Pediatric Rheumatology

RESEARCH ARTICLE Open Access

Evaluation of temporomandibular joint involvement in juvenile idiopathic arthritis patients

Asena Pinar Sefer[1*] and Muferet Erguven[1,2*]

Abstract

Objective Juvenile idiopathic arthritis (JIA) is a common, chronic and inflammatory rheumatological disease of childhood. The disease can affect all synovial joints in the body. Temporomandibular joints (TMJs) are important areas of involvement in JIA, which are frequently involved but often not noticed because the involvement is usually asymptomatic. The aim of this study is to determine the frequency and risk factors of TMJ joint involvement in juvenile idiopathic arthritis patients admitted to our clinic, and to guide for early diagnosis and treatment.

Methods Patients who applied to this study with the diagnosis of JIA between January 2014 and May 2017 at Pediatric Rheumatology Clinic, were followed up regularly in our clinic, had a accessible medical history, and a rheumatology polyclinic record. Patients with contrast-enhanced TMJ Magnetic Resonance Imaging (MRI) taken and reported by the radiologist were included.

Results TMJ involvement was detected in 51.2% of the 41 patients included in the study. It was found that 71.5% of the patients with TMJ involvement were asymptomatic and 71.5% of the patients had chronic involvement. When the patients with and without TMJ involvement were compared according to the contrast-enhanced TMJ MRI results; In the patient group with involvement, the polyarticular onset subtype was seen at a higher rate ($p=0.005$), the age of onset was earlier ($p=0.003$), the disease duration was longer ($p=0.037$), more joints were involved ($p=0.005$), the ESR values were higher ($p=0.0001$), and the treatment compliance and treatment responses of the patients in this group were worse ($p=0.001$, $p=0.0001$).

Conclusion TMJ involvement is common in JIA patients and can occur at any stage of the disease. It is often asymptomatic and progresses insidiously, leading to chronic and degenerative changes in the mandible at an early stage. Due to its asymptomatic nature, the insidious progression, and the risk of causing chronic, irreversible sequelae, it is crucial to screen high-risk JIA patients regularly with contrast-enhanced TMJ MRI, which remains the gold standard method. While specific risk factors are difficult to pinpoint, some factors may increase the likelihood of TMJ involvement. To better identify these high-risk patients and determine which individuals require regular screening, larger-scale and multicenter studies are essential.

*Correspondence:
Asena Pinar Sefer
asenasefer@gmail.com
Muferet Erguven
muferete@yahoo.com

Full list of author information is available at the end of the article

Keywords Juvenil idiopathic arthritis, Magnetic resonance imaging, Temporomandibular joint

Introduction

Juvenile Idiopathic Arthritis (JIA) is a heterogeneous, idiopathic, chronic, inflammatory and rheumatic disease of childhood in which factors such as immunological, genetic, infections and trauma are assumed to play a role in its pathogenesis [1, 2]. The disease is characterized by chronic joint involvement. In addition to arthritis, extra-articular system involvement such as fever, rash, uveitis and pulmonary involvement may also be observed in the course of JIA [1, 3].

JIA can effect all synovial joints in the body. Temporomandibular Joints (TMJ) are also one of the common and important area of involvement [4]. Studies have shown that the prevalence of TMJ involment in JIA patients ranges between 17 and 87% [5, 6] and frequency increases as the number of effected joints increases. But, TMJ may also be the first or only joint involment JIA [7, 8].

Owing to the anatomical features and cartilage structure of the TMJ, active arthritis affecting the developing joint in the pediatric age group can lead to chronic irreversible sequelae such as mandibular dysfunction and facial appearance disorders in the long term [9–12]. Beside, TMJ arthritis is usually asymptomatic or cause mild and usually insignificant clinical findings, which delays the diagnosis [9]. Thus, all JIA patients should be investigated for TMJ involvement with appropriate methods in the early period to prevent complications [9, 13]. Studies have shown that contrast-enhanced Magnetic Resonance Imaging (MRI) is the gold standard method for detecting TMJ involvement [14, 15].

In this study, we aimed to determine the frequency and risk factors of TMJ in JIA patients admitted to our clinic and to provide guidance for early diagnosis and treatment.

Materials and methods

Methodology and sampling

Our study designed as retrospective cross sectional study. Patients diagnosed with JIA according to International League of Associations for Rheumatology (ILAR) criteria who were followed up regularly in Pediatric Rheumatology Clinic, between January 2014 and May 2017, and had a TMJ MRI reported by a radiology physician, enrolled the study. Patients with concomitant chronic diseases, malnutrition, who did not fully meet the ILAR criteria, or whose imaging reports could not be accessed were not included in the study. There was a total of 320 JIA patient applications but only 247 of them had reliable medical records. Only 41 of them had TMJ MRI reported by radiology physician. These patients were regularly followed with a diagnosis of JIA, and those with suspected TMJ involvement based on clinical findings were included. Upon reviewing the patients' past records, it was determined that, even if asymptomatic, MRIs were performed on patients who had risk factors for TMJ involvement according to the current literature include female sex, younger age at disease onset, and involvement of multiple joints, particularly the upper extremities.

