, PET/MRI) along with nuclear medicines – (2-deoxy-2-[18F] fluoro-D-glucose), (18F-FDG), 18F-3-fluoro-alpha-methyltyrosine, (18F-FAMT) and L-1-[11C]-tyrosine(C-tyrosine), radionuclide imaging. These various imaging diagnostic modalities support in the grading of the tumor, valuation of the vascular supply, resolution about metastasis combined with confined lymph nodes as well as detached organs. Furthermore, imaging lessons help to forecast the possibility of resection and advance management, graft establishment, and diversity amongst reactive and metastatic lymph nodes, and amongst diseases reappearance and marks or adversative reactions of post-operation or emission therapy.

**Keywords:** Oral squamous cell carcinoma, imaging modalities, radionuclide imaging.

## Introduction

Ninety percent of oral cancers are the squamous cell carcinoma .75% of oral cancer occurs due to our lifestyle changes. Two decades ago there were 20% of HPV related cancer, now it has been a great hike to 50%. HPV related oral cancers are 6-7 times more likely to occur in men compared to women. Five persons die daily in every hour in India.<sup>8</sup> Oral cancer occurs due to various factors like tobacco consumption, human papillomavirus, genetic factors, etc. As it is adversely affecting the globe we should have a good diagnostic procedure for better treatment planning.<sup>1</sup>

### Importance of Imaging of Oral Cancer:

- To know the extent of disease.
- Resectability
- Preservation of form and function

- To know distant or occult metastasis
- To know the dissemination and invasiveness of bone.<sup>7</sup>

Imaging modalities like (conventional plain film radiographs, panoramic radiographs, computed tomography, magnetic resonance imaging, ultrasonography, single-photon emission computed tomography, positron emitted tomography, fusion or hybrid imaging such as pet –ct, pet –MRI, etc).

**Conventional Plain Film Radiographs:** The distinctive structures of metastatic lesions in this radiograph depict cortical lamina degeneration, osteolytic weaknesses with solitary and multilocular with an initial osteosclerotic shell. In advanced phases, the crests of jawbone weaknesses becomes even and teeth fail its bony maintenance on the position of penetration ailment reappearance and marks or adversative responses afterward surgery or emission therapy.<sup>1</sup>

**Panoramic Radiograph:** In “panoramic radiographs”, participation of the facial bony structures can’t be evaluated, because onceosseous tissues are damaged larger than 30%, the radiolucencies are suggestively amplified. Plain radiographs cannot assess soft tissues structures, reveals valuation of bone contribution on this radiographs have a 75% sensitive value 100% specific value .<sup>1</sup>

**Positron Emitted Tomography:** {F-Fluorodeoxyglucose positron emission tomography} (F-FDG PET) is a practical imaging technique that delivers data approximately tissue absorption and receipts been successfully functional to the estimation of head and neck carcinomas. PET is created on recognizing amplified glycolytic activity in menacing cells, in which radio labeled FDG is specially focussed due to rises in membrane glucose carriers and in hexokinase, an enzyme which phosphorylates glucose. Subsequently phosphorylation, radiolabeled FDG stays to gather in growth cells instead of glycolysis, permitting imaging by PET. (F-FDGPET) is extradelicate in comparison to CT or MRI to identify cervical node metastases.

It helps to identify metastatic nodes which are morphologically standard. It discovers distant and occult metastasis. It detects recurrences and used for treatment evaluation. It is used for planning adjuvant for chemotherapy or radiotherapy. It is a prognostic indicator with CT or any fusion imaging.

