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Original Article

Clinical Presentations of Temporomandibular Joint Ankylosis in Children and Their Association with Sawhney Classification: A Cross-Sectional Study

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https://doi.org/10.52206/jsmc.2026.16.2.1175

Abstract

Background: Temporomandibular joint (TMJ) ankylosis in children is a debilitating condition characterized by restricted mandibular movement, often resulting in facial asymmetry, malocclusion, feeding difficulties, and impaired speech due to disruption of normal craniofacial growth.

Objective: To determine the frequency of clinical presentations of TMJ ankylosis in children and to evaluate their association with Sawhney radiographic classification.

Methodology: This descriptive cross-sectional study was conducted at the Department of Oral and Maxillofacial Surgery, Khyber College of Dentistry, from August 2022 to February 2023. A total of 77 children aged 1–18 years with clinically and radiographically confirmed TMJ ankylosis were enrolled using non-probability consecutive sampling. Maximum mouth opening (MMO) was measured as maximal interincisal distance and categorized into severity levels. Facial asymmetry and malocclusion were assessed using predefined clinical criteria. Radiographic classification was performed using Sawhney Types I–IV based on the best available imaging modality (OPG/CT/CBCT).

Results: The mean age of participants was 8.48 ± 4.85 years. Severe limitation of MMO was observed in 45.5% of cases, facial asymmetry in 51.9%, and malocclusion in 76.6%. Sawhney Type I was the most frequent (32.5%), followed by Type IV (26.0%). Significant associations were observed between Sawhney classification and MMO severity ($p<0.001$; Cramer's $V=0.44$), facial asymmetry ($p<0.001$; Cramer's $V=0.53$), and malocclusion ($p<0.001$; Cramer's $V=0.48$). Age-stratified analysis demonstrated a decreasing trend in severe clinical manifestations with increasing age.

Conclusion: Pediatric TMJ ankylosis commonly presents with severe functional limitation and dentofacial deformities. Strong clinico-radiologic associations highlight the relevance of Sawhney classification in reflecting disease severity at presentation.

Keywords: Children; Mouth opening, Facial asymmetry, Malocclusion, Sawhney classification, Temporomandibular joint ankylosis.

ISSN (P): 1819-4583
ISSN (E): 3007-9470

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Citation:
Khattak MN, Khan M, Sajjad M, Khan J, Saleem M, Iqbal H, et al. Clinical presentations of temporomandibular joint ankylosis in children and their association with Sawhney classification: A cross-sectional study. *J Saidu Med Coll.* 2026;16(2):252–258.

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Funding:
The authors received no external funding for this study.

Conflicts of Interests:
The authors have declared that no competing interests exist.

Data Sharing Statement:
The data that support the findings of this study are available on request from the corresponding author. The data is not publicly available due to privacy or ethical restrictions.

Received: December 12, 2024
1st Revision: March 15, 2025
2nd Revision: December 24, 2025
3rd Revision: January 22, 2026
Accepted: February 15, 2026

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Introduction

Temporomandibular joint (TMJ) ankylosis is a pathological condition characterized by fibrous or bony fusion between the mandibular condyle and the temporal bone, resulting in partial or complete restriction of mandibular movement [1]. In children, this condition is particularly significant due to its profound impact on craniofacial growth and development. Persistent limitation of joint mobility during critical growth periods may lead to progressive facial asymmetry, malocclusion, compromised mastication, and speech difficulties [2].

The etiology of TMJ ankylosis is multifactorial, with trauma and infection being the most commonly reported causes in pediatric populations. However, the severity and clinical presentation of the condition are influenced by several factors, including age at onset, duration of ankylosis, extent of bony fusion, and laterality of involvement [3]. Younger children, in particular, are more susceptible to severe deformities due to the ongoing growth of the mandible and surrounding structures.

Maximum mouth opening (MMO) is a key clinical parameter used to assess functional limitation in TMJ ankylosis. However, its interpretation in children is complex, as normal values vary with age and developmental stage. Studies have demonstrated that MMO increases progressively with age, and therefore, uniform cut-off values may not accurately reflect severity across different pediatric age groups [4,5]. This highlights the importance of age-stratified analysis in pediatric populations.

Radiographic evaluation plays a crucial role in confirming diagnosis and determining the anatomical extent of ankylosis. Advanced imaging modalities such as computed tomography (CT) and cone-beam computed tomography (CBCT) provide superior visualization of bony structures compared to conventional radiographs, facilitating accurate classification and surgical planning [6,7]. Among the available systems, Sawhney classification is widely used to categorize TMJ ankylosis into four types based on radiographic morphology [1].