Clinical features like; demographic characteristics, age at diagnosis, duration of disease, JIA subtypes, number of joints involved, clinical findings suggestive of TMJ involvement, laboratory findings as leukocyte and platelet counts in Complete Blood Count (CBC), Anti Nuclear Antibody (ANA), Human Leukocyte Antigen (HLA) B27, Rheumatoid Factor (RF) results, Eritrocyte Sedimentation Rate (ESR), C-Reactive Protein (CRP) values, treatments they were receiving, treatment compliance and treatment responses were collected by retrospectively reviewing the hospital system records. Patients with TMJ MRI findings showing active inflammation, such as synovial effusion, increased contrast enhancement in the synovium, synovial thickening, or bone marrow edema, were classified as having acute arthritis. Conversely, patients exhibiting chronic arthritis features, including pannus formation, condylar flattening, bone destruction, hypertrophic bone (osteophyte) formation, condylar erosion, destruction, slippage, or micrognathia, were considered to have chronic TMJ involvement [13, 14, 16]. The diagnostic sub-group distribution of the patients was based on the ILAR diagnostic criteria: systemic, oligoarticular, polyarticular, juvenile psoriatic arthritis, and arthritis associated with enthesitis [17]. Patients diagnosed before 8 years of age were considered as early-onset JIA and those diagnosed later were considered as late-onset JIA [17]. According to ILAR criteria, involvement of 4 or fewer joints was considered as few joint involvement and involvement of 5 or more joints was considered as multiple joint involvement [17]. Patients were screened for the presence of symptoms and signs [15] indicating TMJ involvement such as jaw pain, decreased range of motion of the jaw joint, noise with jaw movements, rapid fatigue in the jaw, asymmetry in the jaw, malocclusion, and micrognathia. TMJ USGs of the patients, which were performed and reported in our hospital or in an external center, were evaluated. The results of blood samples taken 72 h before or 72 h after TMJ MRI were taken as ESR and CRP values, and values above 20 mm/h for ESR and above 0,5 mg/dl for CRP were considered positive. Patients with elevated CRP and ESR levels underwent a detailed clinical examination to rule out any concurrent infections. No evidence of active

infection was found in any of the patients. Treatment compliance of the patients was determined according to the anamnesis obtained from the patients and their families. Good compliance refers to patients following their prescribed treatment plan as directed. This includes regularly taking medications, attending follow-up appointments, and adhering to lifestyle recommendations. Patients with good compliance generally exhibit better disease control and fewer complications. Poor compliance is marked by missed doses, inconsistent medication use, or failing to attend follow-up appointments. This can lead to worsening symptoms, uncontrolled disease activity, and potentially more aggressive disease progression. The definition of treatment response in this study is based on clinical improvement or persistence of disease activity. Good treatment response is characterized by significant reduction or absence of active disease symptoms, such as joint swelling, pain, and stiffness, following consistent use of prescribed medications. These patients exhibit lower Juvenile Arthritis Disease Activity Scores (JADAS) and maintain functional joint movement. In contrast, poor treatment response is defined by ongoing or worsening disease activity, despite adherence to treatment, which may necessitate escalation of therapy, such as adding biologic agents or steroids. Regarding the term "attack", it refers to periods of increased disease activity or flare-ups, defined by the recurrence of symptoms such as joint inflammation and pain. For the purposes of this study, an "attack" was considered if symptoms occurred within six months prior to the MRI, consistent with the assessment of recent disease activity. Patients experiencing two or more attacks in this period were categorized as having a poor treatment response [18].

After the data were gathered, the patients were divided into two main groups as those with and without TMJ involvement according to TMJ MRI findings and other variables were statistically analyzed between these two groups.

Table 1 Clinical and demographical characteristics of patients

	***n* (%)**
Gender	
Male	20 (48.7%)
Female	21 (51.2%)
Age (y) (median, IQR)	11.55 ± 4.21 (3.6–17.3)
Age at Diagnosis	
Early-Onset	18 (43.9%)
Late-Onset	23 (56.01%)
Disease Duration (y) (median, IQR)	3.16 ± 1.05 (0.5-7)
JIA Subtype	
Oligoarticular Onset	13 (31.7%)
Polyarticular Onset	15 (36.5%)
Systemic Onset	5 (12.1%)
Enthesitis-Related	4 (9.7%)
Juvenile Psoriatic Arthritis	0 (0.0%)
Number of Involved Joints	
1–4	18 (43.9%)
≥5	23 (56.01%)
ESR (mm/h)	
High (> 20)	22 (52.6%)
Normal	19 (47.4%)
CRP (mg/dl)	
Positive (> 0.05)	19 (47.4%)
Negative	22 (52.6%)
Treatment	
NSAID	31 (75.6%)
DMARD	38 (92.6%)
Steroids	30 (73.1%)
Biological Agents	7 (17.0%)
Treatment Response	
Good	24 (58.5%)
Poor	17 (41.5%)

(CRP: C-Reactive Protein; dl: deciliter; ESR: Eritrocyte Sedimentation Rate; h: hour; IQR: Inter Quarteral Range; JIA: Juvenile Idiopathic Arthritis; mg: miligram; mm: millimeter; n: number; NSAID: Non Steroid Anti Inflammatory Drugs; DMARD: Disease Modifying Anti-Rheumatological Drugs; y: years)

Ethics committee approval

Ethics Committee Approval prepared in accordance with the Declaration of Helsinki and was obtained from the ethics committee of our university (dated 04/07/2017 and numbered 2017/0234) prior to the study.