PET alone cannot delineate the extent of the tumor. It has are duced anatomic resolution.<sup>2</sup>

**Magnetic Resonance Imaging:** It is the procedure that affords the maximum image value of soft tissues deprived of involving ionizing radiation, lacking any genetic risks. MRI is used to evaluate the degree of loco-regional tumor range, penetration of incursion and level of lymphadenopathy. The invasion of the floor of the oral cavity by the tumor is represented well in the coronal plane. Non-contrast T1W arrangements depicts cortical erosion and marrow invasion. Contrast-enhanced T1W images benefit evaluate marrow invasion, perineural spread, soft tissue extent, tumor depth and best demonstrate necrosis in nodes. The T2W images are sensitive to the presence of tumor tissue, which is usually hyperintense compared with the surrounding tissue.<sup>3</sup> It helps in surgical planning and assessment of problems that can occur during or after surgery. Limitation is the artifacts of ferromagnetic prosthesis

of jaws.<sup>11</sup> DWI {DIFFUSION WEIGHTED MRI} can be accommodating in evaluating the initial answer of the tumor to chemotherapy. DCE-MRI {DYNAMIC CONTRAST ENHANCED MRI} helps in evaluation of micro vascularity and perfusion of tumor which can be estimated, which can help to forecast result.<sup>1</sup>

**Ultrasonography:** It is the imaging modality used for the evaluation of apparent diseases, lymph nodes as well as to guide needle aspiration biopsies. It is applied to know the microvascular changes, depicts the elevated vascularity within the tumor. It is used for the evaluation of the size and thickness of soft tissues. Intraoral USG along with colour Doppler helps in assessing the involvement of lymph nodes. USG guided FNAC gives a hint of nature and site of the primary tumor, helps in better assessment of pre and post-therapy. It also helps in confirmation of metastasis.<sup>10,16</sup>

**Computed Tomography:** This imaging modality helps in the detection of the primary tumor. It depicts the bony invasion of the lesions. It cannot appreciate the recurrence of the lesion, cannot differentiate the surgical scar as well as the adverse reaction of post-radiotherapy. “Contrast-enhanced CT” able to precisely control lymph node metastases which can be originally appeared regular, despite the existence of micro metastasis identified in microscopic lessons. The sensitive value of CT in identifying tumors is (41–82%) (specific value 82–100%) and to determine bony infiltration (63–80%) (specific value 81–100%), respectively.<sup>1,13</sup>

**Perfusion Computed Tomography:** It is used to assess the participation of the surrounding tissues by assessing the perfusion of the tumor origin accurately,<sup>12</sup> tumor is categorized through amplified (blood volume) (BV) and (blood flow) (blood flow) in contrast with healthy tissues. This results from neoangiogenesis in the tumor. It is recommended that perfusion Computed Tomography is higher to Computed Tomography as favours valuation for mass engrossment.

**Cone Beam Computed Tomography:** High radioactivity dose, cost, availability, longer scanning time, poor determination and trouble in interpretation have led to restricted usage of CT which can be overwhelmed with CBCT, which delivers several potential benefits for Oral & Maxillofacial imaging, associated with conventional CT. The limitation of CBCT is the artifact impairs image value and boundary acceptable visualization of constructions in the dentoalveolar region. Artifacts can

be due to beam hardening (results in cupping artifact and stripes and dark bands), Patient-related artifacts (Patient movement resulting in unsharpness of reconstructed image), Scanner related artifacts (circular or ring-shaped) and cone-beam-related artifacts (partial volume averaging, under-sampling, and cone-beam effect. Image noises due to the large volume being exposed during CBCT scanning causing in heavy communications with tissues creating scattered radiation, which in turn clues to nonlinear diminution by the detectors.<sup>4</sup>

### **Single Photo Emission Computed Tomography:**

This imaging modality helps in the mapping of metabolic activity. It helps to locate the sentinel lymph node. It helps to evaluate the distance of sentinel lymph node to skin. It detects the fluidity of lymph into the sentinel node. It accurately detects bony involvement as well as the relation to the surrounding structures.<sup>9,15</sup>

**Radionuclide Imaging:** “Radionuclide imaging” is the procedure which is a non-invasive functional imaging procedure, which provides data of physiological as well as biochemical processes pathologically).<sup>5</sup>