Despite its widespread use, the relationship between Sawhney classification and clinical presentation at initial diagnosis remains inadequately explored. Existing literature often reports clinical and radiographic findings separately, with limited integration of clinico-radiologic correlations [8]. Understanding these associations is essential for improving diagnostic accuracy, predicting disease severity, and guiding management strategies.

Therefore, this study aimed to determine the frequency of key clinical presentations—namely limitation of mouth opening, facial asymmetry, and malocclusion—in children with TMJ ankylosis, and to evaluate their association with Sawhney radiographic classification. By integrating clinical and radiological findings, this study seeks to contribute to a more comprehensive understanding of disease patterns in pediatric TMJ ankylosis.

Methodology

Study Design

This study employed a descriptive cross-sectional design to evaluate the frequency of clinical presentations of temporomandibular joint (TMJ) ankylosis in children and their association with Sawhney radiographic classification. The cross-sectional approach was selected to provide a snapshot of clinico-radiological characteristics at the time of presentation without intervention or follow-up.

Ethics

Ethical approval for the study was obtained from the Institutional Review Board of Khyber College of Dentistry (Ref No. 64/ADR/KCD). The study adhered to ethical principles for human research, including voluntary participation, confidentiality, and the right to withdraw. Written informed consent was obtained from parents or legal guardians, and assent was obtained from older children where appropriate.

Setting

The study was conducted at the Department of Oral and Maxillofacial Surgery, Khyber College of Dentistry, Peshawar, Pakistan. Data collection was carried out over a six-month period from 26 August 2022 to 26 February 2023 in a tertiary care clinical setting where patients with TMJ disorders are routinely managed.

Participants

Children aged 1–18 years of either gender with clinically suspected and radiographically confirmed TMJ ankylosis were included. Participants were recruited using non-probability consecutive sampling. Inclusion criteria comprised restricted mandibular movement consistent with ankylosis and confirmatory imaging evidence. Exclusion criteria included previously treated or recurrent TMJ ankylosis, presence of craniofacial syndromes, neuromuscular disorders, or systemic inflammatory conditions (e.g., rheumatoid arthritis, ankylosing spondylitis, psoriasis-related arthropathy), as well as lack of consent from guardians.

Variables

Key variables included demographic characteristics (age, gender), clinical features (maximum mouth opening, facial asymmetry, malocclusion), and radiographic classification (Sawhney Types I–IV). Additional variables included symptom duration, etiology (trauma, infection, or unknown), and laterality (unilateral or bilateral involvement).

Data sources/measurement

Data were collected using a structured and standardized proforma to ensure consistency. Maximum mouth opening (MMO) was measured as maximal interincisal distance (in millimeters) using a calibrated ruler or vernier caliper, with the highest of two readings recorded. MMO was categorized into severe (0–10 mm), moderate (11–20 mm), and mild (>20 mm). Facial asymmetry was assessed clinically through standardized frontal inspection, including chin deviation and facial contour imbalance. Malocclusion was determined through clinical occlusal examination and classified using Angle's classification where applicable. Radiographic evaluation was performed using orthopantomogram (OPG) for all patients, with CBCT or CT utilized in cases requiring further anatomical clarification. Sawhney classification was assigned based on the highest-quality imaging available.

Bias

To minimize measurement bias, predefined operational criteria were used for clinical assessments, and standardized instruments were employed. However, potential sources of bias included observer variability in clinical examination, lack of inter-observer reliability assessment, and variability in imaging modalities (OPG vs. CT/CBCT). Selection bias may also be present due to non-probability sampling and single-center design.

Study size

A total of 77 children meeting the inclusion criteria were enrolled during the study period. The sample size was based on the number of eligible patients presenting within the defined timeframe, consistent with descriptive cross-sectional study methodology.

Quantitative variables

Continuous variables such as age, symptom duration, and MMO (in mm) were treated as quantitative variables and summarized using mean and standard deviation. Categorical variables such as MMO categories, facial asymmetry, malocclusion, and Sawhney classification were expressed as frequencies and percentages. Age was further stratified into clinically relevant groups to account for developmental variability.

Statistical methods

Data were entered and analyzed using SPSS version 22. Descriptive statistics were used to summarize demographic and clinical characteristics. Associations between Sawhney classification and clinical variables (MMO severity, facial asymmetry, and malocclusion) were assessed using Chi-square test or Fisher's exact test where appropriate. Effect size was calculated using Cramer's V to quantify the strength of associations. Confidence intervals (95%) were reported for key proportions. A p-value ≤0.05 was considered statistically significant.