Statistical analysis

In this study, statistical analyses were performed with the NCSS (Number Cruncher Statistical System) 2007 Statistical Software (Utah, USA) package program. In addition to descriptive statistical methods (mean, standard deviation), independent samples t-test was used to compare two independent groups. Comparisons of qualitative data were performed using chi-square test, and regression results were presented as Odds Ratio (OR) and 95% Confidence Interval (CI). Logistic regression analysis was conducted to determine the factors determining the risk of TMJ joint involvement. The results were evaluated at significance level $p < 0.05$ and 95% confidence interval.

Results

41 JIA patients who had TMJ MRI reported by radiology physicians were included in the study. Detailed demographic and clinical characteristics of the patients are shown in Tables 1 and 2.

These patients divided into 2 main groups according to TMJ MRI findings. Patients with acute or chronic arthritis findings on TMJ MRI were considered as patients with TMJ involvement. 21 (51.2%) patients had arthritis findings on MRI of the TMJ. In our study, the frequency of TMJ involvement in JIA patients was 51.2% (Fig. 1). Of the patients with arthritis on TMJ MRI, 6 (28.5%) had

Table 2 Comparison of clinical and demographical characteristics of patients with or without TMJ involvement

	TMJ MRI Arthritis Findigs (+) (*n*: 21)	TMJ MRI Arthritis Findigs (+) (*n*: 20)	*p*
Age at Diagnosis (y)	14 (66,67%)	4 (20.00%)	**0,003***
0–8 (Early-Onset)	7 (33,33%)	16 (80,00%)	
8–16(Late-Onset)			
Disease Duration (y)	3,88 ± 2,57	2,45 ± 01,50	**0,037***
JIA Subtype	3 (14,29%)	12 (60,00%)	**0,006***
Oligoarticular Onset	11 (52,38%)	2 (10,00%)	**0,005***
Polyarticular Onset	6 (28,57%)	3 (15,00%)	0,402
Systemic Onset	1 (4,76%)	3 (15,00%)	0,563
Enthesitis-Related			
Average Number of Involved Joints	0,86 ± 0,36	0,25 ± 0,44	**0,0001***
Number of Involved Joints	3 (14,29%)	15 (75,00%)	**0,0001***
1–4	18 (85,71%)	5 (25,00%)	
>5			

(JIA: juvenile idiopathic arthritis, MRI: magnetic resonance imaging, n: number, TMJ: Temporo Mandibular Joint, y: years, *$p<0.05$)

acute arthritis and 15 (71.4%) had chronic arthritis findings (Fig. 2A).

Clinical symptoms and/or findings suggestive of TMJ involvement of JIA were present in 6 patients (28.5%) with evidence of involvement on TMJ MRI. One patient had retrognathia and the other had micrognathia, these two patients had no recorded history of jaw pain, crepitation, or difficulty in chewing, while the other four patients had complaints of jaw pain and noise from the jaw while chewing. Among our patients with TMJ involvement, 71.5% were asymptomatic (Fig. 2B). All patients with clinical symptoms and signs related to TMJ were found to have TMJ involvement on MRI.

20 of the patients included in the study had TMJ Ultrasonographies (USGs) obtained and reported by a radiologist; none of these USGs showed any evidence of TMJ involvement. Of the patients with arthritis findings on MRI of the TMJ, 9 (42%) had a USG of the TMJ, all of which were reported as normal.

Among patients with TMJ involvement, 11 (52.3%) had polyarticular onset, 6 (28.5%) had systemic onset, 3 (14.29%) had oligoarticular onset, and 1 (4.7%) had enthesitis-related JIA (Fig. 2A). The rate of polyarticular-onset JIA was statistically significantly higher in the group with involvement on TMJ MRI compared to the group without involvement ($p=0.005$) and the risk of polyarticular-onset type was 9.9 (1.82–53.8) times higher in the group with involvement compared to that without involvement (Table 2). The rate of oligoarticular-onset JIA was statistically significantly lower in the patient group with TMJ involvement than in that without TMJ involvement ($p=0.003$), and the risk of oligoarticular-onset type was 0.11 (0.2–0.5) times higher in the group with involvement than in that without involvement (Table 2). There was no statistically significant difference in the distribution of other subtypes between the two groups (Table 2).

