Impact of temporomandibular joint pain on activities of daily living in patients with rheumatoid arthritis

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Voog Ü, Alstergren P, Leibur E, Kallikorm R, Kopp S. Impact of temporomandibular joint pain on activities of daily living in patients with rheumatoid arthritis. Acta Odontol Scand 2003;61:278–282. Oslo. ISSN 0001-6357.

The aim of this study was to investigate the impact of temporomandibular joint (TMJ) pain on daily living in patients with rheumatoid arthritis (RA) involving the TMJ. Nineteen patients (17 F, 2 M) with a median (IQR) age of 44 (23) years were included. A scale for the influence of TMJ pain/discomfort on the activities of daily living was used. TMJ resting pain and pain upon maximum mouth opening according to a visual analog scale as well as pressure pain threshold and tenderness to digital palpation of the TMJ were assessed. Blood samples were collected to measure the level of acute phase proteins. Activities of daily living were influenced in all patients at different levels. The impact on daily living by TMJ pain/discomfort was greatest on the performance of physical exercises and jaw movements, while it was smallest on the performance of hobbies and eating. Pain during maximum mouth opening and tenderness to digital palpation were correlated to difficulties with several activities such as to yawn and open the mouth wide, while pressure pain threshold was correlated with difficulties during eating, which confirms that the pain was located in the TMJ. In conclusion, this study indicates that pain/discomfort from the TMJ in patients with RA has a significant negative impact on activities of daily living □ *Inflammation; joints; pain threshold; physical exercise; visual analog scale*

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Pain is a major determinant of quality of life in people living with rheumatoid arthritis (RA). It can take a heavy psychological toll and half to two-thirds of patients report lost social relationships, disrupted leisure activities, and unwanted limitations in employment (1). Chronic pain in RA is a multidimensional symptom, where pain intensity and persistence as well as pain-related disability are major contributing factors for the individual impact of RA. As a result, well-being and quality of life are affected (2). The fatigue, weakness, and stiffness that commonly accompany pain in RA also contribute to a decreased quality of life (3). About half of all RA patients in the study by Zink et al. (4) rated their overall health status as 'not so good' or 'bad'. Involvement of single joints such as the temporomandibular joint (TMJ) by RA may, besides pain, cause limitations of jaw motion due to restriction of condylar translation and anterior opening of the bite (5). About a third of patients with RA experience TMJ problems (6). These symptoms and signs are assumed to have impact on specific aspects of daily living as well as on social life functions.

Impairment in patients with arthritis is reflected in pain and restriction of range of motion, while disability is reflected in difficulties in performing activities of daily living according to the World Health Organization (7). Assessment of the individual daily activity level is important in the overall evaluation of patients with RA (3, 8). Assessment of the impact on daily living by general and local pain is also an important aspect in order to evaluate the effect of therapy (9). The Activity of Daily Living (ADL) scale is intended to give a semi-quantitative assessment of the patient's overall function. It does not describe the details of disability, but rather how the current status is reflected in day-to-day activities. The original ADL scale created by Katz (10) was intended to be used in chronically ill and aging populations for objective evaluation of physical functions. It was primarily designed to measure the ability to carry out basic activities necessary for daily living, such as eating, shopping, and walking. The scale has since been validated for specific age groups and diagnostic groups (11) including RA patients (12). It has also been modified for specific use in patients with temporomandibular disorders (13) and thereby reported to have an acceptable reproducibility and validity. The aim of this study was to investigate the impact of pain in the TMJ on daily living in patients with clinical TMJ involvement of RA.

