Pain, tenderness, mandibular mobility, and anterior open bite in relation to radiographic erosions in temporomandibular joint disease

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The relationship between radiographic changes and clinical signs and symptoms of the temporomandibular joint (TMJ) was investigated in 39 patients with joint diseases. Radiographic erosions were found in 33% of the TMJ joints, and overall frequency of radiographic changes including remodeling was 47%. Fifty-four per cent of the patients had an anterior open bite (AOB). The AOB showed statistically significant correlation to the extension of erosion of the TMJ. Pain expressed by means of a visual analog scale, tenderness to palpation of the TMJ, and pressure pain threshold showed no significant correlation to erosion, but mandibular mobility showed significant negative correlation to erosive changes. In conclusion, AOB is correlated with erosive radiographic changes in this patient group. However, the degree of local pain and tenderness showed no correlation to radiographic changes. □ *Erosion; occlusal change; radiography; temporomandibular joint*

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Several systemic diseases, such as psoriasis, pelvospondylitis, polymyalgia rheumatica, Sjögren's syndrome, and rheumatoid arthritis (RA), frequently involve the temporomandibular joint (TMJ). It has been reported that 30–50% of patients with RA will experience symptoms from the TMJ (1, 2). Frequent subjective symptoms are pain both during rest and on mandibular movements, and common clinical signs are tenderness to palpation of the joint and restricted mandibular mobility. A less frequent but functionally detrimental sign is anterior open bite (AOB).

The inflammatory process in the TMJ can result in extensive resorption of cartilage and bone, with ensuing destruction of the joint components, imaged in radiographs as erosive changes. The radiographic changes of the TMJ in RA or other joint diseases vary from slightly decreased density of the surface of the cortical bone to severe destruction of the condyle and the temporal component of the joint. The reported frequency of radiographic changes in the TMJ has differed considerably in different studies and for different joint diseases. In a study of 110 patients with RA by Syrjänen (3) radiographic changes were found in about 60% and erosions of the condyle in 29%. In a study of 64 patients with psoriatic arthritis radiographic changes, mostly erosions, were found in 41% of the condyles (4). In a study of 101 patients with RA Åkerman et al. (5) used the grading system for radiographic changes described by Rohlin & Petersson (6) and found significant correlations between the degree of radiographic change and clinical signs like AOB and restricted mouth opening but no correlation between radiographic grade and pain on palpation. Erosive changes were not specifically dealt with in that study.

The aim of this study was to investigate, in a group of patients with joint diseases, the relationship between radiographic changes, particularly erosions, in the TMJ and pain, tenderness, mandibular mobility, and occlusal changes.

Materials and methods

Thirty-nine patients with a diagnosis of joint disease with TMJ involvment were included in this study. Patients with a history of traumatic injury or surgery of the TMJ were excluded. The mean age of the patients was 53 years, with a range of 22–74 years. The mean duration of systemic joint disease was 14 years, and that of TMJ disease 5 years. The medical diagnoses and the male to female ratio are shown in Table I. All patients had been referred to the Dept. of Clinical Oral Physiology, School of Dentistry, Karolinska Institutet, for TMJ disorder. The patients were clinically examined, and a radiographic examination of the TMJ was performed. The patients were asked to express their subjective level of general joint pain and pain in the TMJ on a visual analog scale (VAS-stickan, ACO AB, Stockholm, Sweden). They were instructed to assess the highest level of pain during the week preceding the clinical examination and to indicate it on a 10-cm VAS

Table 1. Medical diagnoses and male to female ratio in the patient group

Diagnosis*	*n*	Male	Female
Rheumatoid arthritis, RF +	8	2	6
Rheumatoid arthritis, RF –	3	0	3
Pelvospondylitis	3	0	3
Osteoarthrosis	1	0	1
Psoriatic arthritis	4	0	4
Chronic unspecific monoarthritis	2	0	2
Chronic unspecific polyarthritis	9	1	8
Sjögren's syndrome	3	1	2
Polymyalgia rheumatica	2	1	1
Systemic sclerosis	2	0	2
Common variable immunodeficiency	2	0	2
Total	39	5	34

* RF = rheumatoid factor.

scale, with the end points of 'no pain' and 'worst pain ever experienced'.

