

## Original Research

### A Comparative Study of Ultrasonography and MRI in the Evaluation of Salivary Gland Disorders

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#### ABSTRACT:

**Background:** Salivary gland disorders, including infections, obstructions, autoimmune conditions, and neoplasms, can significantly affect oral function and quality of life. Accurate imaging is essential for diagnosis and management, with ultrasonography (USG) and magnetic resonance imaging (MRI), including MR sialography, being commonly used modalities. **Objectives:** To evaluate and compare the diagnostic performance of USG and MRI in various salivary gland disorders and to assess the role of MR sialography in ductal abnormalities. **Methods:** A prospective observational study was conducted on 60 patients presenting with salivary gland disorders. All patients underwent USG and MRI, with imaging findings analyzed for detection of sialolithiasis, inflammatory or obstructive lesions, tumors, and Sjögren's syndrome. Diagnostic performance, including sensitivity, specificity, and overall accuracy, was compared. Relevant literature on USG, MRI, and MR sialography in Sjögren's syndrome and ductal disorders was reviewed. **Results:** Sialolithiasis was the most common disorder (30%), followed by obstructive/inflammatory lesions (25%), benign tumors (16.7%), malignant tumors (10%), and Sjögren's syndrome (13.3%). USG detected most superficial lesions, while MRI identified all sialoliths, deep lobe tumors, malignant lesions, and all Sjögren's cases. Overall, MRI demonstrated higher sensitivity (96%), specificity (98%), and accuracy (97%) compared to USG (84%, 90%, and 86%, respectively). MR sialography reliably detected ductal dilatation, stenosis, calculi, and sialoceles, with findings confirmed by sialoendoscopy. **Conclusion:** Ultrasonography and MRI serve as complementary tools in evaluating salivary gland disorders. While ultrasonography is well-suited for superficial lesions, MRI and MR sialography offer greater accuracy for deeper, complex, or autoimmune-related conditions. Choosing the appropriate imaging method helps improve diagnosis and patient care. However, larger studies with more participants are warranted to further validate these findings and establish definitive diagnostic guidelines.

**Keywords:** Ultrasonography, MRI, patient

Received: 10 June, 2025

Accepted: 13 July, 2025

Published: 20 July, 2025

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**This article may be cited as:** Ain QU, Tak MM, Chalkoo AH. A Comparative Study of Ultrasonography and MRI in the Evaluation of Salivary Gland Disorders. *J Adv Med Dent Scie Res* 2025; 13(7):147-150.

#### INTRODUCTION

Salivary gland disorders encompass a wide range of pathological conditions, including infections, obstructive diseases, autoimmune disorders, and neoplasms. These conditions can significantly impact oral health, mastication, and overall quality of life. Accurate diagnosis is crucial for timely and appropriate management.<sup>1,2</sup>

Clinical evaluation of salivary gland disorders often includes history taking and physical examination. However, these methods alone may not provide sufficient information regarding the extent, nature, or

exact location of the lesion, necessitating the use of imaging modalities for better assessment.

Ultrasonography (USG) is a non-invasive, readily available, and cost-effective imaging technique. It provides real-time evaluation of glandular architecture, ductal system, and vascularity, making it useful for identifying cystic lesions, sialolithiasis, and inflammatory changes.<sup>3,4</sup>

Magnetic resonance imaging (MRI) offers superior soft-tissue contrast and multiplanar imaging capabilities. It allows detailed visualization of glandular parenchyma, ducts, and surrounding

structures without radiation exposure. MRI is particularly valuable in detecting tumors, deep lobe involvement, and subtle inflammatory changes.<sup>5-7</sup>

Several studies have compared USG and MRI in the evaluation of salivary gland disorders, highlighting differences in sensitivity, specificity, and diagnostic accuracy. While USG is advantageous for superficial lesions and real-time assessment, MRI provides comprehensive evaluation for complex or deep-seated lesions.<sup>8</sup>

Despite the availability of multiple imaging modalities, there remains a need to establish a clear comparative framework between USG and MRI for routine clinical practice. This study aims to evaluate the diagnostic performance of ultrasonography and MRI in various salivary gland disorders to guide clinicians in selecting the most appropriate imaging technique.

