Temporomandibular joint osseous morphology in a consecutive sample of ankylosing spondylitis patients

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Abstract

***Objective*—To evaluate temporomandibular joint (TMJ) osseous morphology in a consecutive sample of Mexican patients with ankylosing spondylitis.**

***Methods*—Consecutive patients with a diagnosis of ankylosing spondylitis who attended two secondary care outpatient rheumatology clinics were included in the study. Patients had a rheumatological assessment using a structured questionnaire and examination. Recorded variables included demographic data, disease characteristics, TMJ symptoms, and axial mobility measurements. Hypocycloidal tomography of the TMJ was obtained on all subjects. Radiographic variables included condyle position, superior joint space, range of movement, condylar osseous changes, and temporal osseous changes. Patients also underwent standard cervical spine radiography. A control group of normal people without either TMJ symptoms or systemic rheumatic disease was obtained.**

***Results*—65 subjects were studied (65 right sided and 63 left sided tomograms). The control group consisted of 22 individuals. Both groups were similar in age [33 (SD 11) *v* 34 (9) years, P = 0.8]. Patients with ankylosing spondylitis had more variability in TMJ mobility than controls (P < 0.05) and showed increased frequency of condylar erosions (P < 0.01), flattening (P < 0.01), sclerosis (P < 0.01), and temporal flattening (P < 0.01). Condylar erosions were associated with longer duration of ankylosing spondylitis (P < 0.05), neck complaints (P < 0.05), and atlantoaxial subluxation (P < 0.05).**

***Conclusions*—TMJ involvement is frequent in this population of patients with ankylosing spondylitis and is associated with variables that suggest more severe disease.**

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Ankylosing spondylitis is a chronic systemic inflammatory disorder primarily affecting the axial skeleton. Involvement of the peripheral joints is rarely persistent or erosive.[1]

Temporomandibular joint (TMJ) disorders can be divided into congenital and developmental disorders, dislocation, inflammatory conditions, arthritides, ankylosis, and fracture. This classification, as developed by the American Academy of Orofacial Pain,[2] is similar to those of disorders in other synovial joints, even though the articular surfaces in the temporomandibular joint are covered with fibrous connective tissue rather than hyaline cartilage.[3]

TMJ involvement in patients with ankylosing spondylitis has been described previously, mainly in non-rheumatological journals. Its reported frequency varies from 11% to 35%,[4–12] depending on the diagnostic criteria, the population studied, and the tools used to assess TMJ involvement. However, the majority of the reports included patients with long lasting ankylosing spondylitis from tertiary care centres, and while they focus on TMJ involvement, little information on the characteristics of the ankylosing spondylitis is given.

The objective of this study was to evaluate TMJ osseous morphology using hypocycloidal tomography in a consecutive sample of patients with ankylosing spondylitis from two community based outpatient rheumatology clinics, and to compare the severity of TMJ changes with clinical and radiographic characteristics of ankylosing spondylitis.

Methods

The study was approved by the ethics committee of the Hospital de Especialidades, CMNO, IMSS of Guadalajara Jal, Mexico, and all individuals provided informed consent.

SAMPLE

Consecutive patients with a diagnosis of ankylosing spondylitis according to the New York criteria[13] who attended two secondary care outpatient rheumatology clinics in Guadalajara, Mexico, between July and September 1993 were included in the study. Patients with Reiter syndrome, psoriasis, inflammatory bowel disease, Brucellosis, or history of overt cervical trauma were excluded.

A control group of normal people without either TMJ symptoms or systemic rheumatic disease were obtained among the students and radiology department staff. The controls were not formally matched, but had similar demographic characteristics.

