

The Analysis of Incidental Findings on Temporomandibular Joint Magnetic Resonance Imaging

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Purpose: The aim of this study was to investigate the types and frequency of the various incidental findings (IFs) on magnetic resonance images (MRI) taken from the patients with temporomandibular disorder (TMD) symptoms.

Materials and Methods: Temporomandibular joint (TMJ) MRI taken from 1,013 patients with TMD symptoms were evaluated retrospectively. IF was defined as imaging features that were accidentally or unexpectedly found, rather than degenerative bony changes of TMJ complex or disc derangement. They were classified into two groups as TMJ site-specific findings and unexpected findings at other regions. The frequency of the sub groups was analyzed.

Result: A total of 26 (2.57%) cases with IFs were classified into 13 cases with TMJ site-specific findings and 13 cases with unexpected findings at other region. TMJ site-specific findings included synovial chondromatosis in 6 cases, synovial cyst in 6 cases and osteochondroma in one case. Unexpected findings included salivary gland tumor in 3 cases, developmental cyst in 3 cases, vascular malformation in 2 cases, mastoiditis in 4 cases and sialadenitis on parotid gland in one case.

Conclusion: When diagnosing TMD through TMJ MRI, clinicians should carefully read the image, considering the possibility of IFs because TMJ MRI can provide pathologic information in TMJ region and other oral and maxillofacial region.

Key Words: Diagnostic imaging; Incidental findings; Magnetic resonance imaging; Temporomandibular joint disorders

Introduction

Temporomandibular disorder (TMD) is a broad term for chronic disorders with chief complaints and

symptoms of pain at the temporomandibular joint (TMJ) or masticatory muscles, joint clicking, trismus, and abnormal jaw movement¹⁾.

Also, TMD is multifactorial and its progress is am-

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biguous and difficult to predict, which requires accurate diagnosis and appropriate intervention from the outset¹⁾. Especially, it is mandatory to discriminate the inflammatory or tumorous lesion of TMJ and its surrounding structures from disc-related dysfunction or myofascial pain. According to the causes of TMD, its treatment plan and prognosis will change. Therefore, precise diagnosis is crucial for the selection of appropriate treatment²⁻⁴⁾. To assess pathological findings in the TMJ area, several imaging modalities have been used including conventional radiography, cone-beam computed tomography (CBCT) or computed tomography (CT)⁵⁻⁹⁾. CBCT or CT are currently regarded as an essential modality for the accurate evaluation of the bony alteration on TMJ structures such as flattening, osteophyte formation, subchondral sclerosis, subchondral cyst, erosion⁷⁻⁹⁾. Magnetic resonance imaging (MRI) can be a proper modality to detect the pathology of articular disc and the neighboring soft tissue such as muscles, ligaments. Particularly, it can be recommended as gold standard for assessing the disc displacement or joint effusion with the highly-proven contrast resolution for soft tissue^{9,10)}.

Clinicians usually need MRI evaluation for precise diagnosis of suspected TMD patients and may encounter unexpected radiologic findings in and out of the TMJ region¹¹⁻¹⁵⁾. In this study, we defined 'incidental findings (IFs)' as radiologic features that are accidentally and unexpectedly detected and distinguished from disc displacement, joint effusion and pathology of the neighboring masticatory tissue¹⁶⁾. The purpose of this study is to suggest various IFs found in TMJ MRI of patients with suspected TMD. This is to inform the clinicians of the clinical significance of differential diagnosis for patients complaining of TMD-like symptoms.

Materials and Methods

1. Patients Review

This study was approved by Institutional Review Board of Yonsei Dental College Hospital (2-2019-0077), and the requirement for patient consent was waived because of the retrospective nature of the study.

A retrospective review of all patients who underwent MRI examination of TMJ at the Yonsei University Dental Hospital from January 2019 to March 2020. Patients with a history of TMJ trauma or systemic disease were excluded. The total number of patients examined in this study was 1,013, with 238 male and 775 female patients and age range from 8 to 82 years.