Material and methods

Patients

Nineteen patients (17 F, 2 M) with clinical TMJ involvement of RA were included (Table 1). All patients with TMJ pain were referred to the Clinic of Stomatology

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DOI 10.1080/00016350310005989

Table 1. Impact on activity of daily living by temporomandibular joint (TMJ) pain/discomfort and distribution of TMJ resting pain intensity, pain intensity during maximum mouth opening, tenderness to digital palpation, pressure pain threshold over the TMJ as well as blood concentration of rheumatoid factor, erythrocyte sedimentation rate and concentration of C-reactive protein in 19 patients with TMJ involvement of rheumatoid arthritis

	Median	IQR	% pos
ADL questions (0–11)			
"When you feel pain/discomfort from the TMJ, are you able to:"			
1 Socialize with family and close friends?	3	4	79
2 Perform daily work?	4	6	74
3 Perform daily household chores?	3	4	84
4 Sit in company or participate in other social activites?	4	4	79
5 Exercise?	6	8	74
6 Perform hobbies?	1	5	74
7 Sleep at night?	3	3	79
8 Concentrate?	3	4	79
9 Eat?	2	4	95
10 Yawn, open mouth wide?	5	5	84
Sum of questions 1 to 10	39	40	100
11 How much does the pain/discomfort affect your daily activites?	5	3	100
Clinical and blood variables			
Pain intensity			
TMJ resting pain intensity	48	36	100
TMJ pain intensity during mandibular movement	72	30	100
Tenderness to digital palpation			
Tenderness to lateral palpation	1	1	100
Tenderness to posterior palpation	0	0	21
Pressure pain threshold	275	128	n.a.
Rheumatoid factor	0	0	21
Erythrocyte sedimentation rate	14	14	n.a.
C-reactive protein	3	6	54

ADL scale: 0–10 where 0 = activity without any pain/discomfort at all and 10 = activity impossible due to pain/discomfort.
TMJ resting pain intensity and TMJ pain intensity during mandibular movement: the sum (right + left) of the current TMJ pain intensity at rest and at maximum mouth opening, respectively, as assessed with a 100-mm visual analogue scale. Tenderness to palpation: the sum (right + left) of the score for tenderness to digital palpation over the TMJ lateral and posterior aspect, respectively. Pressure pain threshold: the sum (right + left) of the pressure pain threshold over the lateral aspect of the TMJ, Rheumatoid factor: concentration in international units, Erytrocyte sedimentation rate in mm/h, C-reactive protein: serum level in mg/L, IQR: interquartile range, % pos: percentage of observations exceeding zero and n.a.: not applicable.

from the Clinic of Rheumatology at the University of Tartu, Estonia, or from rheumatology specialists in other parts of Estonia and consecutively examined for inclusion. They had their RA diagnosis verified and were screened for TMJ pain by one and the same rheumatologist (RK).

The diagnosis of RA was determined according to the 1987 classification criteria of the American College of Rheumatology (14). Inclusion criteria were diagnosis of RA and clinical involvement of the TMJ, i.e. pain localized to the TMJ region as well as at least 35% decrease in TMJ pain upon maximum mouth opening 5 min after an auriculotemporal nerve block with 2 mL lidocaine (Xylocain®, 20 mg/mL). Exclusion criteria were any other disease that may cause pain in the TMJ region. Sixteen patients used non-steroid anti-inflammatory drugs (diclofenac, movalis, meloxicam), 7 patients oral glucocorticoid (methylprednisolone, triamcinolone), and 8 patients used disease-modifying anti-rheumatic drugs (sulfazalasine, methotrexate, salazopyrin) as regular pharmacological treatment. The study was approved by the local ethics committees at the University of Tartu, Estonia (55/5, 1998) and at the Huddinge University Hospital, Sweden (310/97). All individuals gave their verbal consent to participate.