Radiographic examination

An axial projection of the TMJ was performed using a precision apparatus for skull radiography, followed by sagittal individualized tomography performed throughout the joint and with the teeth in intercuspal position (7). For simultaneous tomography, a cassette with five pairs of intensifying screens was used. The interspace was 2 mm. Two cassettes were used to include the full mediolateral extent of each joint.

Each tomographic image was evaluated with regard to erosive change of the mineralized articular surfaces. Erosion was defined as a local area with decreased density of the cortical joint surface and adjacent subcortical bone. The extension of the erosions was estimated in the radiographs by separate registration of the presence of erosion in the lateral, central, and medial third of the temporal and condylar surfaces. The radiographic changes in the temporal component or the condyle could thus have the extension of zero to three zones, with a maximal score for each joint of 6 units. For comparison with earlier studies a comprehensive diagnosis of the entire joint in accordance with Rohlin & Petersson (6) was also included. This diagnosis comprises the following classification: grade 0 = normal joint; grade 1 = slight abnormality; grade 2 = definite early abnormality; grade 3 = moderate destructive abnormality; grade 4 = severe destructive abnormality; and grade 5 = mutilating abnormality. All radiographic recordings were read by the same oral radiologist and the findings were recorded on premade forms.

Clinical examination

Tenderness of the TMJ was recorded by palpation over the lateral aspect of the joint with the patient's jaw in postural position and posteriorly through the auditory meatus. The recording was 0 if there was no tenderness at any of the sites and 1 if there was tenderness at least at one of the four sites. The pressure pain threshold (PPT) and the pressure pain tolerance level (PPTL) were determined with an algometer with a 1-cm^2 rubber tip (Pain, Diagnostics & Thermography, Great Neck, N.Y., USA) (8, 9).

The range of mandibular mobility was measured at four different movements: maximum voluntary mouth opening (MVM), maximum laterotrusion to both sides (LTR), and maximum protrusion (PTR). The measurements were made between the right upper and lower

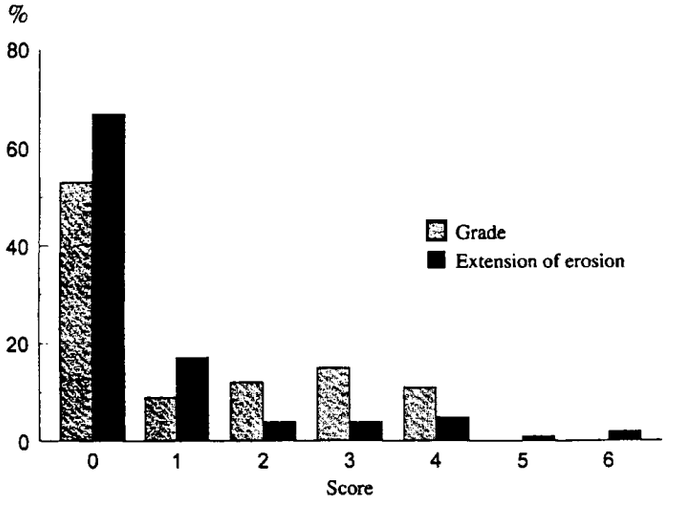

Fig. 1. The relative frequency (%) of extension of erosion (0–6) and grade of radiographic change (0–4) in the temporomandibular joint (TMJ) (n = 78) of 39 patients with local or systemic joint disease and TMJ involvment.

