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The Role of MRI and CECT in Evaluation of Oral Cavity Malignancy and Its Staging

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Abstract: ***Background: Oral cavity cancers, predominantly squamous cell carcinomas, constitute nearly one-third of all malignancies in India and continue to pose a major clinical challenge. Accurate staging is essential for optimizing treatment outcomes, with imaging playing a pivotal role. Objective: To compare the diagnostic performance of Contrast-Enhanced Computed Tomography (CECT) and Magnetic Resonance Imaging (MRI) in the pretreatment staging of oral cavity cancers, using histopathology as the reference standard. Methods: A prospective analysis of 41 patients with histopathologically confirmed oral cavity cancers was undertaken. All patients underwent both CECT and MRI, and imaging findings were compared with histopathological staging. Results: MRI demonstrated superior soft tissue contrast and more precise delineation of tumor extent compared to CECT. MRI was particularly effective in detecting subtle extensions into adjacent anatomical spaces and identifying metastatic spread, findings that were frequently under detected by CECT. Conclusion: MRI offers greater accuracy than CECT in the staging of oral cavity cancers and provides critical detail for surgical planning and prognostication. While its routine adoption is limited by cost and accessibility, MRI should be strongly considered as a complementary imaging modality in comprehensive pretreatment evaluation.***

Keywords: Oral cancer staging, MRI v CT, Squamous cell carcinoma, head and neck imaging and radiological diagnosis

1. Introduction

Oral malignancies constitute over 30 % of malignancies in India.The commonest malignancy in the oral cavity is Squamous cell carcinoma. The imaging of oral cavity and its subsites is considered complex. For each subsite, it is important to know the patterns of spread of the malignancy. Radiological imaging plays an important role by providing accurate staging, in assessing respectability and thus in planning multimodality treatment.

Contrast Enhanced Contrast Tomography (CECT) is being widely used for evaluation, pretreatment assessment of oral cavity malignancies as it is more patient compliant and can be performed at much cheaper cost. The complexity of the anatomy of oral cavity and the need for increased soft tissue resolution to identify intrinsic details demands other imaging modalities for accurate pretreatment planning. MRI with its ability to produce excellent soft tissue resolution is considered an adjunct or potential replacement for CECT to assess oral cavity malignancy.

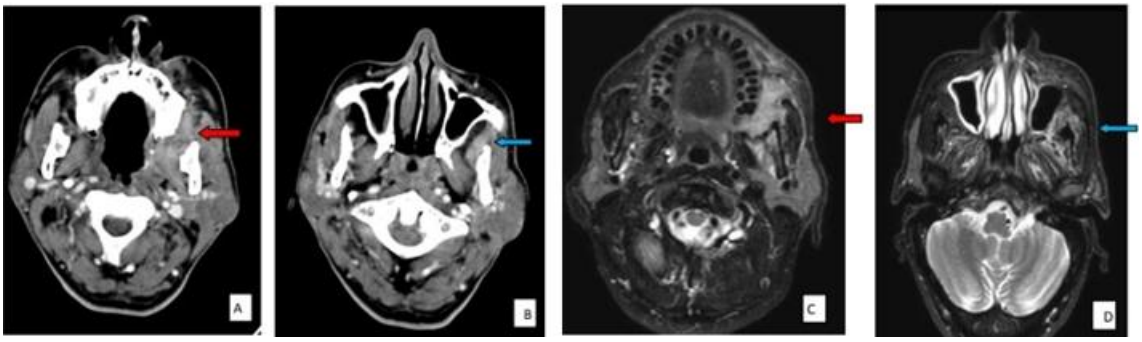
Aims and Objectives of the Study
To establish the significance of the role played by MRI in evaluation of oral cavity malignancy and its staging.

Objectives of the study
- To evaluate the role of MR imaging in staging of oral cavity tumors and to assess sensitivity and specificity of the same.
- To compare CT staging with histopathological staging.
- To compare MR imaging staging with histopathological staging.