ASSESSMENT

All patients received a rheumatological assessment conducted by a single rheumatologist (CRR). Demographic data, disease characteristics,

Table 1 Selected demographic and clinical data of the 65 patients with ankylosing spondylitis

Age, mean years (SD)	33 (11)
Gender, n (%)	
Male	48 (71)
Female	20 (29)
Juvenile onset AS, n (%)	19 (29)
Disease duration, mean years (SD)	8 (7)
Dougados functional index, mean (SD)	12 (9)
Neck complaints, n (%)	56 (82)
Peripheral enthesitis, n (%)	56 (82)
Peripheral arthritis, n (%)	49 (72)
Patients with TMJ symptoms, n (%)	32 (49)
Occiput-wall distance, mean, cm (SD)	1 (3)
Modified Schober, mean, cm (SD)	5.7 (1.7)
Radiological sacroiliitis, n (%)	
Grade II	27 (40)
Grade III	31 (45)
Grade IV	10 (15)
HLA-B27$^+$, n (%)	57 (84)

co-morbid conditions, Dougados activity index,[14] and drug history were documented using a structured questionnaire and review of case notes. All patients completed a questionnaire designed to elicit symptoms of TMJ disease.[15] The questionnaire involved six questions assessing various symptoms of TMJ disease, such as morning stiffness or tiredness in the jaws, sounds from the TMJ, difficulties in wide mouth opening, pain the face or jaws at rest, pain in the face or jaws on opening wide or chewing, and TMJ locking or luxation. Physical examination included axial mobility measurements (modified Schober, lateral Schober, and occiput-wall distance).[16] The rheumatologist completing the physical assessment was blind to the other recorded data. Molecular typing for HLA-B27 was performed in the patients with ankylosing spondylitis using a previously described method.[17]

Radiographic assessment of left and right temporomandibular joints was completed using hypocycloidal movement tomography. A CGR Titanos 71S tomography unit was used to obtain a series of four 1-2 mm thick sagittal slices taken at 45 degrees to the midsagittal plane. Images were obtained with the jaw closed into maximum intercuspation and with maximum jaw opening. Radiographs were coded and reported by an oral maxillofacial radiologist (GP) who was blinded to clinical assessment results. Osseous morphological characteristics and joint space dimensions were subjectively classified according to criteria reported by de Leeuw *et al*.[18] Reliability was determined by the same radiologist re-reporting 40 randomly selected cases two months after completing the first reading.

STATISTICAL ANALYSIS

Differences between two continuous variables were compared with two tailed *t* tests. Differences between proportions were compared with χ^2 and Fisher's exact tests. Logistic regression was performed to evaluate the association of various independent variables with condylar erosions. Statistical significance was set at $P < 0.05$.

Intraobserver reliability of TMJ radiographic assessment was established using Cramer's V correlation coefficient for condyle position, superior joint space, and mobility; κ correlation was used for the remaining values.

Results

Three sets of tomograms and two other tomograms of the left side were not of diagnostic quality, reducing the ankylosing spondylitis group to 65 subjects (65 right sided and 63 left sided tomograms). The control group consisted of 22 individuals. There were no significant differences in the mean age of the patients with ankylosing spondylitis and the controls [33 (SD 11) *v* 34 (9) years, P = 0.8]. However, 50% of the control group were females. Demographic and clinical data

Table 2 Summary of main features of hypocycloidal tomography in ankylosing spondylitis patients and controls

	Ankylosing spondylitis		*Controls*		*Interobserver reliability*	
	Right n=65	*Left n=63*	*Right n=22*	*Left n=22*	*Left*	*Right*
Condyle position						
Centred	41 (63%)	41 (66%)	*20 (91%)	*18 (82%)	0.71	84
Anterior	16 (25%)	16 (26%)	*1 (4.5%)	*2 (9%)		
Posterior	8 (12%)	6 (8%)	*1 (4.5%)	*2 (9%)		
Superior joint space						
Norma	34 (52%)	28 (44%)	15 (68%)	*17 (77%)	0.62	0.48
Widened	31 (48%)	32 (51%)	6 (27%)	*5 (23%)		
Decreased	0	3 (5%)	1 (5%)	0		
Range of movement						
Normal	16 (25%)	19 (30%)	†19 (86%)	†16 (73%)	0.89	0.94
Hypermobile	33 (50%)	26 (41%)	†2 (9%)	†3 (14%)		
Hypomobile	16 (25%)	18 (29%)	†1 (4%)	†3 (14%)		
Osseous changes - Condyle						
Flattening	14 (21.5%)	14 (22%)	†0	*1 (4.5%)	0.86	0.86
Sclerosis	16 (25%)	13 (21%)	†0	*1 (4.5%)	0.71	0.61
Osteophytes	2 (3%)	5 (8%)	0	1 (4.5%)	1.0	0.65
Erosions	6 (9%)	7 (11%)	†0	*1 (4.5%)	1.0	0.78
Osseous changes - Temporal						
Flattening	21 (32%)	19 (30%)	†0	†1 (4.5%)	0.84	0.83
Sclerosis	25 (38%)	19 (30%)	†2 (9%)	†1 (4.5%)	0.83	0.79
Erosions	1 (1.5%)	2 (3%)	0	1 (4.5%)		

