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ORIGINAL RESEARCH

CLINICAL & IMAGING FEATURES OF TEMPOROMANDIBULAR JOINT SYNOVIAL CHONDROMATOSIS: A RETROSPECTIVE STUDY

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ABSTRACT

Background: Synovial chondromatosis (SC) of the temporomandibular joint (TMJ) is a rare, benign proliferative disorder of the synovium, characterized by intra-articular cartilaginous nodules. Clinical symptoms mimic common temporomandibular disorders (TMDs), leading to delayed diagnosis. Imaging plays a crucial role in differentiating SC from degenerative or neoplastic conditions.

Materials and Methods: This retrospective study was conducted at Taibah University Dental College and Hospital, Madinah, Saudi Arabia, between 2012–2022. Records of patients with histopathologically confirmed TMJ SC were reviewed. Demographic data, clinical features, and imaging findings from CT, CBCT, and MRI were analyzed. Statistical analysis included descriptive statistics and comparative tests for joint space measurements.

Results: Fifteen patients (11 females, 4 males; mean age 39.2 ± 9.6 years) were included. Pain (86.7%), swelling (66.7%), and restricted mouth opening (73.3%) were the most common presenting symptoms. CT and CBCT revealed calcified loose bodies in 80% of cases, condylar erosion in 53.3%, and glenoid fossa involvement in 46.7%. MRI demonstrated joint effusion in 60% and non-calcified cartilaginous nodules in 73.3%. The superior joint space was the predominant lesion epicenter (93.3%). Comparative joint space analysis revealed statistically significant widening on the affected side ($p<0.01$).

Conclusions:TMJ SC demonstrates distinct clinical and imaging characteristics. Pain, swelling, and limited opening were the dominant symptoms, while imaging findings—particularly calcified nodules and joint space widening—remain crucial for diagnosis. Recognition of these features enhances early detection and guides surgical management.

Keywords**:** Schneiderian membrane; maxillary sinus augmentation; collagen pouch; Loma Linda technique; collagen membrane repair; CBCT; graft containment; implant survival

INTRODUCTION

Synovial chondromatosis (SC) is an uncommon benign metaplastic disorder of synovium resulting in cartilaginous nodules within the joint space [1]. It is most frequently reported in large joints such as the knee, hip, and elbow. Temporomandibular joint (TMJ) involvement is rare, with fewer than 300 cases described in the literature [2,3].

Clinically, patients often present with pain, swelling, limitation of mouth opening, joint sounds, or deviation. These nonspecific symptoms overlap with temporomandibular disorders (TMDs), complicating early diagnosis [4]. Imaging therefore plays a central role. Computed tomography (CT) and cone-beam computed tomography (CBCT) can identify calcified loose bodies and osseous changes [5], whereas magnetic resonance imaging (MRI) depicts cartilaginous nodules, joint effusion, and synovial proliferation [6,7].

Several retrospective series have reported the clinical and radiologic spectrum of TMJ SC. Liu et al. [8] evaluated 11 cases and found pain, swelling, and limited mouth opening as predominant features, with calcified nodules visible in most patients. Jang et al. [9] studied 34 cases and reported that the superior joint space was the lesion epicenter in >90% of patients, with calcification, bone sclerosis, and joint space widening as frequent imaging findings.

Despite this, literature from Middle Eastern populations remains scarce. This study aims to evaluate the clinical and imaging features of TMJ SC in a Saudi cohort, thereby contributing to regional data and supporting diagnostic strategies.

MATERIALS AND METHODS

Study Design and Setting

This retrospective study was conducted at **Taibah University Dental College and Hospital, Madinah, Saudi Arabia**

Study Population

Patient records from 2012 to 2022 were reviewed. Inclusion criteria:

- Histopathologically confirmed TMJ SC
- Complete clinical and imaging records (CT/CBCT and/or MRI)

Exclusion:

- Secondary SC (associated with trauma, osteoarthritis, or other joint disease)
- Incomplete records

Data Collection

Demographics: age, sex, duration of symptoms

Clinical features: pain, swelling, limitation of mouth opening (<35 mm), joint sounds, deviation

Imaging features:

- CT/CBCT: calcified bodies, bone erosion, sclerosis, condylar deformity, glenoid fossa changes
- MRI: non-calcified nodules, effusion, synovial thickening
- Lesion epicenter (superior/inferior/posterior joint space)
- Joint space measurement (affected vs unaffected side)

Statistical Analysis

Descriptive statistics summarized categorical and continuous variables. Joint space widths were compared using paired t-tests. Significance was set at $p<0.05$. SPSS software version 25.0 (IBM Corp, Armonk, NY) was used.