ADL scale

The patients were asked to evaluate the influence on daily activities of pain/discomfort in the TMJ. A rating scale based on methods used in medical and behavioral science and modified by List and Helkimo (13) for assessment of daily activities in patients with temporomandibular disorders was used. The scale was translated into Estonian from English by one of the authors (ÜV). A modification of the scale was used, where one of the questions in the original scale was excluded since it proved inadequate (13). The scale ranged from 0 (activity without any pain/discomfort in the TMJ) to 10 (activity impossible due to pain/discomfort in the TMJ). The patients were asked to mark the number that best described their present ability to perform each activity considering their pain/discomfort from the TMJ. The questions in English were: If you feel pain/discomfort in the area of TMJ are you able to:

1. socialize with family and close friends?
2. perform daily work?
3. perform daily household chores (preparing meals, cleaning, taking care of small children)?
4. sit in company or participate in other social activities (e.g. parties)?

5. exercise (walk, bicycle, jog, etc)?
6. perform hobbies (read, fish, knit, play an instrument)?
7. sleep at night?
8. concentrate?
9. eat (chew, swallow)?
10. yawn, open mouth wide?
11. how much does the pain/discomfort affect your daily activities?

Pain assessment

TMJ resting pain and pain during maximum mouth opening were measured with a 100 mm visual analog scale (VAS, ACO, Stockholm, Sweden) with end-points marked 'No pain' and 'Worst pain ever experienced'. TMJ pain during maximum mouth opening was assessed after the patients opened and closed the mouth 5 times. The sums of the VAS scores for the right and left TMJ were used.

Clinical examination

Pressure pain threshold and tenderness to digital palpation were included to provide a different aspect of pain/discomfort and to validate the presence of local TMJ pain. An electronic pressure algometer (Somedic Sales AB, Sollentuna, Sweden) was used to estimate the pressure pain threshold to linearly increasing pressure over the lateral aspect of both TMJs. The algometer had a blunt rubber tip with an area of 1 cm^2. The algometer tip was applied perpendicularly to the skin surface and the pressure was increased with a pressure rate of 50 kPa/s. The patients were asked to press a button to freeze the pressure pain threshold value as soon as the sensation of pressure turned to pain. The pressure pain threshold was measured three times and the mean of the second and third measurements was used in the analysis.

The tenderness to digital palpation was assessed over the lateral and posterior aspects of the TMJ on each side. A three-graded scale was used where 0 = no pain, 1 = tenderness without pain reflex, and 2 = with pain reflex. The sum of the tenderness to digital palpation score on the left and right TMJ was calculated and used in the analysis.

Blood sampling and analysis of inflammatory markers

Inflammatory markers were analyzed and used as background factors. Venous blood was collected in a sodium citrate tube (0.105 mol/L) for measurement of the erythrocyte sedimentation rate. In addition, venous blood was collected without additives for analysis of rheumatoid factor and C-reactive protein. The latter was left at room temperature for 60 min for coagulation and thereafter centrifuged (1500 *g* for 10 min at 4°C). The serum was then removed and analyzed. C-reactive protein levels below 10 mg/L and RF levels below 20 IU/mL were considered as zero values.

Statistics

For descriptive statistics of the variables, median and interquartile range were used. The significance of correlations was tested with the Spearman rank correlation test. A probability level of <0.05 was considered as significant.

Results

Impact on activities of daily living

The impact on ADL by pain or discomfort in the TMJ is indicated in Table 1. Two patients had almost no limitations of ADL at all, while the others had difficulties of different degrees. The impact of TMJ pain/discomfort was greatest on the performance of physical exercise and jaw movements and smallest on the performance of hobbies and eating. For one patient it was impossible to perform physical exercise due to the TMJ pain/discomfort. The inter-individual variation was large for all these variables, which is demonstrated by the variation of the sum of the ADL scores. On the question of how much the TMJ pain/discomfort affected daily activities in general, question 11, the median score was 5, i.e. at the mid-point of the scale.

Relations between activities of daily living, TMJ pain, and inflammatory markers

The distribution of TMJ resting and movement pain intensity as assessed by VAS, tenderness to digital palpation, and pressure pain threshold is given in Table 1, while Table 2 gives the significant correlations between ADL and TMJ pain variables. Neither TMJ resting pain intensity nor age was significantly correlated to ADL.