*P < 0.05, †P < 0.01*v* controls

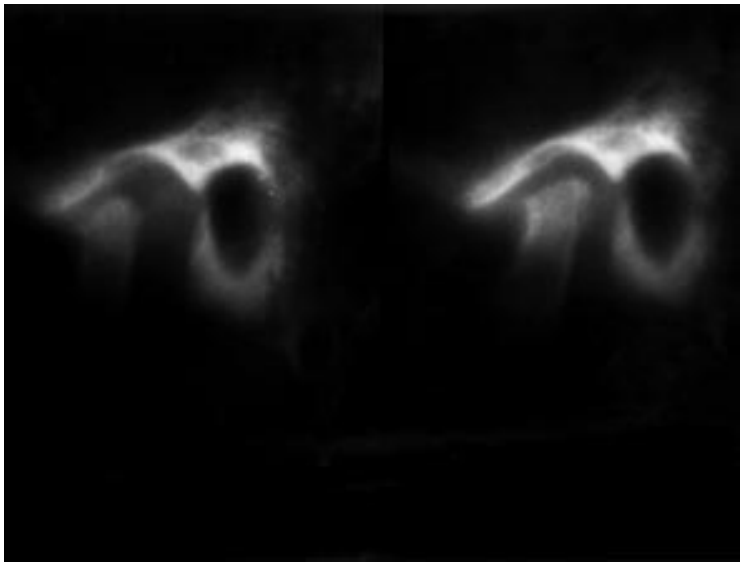
Table 3 Selected clinical and demographic data of the patients with and without condylar erosions

	Condylar erosions		*P*
	Present n=12	*Absent n=53*	
Age, mean, years (SD)	29.5 (10)	33 (10)	0.3
Gender			
Male	8 (67)	39 (74)	0.7
Female	4 (33)	14 (26)	
Disease duration, mean years (SD)	12 (7)	7 (7)	0.03
Dougados functional index, mean (SD)	10.5 (7)	12 (9)	0.5
Peripheral arthritis, n (%)	11 (92)	38 (72)	0.2
Neck complains ever, n (%)	9 (75)	44 (83)	0.5
Neck complains as presenting symptom	5 (42)	8 (15)	0.03
Number of TMJ symptoms, mean (SD)	1 (1)	1 (1)	0.6
Patients with TMJ symptoms, n (%)	7 (58)	25 (47)	0.4
Occiput-wall distance mean* (SD)	0.5 (1.7)	1.1 (3.4)	0.5
Modified Schober, mean* (SD)	5.6 (2)	5.7 (2)	0.8
HLA-B27+	11 (100)	44 (83)	0.3
Atlantoaxial subluxation, n (%)	5 (42)	7 (13)	0.03
Anterior altantoaxial distance, mean* (SD)	3.5 (2)	2.3 (1.1)	0.006

TMJ, temporomandibular joint.
*Measurement in centimetres.

obtained for the subjects with ankylosing spondylitis are shown in table 1. Forty nine per cent of these patients reported subjective temporomandibular joint symptoms: no symptoms in 33 patients (51%), one symptom in 14 (21%), two symptoms in 7 (11%), three symptoms in 7 (11%), and four symptoms in 4 (6%). It is of interest that none of the patients complained spontaneously of symptoms of TMJ disease before the study. No clinical abnormalities were recorded in the control group .