2. Magnetic Resonance Imaging Protocol

The MRI examination of the TMJ was performed using a 3.0 T scanner (Pioneer; GE Healthcare, Waukesha, WI, USA). The imaging protocols were a 300×250 matrix, 210 mm field of view, and a pixel size of 0.449×0.449 mm. The axial slices were obtained with 4.0 mm thickness with T2-weighted images (repetition time [TR]/time to echo [TE]: 3,217/89). The oblique sagittal and coronal slices were obtained in proton density sequence (TR/TE: 2,143/52) with 2.5 mm thickness. The oblique sagittal slices were also obtained in T2-weighted sequence (TR/TE: 3,120/84) with 2.5 mm thickness. The oblique sagittal images of all imaging sequences were obtained with open and closed mouth position.

3. Image Analysis and the Criteria of Incidental Findings

Experienced oral and maxillofacial radiologists evaluated all MRI images. IFs were defined as radiologic features which the accidentally found without any relation to the clinical indication of imaging purpose in field of view of each scan. Because the purpose of diagnosis for suspected TMD patient is

to identify the pathologic findings of the articular disc or the surrounding masticatory tissue on TMJ area, the former pathologic findings were excluded from IFs. Mucosal thickening and small lymph node enlargement without any clinical significance were excluded as well. According to the location of the lesion, IFs were classified into two groups; TMJ site-specific findings and unexpected findings at other regions.

1) Group of temporomandibular joint site-specific findings

TMJ site-specific findings included neoplastic lesions that appear more frequently than other jaw bones due to the histological specificity of the TMJ site which consisted of synovium, cartilage, and articular disc tissue. Degenerative joint disease or morphological pathology of disc were excluded. Resultantly, the findings included such lesions as synovial chondromatosis, osteochondroma, synovial cyst, giant cell tumor of TMJ, and condylar hyperplasia.

2) Group of unexpected findings

Unexpected findings were defined as IFs that appear at other sites than the TMJ in the field of TMJ MRI. This included neoplastic or inflammatory lesions originated from the major or minor salivary glands and vascular malformations, and other congenital lesions such as thyroglossal duct cyst.

4. Statistical Analysis

The prevalence analysis was performed for IFs. For each group, TMJ site-specific and unexpected findings, the prevalence of individual disease was presented.

Result

Twenty-six cases (2.57%) of the 1,013 suspected TMD symptoms patients had IFs in TMJ region or outside the TMJ area. Thirteen cases were regarded

Table 1. The frequency by MR findings incidentally found during TMJ MRI screening

Incidental finding	No. of case (frequency, %)
TMJ site-specific findings	13 (1.28)
Synovial chondromatosis	6 (0.59)
Synovial cyst	6 (0.59)
Osteochondroma	1 (0.10)
Unexpected findings at other regions	13 (1.28)
Mucoepidermoid carcinoma	1 (0.10)
Pleomorphic adenoma	2 (0.20)
Epidermoid cyst	1 (0.10)
Hypoglossal duct cyst	1 (0.10)
Tornwaldt's cyst	1 (0.10)
Vascular malformation	2 (0.20)
Mastoiditis	4 (0.39)
Sialadenitis of parotid gland	1 (0.10)
Total	26 (2.57)

TMJ: temporomandibular joint, MRI: magnetic resonance imaging.

as the TMJ site-specific findings, and not pathologic findings on articular disc tissue. The other 13 cases were radiologic findings of clinical importance such as cyst and tumor detected in other areas than TMJ region. Each finding was described with its frequency distribution in Table 1. The case report for each case is as follows.

1. TMJ Site-Specific Findings

1) Synovial chondromatosis

A 29-year-old male was referred to our dental hospital for the evaluation of osteoarthritis of left TMJ from the local clinic. He was complaining pain and clicking sound on left TMJ when opening the mouth at the end of orthodontic treatment. MR images showed well-defined T2 hyperintensity on the left joint space. The lesion included multiple low signal foci suggesting calcifications. Imaging diagnosis was synovial chondromatosis and it was confirmed with histopathology after the mass excision (Fig. 1).

