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

Cesar Ramos-Remus, Paul Major, Amparo Gomez-Vargas, Grace Petrikowski, Abel Hernandez-Chavez, Enrique Gonzalez-Marin, Anthony S Russell

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) vs 34 (9) years, P = 0.81). 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), 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%,4–11 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 criteria12 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

<table>
<thead>
<tr>
<th>Age, mean years (SD)</th>
<th>Gender, n (%)</th>
<th>Ethnicity, n (%)</th>
<th>Co-morbid conditions, n (%)</th>
<th>Drug history, n (%)</th>
<th>Demographic data, n (%)</th>
<th>Disease characteristics, n (%)</th>
<th>Disease duration, mean years (SD)</th>
<th>Disease quality, n (%)</th>
<th>Intraobserver reliability of TMJ radiographic assessment, n (%)</th>
</tr>
</thead>
</table>
| 33 (11)              | 48 (71)       | Male            | 20 (29)                     | Juvenile onset AS | 34 (9)                 | Pain in the face or jaws at rest | 8 (7)                         | Moderate AS | Grades of radiographic assessment: Grade I 5 (7%)

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

<table>
<thead>
<tr>
<th>Condyle position</th>
<th>Right n=65</th>
<th>Left n=63</th>
<th>Controls</th>
<th>Right n=22</th>
<th>Left n=22</th>
<th>Interobserver reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Centred</td>
<td>41 (63%)</td>
<td>41 (66%)</td>
<td>*20 (91%)</td>
<td>*18 (82%)</td>
<td>0.71</td>
<td>84</td>
</tr>
<tr>
<td>Anterior</td>
<td>16 (25%)</td>
<td>16 (26%)</td>
<td>*1 (4.5%)</td>
<td>*2 (9%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Posterior</td>
<td>8 (12%)</td>
<td>6 (8%)</td>
<td>*1 (4.5%)</td>
<td>*2 (9%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Superior joint space</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>34 (52%)</td>
<td>28 (44%)</td>
<td>*17 (77%)</td>
<td>*5 (23%)</td>
<td>0.62</td>
<td>0.48</td>
</tr>
<tr>
<td>Decreased</td>
<td>0</td>
<td>3 (5%)</td>
<td>1 (3%)</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Range of movement</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>16 (25%)</td>
<td>19 (30%)</td>
<td>*19 (86%)</td>
<td>*16 (73%)</td>
<td>0.89</td>
<td>0.94</td>
</tr>
<tr>
<td>Hypomobile</td>
<td>33 (50%)</td>
<td>26 (41%)</td>
<td>*12 (9%)</td>
<td>*3 (14%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Osseous changes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Condyle</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flattening</td>
<td>14 (21.5%)</td>
<td>14 (22%)</td>
<td>*10 (45%)</td>
<td>*10 (45%)</td>
<td>0.86</td>
<td>0.86</td>
</tr>
<tr>
<td>Sclerosis</td>
<td>16 (25%)</td>
<td>13 (21%)</td>
<td>*11 (45%)</td>
<td>*11 (45%)</td>
<td>0.81</td>
<td>0.61</td>
</tr>
<tr>
<td>Osteophytes</td>
<td>2 (3%)</td>
<td>5 (8%)</td>
<td>0</td>
<td>1 (4.5%)</td>
<td>1.0</td>
<td>0.65</td>
</tr>
<tr>
<td>Erosions</td>
<td>6 (9%)</td>
<td>7 (11%)</td>
<td>*10 (45%)</td>
<td>*1 (4.5%)</td>
<td>1.0</td>
<td>0.78</td>
</tr>
<tr>
<td>Temporal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flattening</td>
<td>21 (32%)</td>
<td>19 (30%)</td>
<td>*10 (45%)</td>
<td>*10 (45%)</td>
<td>0.84</td>
<td>0.83</td>
</tr>
<tr>
<td>Sclerosis</td>
<td>28 (38%)</td>
<td>19 (30%)</td>
<td>*12 (9%)</td>
<td>*1 (4.5%)</td>
<td>0.83</td>
<td>0.79</td>
</tr>
<tr>
<td>Erosions</td>
<td>1 (1.5%)</td>
<td>2 (3%)</td>
<td>0</td>
<td>1 (4.5%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*P < 0.05, †P < 0.01: controls
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 suggest 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 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 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 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 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 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 erosion with widened joint space. Approximately half of the affected patients had asymptomatic or unilateral involvement.

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

<table>
<thead>
<tr>
<th></th>
<th>Present n=12</th>
<th>Absent n=53</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean, years (SD)</td>
<td>29.5 (10)</td>
<td>33 (10)</td>
<td>0.3</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>4 (33)</td>
<td>14 (26)</td>
<td>0.03</td>
</tr>
<tr>
<td>Disease duration, mean (SD)</td>
<td>12 (7)</td>
<td>7 (7)</td>
<td>0.03</td>
</tr>
<tr>
<td>Dougados functional index,</td>
<td>10.5 (7)</td>
<td>12 (9)</td>
<td>0.5</td>
</tr>
<tr>
<td>mean (SD)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peripheral arthritis, n (%)</td>
<td>11 (92)</td>
<td>38 (72)</td>
<td>0.2</td>
</tr>
<tr>
<td>Neck complaints ever, n (%)</td>
<td>9 (75)</td>
<td>44 (83)</td>
<td>0.5</td>
</tr>
<tr>
<td>Neck complaints as presenting symptom</td>
<td>5 (42)</td>
<td>8 (15)</td>
<td>0.03</td>
</tr>
<tr>
<td>Number of TMJ symptoms, mean (SD)</td>
<td>1 (1)</td>
<td>1 (1)</td>
<td>0.6</td>
</tr>
<tr>
<td>Patients with TMJ symptoms, n (%)</td>
<td>7 (58)</td>
<td>25 (47)</td>
<td>0.4</td>
</tr>
<tr>
<td>Modified Schober, mean* (SD)</td>
<td>0.5 (1.7)</td>
<td>1.1 (3.4)</td>
<td>0.5</td>
</tr>
<tr>
<td>Atlantoaxial subluxation, n (%)</td>
<td>5 (42)</td>
<td>7 (13)</td>
<td>0.03</td>
</tr>
<tr>
<td>Anterior atlantoaxial distance, mean* (SD)</td>
<td>3.5 (2)</td>
<td>2.3 (1.1)</td>
<td>0.006</td>
</tr>
</tbody>
</table>

*Measurement in centimetres.

---

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.
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. 10 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 1 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 10–11 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. 1 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 force 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. Hypermobility 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. 23 Crum and Loiselle 28 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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