Tomographic features of the patients with ankylosing spondylitis and the controls are shown in table 2. The patients showed significantly more variability in anteroposterior condylar position and condylar mobility than controls. They also had a significantly increased frequency of condylar erosions, flattening and sclerosis, as well as flattening and sclerosis of the temporal component (figure). Osteophytes and erosions of the temporal bone were infrequent in both groups.



A 19 year old male with juvenile ankylosing spondylitis of five years' duration. Hypocycloidal tomography shows severe temporomandibular joint changes, with condyle erosions, and osteophyte formation. Open mouth (left panel) and closed mouth positions show minimal condylar translation.

Condyle erosions were statistically associated with longer disease duration and with the presenting symptom of neck complaints. The presence of anterior atlantoaxial subluxation, defined as a distance equal to or greater than 4 mm, was also associated with condyle erosion (table 3). Other variables such as age, gender, disease duration, juvenile ankylosing spondylitis, mean number of TMJ symptoms, or number of patients having TMJ symptoms, were associated with condyle erosions. Logistic regression analyses showed that statistically significant associations of condylar erosions with anterior atlantoaxial subluxation, neck complaints, and duration of the disease remained after adjusting for the other independent variables.

Discussion

Existing reports suggests an increased clinical and radiographic frequency of TMJ disorders in patients with ankylosing spondylitis. However, reported patients were from tertiary care centres, usually had long lasting ankylosing spondylitis, and the descriptions focus principally on TMJ abnormalities; scant information is given on relations between clinical and radiographic characteristics of ankylosing spondylitis and the TMJ findings. There are several clinical studies of TMJ in ankylosing spondylitis. Crum and Loiselle[4] reported that four of their sample of 26 patients with ankylosing spondylitis had complaints of pain and tenderness in the region of the temporomandibular joints, with limited jaw opening. Davidson *et al* [5] reported that eight (11.5%) of their sample of 79 patients with ankylosing spondylitis had restricted jaw opening. These eight patients were older and had more extensive spinal and peripheral involvement. Wenneberg and Kopp[6 7] compared 100 ankylosing spondylitis patients with an age and sex matched control group. In the patient group, 13% had restricted jaw opening and 31% were tender to palpation of the temporomandibular joints compared to the controls, with 4% having restricted opening and 11% having tenderness. Clicking sounds were not found more frequently in patients with ankylosing spondylitis. Temporomandibular joint symptoms were positively correlated with the individuals' own estimation of the severity of their general joint symptoms. In a more recent study Kononen *et al* [8] reported that clinical signs of temporomandibular dysfunction are common in patients with rheumatoid arthritis, psoriatic arthritis, or ankylosing spondylitis.

Involvement of the TMJ based on radiographic assessment has also been reported. Resnick[9] reported 32% of his sample of 25 consecutive patients with long standing ankylosing spondylitis had tomographic TMJ abnormalities. The most common feature was joint space narrowing, followed by erosions, reduced mobility, osteophyte formation, excessive sclerosis, and extensive erosion with widened joint space. Approximately half of the affected patients had asymptomatic or unilateral involvement.

Wenneberg *et al* [10 11] used panoramic radiographs to compare 90 patients with ankylosing spondylitis to age and sex matched controls. Radiographic changes were observed in 25% of the patients compared with 11% in the controls. Condylar erosions were reported to be correlated with the severity of the ankylosing spondylitis. The mean age of the patients was 43 years and the disease severity was determined by a self report of pain severity. In a subsequent study Wenneberg *et al* [12] found panoramic radiographic changes more frequently in patients with rheumatoid arthritis (66%), psoriatic arthritis (38%), and ankylosing spondylitis (30%) than in the controls (12%).

