

# Role of MRI in Assessment of Malignant Lesions of Tongue and Oral Cavity

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**Abstract****Original Research Article**

**Background:** In India, oral squamous cell carcinomas are among the top three cancer forms. Its diagnosis is primarily clinical, although preoperative imaging is important for tumour staging and depth of invasion. In order to determine the best course of treatment for an oral cancer patient, magnetic resonance imaging (MRI) has emerged as the gold standard. **Methods:** A cross sectional study was conducted on 50 patients with oral cavity malignancies, and who were referred for MRI for preoperative assessment. Post-surgical assessment of the lesions and nodal metastases was done using histopathological examination. **Results:** Out of the 50 patients with malignancy, 52% had tongue involvement followed by buccal mucosa involvement. There was a moderate to substantial correlation in the T staging ( $k=0.61$ ) and N ( $k=0.75$ ) staging between MRI and histopathological examination. Mean depth of invasion measured by MRI and histology was 1.47 and 1.49 respectively, with a significant correlation ( $p<0.001$ ). **Conclusion:** MRI has been demonstrated to be the imaging technique of choice for determining the T and N stages of oral carcinomas. It is also capable of assessing the depth of invasion precisely, which is essential for optimizing therapy options.

**Keywords:** Oral cancer, MRI, Depth of invasion, nodal metastasis, staging of tumor.

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## INTRODUCTION

The most prevalent cancer in the Indian subcontinent is oral cavity cancer, with an age-adjusted incidence of 20 cases per 100,000 people [1]. Lately, there is an increased prevalence, which can be attributed to behaviours including smoking, chewing betel nut, and drinking alcohol among the Indian population, which also correlates with the fact that males are mostly affected with oral cancer, it being the most common cancer among them (16.1 % of all cancers) [2].

The sub sites of oral cavity cancers include the buccal mucosa, alveolus with gingiva, hard palate, retro molar trigone, tongue, and mouth floor. The degree of histological differentiation, tumour size, invasion of the surrounding tissue, and metastasis are recognised clinical diagnostic and prognostic markers for oral cancer. The extent of the tumour is frequently underestimated by clinical examination, the infiltration and invasion of deeper structures may not be recognised, and the majority of metastatic lymph nodes that are less than 10 mm are misinterpreted as normal

cervical lymph node status on clinical examination [3].

Magnetic Resonance Imaging (MRI) offers superior soft tissue contrast, direct multiplanar formats without ionising radiation, and a better representation of the intricate anatomy of the oral cavity. It precisely delineates the tumour's boundaries and area of infiltration while also determining the depth of invasion, involvement of vital structures, such as bone and the internal carotid artery, and perineural dissemination, which are crucial elements in treatment planning [4].

The usefulness of precise preoperative imaging in determining operability and assessing the prognostic factors in oral cancers is also very crucial. The most important prognostic indicator for survival is the presence of cervical lymph node metastases, which can be determined by shape, size, extracapsular dissemination, and an aberrant interior architecture [4]. Diffusion weighted MRI (DW-MRI), in addition to anatomical MRI, has recently emerged as the primary area of research to characterize and stage these malignancies. They were shown to be better in

identifying cervical lymph node metastases [5].

In the context of tumour infiltration, Depth of Invasion (DOI) is more significant than tumour thickness. It is well established that as DOI rises, so does the risk of nodal metastasis and recurrence [6]. Therefore this study was planned to understand the accuracy of MRI in evaluating the radiological depth of invasion, staging with nodal metastasis, and comparing this with pathological confirmation.

## METHODOLOGY

This is a prospective, cross sectional study conducted in Sri Aurobindo Medical College & Post Graduate institute, Indore for a period of one year. This study included all the patients who underwent MRI imaging with a suspicion of malignancies of tongue, floor of mouth, buccal mucosa, alveolus and gingiva, during the study period. The method of sampling is using convenient sampling, and included a total sample size of 50 patients. Using a pre-structured questionnaire, the basic details of the patient and the clinical findings of the lesions were collected.

The radiological findings of the patient were collected using a Siemens 1.5 T MAGNETOM® Symphony® with Tim technology MR Machine. Routine MR pulse sequences fat saturation in axial, sagittal and coronal planes, sagittal gradient, coronal

T1WI, and T2 sagittal plane were obtained using phased-array head coil. The final confirmation of staging and lymph node metastasis was done using histopathological examination of the lesions post operatively.

## RESULTS

Out of the 50 participants in the study, 35 were males (70%), and 15 were females (30%). The mean age of the study participants was 45.1 years with a standard deviation of 9.9. The site of the lesion is tongue for the majority of the patients (52%), followed by buccal mucosa in 16 patients (32%), and alveolus in 10%, and lip in 2% of the patients. Of those with tongue lesions, left half of the tongue (20%) was affected more than right half (18%), and anterior-lateral pars of tongue involvement was also seen in five patients (Figures 1 & 2). Right buccal mucosa was involved in eight patients (18%), and left mucosa was involved in 14% of the patients. Other subsites that were involved include lower alveolus (14%), lower lip (4%), left retromolar trigone (2%), and base of tongue (2%) (Figures 3 & 4).