Among the patients with arthritis findings on TMJ MRI, 14 (66.6%) had early-onset JIA and 7 (33.3%) had late-onset JIA (Fig. 1B). In the patient group with TMJ involvement, the age of early onset was found to be statistically significantly higher ($p=0.003$) (Table 2).

The average duration of disease from the onset of JIA to the time of TMJ MRI was 3.88 ± 2.57 years in the patient group with arthritis findings on TMJ MRI and 2.45 ± 01.50 years in the patient group without findings. The average duration of disease was statistically significantly higher in the patient group with TMJ involvement ($p=0.037$) (Table 2) (Fig. 2A).

In patients with arthritis findings on TMJ MRI, the average number of involved joints was statistically significantly higher than in patients without arthritis findings ($p=0.0001$). 18 (85.21%) of the patients with TMJ involvement had involvement of 5 or more joints, and the rate of multiple joint involvement was significantly higher in this patient group ($p=0.003$) (Table 2) (Fig. 2A).

There was no statistically significant difference in the distribution of ANA positivity and RF positivity between the patient groups with and without arthritis findings on TMJ MRI ($p=0.606$, $p=0.592$) (Fig. 2B).

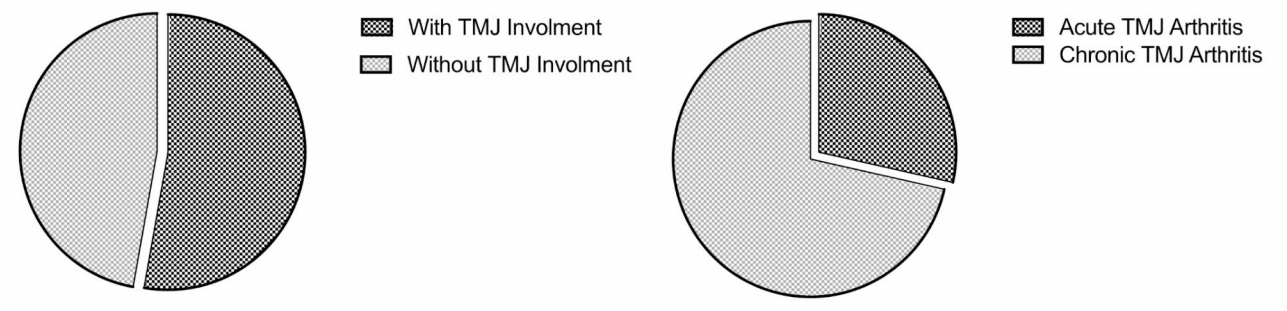

Fig. 1 Proportional characteristics of TMJ involvement in study group

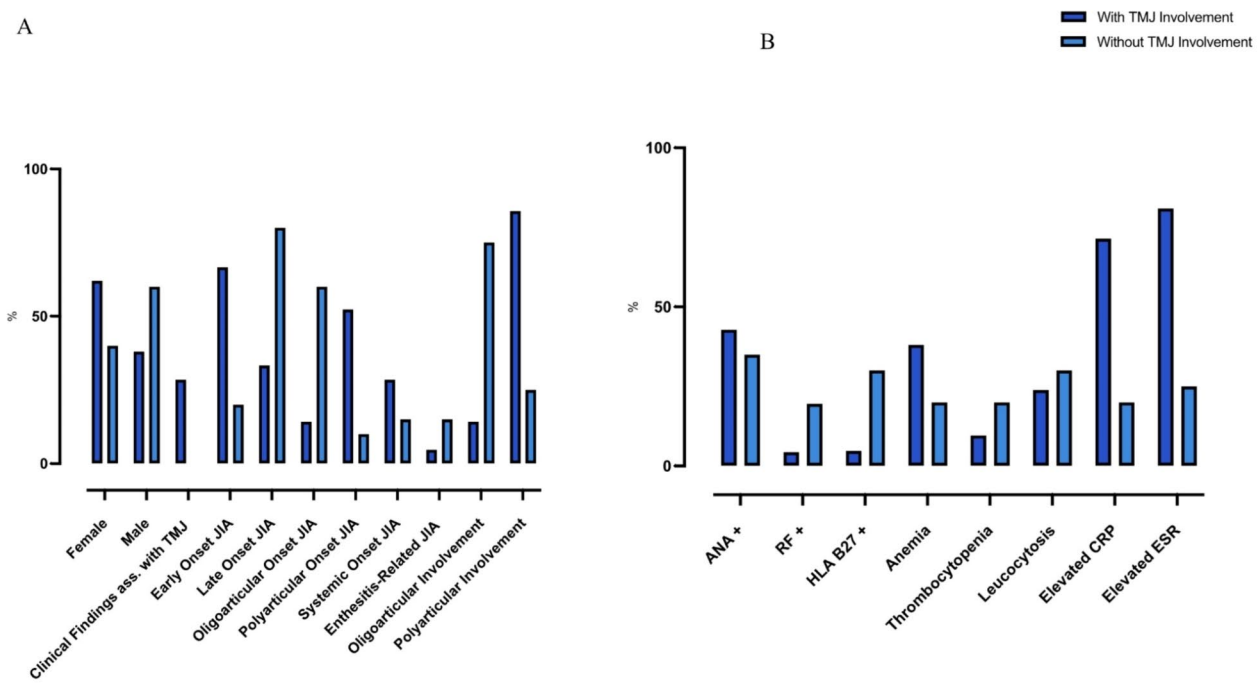

Fig. 2 Comparison of **(A)** clinical and demographical characteristics, and **(B)** laboratory findings of patients with and without TMJ involvement