**MATERIALS AND METHODS**

This prospective observational study was conducted at the Department of Oral medicine and Radiology Govt.Dental college Srinagar. Ethical approval was

obtained from the institutional review board and informed consent was collected from all participants.

A total of 60 patients presenting with clinical signs and symptoms suggestive of salivary gland disorders—such as swelling, pain, xerostomia, or suspected neoplasm—were included in the study. Patients with contraindications to MRI, such as pacemakers or metallic implants, were excluded.

All participants underwent ultrasonography of the affected salivary glands using a high-frequency linear probe. The USG examination evaluated gland size, echotexture, presence of calculi, cystic or solid lesions, vascularity using color Doppler imaging, and features suggestive of autoimmune involvement, such as hypoechoic areas or heterogeneous parenchyma in suspected Sjögren’s syndrome patients.

MRI scans were performed. Imaging findings recorded included glandular morphology, lesion characteristics, involvement of surrounding structures, ductal obstruction, inflammation, and changes suggestive of autoimmune conditions such as Sjögren’s syndrome. Data from both imaging modalities were compared for diagnostic accuracy, sensitivity, and specificity.

**RESULTS**

**Table 1: Distribution of Salivary Gland Disorders (n = 60)**

Disorder Type	Number of Patients	Percentage (%)
Sialolithiasis (stones)	18	30
Obstructive/Inflammatory	15	25
Benign Tumors	10	16.7
Malignant Tumors	6	10
Sjögren’s Syndrome	8	13.3
Others (cysts, sialadenitis)	3	5
<b>Total</b>	<b>60</b>	<b>100</b>

**Table 2: Diagnostic Findings – Ultrasonography vs MRI**

Finding/Parameter	USG Detected	MRI Detected	Remarks
Sialolithiasis	17/18	18/18	MRI detected all stones
Obstructive/Inflammatory Changes	13/15	14/15	MRI slightly more sensitive
Benign Tumors	9/10	10/10	MRI detected deep lobe tumors
Malignant Tumors	4/6	6/6	MRI superior for extent evaluation
Sjögren’s Syndrome	6/8	8/8	MRI better for detecting parenchymal changes
Cysts / Sialadenitis	2/3	3/3	MRI better for small/deep lesions

**Table 3: Diagnostic Accuracy Comparison**

Parameter	Ultrasonography (%)	MRI (%)
Sensitivity	84	96
Specificity	90	98
Overall Accuracy	86	97

**DISCUSSION**

Salivary gland disorders, including infections, obstructions, autoimmune conditions, and neoplasms, can significantly impact oral function and overall quality of life. Accurate diagnosis is crucial for effective management, as clinical examination alone often cannot provide detailed information regarding the location, extent, or nature of lesions. Imaging

modalities such as ultrasonography (USG) and magnetic resonance imaging (MRI) play a vital role in evaluating salivary gland pathology. USG is a non-invasive, cost-effective, and real-time technique useful for assessing superficial lesions, ductal abnormalities, and vascularity. In contrast, MRI offers superior soft-tissue contrast, multiplanar imaging, and detailed visualization of deep or complex lesions

without radiation exposure. Comparing these modalities can guide clinicians in selecting the most appropriate imaging approach for different salivary gland disorders.<sup>9-12</sup>