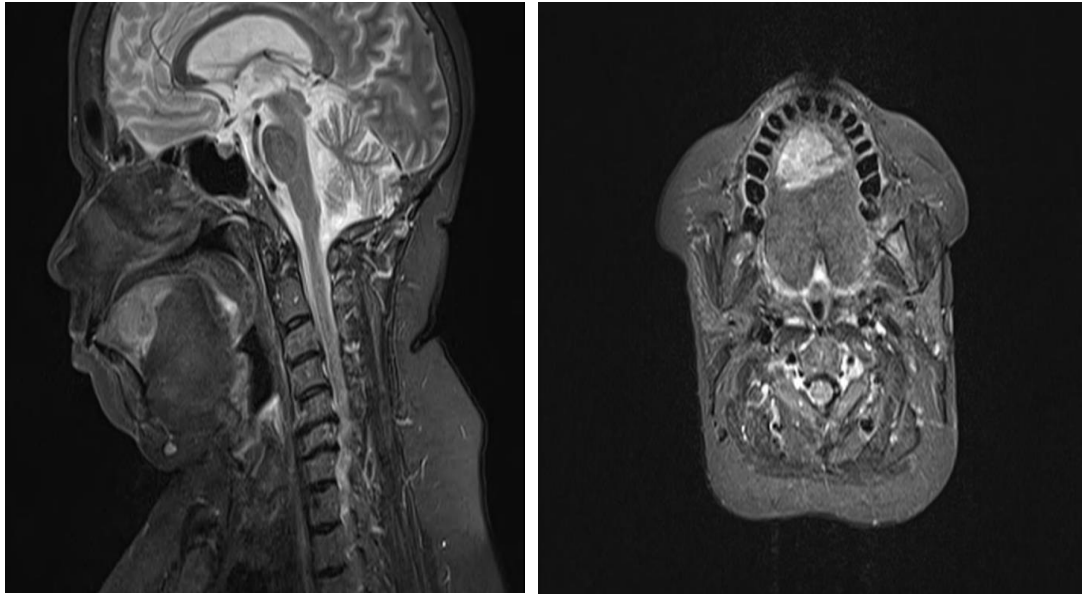
On radiological assessment, lymph nodes were involved in 66% of the patients, and contralateral involvement is seen in 9 out of 50 patients (18%). Adjacent structures were involved in 41 patients (82%), and floor of the mouth was the mostly involved structure seen in the study.

**Table 1: Baseline parameters of the study participants**

Variable	Frequency	Percentage
<b>Age</b>		
30-40 years	20	40.0
41-50 years	19	38.0
>51 years	11	22.0
<b>Gender</b>		
Male	35	70.0
Females	15	30.0
<b>Lesion site</b>		
Tongue	26	52.0
Buccal Mucosa	16	32.0
Alveolus	5	10.0
Lip	2	4.0
Retromolar trigone	1	2.0
<b>Lymph node involvement</b>		
Present	33	66.0
Absent	17	34.0
<b>Adjacent structures involvement</b>		
Present	41	82.0
Absent	9	18.0

A positive association between the MR and pathological staging was discovered in the T stage evaluation of oral cavity cancers. MRI was able to identify 6 out of 7 T1 stage cancers accurately, 14 out of 18 T2 stage cancers, 8 out of 11 T3 stage cancers,

and 8 out of 14 T4 stage cancers. There was a moderate agreement between MRI and histopathological diagnosis of staging of the lesions, with a kappa value of 0.61 ( $p=0.000$ ). This association was found to be statistically significant ( $p=0.000$ ).



**Figure 1: A. T2 Sagittal/ axial image showing heterogeneously hyperintense ill-defined lesion on anterior 2/3<sup>rd</sup> of oral tongue with no obvious involvement of floor of mouth and base of tongue, likely suggestive of neoplastic etiology.**

**Table 2: Comparison of Radiological staging with Histological staging**

	Histological staging of Tumor				Total
	T1	T2	T3	T4	
Radiological Staging of Tumor					
T1	6	1	0	0	7
T2	1	14	1	0	16
T3	0	1	8	6	15
T4	0	2	2	8	12
<b>Total</b>	7	18	11	14	50

Radiological assessment of the nodal status was also positively correlated with the histopathological assessment of lymph nodes. MRI was not able to identify N3 status, but only one case had N3 status. N0 status was identified with an 85.7% accuracy by MRI,

N2 status was identified with 80% accuracy, and N2 status with 88.8% accuracy. This association was also found to be significant (p=0.00), and the kappa measure of agreement between these two was 0.757, with a good to satisfactory agreement.