Table 3 Comparison of treatments, compliance, and response of treatments between patients with or without TMJ involvement

	TMJ MRI Arthritis Findigs (+) (*n*: 21)	TMJ MRI Arthritis Findigs (+) (*n*:20)	*p*
NSAID	9 (42,86%)	1 (5,00%)	**0,005***
+	12 (57,14%)	19 (95,00%)	
-			
DMARD	1 (4,76%)	2 (10,00%)	0,521
+	20 (95,24%)	18 (90,00%)	
-			
Steroid	1 (4,76%)	10 (50,00%)	**0,001***
+	20 (95,24%)	10 (50,00%)	
-			
Biological Agents	15 (71,43%)	19 (95,00%)	**0,045***
+	6 (28,57%)	1 (5,00%)	
-			
Tx Compliance	7 (33,33%)	17 (85,00%)	**0,001***
Good	14 (66,67%)	3 (15,00%)	
Poor			
Tx Response	5 (23,81%)	19 (95,00%)	**0,0001***
Good	16 (76,19%)	1 (5,00%)	
Poor			

(NSAID: Non Steroid Anti İnflammatory Drugs, DMARD: Disease Modifying Anti-Rheumatological Drugs, MRI: Magnetic Resonance Imaging, n: number, TMJ: Temporo Mandibular Joint, y: years, *$p<0.05$)

HLA B27 positivity was detected in 1 (4%) of patients with TMJ involvement, while HLA B27 positivity was detected in 6 (30%) of patients without TMJ involvement. In the group of patients with arthritis findings on TMJ MRI, HLA B27 positivity was statistically significantly lower than the other group ($p=0.032$). ESR and CRP positivity and the average ESR values were significantly higher in the patient group with arthritis findings on TMJ MRI ($p=0.0001$, $p=0.001$, $p=0.0001$) (Fig. 2B).

When the treatment distribution was analyzed, 31 (75.6%) of the patients were receiving Non Steroidal Anti Inflammatory Drugs (NSAIDs), 38 (92.6%) were receiving Disease Modifying Anti Rheumatic Drugs (DMARDs), 30 (73.1%) were receiving steroids and 7 (17%) were receiving biological agents (Table 1). NSAID use in the patient group with arthritis findings on TMJ MRI was significantly lower than in those without arthritis findings ($p=0.005$). There was no statistically significant difference between the use of DMARDs in the two patient groups ($p=0.521$). Steroid use and biologic agent use were significantly higher in the patient group with arthritis findings on TMJ MRI ($p=0.005$, $p=0.045$) (Table 3).

Logistic regression analysis as well as the variables of age at diagnosis, average disease duration, total number of joints involved, presence of clinical symptoms and findings suggestive of TMJ involvement, HLA B27 positivity, elevated ESR and average ESR values, CRP positivity, use of NSAIDs, steroids, biologic agents, and disease subtypes were performed to determine the factors affecting the risk of TMJ involvement, and it was found that high number of joints involved ($p=0.02$) and elevated ESR ($p=0.027$) were the factors that increased the risk of TMJ involvement.

Discussion

JIA is a chronic inflammatory disease that can involve all synovial joints in the body. The TMJ is one of the important sites of involvement. In all subtypes of JIA, TMJs may be involved unilaterally or bilaterally at any stage of the disease, and may appear as the first involved joint or the only involved joint [4].

The frequency of TMJ joint involvement in JIA varies between 17 and 87% [4, 19]. The wide range of frequency of TMJ involvement is due to the fact that the criteria suggesting TMJ involvement are not fully established and the use of screening methods varies between centers. In our study, the prevalence of TMJ involvement in JIA patients was 52.8%. Since our study was single-centered and the number of patients was small, the frequency of TMJ involvement in our study does not reflect the frequency of involvement in our country.

TMJ arthritis in JIA is asymptomatic in 65–85% of patients [7, 11, 12]. The severity of clinical signs and symptoms is directly related to the severity of inflammation, and the sensitivity of clinical signs and symptoms is low but the specificity is high [7]. In our study, 71.5% of the patients with TMJ involvement had no clinical signs and symptoms suggestive of TMJ involvement. All of the symptomatic patients had TMJ MRI involvement. These findings obtained in our study showed that clinical signs and symptoms have low sensitivity but high specificity in the demonstration of TMJ involvement, in accordance with other studies.