Hypocycloidal tomography is necessary to establish joint space relations and bony morphology. Only one of the published studies[9] used tomography. The ankylosing spondylitis sample in this study showed a wide range of TMJ mobility compared to normal controls, as assessed by hypocycloidal tomography.

In our study, osseous changes—with the exception of condylar osteophytes and temporal erosions—were significantly more frequent in the patients with ankylosing spondylitis. Flattening and sclerosis may represent adaptive remodelling to increased loading.[19] Erosions are diagnostic of degenerative change in osseous tissue and were therefore used in comparisons with selected clinical and demographic data in the patients. Consistent with previous studies,[10 11] degenerative changes identified by erosions were associated with the duration of ankylosing spondylitis. Erosions were not significantly associated with patient age, disease duration, juvenile onset ankylosing spondylitis, activity index, TMJ symptoms, thoracic mobility, lumbar spine mobility, or the possession of HLA-B27. Interestingly, other peripheral joint involvement was not associated with temporomandibular joint erosion. The frequency of some of the clinical characteristics of the patients reported here, such as juvenile onset ankylosing spondylitis and peripheral arthritis, differs from other reports. This may reflect either differences in clinical expression related to ethnicity or perhaps referral bias.

Subjective assessment of superior joint space had a low level of reliability, and care must be taken in interpreting the results. Resnick[9] reported that superior joint space narrowing was the most common radiographic feature. He also used subjective assessment of joint space with a sample of only 25 patients. Examiner reliability was not reported. Other research[20 21] has found that intra-articular joint space may be of limited value because of significant variation in the normal population.

There are no histological studies suggesting the pathogenesis of ankylosing spondylitis in the TMJ. The TMJ has unusual anatomical and functional features in comparison with most other synovial joints. The articular surface is composed of dense fibrous connective tissue rather than hyaline cartilage.[3] The joint is maximally loaded during movement and there is relative incongruity of the temporal and condylar surfaces. The articular disc is firmly attached to the condyle neck by the collateral ligament at the same site as the capsular attachment. The articular disc functions to distribute loading forces generated during function while allowing movement.[22]

There are two potential mechanisms for the pathogenesis of temporomandibular joint involvement in ankylosing spondylitis. One could involve destruction of the capsular/disc attachment, resulting in internal derangement and subsequent degenerative joint disease. Alternatively, there could be a primary synovitis with direct breakdown of the articular surfaces. Internal derangement would then result from articular surface changes and not precede them. Hypermobility was the most common finding, with normal or decreased mobility being less frequent. Destruction of the capsular attachment would result in hypermobility. Hypomobility could be due to disc derangement or fibrosis of the capsule.

Cervical dysfunction, with neck complaints as a presenting symptom, and atlantoaxial subluxation were significantly associated with advanced temporomandibular joint involvement, as evidenced by erosions. Atlantoaxial subluxation is not associated with peripheral arthritis.[3] Crum and Loiselle[4] noted that ankylosing spondylitis causes debilitating postural changes with forward thrusting of the head. Postural imbalance of the neck may affect the function of the masticatory system and temporomandibular joint involvement may be a result of this abnormal posture, rather than of the disease itself. In view of the results of the current study this hypothesis appears unlikely. Subjective complaints of temporomandibular symptoms were not associated with erosions, but subjective neck complaints were. If the pathogenesis of temporomandibular joint involvement was through dysfunction of the masticatory muscles, most patients would also have reported facial pain.

We conclude that TMJ involvement is frequent in ankylosing spondylitis. Although the pathogenesis of this involvement remains unknown, altered joint mobility and association with atlantoaxial subluxation suggest primary involvement of the capsular and disc attachment. Although this study identifies the associations of TMJ osseous changes and osseous spatial relationships with ankylosing spondylitis, it does not identify soft tissue changes. Magnetic resonance imaging may prove useful in determining the staging of internal derangement,[24] which would have implications for clinical management. However, the impact of TMJ involvement on the overall wellbeing and nutritional status of patients with ankylosing spondylitis remains to be determined.

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