2. Materials and Methods

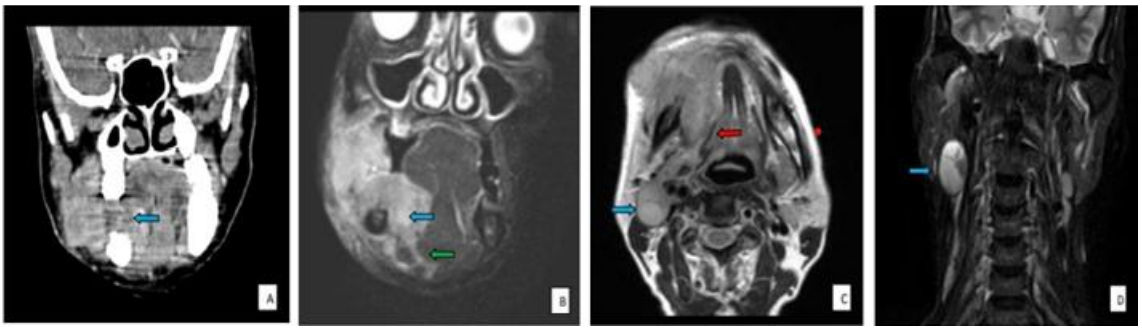
Sample size: 41Sampling technique: Convenience samplingAt first, using Siemens SomatomEmo 6 – slice CT scanner plain serial axial sect ions from scalp to thoracic inlet were obtained. Subsequently, intravenous contrast (Iohexol) was administered and serial axial sect ions were obtained. Subsequently, using Philips 1.5 TESLA MRI machine T2W axial, DWI axial and STIR axial sequences were obtained.

Case 1
CECT Axial sections shows A) involvement of left Retromolar trigone (Red arrow) & B) Cranial extension into the pterygo maxillary fissure (Blue arrow) Corresponding Axial STIR MRI image shows similar findings in C and D



Case 2

A) Coronal reformation of CECT shows tumor in right lower gingivobuccal mucosa extending into sublingual space (Blue arrow), adherent to tongueB) Corresponding STIR coronal image shows similar findings (Blue arrow) found in CECT with an additional information on signal changes in the right mylohyoid (Green arrow) suggesting involvement of floor of mouthC) T2 axial image shows tumor margin indenting and causing signal changes in right hyoglossus (Red arrow)D) STIR coronal image shows enlarged right level II lymph node (Blue arrow) – suggestive of metastasis

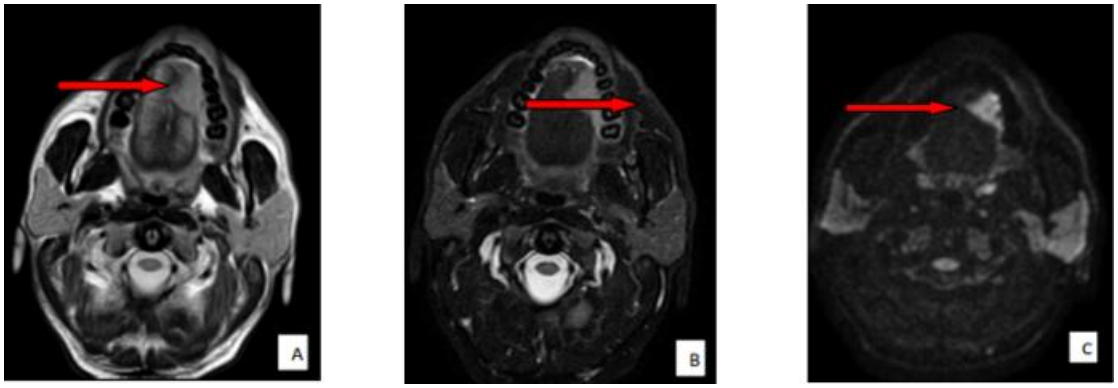


Case 3

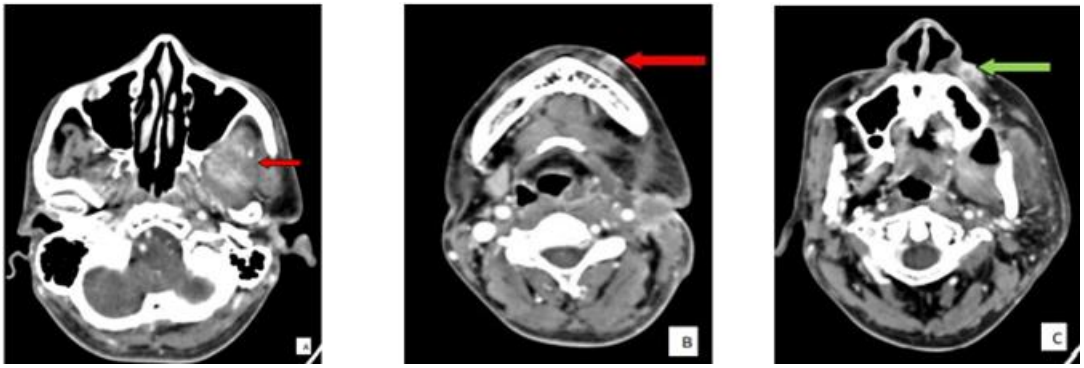
CECT Axial section Soft tissue (A) and Bone window (B) shows a small left lower gingival lesion (red arrow) causing erosion of adjacent mandible. STIR Axial MRI shows similar finding with additional information on marrow signal changes (Red arrow) which is not seen on CECT.