Since the majority of patients with TMJ involvement in JIA are asymptomatic, arthritis shows insidious progression in the joint and in most patients, the involvement is detected after the development of a chronic and degenerative process. In a study conducted by Arvidsson et al. İn 2010 in adult patients with JIA, it was found that 80% of patients had chronic TMJ involvement [20]. In our study, 28.5% of patients with MRI findings of TMJ involvement had acute arthritis and 71.5% had chronic arthritis. Because of the anatomic feautures TMJ, degenerative processes in the joint affect the growth plate in the early period [9, 10]. Degenerative changes in the growth plate during the active growth period disrupt the growth and development of the mandible and cause irreversible, chronic, difficult to treat findings such as micrognathia, retrognathia, malocclusions, jaw asymmetry, chronic jaw pain, which significantly reduce the quality of life. Among the patients with TMJ involvement included in our study, one had micrognathia and one had retrognathia, that is, 9.52% of the patients with involvement had chronic irreversible sequelae affecting the external appearance and causing loss of function, but these findings were obtained from patient records, detailed orthodontic examination information of all patients is needed to give exact percentages.

Studies have shown that polyarticular subtype, early age of onset, long disease duration, elevated ESR and ANA positivity increase the risk of TMJ involvement, while HLA B27 positivity decreases the risk of TMJ involvement [11, 21]. In 2009, Arygropoluo et al. showed that systemic subtype, early age of onset, long disease duration, presence of multiple joint involvement and elevated ESR increased the risk of TMJ involvement [22]. In the studies conducted by Weiss et al. in 2008 and Billiau et al. in 2007, no correlation was shown between JIA subtypes, laboratory parameters, number of joints involved, age at onset and duration of disease and TMJ involvement [23, 24]. IPolyarticular JIA, high number of involved joints and high ESR are conditions associated with the presence of severe inflammation in the body in JIA patients, and it is thought that the higher frequency of TMJ involvement in these patients is related to this high inflammatory status [11, 21, 22]. HLA B27 positivity is usually seen in patients with JIA associated with enthesitis with a late age of onset and TMJ involvement is rare, and the lower incidence of TMJ involvement in these patients is explained by these conditions [21]. Inflammation in the body is more severe in JIA patients with RF positivity and joint involvement in these patients is followed by destructive chronic changes, but studies have not found a relationship between RF positivity and TMJ involvement [11, 21, 22, 24]. In our study, no association was found between RF positivity and TMJ involvement. In 2014 studies by Gorska et al. and in 2017 studies by Kalaykova et al. TMJ involvement is more common in patients with poor treatment response and in JIA patients who need multiple drug therapy [25, 26]. In our study, it was determined that the treatment compliance and responses of patients with TMJ involvement were worse than those of patients without involvement and that these patients were in need of multidrug therapy. Poor treatment response and the need for more aggressive treatment is associated with high disease activity and the higher frequency of TMJ involvement in these patients may be explained by high disease activity.

In our study, in order to determine the risk factors for TMJ involvement, logistic regression analysis was performed with the variables of age at diagnosis, mean disease duration, total number of joints involved, presence of clinical symptoms and signs suggestive of TMJ involvement, HLA B27 positivity, elevated ESR and mean ESR values, CRP positivity, use of NSAIDs, steroids, biological agents, and disease subtypes, and high number of joints involved and high sedimentation were found to be the risk factors for TMJ involvement. The risk factors for TMJ involvement differ among the studies and no definite risk factors have been identified. For these reasons, it is thought that TMJ involvement may occur in all JIA

patients at any stage of the disease and screening for TMJ involvement in all JIA patients is recommended [22, 24].

Study limitations

There is a potential for selection bias due to the retrospective design of our study and the clinical rationale behind selecting patients for MRI. The patients who underwent MRI were those identified as having risk factors for TMJ involvement or presenting with symptoms, based on the clinical practices and literature available at the time. This selection process might have introduced bias into our study, potentially leading to a focus on more severe cases of TMJ involvement. Furthermore, our study is limited by being single-center and having a small sample size, which may affect the generalizability of our findings. Additionally, as a retrospective study, we were unable to control certain aspects of the data collection, such as the specific MRI reporting methods and sequences used, or whether two radiologists read the scans independently to assess inter-reader reliability. This limitation restricts our ability to evaluate the consistency of the MRI findings. Moreover, due to the retrospective nature of the study, it remains unclear which patients will progress and which will respond to therapies. The lack of detailed treatment protocols and follow-up in terms of treatment effects further limits the conclusions that can be drawn about treatment efficacy. These are important considerations for future research to address.

Conclusions

TMJ involvement is common in patients with JIA. Most of patients with TMJ involvement were asymptomatic and most of them had chronic, degenerative changes in their TMJ. Thus, all JIA patients should be screened regularly with contrast-enhanced MRI of the TMJ, which is the gold standard method to prevent chronic irreversible sequelae. While regular MRI screening is recommended for all JIA patients, certain practical limitations must be considered. Factors such as the need for sedation in younger patients, limited access to MRI machines, and cost should be taken into account. Therefore, screening should be prioritized for high-risk patients. Furthermore, some factors may increase the risk of TMJ involvement, and to better identify these high-risk patients and fully understand which patients require screening, larger-scale and multicenter studies are needed.