Results

Participants

A total of 77 children diagnosed with temporomandibular joint (TMJ) ankylosis were included in the study. The mean age of participants was 8.48 ± 4.85 years, reflecting a predominantly pediatric population across a wide developmental range. The mean duration of symptoms prior to presentation was 191.45 ± 101.86 days, indicating a considerable delay between onset and clinical evaluation. Gender distribution showed a higher proportion of females (n=46; 59.7%) compared to males (n=31; 40.3%), as summarized in Table 1.

Descriptive data

Clinical presentation revealed varying degrees of functional limitation and dentofacial abnormalities. Severe restriction in maximum mouth opening (MMO; 0–10 mm) was observed in 35 patients (45.5%), while moderate limitation (11–20 mm) and mild limitation (>20 mm) were noted in 18 (23.4%) and 24 (31.2%) children, respectively. Facial asymmetry was present in 40 children (51.9%), indicating a substantial burden of craniofacial imbalance. Malocclusion was highly prevalent, affecting 59 participants (76.6%), with Angle's Class II malocclusion being the most frequent subtype (32.5%), followed by Class III (24.7%) and Class I (19.5%). A minority (23.4%) had no malocclusion. Radiographic evaluation using Sawhney classification demonstrated that Type I ankylosis was most common (32.5%), followed by Type IV (26.0%), Type II (23.4%), and Type III (18.2%) (Table 1).

Outcome data

Gender-based comparisons of clinical outcomes showed no statistically significant differences between males and females. Specifically, mouth opening severity did not differ significantly across gender groups (p = 0.246), nor did the

presence of facial asymmetry (p = 0.677) or malocclusion (p = 0.494). Similarly, the distribution of malocclusion subtypes across genders was not statistically significant (p = 0.678). These findings suggest that gender was not a determinant of clinical severity or presentation in this cohort (Table 2).

Main results

A strong and statistically significant association was observed between Sawhney radiographic classification and key clinical variables. The severity of mouth opening limitation was significantly associated with Sawhney type (p < 0.001; Cramer's V = 0.44), with mild limitation predominantly seen in Type I (60.0%), while severe limitation was concentrated in advanced types, particularly Type IV (85.0%) and Type III (64.3%) (Table 3A). Similarly, facial asymmetry demonstrated a significant association with Sawhney classification (p < 0.001; Cramer's V = 0.53), with prevalence increasing progressively from 24.0% in Type I to 90.0% in Type IV (Table 3B). Malocclusion also showed a significant relationship with Sawhney type (p < 0.001; Cramer's V = 0.48), being least frequent in Type I (48.0%) and most frequent in Type IV (95.0%) (Table 3).

Age-stratified analysis further revealed clinically meaningful trends. The proportion of severe MMO limitation decreased with increasing age, from 66.7% in children aged 1–5 years to 16.7% in those aged 15–18 years. A similar declining trend was observed for facial asymmetry across age groups, whereas malocclusion remained consistently high across all age strata. In terms of radiographic patterns, Sawhney Type IV was more prevalent in younger children (38.9% in 1–5 years), while Type I showed increasing frequency in older age groups, suggesting a potential relationship between disease chronicity, growth, and radiographic presentation (Table 4).

Table 1: Demographic and Clinical Characteristics of Study Population (n = 77)

Variable	Value
Age (mean ± SD)	8.48 ± 4.85
Symptom duration, days (mean ± SD)	191.45 ± 101.86
Gender	
Male	31 (40.3%; 95% CI: 30.0–51.4)
Female	46 (59.7%; 95% CI: 48.6–70.0)
Mouth opening severity (MMO)	
Mild (>20 mm)	24 (31.2%; 95% CI: 21.9–42.2)
Moderate (11–20 mm)	18 (23.4%; 95% CI: 15.3–34.0)
Severe (0–10 mm)	35 (45.5%; 95% CI: 34.8–56.5)
Facial asymmetry	
Yes	40 (51.9%; 95% CI: 41.0–62.7)
No	37 (48.1%; 95% CI: 37.3–59.0)
Malocclusion	
Yes	59 (76.6%; 95% CI: 66.0–84.7)
No	18 (23.4%; 95% CI: 15.3–34.0)
Malocclusion (Angle's class)	
Class I	15 (19.5%; 95% CI: 12.2–29.7)
Class II	25 (32.5%; 95% CI: 23.1–43.5)
Class III	19 (24.7%; 95% CI: 16.4–35.4)
None	18 (23.4%; 95% CI: 15.3–34.0)
Sawhney classification	
Type I	25 (32.5%; 95% CI: 23.1–43.5)
Type II	18 (23.4%; 95% CI: 15.3–34.0)
Type III	14 (18.2%; 95% CI: 11.2–28.2)
Type IV	20 (26.0%; 95% CI: 17.5–36.7)