Case 4

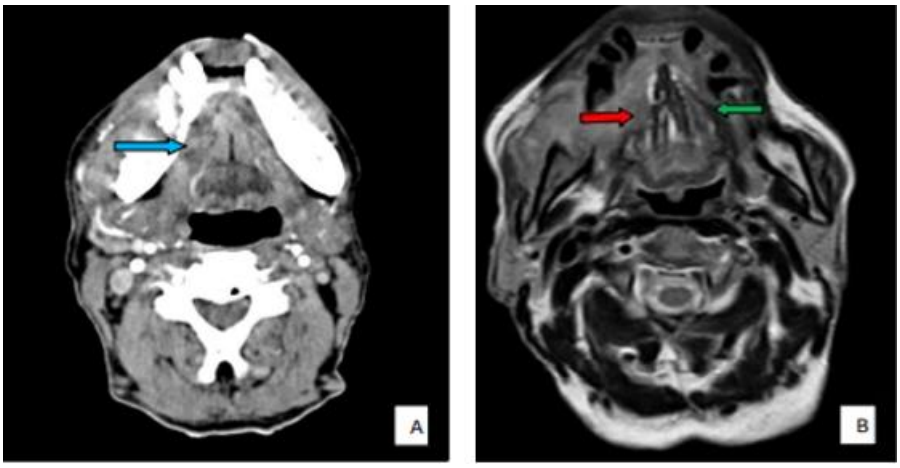
On CECT superficial ulcer was seen. Corresponding MRI axial images A) T2WI B) STIR C) DWI shows internal extent of the lesion (Red arrow) which reaches upto median lingual septum



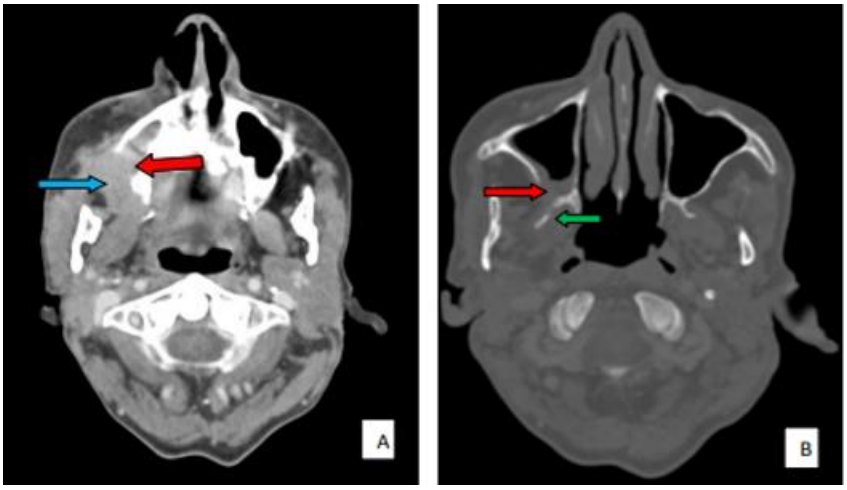
Case 5
A case of left gingivobuccal CA Axial CECT section shows extension of tumor into the A)left Pterygomaxillary fissure (Red arrow) Axial CECT section shows nodular metastasis in B) subcutaneous plane of lower lip (Red arrow) C) left Premaxillary region (Green arrow)



Case 6
A) CECT axial section shows extension of right lower gingivobuccal tumour invading the tongue (Blue arrow) B) T2 Axial image shows tumour margin causing signal changes and partial non visualisation of right styloglossus (Red arrow) suggestive of invasion which was not detected on CECT. Normal left styloglossus (Green arrow)