Table 2. Correlation between radiographic changes and clinical signs and symptoms*

	Extension of erosion			Grade of radiographic change	
	n	r_s	*P*	r_s	*P*
Pain					
VAS	78	−0.03	0.78	0.07	0.54
Pain at max. opening	78	0.20	0.08	0.22	**0.05**
Pain at LTR ips	78	0.09	0.44	0.08	0.23
Pain at LTR contr	78	0.01	0.91	0.04	0.74
Pain at PTR	78	0.06	0.60	0.19	0.10
Tenderness					
Palpation	78	0.02	0.88	0.05	0.64
PPT	78	0.05	0.68	0.04	0.72
PPTL	78	0.08	0.50	0.09	0.44
Occlusal changes					
AOB	78	0.27	**0.02**	0.20	0.08
Mobility					
Max. open	39	−0.27	**0.05**	−0.34	**0.02**
Laterotrusion	39	−0.14	0.20	0.09	0.29
Protrusion	39	−0.01	0.94	−0.01	0.47

* r_s = Spearman's rank correlation coefficient; VAS = visual analog scale; pain at LTR ips = pain in the ipsilateral temporomandibular joint (TMJ) at laterotrusion; pain at LTR contr = pain in the contralateral TMJ at laterotrusion; PTR = protrusion; PPT = pressure pain threshold; PPTL = pressure pain tolerance level; AOB = anterior open bite.

medial incisors. The patients were also asked to report if they experienced pain in the TMJ on any of these movements and on which side. The readings were scored 0 = no pain and 1 = painful. Occlusal contacts were recorded with occlusal foil (GHM 2 × 8 µm, Hanel-GHM-dental GmbH, Nürtingen, Germany), with the patient biting hard in intercuspal position. AOB was determined on the basis of the following scale: contact on the cuspid and posteriorly was scored 0, contact from the first premolar and posteriorly 1, from the second premolar 2, from the first molar 3, and from the second molar 4.

Statistics

Spearman's rank correlation coefficient was used to determine the correlation between variables measured on an ordinal scale. A probability level of $P < 0.05$ was considered significant. Of the clinical variables, tenderness to palpation, algometric testing for pain on pressure, and pain on mandibular movements were related to the joint and not to the individual. For these variables the number of the recorded values (*n*) was 78.

Results

Radiographic changes

Erosion of the TMJ condyle or temporal bone was recorded in 20 patients (51%). Fourteen patients had unilateral erosions, whereas six had bilateral erosions. Erosive change was thus seen in 26 joints (33%). Erosions in at least one of the three zones from the medial to the lateral part of the joint were seen in 23 of the 78 condyles (29%) and in 13 of the 78 temporal components (17%). Erosions extending over all 3 zones were seen in 5 of the 78 condyles (6%) and in 6 of the 78 temporal components (8%). Grade of radiographic change exceeding 0 was recorded for 25 patients (64%), of which 13 had unilateral changes and 12 had bilateral changes. The number of joints with grade >0 was 37 (47%). Most joints with erosions had an extension confined to only one of the six zones (17%), whereas an extension through all six zones was an infrequent finding (2%). There was no significant correlation between the duration of TMJ disease and the extension of erosions ($r_s = 0.16$, $P = 0.33$). The relative frequency of radiographic change in the joints on the basis of the grading system and the extension of erosion per joint are shown in Fig. 1.

Clinical findings

Pain and tenderness. No significant correlation was found between the VAS scores and radiographic changes (Table 2). Twenty-seven of the 39 patients (69%) had pain in at least 1 joint on MVM. Thirty (77%) had pain on LTR and 22 (56%) on PTR. There was no significant correlation between extension of erosion and pain on any of the movements. A weak but significant correlation between pain at MVM and grade of radiographic change was found ($r_s = -0.34$, $P = 0.02$). Palpation did elicit pain from at least one tender site in 60% of the joints. Neither palpation nor PPT or PPTL showed significant correlation with extension of erosion or grade of radiographic change (Table 2).