RESULTS

A total of fifteen patients met the inclusion criteria for this study. The demographic profile (Table 1) revealed a mean age of 39.2 ± 9.6 years (range, 24–56 years) with a distinct female predominance (73.3%). The average duration of symptoms before diagnosis was 18.4 ± 7.2 months, underscoring the chronic and often delayed recognition of this rare disorder.

Clinically, the majority of patients presented with pain (86.7%), which was the most consistent feature, followed by restricted mouth opening in 73.3% of cases. Swelling was documented in two-thirds of the cohort, while joint sounds such as clicking or crepitus were recorded in 33.3%. Deviation on opening occurred in 40% of patients (Table 2). These findings confirm that pain and functional limitation are the most

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reliable indicators prompting further imaging investigation.

Radiologic assessment demonstrated hallmark features of synovial chondromatosis. Calcified loose bodies were identified in 80% of cases, predominantly within the superior joint space, while condylar erosion and glenoid fossa involvement were observed in 53.3% and 46.7% respectively. Sclerosis was present in 40% of patients. MRI enhanced diagnostic accuracy by detecting non-calcified nodules in 73.3% of cases and joint effusion in 60%, with the superior joint compartment serving as the epicenter in 93.3% (Table 3).

Quantitative joint space analysis confirmed a significant difference between affected and unaffected sides (Table 4). The mean superior joint space on the diseased side measured 5.2 ± 1.1 mm compared with 2.8 ± 0.7 mm on the contralateral normal side ($p < 0.01$). This consistent widening is an objective radiographic parameter that, when correlated with clinical features, strengthens the diagnostic process.

Table 1. Demographic Characteristics of Patients with TMJ SC

Characteristic	n (%) or Mean ± SD
Total patients	15
Age (years)	39.2 ± 9.6
Female	11 (73.3%)
Male	4 (26.7%)
Duration of symptoms (months)	18.4 ± 7.2

Table 2. Clinical Features of Patients with TMJ SC

Symptom	Frequency (n=15)	Percentage (%)
Pain	13	86.7
Swelling	10	66.7
Limited mouth opening	11	73.3
Joint sounds (click/crepitus)	5	33.3
Deviation during opening	6	40.0

Table 3. Imaging Features of TMJ SC (n=15)

Imaging Finding	Frequency	Percentage (%)
Calcified loose bodies (CT/CBCT)	12	80.0
Condylar erosion	8	53.3
Glenoid fossa involvement	7	46.7
Sclerosis	6	40.0
Non-calcified nodules (MRI)	11	73.3
Joint effusion (MRI)	9	60.0
Superior joint space epicenter	14	93.3

Table 4. Comparison of Superior Joint Space Between Affected and Unaffected Sides

Measurement	Affected Side (mm)	Unaffected Side (mm)	p-value
Superior joint space (mean ± SD)	5.2 ± 1.1	2.8 ± 0.7	<0.01

DISCUSSION

In this retrospective series from a tertiary maxillofacial center, the clinical and imaging patterns of temporomandibular joint (TMJ) synovial chondromatosis (SC) were broadly concordant with contemporary literature. Patients typically presented with chronic preauricular pain, swelling, and limitation of mouth opening; mechanical symptoms (clicking/crepitus) were frequent but not universal. These findings mirror aggregated case reviews and recent case series, which also emphasize a middle-aged predominance and frequent diagnostic delay due to overlap with internal derangement and degenerative TMJ disorders [1–5]. Our data therefore add to the growing evidence base that persistent unilateral TMJ symptoms, particularly when progressive over months, warrant targeted imaging beyond routine TMJ dysfunction pathways [2,5,6].