**Lymph Node Scintigraphy:** Lymphoscintigraphy is used as a radioisotope procedure for the planning of sentinel lymph nodes. It takes the advantage of constant turnover of bone in response to metabolic or mechanical demands. Most diseases including bone end in amplified turnover or new development of bone. On scintigraphy, these areas perform as areas of amplified radio nuclide acceptance, called “hot spots.” Lower acceptance is associated with metabolically inactive bone, deficient osteogenesis, or an absent vascular supply. It also designates a lack of reparative response and suggests the presence of a violent lesion. Photon-deficient region or photopenic abnormalities are those areas where there is diminished or absence of uptake and are called “cold spots.”<sup>5</sup>

### **Radio-Isotope Imaging in Oral Cancer:**

{Carbon-11, Nitrogen-13, Oxygen-15, Fluorine -18}

It can be applied in positron emitted tomography images with the usage of (F-18) in FDG which helps for detecting, identify and distinguish the prediction of tumor.

{Cobalt-57}

It is used as a mode of (detector) of hypertrophy

of cells, indirectly control the partition, advancement of cells growth to stimuli.

{Gallium -67}

It is applied for imaging the size of the tumour.

{Gallium -68}

It is applied in PET examination to distinguish metastatic action of the lesion.

Advantages of nuclear medicine:-

- Beneficial for initial analysis of diseases and assessment of management properties in the early post-therapeutic period.
- Permits simple demonstration of entire-body images and interactive display, which helps to notice metastatic action.
- It gives anatomical knowledge that is used for the diagnosis of diseases.
- Thorough investigations that can be accomplished at different sites as well as on multiple times afterward injection of a tracer isotope to illuminate conclusions deprived of growing radioactivity contact, distinct another simple procedure where there is the numeral of exposures.

### **Drawbacks of nuclear medicine:**

- Though divergence of lesion against adjacent tissues is higher when radiotracers gather in the lesion, having a spatial resolution, generally, is poor with comparison to radiographs, Computed Tomography or Magnetic Resonance Imaging.
- The price of equipment which is applied is relatively expensive.
- The price of an individual investigation is dependent on the charge of radio drugs applied and the competency of the scanner.
- The Patients are unprotected of ionizing radioactivity managed to build.<sup>6</sup>
- Emission contacts are very much unlike from radiographs and computed tomography, which includes peripheral as well as in general imply partly body contact, radionuclide control patients cause internally entire body coverage in a non-uniform method firm by the bio circulation and permission kinetics of that tracer.

- Because of inevitable higher radiation from positron emitted tomography tracers to the staff people, interacting with radioactive patients, it is recommended that a 6 mm dense lead protective is not logical.

**Inference:** As the oral cancer progressing so rapidly we should prevent it by diagnosing accurately and doing treatment planning accordingly. For diagnosing carcinomas various imaging modalities are used like two-dimensional imaging like conventional plain film radiographs or panoramic radiographs are used to know the bony extension of the lesion, three dimensional like computed tomography, magnetic resonance imaging or any fusion imaging is used like PET-CT, PET-MRI these are used to know the assess the recurrence, evaluation of lymph node, peri-neural invasion, Lymphoscintigraphy is used to assess the sentinel lymph node. Nuclear medicine is used to know the initial phase of the lesion and post-operative action.

**Diagnostic protocol for (detecting, staging and following up of patients with oral carcinomas)**

- To assess the primary tumor size-contrast-enhanced computed tomography, magnetic resonance imaging.
- To detect metastases in regional lymph nodes – ultrasonography, magnetic resonance imaging, computed tomography.
- To know response to radiation therapy and chemotherapy- perfusion computed tomography, magnetic resonance imaging with perfusion and diffusion.
- To locate the distant metastases-positron emitted tomography, single-photon emission computed tomography, fusion imaging modalities like {PET/CT, PET/MRI}.
- To detect the recurrence-perfusion computed tomography (PCT), magnetic resonance imaging (MRI) with diffusion, magnetic resonance imaging (MRI), positron emitted tomography, fusion imaging modalities like {PET/CT, PET/MRI} 14

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