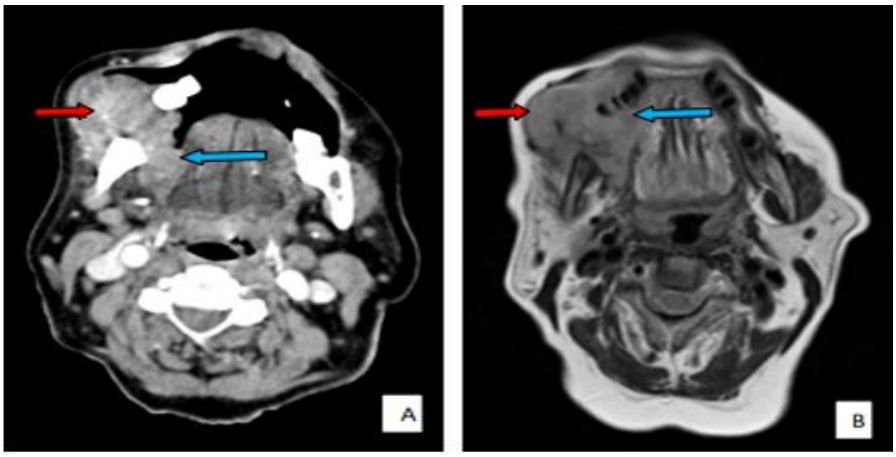


Case 7
A) Axial CECT section shows tumor extending through the pterygomaxillary fissure (Blue arrow) into the right maxillary sinus eroding the lateral wall (Red arrow) B) Bone window shows erosion of right lateral pterygoid plate (Green arrow)



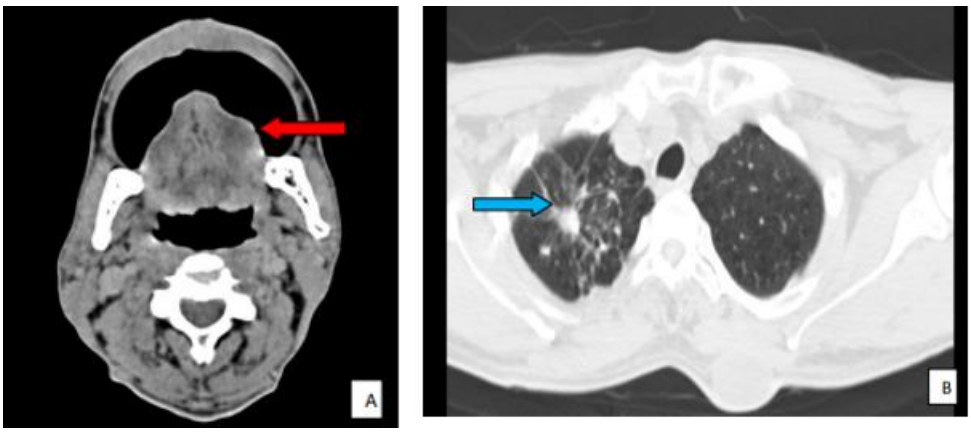
Case 8

A) Axial CECT section & B) T2WI axial image shows right lower gingivobuccal lesion laterally adherent to the buccinator (Red arrow), medially extending to sublingual space (Blue arrow)