2. Unexpected Findings at Other Regions

1) Mucoepidermoid carcinoma

A 61-year-old female was referred to our dental hospital complaining of pain and click sounds in both TMJ areas at the open mouth position. Additional MR examination was performed for the differential diagnosis of discal pathologic change and MRI described T2 hyperintense lesion with approximately 1.3 cm size on the left parotid gland. The lesion was relatively well-defined while it showed irregular margin locally. Imaging diagnosis was made as be-

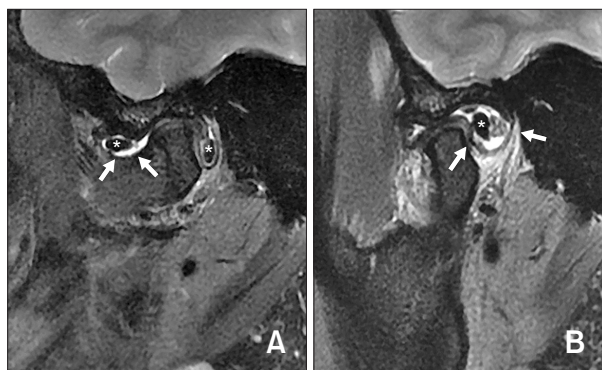


Fig. 1. (A, B) The T2-weighted magnetic resonance image of sagittal view presents well defined T2 hyperintensity within the temporomandibular joint space (arrows). The lesion includes multiple low signal foci indicating calcification (asterisk). Imaging diagnosis is synovial chondromatosis.

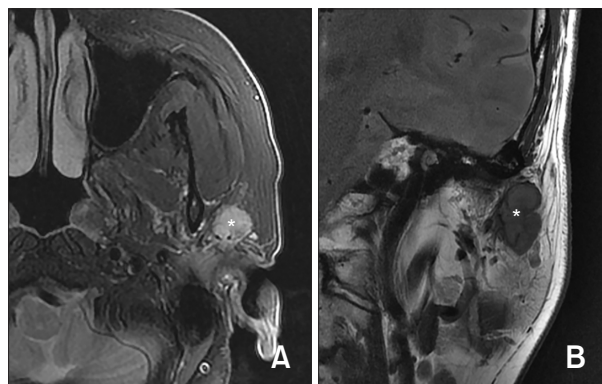


Fig. 2. (A) The axial view of T2-weighted image shows 1.3 cm-sized T2 hyperintense lesion (asterisk) at the superficial lobe of left parotid gland. (B) The coronal view of proton density image presents mass with lobulating shape (asterisk). Imaging diagnosis is made as benign salivary gland tumor or low grade malignancy and the final histopathology is confirmed as mucoepidermoid carcinoma.

nign salivary gland tumor or low grade malignancy. The lesion was resected and histopathologically confirmed as intermediate grade of mucoepidermoid carcinoma (Fig. 2).

2) Pleomorphic adenoma

A 20-year-old female visited our hospital complaining of consistent facial swelling and locking sensation on left preauricular region when mouth opening. The axial view of TMJ MR images showed 1.9 cm-sized lesion with heterogeneous T2 signal at the superficial lobe of left parotid gland. After then,

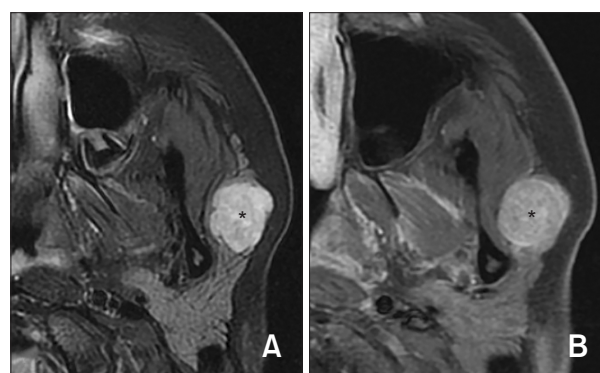


Fig. 3. (A) The T2-weighted axial image showed relatively well encapsulated round mass (asterisk) with heterogeneous high T2 signal. (B) The gadolinium-enhanced axial image reveals the lesion with increased enhancement (asterisk). Imaging diagnosis is made as benign salivary gland tumor, most likely pleomorphic adenoma and the histopathology is confirmed as pleomorphic adenoma.