Abbreviations

ANA	Anti Nuclear Antibody
CBC	Complete Blood Count
CRP	C-Reactive Protein
DMARDs	Disease Modifying Anti Rheumatic Drugs
ESR	Eritrocyte Sedimentation Rate
HLA	Human Leukocyte Antigen
ILAR	International League of Associations for Rheumatology
JIA	Juvenile Idiopathic Arthritis
MRI	Magnetic Resonance Imaging
NSAIDs	Non Steroidal Anti Inflammatory Drugs
RF	Rheumatoid Factor
TMJ	Temporomandibular Joint,
USG	Ultrasonography

Acknowledgements

None.

Author contributions

A.P.S and M.E. conceptualized and supervised the study. A.P.S and M.E. provided patient care, collected clinical data and conducted the questionnaires. A.P.S. and M.E. wrote the paper. All authors reviewed and approved the final version of the manuscript.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Data availability

The data generated during the study are included in this published article.

Declarations

Ethics approval and consent to participate

Ethics Committee Approval prepared in accordance with the Declaration of Helsinki and was obtained from the ethics committee of our university (dated 04/07/2017 and numbered 2017/0234) prior to the study. Informed consent for participation was obtained from all individuals.

Consent for publication

Informed publication consent was obtained from all participants.

Competing interests

M.E. and A.P.S. have no conflict of interest to disclose.

Author details

[1]School of Medicine, Division of Pediatric Allergy and Immunology, Recep Tayyip Erdogan University, Rize, Türkiye
[2]Division of Pediatric Rheumotology, Center of Duzce, Duzce University School of Medicine, Yorukler Street, Konuralp Neighborhood, 81620 Duzce, Türkiye

Received: 6 July 2024 / Accepted: 22 October 2024
Published online: 25 November 2024

Referances

1. Giancane G, Consolaro A, Lanni S, Davi S, Schiappapietra B, Ravelli A. Juvenile idiopathic arthritis: diagnosis and treatment. Rheumatol Ther. 2016;3(2):187–207. : 10.1007/s40744-016-0040-4 [published Online First: 2016/10/18].
2. Lipnick RN, Tsokos GC, Magilavy DB. Immune abnormalities in the pathogenesis of juvenile rheumatoid arthritis. Rheum Dis Clin North Am. 1991;17(4):843–57. [published Online First: 1991/11/01].
3. Petty RECJ. Chronic arthritis. In: Cassidy JT PR, ed. Textbook of Pediatric Rheumatology. Fifth edition ed. Elsevier Saunders Company, 2005:206–341.
4. Pedersen TK, Jensen JJ, Melsen B, Herlin T. Resorption of the temporomandibular condylar bone according to subtypes of juvenile chronic arthritis. J Rheumatol. 2001;28(9):2109–15. [published Online First: 2001/09/12].
5. Ronning O, Valiaho ML. Involvement of the facial skeleton in juvenile rheumatoid arthritis. Ann Radiol (Paris). 1975;18(4):347–53. [published Online First: 1975/05/01].
6. Kuseler A, Pedersen TK, Herlin T, Gelineck J. Contrast enhanced magnetic resonance imaging as a method to diagnose early inflammatory changes in the temporomandibular joint in children with juvenile chronic arthritis. J Rheumatol. 1998;25(7):1406–12. [published Online First: 1998/07/24].
7. Martini G, Bacciliero U, Tregnaghi A, Montesco MC, Zulian F. Isolated temporomandibular synovitis as unique presentation of juvenile idiopathic arthritis. J Rheumatol. 2001;28(7):1689–92. [published Online First: 2001/07/27].