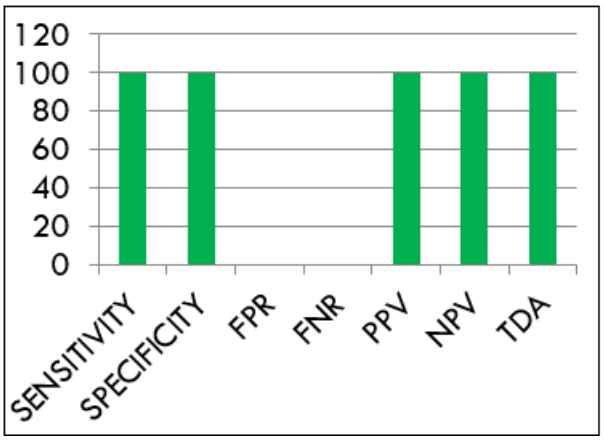


Case 9

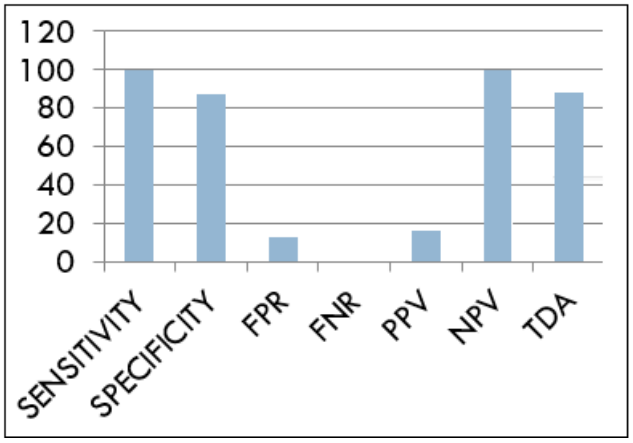
A) Axial CECT section of oral cavity shows tumour in the left lateral portion of the tongue (Red arrow) B) CT section of thorax of the same patient shows a spiculated metastasis in right upper lobe (Blue arrow)



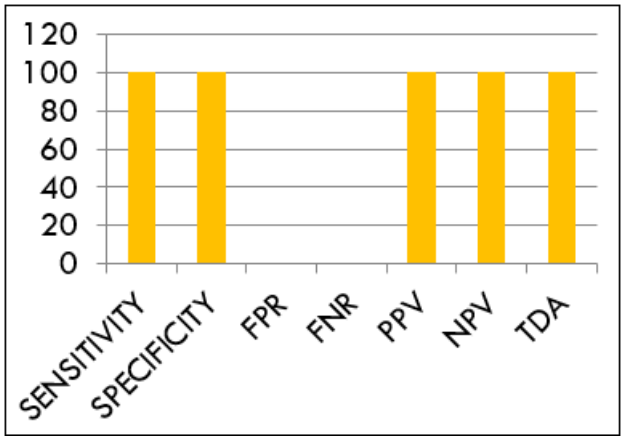
Discussion Predictive Validity of MRI for each of the Staging Criteria Used in TNM Classification



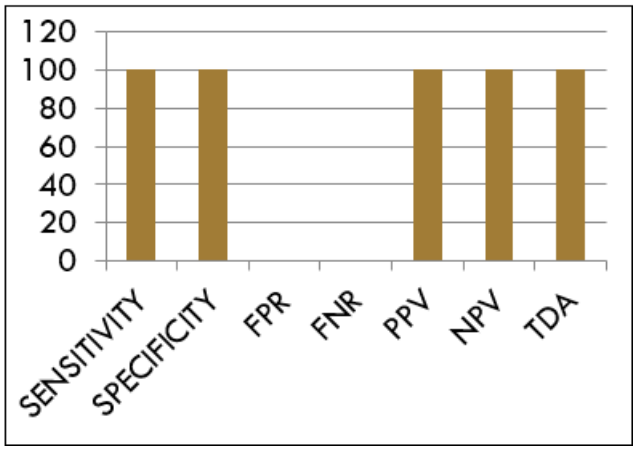
Criteria 1: Adjacent Cortical Bone Involvement
FPR – False positive rate; FNR – False negative rate; PPV – Positive predictive value; NPV – Negative predictive value; TDA – Total diagnostic accuracy



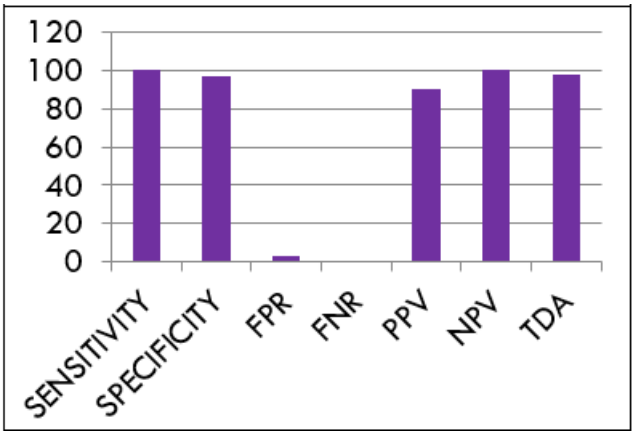
Criteria 2: Deep Muscle of Tongue Involvement



Criteria 3: Maxillary Sinus Involvement
FPR – False positive rate; FNR – False negative rate; PPV – Positive predictive value; NPV – Negative predictive value; TDA – Total diagnostic accuracy