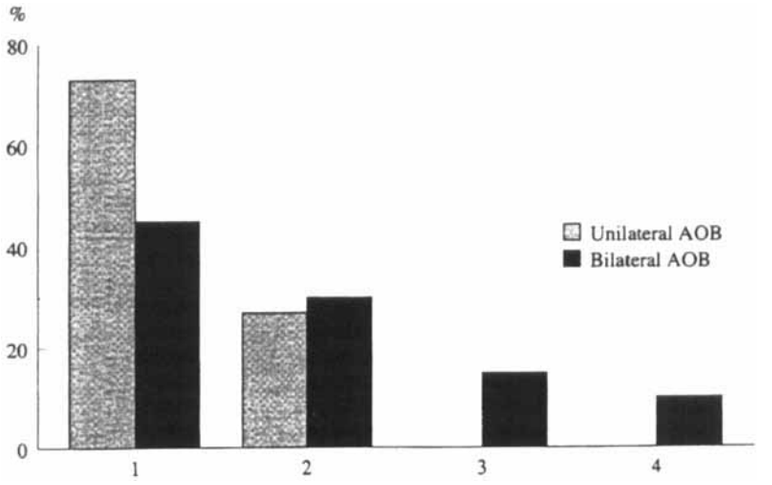

Fig. 2. The relative frequency (%) of anterior open bite (AOB) scores 1–4 for 21 patients, 11 with unilateral and 10 with bilateral open bite.

Anterior open bite. Twenty-one patients (54%) had an AOB score between 1 and 4. The same proportion of AOB was found in patients with RA and patients with other joint diseases. The open bite was unilateral in 11 of the patients and bilateral in 10. Of the 21 patients with AOB, 13 (62%) had radiographic erosions, and of the 18 without AOB, 11 (61%) had erosions. The degree of AOB in unilateral and bilateral AOB is shown in Fig. 2. There was a statistically significant correlation between the extension of erosions and the degree of AOB (Table 2).

Mandibular mobility. The MVM was negatively and significantly correlated to the extension of erosions and to the grade of radiographic change (Table 2).

Discussion

The level of TMJ pain indicated by the patient on the VAS scale was not related to the extension of erosion or the grade of radiographic change in the TMJ. In addition, neither palpation nor algometric testing was more painful in joints with erosive change than in joints without. In their study of joints in the hand and wrist of RA patients, Fuchs et al. (10) suggested that radiographic change and joint tenderness may reflect different aspects of the inflammatory process, which is in agreement with our findings.

The proportion of AOB among the RA patients in our study is concordant with a previous study of RA patients by Tegelberg & Kopp (2), and the same proportion was found for the patients with other joint diseases. A relatively weak correlation between the grade of radiographic changes and AOB has previously been reported in a study by Åkerman et al. (5) for patients with RA. In our study AOB had a somewhat stronger correlation to radiographic erosion than to the grade of radiographic change. Radiographic grade comprises a mix of degenerative and inflammatory changes as well as remodeling due to age and function and is therefore a less specific sign of inflammatory change. The correlation we found between radiographic erosion and AOB may not provide a total explanation of AOB in this group of patients, since erosions were as frequent in the group with AOB as in those without. However, the relationship was stronger for more severe AOB, and only one patient with bilateral AOB had no radiographic changes.

In a recent study of an autopsy material, Flygare et al. (11) compared the prevalence of erosions in the TMJ as determined by radiography and microscopy and showed underestimation both of the presence and extension of erosions in tomograms. The difference between our study and that of Flygare et al. is considerable—patients versus autopsy material and mean ages of 53 years and 75 years, respectively, and lack of medical history and diagnoses in the autopsy study—therefore comparisons should be made cautiously. Nevertheless, considering the results of Flygare et al., an underestimation of the prevalence of erosions in our material seems likely.

A weak negative correlation was found between MVM and erosion and radiographic grade in our study. This is in agreement with the reduced mandibular mobility found in previous studies of the TMJ of RA patients by Syrjänen (3) and Åkerman et al. (5).

In conclusion, this study indicates that pain and tenderness of the TMJ occurs independently of radiographic erosion or other radiographic changes of the TMJ with the important exception of pain on MVM. There is a correlation between AOB and radiographic signs of erosion, especially for the more severe forms of

open bite. AOB and erosive changes were found in patients with various joint diseases. From a clinical point of view, radiographic examination of the TMJ is to be recommended when a patient with joint disease is developing an AOB, to ascertain whether there is destruction of the joint structures.

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