**Table 3: Comparison of Radiological Nodal status with Histological Nodal status**

	Histological Nodal status				Total
	N0	N1	N2	N3	
Radiological Nodal Status					
N0	18	2	0	0	20
N1	3	8	2	0	13
N2	0	0	16	1	17
<b>Total</b>	21	10	18	1	50

The depth of invasion measured through MRI showed a mean value of 1.47, and a standard deviation

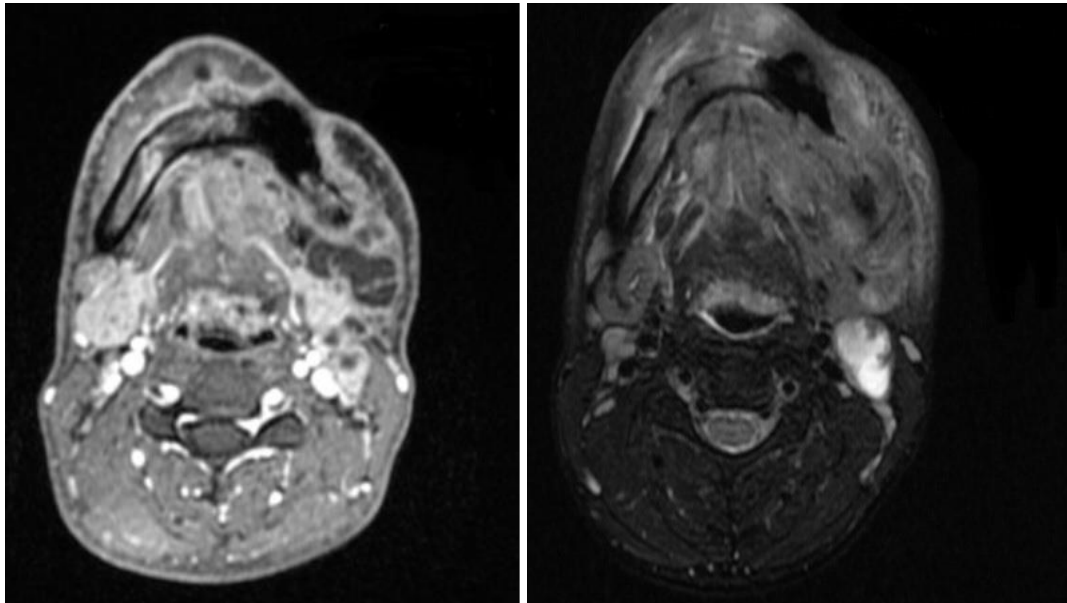
of 1.25, whereas histopathological confirmation showed a mean of 1.49 with a standard deviation of 1.

**Table 4: Depth of Invasion in MRI and Histopathology**

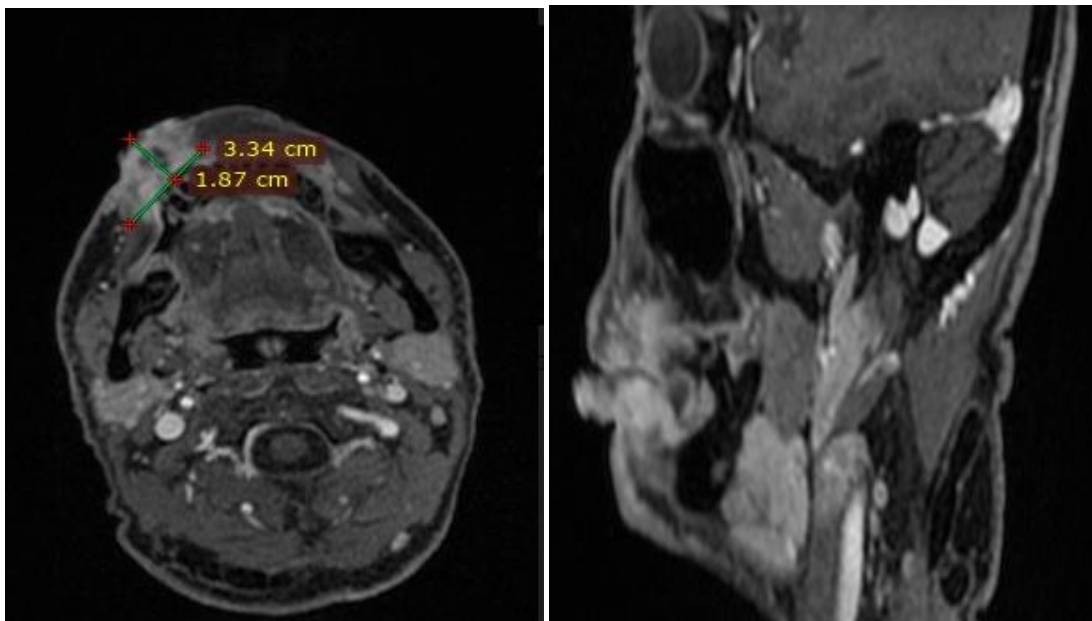
	N	Mean	Std. Deviation	Std. Error Mean
<b>DOI- MRI</b>	50	1.47	1.25	0.177
<b>DOI- Histology</b>	50	1.49	1.30	0.184

There was a positive and significant correlation between depth of invasion measured

radiologically and histopathological with regard to the T staging of the disease (P<0.001).