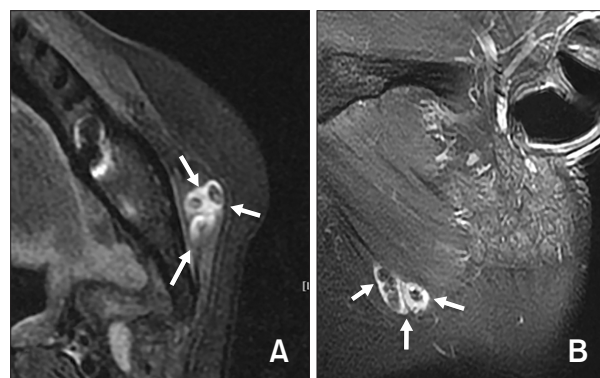


Fig. 4. (A) The axial T2-weighted image shows T2 hyperintense lesion (arrows) at inferior border of left master muscle. The lesion includes multiple low signal foci. (B) The lesion (arrows) is appeared in the sagittal T2-weighted image as well. Imaging diagnosis is made as venous malformation with phlebolith.

additional gadolinium-enhanced MR images was obtained for differential diagnosis. The lesion was well-encapsulated and heterogeneously enhanced. The imaging diagnosis was made as benign salivary gland tumor, most likely pleomorphic adenoma. The mass resection was performed and final diagnosis was pleomorphic adenoma (Fig. 3).

3) Vascular malformation

A 61-year-old female visited our dental hospital with the chief complaint of the discomfort on the left preauricular region and masseter muscle area, especially under stressful or insomnia condition. The TMJ MR images presented the T2 hyperintense lesion within inferior region of masseter muscle. It includes multiple low signal foci indicating calcifications. Imaging diagnosis was made as venous malformation with multiple phlebolith (Fig. 4).

Discussion

TMD is caused mainly by structural or functional problems among the articular fossa, mandibular condyle, articular disc, and the adjacent muscles. TMD is a collective term encompassing a number of clinical problems involving both the masticatory muscles and TMJ. Typical complaints reported by TMD patients are pain in the masticatory muscles and/or the preauricular area particularly during mandibular movement, stiffness in the masticatory muscles, limitation in mandibular movement, and joint sounds¹⁾.

MRI has a pivotal role for the diagnosis of the TMD and the soft tissue pathology in head and neck imaging^{9,10)}. From TMJ MRIs taken for the detection of disc pathology, oral radiologists often encounter incidentally and unexpectedly detected radiologic features – 'IFs'¹⁵⁾. These findings vary in their clinical importance, from common benign lesion to significant pathologic findings that may have an important impact on the health of the patient¹⁶⁾.

IFs on TMJ MRI has been reported as a various

frequency from 0.072% to 26.85%¹¹⁻¹⁴⁾. Yanagi et al.¹¹⁾ reported two tumor cases (0.072%) as IFs on MRI of consecutive TMD 2,776 patients in Japan, which was the first report of IFs of the TMJ MRI. Makdissi et al.¹²⁾ explained total 53 cases (7.3%) including 11 cases of intracranial findings (1.5%) and 42 cases of extracranial findings (5.7%) in 730 symptomatic British patients. Kamio et al.¹⁴⁾ reported 461 cases (26.85%) in a retrospective study of 1,717 MR images taken from suspected TMD patients in Japan. The higher frequency of IFs on previous study was attributed for the combination method using both typical TMJ coil and conventional coil for the head and neck. The superficial coil used in the former¹¹⁾ would have a limit in obtaining deeper scans in oral and maxillofacial region than the conventional head coil used in the latter^{17,18)}. In our study, the frequency of IFs detected on TMJ MRI was 2.57%, that was the result performed using the surface coil and 3.0 Tesla.

Apart from the difference of used coil, many variables have made differences in the results among previous studies. The variables include the scan protocol, the slice thickness, the number of patients and the inclusion criteria of IFs^{19,20)}. Also the several overestimated studies included lymph node enlargement or mucosal thickening of sinus without any symptom, which may occur and regress spontaneously¹²⁻¹⁴⁾. In the present study, only IFs with clinical significance to make a treatment or follow up were included²¹⁾.

In conclusion, the prevalence of IFs was 2.57% in TMJ MRI scanning. In all cases of IFs, some were congenital lesions or anatomic variations, while other cases required scrutiny and urgent surgical intervention. When diagnosing TMD through TMJ MRI data, clinicians should carefully read the image, considering the possibility of IFs because TMJ MRI can provide the pathologic information in TMJ region and other oral and maxillofacial regions.

Conclusion

Advanced MRI could be regarded as a gold standard for the evaluation of TMD and differential diagnosis of other mimicking lesions. The incidence of IFs of TMJ MRI were up to 2.57% among the suspected 1,013 TMD patients. This study is helpful to inform the clinicians of the need for precise differential diagnosis using MRI during routine diagnosis of patients with TMD symptoms.

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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