Table 2: Gender-Based Distribution of Clinical Presentations with Temporomandibular Joint Ankylosis (n = 77)

Variable	Category	Gender		Total n (%)	p-value
		Male n (%)	Female n (%)		
Mouth Opening	Mild	13 (41.9)	11 (23.9)	24 (31.2)	0.246
	Moderate	6 (19.4)	12 (26.1)	18 (23.4)	
	Severe	12 (38.7)	23 (50.0)	35 (45.5)	
Facial Asymmetry	Yes	17 (54.8)	23 (50.0)	40 (51.9)	0.677
	No	14 (45.2)	23 (50.0)	37 (48.1)	
Malocclusion	Yes	25 (80.6)	34 (73.9)	59 (76.6)	0.494
	No	6 (19.4)	12 (26.1)	18 (23.4)	
Malocclusion Class	Class I	8 (25.8)	7 (15.2)	15 (19.5)	0.678
	Class II	10 (32.3)	15 (32.6)	25 (32.5)	
	Class III	7 (22.6)	12 (26.1)	19 (24.7)	
	None	6 (19.4)	12 (26.1)	18 (23.4)	

Table 3: Association between Sawhney type and clinical presentations with TMJ ankylosis (n=77)

A) Sawhney type vs mouth opening severity (MMO)

Sawhney type	Mild (>20 mm) n (%)	Moderate (11–20 mm) n (%)	Severe (0–10 mm) n (%)	p-value	Cramer's V
I (n=25)	15 (60.0)	6 (24.0)	4 (16.0)		0.44
II (n=18)	6 (33.3)	7 (38.9)	5 (27.8)		
III (n=14)	2 (14.3)	3 (21.4)	9 (64.3)		
IV (n=20)	1 (5.0)	2 (10.0)	17 (85.0)	<0.001	

B) Sawhney type vs facial asymmetry

Sawhney type	Asymmetry present n (%)	Asymmetry absent n (%)	p-value	Cramer's V
I (n=25)	6 (24.0)	19 (76.0)	<0.001	0.53
II (n=18)	7 (38.9)	11 (61.1)		
III (n=14)	9 (64.3)	5 (35.7)		
IV (n=20)	18 (90.0)	2 (10.0)		

C) Sawhney type vs malocclusion

Sawhney type	Malocclusion present n (%)	Malocclusion absent n (%)	p-value	Cramer's V
I (n=25)	12 (48.0)	13 (52.0)	<0.001	0.48
II (n=18)	15 (83.3)	3 (16.7)		
III (n=14)	13 (92.9)	1 (7.1)		
IV (n=20)	19 (95.0)	1 (5.0)		

Table 4: Age-stratified distribution of clinical severity and Sawhney types (n=77)

Age group (years)	n	Severe MMO (0–10 mm) n (%)	Facial asymmetry n (%)	Malocclusion n (%)	Sawhney I n (%)	II n (%)	III n (%)	IV n (%)
1–5	18	12 (66.7)	12 (66.7)	12 (66.7)	4 (22.2)	4 (22.2)	3 (16.7)	7 (38.9)
6–10	30	15 (50.0)	16 (53.3)	24 (80.0)	10 (33.3)	8 (26.7)	5 (16.7)	7 (23.3)
11–14	17	6 (35.3)	8 (47.1)	14 (82.4)	6 (35.3)	4 (23.5)	3 (17.6)	4 (23.5)
15–18	12	2 (16.7)	4 (33.3)	9 (75.0)	5 (41.7)	2 (16.7)		

Discussion

The present study provides a comprehensive evaluation of the clinical and radiographic characteristics of temporomandibular joint (TMJ) ankylosis in children, demonstrating that the condition frequently presents with significant functional impairment and dentofacial deformity. The high prevalence of severe limitation in maximum mouth opening (MMO), facial asymmetry, and malocclusion observed in this cohort underscores the substantial clinical burden of TMJ ankylosis during critical periods of craniofacial growth [9,10].