8. Scolozzi P, Bosson G, Jaques B. Severe isolated temporomandibular joint involvement in juvenile idiopathic arthritis. J Oral Maxillofac Surg. 2005;63(9):1368–71. https://doi.org/10.1016/j.joms.2005.05.300. [published Online First: 2005/08/27].
9. Svensson B, Larsson A, Adell R. The mandibular condyle in juvenile chronic arthritis patients with mandibular hypoplasia: a clinical and histological study. Int J Oral Maxillofac Surg. 2001;30(4):300–5. https://doi.org/10.1054/ijom.2001.0058. [published Online First: 2001/08/24].
10. Karhulahti T, Ylijoki H, Ronning O. Mandibular condyle lesions related to age at onset and subtypes of juvenile rheumatoid arthritis in 15-year-old children. Scand J Dent Res. 1993;101(5):332–8. https://doi.org/10.1111/j.1600-0722.1993.tb01128.x. [published Online First: 1993/10/01].
11. Larheim TA, Haanaes HR. Micrognathia, temporomandibular joint changes and dental occlusion in juvenile rheumatoid arthritis of adolescents and adults. Scand J Dent Res. 1981;89(4):329–38. https://doi.org/10.1111/j.1600-0722.1981.tb01690.x. [published Online First: 1981/08/01].
12. Ronning O, Valiaho ML. Progress of mandibular condyle lesions in juvenile rheumatoid arthritis. Proc Finn Dent Soc. 1981;77(1–3):151–7. [published Online First: 1981/01/01].
13. Pedersen TK, Kuseler A, Gelineck J, Herlin T. A prospective study of magnetic resonance and radiographic imaging in relation to symptoms and clinical findings of the temporomandibular joint in children with juvenile idiopathic arthritis. J Rheumatol. 2008;35(8):1668–75. [published Online First: 2008/07/18].
14. Hu YS, Schneiderman ED, Harper RP. The temporomandibular joint in juvenile rheumatoid arthritis: part II. Relationship between computed tomographic and clinical findings. Pediatr Dent. 1996;18(4):312–9. [published Online First: 1996/07/01].
15. Muller L, Kellenberger CJ, Cannizzaro E, et al. Early diagnosis of temporomandibular joint involvement in juvenile idiopathic arthritis: a pilot study comparing clinical examination and ultrasound to magnetic resonance imaging. Rheumatology (Oxford). 2009;48(6):680–5. https://doi.org/10.1093/rheumatology/kep068. [published Online First: 2009/04/24].
16. Bonjardim LR, Gaviao MB, Carmagnani FG, Pereira LJ, Castelo PM. Signs and symptoms of temporomandibular joint dysfunction in children with primary dentition. J Clin Pediatr Dent. 2003;28(1):53–8. https://doi.org/10.17796/jcpd.28.1.0772w75g91963670. [published Online First: 2003/11/08].
17. Fink CW. Proposal for the development of classification criteria for idiopathic arthritides of childhood. J Rheumatol. 1995;22(8):1566–9.
18. Kasapcopur O, Barut K. Treatment in juvenile rheumatoid arthritis and new treatment options. Turk Pediatri Ars. 2015;50(1):1–10. https://doi.org/10.5152/tpa.2015.2229. [published Online First: 20150301].
19. El Fuente A, Angenete S, Jellestad O, Tzaribachev S, Koos N, Rosendahl B. Juvenile idiopathic arthritis and the temporomandibular joint: a comprehensive review. J Craniomaxillofac Surg. 2016;44(5):597–607. https://doi.org/10.1016/j.jcms.2016.01.014. [published Online First: 2016/03/01].
20. Arvidsson LZ, Smith HJ, Flato B, Larheim TA. Temporomandibular joint findings in adults with long-standing juvenile idiopathic arthritis: CT and MR imaging assessment. Radiology. 2010;256(1):191–200. https://doi.org/10.1148/radiol.10091810. [published Online First: 2010/06/25].
21. Cannizzaro E, Schroeder S, Muller LM, Kellenberger CJ, Saurenmann RK. Temporomandibular joint involvement in children with juvenile idiopathic arthritis. J Rheumatol. 2011;38(3):510–5. https://doi.org/10.3899/jrheum.100325. [published Online First: 2010/12/17].
22. Argyropoulou MI, Margariti PN, Karali A, et al. Temporomandibular joint involvement in juvenile idiopathic arthritis: clinical predictors of magnetic resonance imaging signs. Eur Radiol. 2009;19(3):693–700. https://doi.org/10.1007/s00330-008-1196-2. [published Online First: 2008/10/30].
23. Weiss PF, Arabshahi B, Johnson A, et al. High prevalence of temporomandibular joint arthritis at disease onset in children with juvenile idiopathic arthritis, as detected by magnetic resonance imaging but not by ultrasound. Arthritis Rheum. 2008;58(4):1189–96. https://doi.org/10.1002/art.23401. [published Online First: 2008/04/03].
24. Billiau AD, Hu Y, Verdonck A, Carels C, Wouters C. Temporomandibular joint arthritis in juvenile idiopathic arthritis: prevalence, clinical and radiological signs, and relation to dentofacial morphology. J Rheumatol. 2007;34(9):1925–33. [published Online First: 2007/08/19].
25. Kalaykova SI, Klitsie AT, Visscher CM, Naeije M, Lobbezoo F. A retrospective study on possible predictive factors for long-term Temporomandibular Joint Degeneration and impaired mobility in Juvenile Arthritis patients. J Oral Facial Pain Headache. 2017;31(2):165–71. https://doi.org/10.11607/ofph.1656. [published Online First: 2017/04/25].
26. Gorska A, Przystupa W, Rutkowska-Sak L, Kwiatkowska M, Chlabicz S, Szarmach I. Temporomandibular joint dysfunction and disorders in the development of the mandible in patients with juvenile idiopathic arthritis - preliminary study. Adv Clin Exp Med. 2014;23(5):797–804. https://doi.org/10.17219/acem/37256. [published Online First: 2014/12/11].

Publisher's note