**Figure 2: CA alveolus: A. T2 axial/STIR images showing evidence of heterogeneously enhancing mass lesion in left lower alveolus with infiltration into left RMT & also crosses the midline and involving body of right sided mandible with multiple enlarged necrotic lymph nodes in cervical region.**



**Figure 3 & 4: A. T2 axial STIR/ sagittal images showing evidence of heterogeneously enhancing ulceroproliferative growth of size, involving the lower lip, inferior vestibule, gingivobuccal sulcus and gingivo alveolar sulcus, predominantly on right side with associated infiltration into the right buccinator and orbicularis oris muscle. Findings are suggestive of CA lip.**

## DISCUSSION

For efficient treatment planning for oral cavity carcinomas, a precise assessment of the tumour stage is essential. Numerous studies that show that larger tumours are associated with worse overall survival since it influence both the frequencies of positive cervical lymphadenopathy and the 5-year survival rates. It has been established that MRI provides more information about the structures within the mouth

cavity as well as the nearby structures than CT does in the preoperative treatment of oral cancer. In the current study, the extent of primary tumor (T) and metastasis to regional lymph nodes (N) was evaluated by MRI, and then final confirmation was done by histopathological examination of the lesion [7].

In our study, majority of the patients had lesions on the tongue, which was similar to various other studies, who found tongue malignancy was more

prevalent, followed by buccal mucosa malignancies [8, 9]. A study by Valecha *et al.*, has found more malignancies in the buccal cavity (48%) in his study than in the tongue, which he attributed to the age group and exposure to risk factors [1].

There was a positive correlation with a good agreement between the MRI staging and pathological staging in this study, with a kappa statistic of 0. This correlated with studies conducted by Zeng *et al.*, [9], Amandeep *et al.*, [8], and Valecha *et al.*, [1]. The agreement values for different studies are given in Table 5.

**Table 5: Agreement levels in different studies**

Agreement between MRI and Histopathology	Present Study	Amandeep <i>et al.</i> ,	Zeng <i>et al.</i> ,	Valecha <i>et al.</i> ,
T Staging	0.61	0.79	0.77	0.74
N-Nodal status	0.75	0.45	0.42	-

In a study by Zeng *et al.*, he observed substantial agreement for T stage between MRI and pathological staging ( $k = 0.77$ ), and only fair agreement in N staging with a kappa value of 0.428 [9].

As observed from the results seen in Amandeep *et al.*, it was shown that the agreement was average ( $k=0.45$ ) in terms of N staging. In contrast, our study was able to get fair agreement ( $k=0.71$ ) in N staging between MRI and histopathological assessment. Valecha *et al.*, observed an accuracy of clinical data in T stage evaluation was 61%, and with MRI, the accuracy was 82%. In our study also, we found a similar accuracy in identifying N status with about 88% accuracy, and T staging with 85% accuracy [1].

All oral cavity subsites, including the oral tongue, are said to have tumour decrease following excision, according to Lawein *et al.*, [10] The reported tumour shrinkage factor for oral tongue carcinoma is 87% [11]. The author noted a strong correlation between the tumour depth and width measurements made by MRI and histopathology. Our study found a strong statistically significant association between pathological depth of invasion and MRI assessed depth of invasion. The mean DOI measured using MRI was 1.47 mm and using pathological assessment was 1.49 mm. Similar observations were seen in the study by Fu *et al.*, [11], who reported a 28% greater mean DOI in MRI than that measured by pathology ( $p<0.0001$ ).

## CONCLUSION

The thickness of the mucosal epithelium and the depth and width of tumours were assessed by MRI, and there was a strong association between these measurements and histopathology. For preoperative tumour thickness and paralingual distance estimate, MRI provides satisfactory accuracy; this is useful for predicting occult cervical nodal metastases.

On MRI, the lamina propria, mucosal epithelium, and tongue muscles could all be clearly seen. When staging oral cavity and tongue cancer using the TNM classification, MRI is the imaging technique of choice. This allows a doctor to better plan treatments like glossectomy/marginal mandibulectomy, radiation,

or a combination of the two. Further research is recommended to validate this observation, and standardize the imaging to strengthen the clinical practice.

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