Severe restriction in MMO emerged as the most prominent clinical feature, consistent with prior studies identifying reduced interincisal distance as a hallmark of TMJ ankylosis and a major contributor to compromised mastication, oral hygiene, and speech function [11-13]. However, interpretation of MMO in pediatric populations requires caution, as normative values vary with age and developmental stage. The use of fixed cut-off values, as applied in this study, may not fully capture age-specific severity, potentially leading to underestimation or overestimation of functional impairment in different age groups [4][5]. The observed age-stratified decline in severe MMO limitation in older children further highlights the importance of incorporating age-adjusted assessment frameworks in future research [14,15].

Facial asymmetry was present in more than half of the participants, reflecting the impact of early-onset joint immobility on mandibular growth and symmetry. Prolonged restriction of condylar movement disrupts normal growth patterns, leading to unilateral mandibular hypoplasia, chin deviation, and soft tissue imbalance [10,11]. While clinical assessment remains a practical approach in routine settings, the absence of objective anthropometric or photogrammetric measurements may introduce observer variability. Future studies should incorporate standardized quantitative methods to enhance reproducibility and diagnostic precision [11].

Malocclusion was highly prevalent in this study, with Class II and Class III patterns predominating. These findings are biologically plausible, as TMJ ankylosis alters mandibular positioning and growth direction, resulting in occlusal discrepancies and dental compensations over time [16,17]. Despite its clinical significance, the present study did not evaluate orthodontic or surgical outcomes, and therefore, conclusions regarding treatment implications remain limited. Longitudinal studies are warranted to explore the progression and management outcomes of malocclusion in affected children [17].

Radiographically, Sawhney Type I and Type IV were the most frequently observed patterns. Variability in the distribution of ankylosis types across studies may reflect differences in etiology, timing of presentation, and access to advanced imaging modalities [18]. The use of cross-sectional imaging (CT/CBCT) enhances diagnostic accuracy and provides superior delineation of bony architecture compared to conventional radiographs, thereby improving classification reliability [6,7]. In this study, the stepwise imaging approach reflects real-world clinical practice; however, variability in imaging modalities may influence classification consistency and should be considered when interpreting findings.

Importantly, this study demonstrated strong and statistically significant associations between Sawhney classification and key clinical variables, including MMO severity, facial asymmetry, and malocclusion. The moderate to strong effect sizes observed (Cramer's V ranging from 0.44 to 0.53) indicate meaningful clinico-radiologic correlations, suggesting that radiographic morphology is closely linked to clinical severity at presentation. These findings contribute to the limited but growing body of evidence supporting the clinical relevance of Sawhney classification beyond descriptive imaging, particularly in pediatric populations [8,18].

No significant gender-based differences were observed in clinical presentations, consistent with previous reports indicating that disease severity is more strongly influenced by factors such as age at onset, duration, and extent of ankylosis rather than sex [17,18]. This reinforces the need to focus on disease-specific and developmental factors when assessing clinical severity.

Conclusion

Temporomandibular joint ankylosis in children commonly presents with severe limitation of mouth opening, facial asymmetry, and a high prevalence of malocclusion, reflecting its significant impact on function and craniofacial development. In this study, Sawhney Types I and IV were the most frequently observed radiographic patterns. Significant and clinically meaningful associations between Sawhney classification and key clinical presentations indicate that radiographic morphology correlates with disease severity at presentation. These findings highlight the importance of early diagnosis, standardized clinical assessment, and appropriate radiographic evaluation in

pediatric TMJ ankylosis. However, given the descriptive cross-sectional nature of the study, the results should be interpreted as clinico-radiologic correlations rather than predictors of prognosis or treatment outcomes.

Authors' Contributions:

All authors meet the ICMJE criteria for authorship.

Author 1: Substantial contribution to conception and design, drafting the manuscript, final approval, agreed to be accountable for all the work.
Author 2: Substantial contribution to conception and design, data acquisition, drafting the manuscript, final approval, agreed to be accountable for all the work.
Author 3: Analysis and interpretation of data, drafting the manuscript, final approval, agreed to be accountable for all the work.
Author 4: Analysis and interpretation of data, critical revision, final approval, agreed to be accountable for all the work.
Author 5&6: Substantial contribution to conception and design, drafting the manuscript, final approval, agreed to be accountable for all the work.
Author 7&8: Substantial contribution to conception and design, data acquisition, drafting the manuscript, final approval, agreed to be accountable for all the work.

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