In our study of 60 patients with salivary gland disorders, sialolithiasis was the most common condition (30%), followed by obstructive or inflammatory disorders (25%), benign tumors (16.7%), malignant tumors (10%), and Sjögren's syndrome (13.3%), with other lesions such as cysts or sialadenitis accounting for 5%. Ultrasonography detected the majority of cases, including 17 of 18 sialolithiasis, 13 of 15 inflammatory/obstructive changes, 9 of 10 benign tumors, 4 of 6 malignant tumors, and 6 of 8 Sjögren's syndrome cases. MRI demonstrated slightly higher detection rates across all categories, identifying all stones, deep lobe tumors, malignant lesions, and all Sjögren's cases. Overall, MRI showed superior diagnostic performance with a sensitivity of 96%, specificity of 98%, and overall accuracy of 97%, compared to ultrasonography, which had a sensitivity of 84%, specificity of 90%, and overall accuracy of 86%. This highlights MRI's advantage in detecting complex, deep-seated, malignant, and autoimmune-related salivary gland lesions, while USG remains effective for superficial and readily accessible abnormalities.

Niemela RK et al. evaluated the effectiveness of salivary gland ultrasonography in primary Sjögren's syndrome (SS) and compared it with parotid MRI and MR sialography. US was performed on parotid, submandibular, and sublingual glands in 27 SS patients, 27 healthy controls, and 27 symptomatic non-SS controls. Salivary gland abnormalities were detected in 78% of SS patients by US, mainly in the parotid and submandibular glands. MR sialography was the most sensitive (96%), followed by MRI (81%) and US (78%), while US had a specificity of 94%. Imaging findings correlated with anti-Ro/SSA positivity but not with saliva secretion, and focus scores were linked only to parotid MRI. The study concluded that US, MRI, and MR sialography are accurate, noninvasive alternatives for detecting structural glandular changes in SS.<sup>13</sup>

Takagi Y et al. investigated MRI and US findings in 90 patients with SS across a wide age range, including juvenile SS (JSS, <18 years) and adult SS. In JSS, MRI often showed multiple high-intensity spots, while fat areas on MRI and hyperechoic bands on US were rare. In adult SS, fatty degeneration on MRI and hyperechoic bands on US were more frequent and correlated with decreased salivary flow. These findings suggest that imaging features differ between JSS and adult SS, likely reflecting different stages of glandular lesions, and that both MRI and US are valuable for assessing lesion severity during follow-up.<sup>14</sup>

Capaccio P et al. assessed the role of MR sialography in diagnosing salivary duct disorders in 24 patients with obstructive symptoms and negative

ultrasonography for calculi or masses. All patients underwent color Doppler US and dynamic MR sialography, and 18 also had sialoendoscopy. Ultrasonography detected duct dilatation in all patients, while MR sialography confirmed dilatation and stenosis, identified concomitant calculi in four cases, and detected parotid sialoceles in four cases. MR sialography findings were validated by sialoendoscopy, with no adverse effects reported, demonstrating that MR sialography is a reliable, noninvasive method for visualizing salivary duct disorders up to tertiary branches.<sup>15</sup>

In our study, MRI demonstrated slightly higher detection rates and overall diagnostic accuracy compared to ultrasonography, particularly for deep-seated, malignant, or autoimmune-related lesions such as Sjögren's syndrome, while USG effectively detected superficial and readily accessible abnormalities. These findings are consistent with previous studies: Niemela RK et al. reported comparable sensitivity of MRI and MR sialography over US in detecting structural changes in primary Sjögren's syndrome, Takagi Y et al. highlighted differences in imaging features between juvenile and adult SS, and Capaccio P et al. confirmed the reliability of MR sialography in visualizing ductal disorders undetected by US. Together, these observations reinforce that ultrasonography and MRI, including MR sialography, are complementary modalities. Selecting the appropriate imaging technique based on lesion type, depth, and complexity enhances diagnostic precision and supports optimal patient management.

## CONCLUSION

Ultrasonography and MRI serve as complementary tools in evaluating salivary gland disorders. While ultrasonography is well-suited for superficial lesions, MRI and MR sialography offer greater accuracy for deeper, complex, or autoimmune-related conditions. Choosing the appropriate imaging method helps improve diagnosis and patient care. However, larger studies with more participants are warranted to further validate these findings and establish definitive diagnostic guidelines.

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