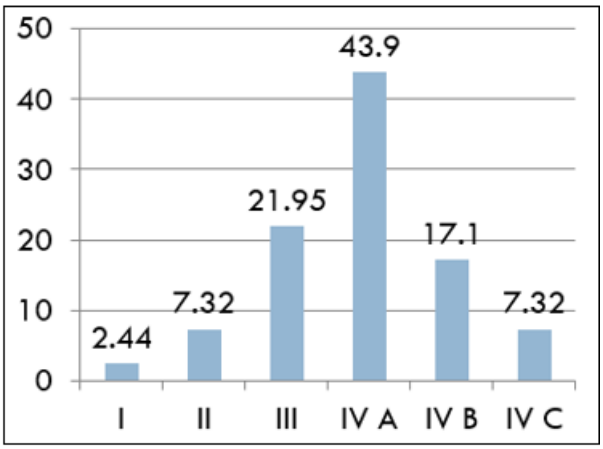


Criteria 4: Skin of Face Involvement

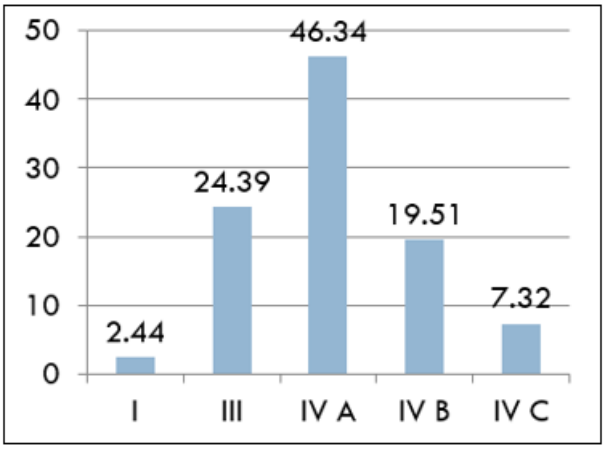


Criteria 5: Masticator Space Involvement
FPR – False positive rate; FNR – False negative rate; PPV – Positive predictive value; NPV – Negative predictive value; TDA – Total diagnostic accuracy

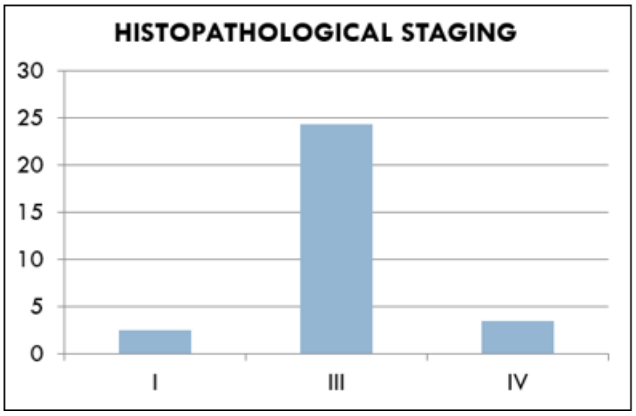
Criteria 6: Lymph Node Detection



Bar Chart of CECT STAGING (AJCC) in Study Population (N=41):



Bar Chart of MR STAGING (AJCC) in Study Population (N=41):



Bar chart of histopathological staging distribution in study population (N=41)

Number of Patients Identified:

	CECT	MRI
Cortical bone Involvement	15	15
Maxillary Sinus Involvement	4	4
Skin of face Involvement	7	7
Pterygoid Plate Invasion	1	Not Detected
Lymph Node Detection	35	35

3. Conclusion

CECT is being preferred by the referring clinicians than MRI because of its wider availability, higher compliance and cheaper cost.The analysis of our study showed good levels of sensitivity and specificity of MRI in assessment of the staging criteria used for staging oral cavity malignancy.Comparing histopathological staging with imaging staging, MRI showed an astonishing equivalence and compliance with histopathological staging while CECT showed mild discordance with respect to histopathologyOur study was unique from other studies in that ours has assessed all the criteria used for staging oral cavity malignancy leaving none and our study was exclusively performed for assessing oral cavity malignancy.

Take Home Points

Oral cavity malignancy is among the commonest cancer in India. As the management is almost entirely dependent on stage of the disease, there is a need for reliable and accurate method for staging of the disease and thus for planning treatment. With availability of quality healthcare increasing by the results recommend the clinician to use MRI for assessment of oral cavity malignancy with a major advantage of it being free of ionizing radiation.

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