Imaging remains central to timely diagnosis and surgical planning. Consistent with prior reports, MRI was the most sensitive modality for early-stage disease (Milgram I–II), detecting synovial proliferation, joint effusion, and non-mineralized nodules that may be occult on radiographs or CT, while CT was superior for ring-and-arc calcifications and osseous remodeling in more advanced (calcified) disease[7–11,19,20]. Recent series further refine this paradigm: Jang et al. detailed characteristic spatial patterns (lesion centered in the superior joint compartment; synovial thickening with variable low–intermediate T2 signal), and Zhang et al. correlated the burden of osseous degenerative change with longer symptom duration and higher histopathologic stage, underscoring the clinical utility of staging patients with MRI plus cross-sectional imaging when calcifications are suspected [7,8]. These insights align with our practice of comprehensive MRI for all suspected cases, with adjunct CT in patients with long-standing symptoms or suspected extraarticular extension. The differential diagnosis includes pigmented villonodular synovitis/tenosynovial giant cell tumor, osteochondroma, and—critically—chondrosarcoma. Advanced imaging criteria can assist: a recent AJNR study reported improved discrimination between chondrosarcoma and SC using CT/MR features (e.g., permeative bone changes, soft-tissue mass with aggressive characteristics), which we applied when preoperative features were atypical [11]. Although malignant transformation of primary SC is rare, vigilance is advised when imaging shows aggressive patterns or when symptoms recur after adequate synovectomy [11].

Surgical management is individualized by stage, distribution, and extension. Our approach parallels current recommendations that favor minimally invasive arthroscopy for intra-articular disease (particularly Milgram I–II), reserving open or combined approaches for extensive Milgram III disease, inferior-space involvement, or extraarticular extension [14–18]. Arthroscopy offers excellent visualization, the ability to remove non-calcified bodies, and opportunities for synovectomy while minimizing morbidity; multiple series and reviews report low relapse when thorough synovectomy accompanies loose-body removal [14–16,18]. When disease is advanced or extends beyond the joint capsule, open surgery (preauricular approach), often with arthroscopic assistance, facilitates complete clearance; Bai et al. observed no recurrence in 33 followed patients (mean 33.3 months) using open surgery assisted by arthroscopy [15]. Conversely, a 2024 single-center cohort (n=37) noted recurrences in ~11% over two years, highlighting that outcomes also reflect stage/severity and completeness of synovectomy and that structured surveillance is prudent [6]. Our practice now integrates interval MRI during the first 12–24 months post-operatively in higher-stage or combined-approach cases, which is consistent with these data.

Pathobiology remains an active area of investigation. While older frameworks separated “primary” (metaplastic) from “secondary” (degenerative/traumatic) SC, evolving evidence—including molecular findings of recurrent FN1-ACVR2A rearrangements in SC from other joints—supports a neoplastic-like proliferation in at least a subset of cases, potentially explaining persistence or recurrence despite removal of loose bodies alone [5,18]. Future work in TMJ-specific cohorts is warranted to clarify genotype–phenotype correlations and refine indications for aggressive synovectomy.

Our study has limitations inherent to its retrospective design and single-institution setting, with modest sample size and limited long-term imaging follow-up, which may underestimate late recurrences. Nevertheless, by applying standardized imaging review and surgical definitions aligned with recent series and systematic reviews, we believe our observations are generalizable to similar referral centers. Clinically, the key implications are: (1) maintain a high index of suspicion for SC in unilateral chronic TMJ symptoms; (2) use MRI early and CT selectively to stage disease and map calcifications; (3) prefer arthroscopy for intra-articular disease, with open or combined approaches for extensive

or extraarticular disease; and (4) institute structured, risk-adapted surveillance to detect early recurrence.

CONCLUSION

Temporomandibular joint synovial chondromatosis is a rare but clinically significant disorder that presents most frequently with unilateral pain, swelling, and restricted mouth opening. In our cohort, female predominance and a mean age in the fourth decade were consistent with global reports. Pain (86.7%) and limitation of mouth opening (73.3%) were the leading clinical features (Table 2), while imaging demonstrated calcified loose bodies in 80% and superior joint space epicenter in 93.3% of cases (Table 3). Comparative analysis confirmed significant widening of the superior joint space on the affected side (Table 4). These findings highlight that the combination of characteristic clinical symptoms with CT/CBCT and MRI findings provides a robust diagnostic pathway. Early detection is essential to prevent destructive sequelae such as condylar erosion and glenoid fossa involvement. We recommend a multidisciplinary diagnostic and surgical approach, with structured postoperative surveillance to reduce recurrence and preserve joint function.

DECLARATIONS

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