Erythrocyte sedimentation rate was positively correlated with difficulties performing physical exercise (Q.5; $r_s = 0.51$, $n = 17$, $P = 0.038$) and ADL in general (Q.11; $r_s = 0.49$, $n = 17$, $P = 0.044$). The levels of C-reactive protein and rheumatoid factor were normal in most cases (Table 1) and were not significantly correlated to impact on ADL.

Discussion

This study provides a picture of the impact of TMJ pain and discomfort on activities of daily living in patients with RA, where the daily activities in general seem to be affected to a significant extent. Although pain in the TMJ area is less likely than back pain or headache to interfere with work activity, many persons with TMJ pain experience substantial psychological impact and disruption of social and recreational activities (15). It is a well-known fact that some patients function fairly well, while others are disturbed by a similar degree of pain and dysfunction (16). The impact of TMJ pain/discomfort on daily living activities in this study was found to vary between activities

Table 2. Relations between questions about difficulties performing activities of daily living and TMJ pain intensity during maximum mouth opening ($n = 19$), temporomandibular joint (TMJ) tenderness to digital palpation ($n = 19$) and TMJ pressure pain threshold ($n = 18$) in patients with TMJ pain involvement of rheumatoid arthritis

Question	TMJ pain intensity during maximum mouth opening	Tenderness to digital palpation	Pressure pain threshold
"When you feel pain/discomfort from the TMJ, are you able to:"			
Socialize with family and close friends?	$r_s = 0.46$ $P = 0.044$	NS	$r_s = -0.50$ $P = 0.034$
Perform daily work?	$r_s = 0.46$ $P = 0.049$	$r_s = 0.57$ $P = 0.012$	$r_s = -0.65$ $P = 0.004$
Perform daily household chores?	$r_s = 0.62$ $P = 0.004$	$r_s = 0.51$ $P = 0.025$	$r_s = -0.73$ $P < 0.001$
Sit in company or participate in other social activities?	$r_s = 0.53$ $P = 0.02$	$r_s = 0.48$ $P = 0.039$	$r_s = -0.54$ $P = 0.018$
Exercise?	NS	NS	$r_s = -0.56$ $P = 0.016$
Perform hobbies?	$r_s = 0.49$ $P = 0.031$	$r_s = 0.51$ $P = 0.025$	$r_s = -0.65$ $P = 0.004$
Sleep at night?	NS	$r_s = 0.56$ $P = 0.013$	$r_s = -0.48$ $P = 0.044$
Concentrate?	NS	NS	NS
Eat?	NS	NS	$r_s = -0.62$ $P = 0.006$
Yawn, open mouth wide?	$r_s = 0.62$ $P = 0.004$	$r_s = 0.58$ $P = 0.009$	NS
Sum question 1–10	$r_s = 0.52$ $P = 0.020$	$r_s = 0.61$ $P = 0.004$	$r_s = -0.56$ $P = 0.014$

TMJ pain intensity during mandibular movement: the sum (right + left) of the current TMJ pain intensity during maximum mouth opening as assessed with a 100-mm visual analog scale. Tenderness to palpation: the sum (right + left) of the score for tenderness to digital palpation over the TMJ. Pressure pain threshold: the sum (right + left) of the pressure pain threshold over the lateral aspect of the TMJ. NS = no significant correlation.

and individuals, but the impact in general was found to be surprisingly high, a median score of 5 out of 10, which must be considered to be a significant influence on daily life and might very well contribute to a decreased quality of life. The degree of influence was not expected to be as strong on physical exercise as found in this study, while the influence on yawning and mouth opening could easily be explained by TMJ pain. The relatively small influence on eating presented in this patient group was also unexpected, although the inter-individual variation was large and eating difficulties were associated with low pressure pain threshold of the TMJ. Individual eating habits may be influenced by pain, leading to a choice of foods that cause as little pain and discomfort as possible. Hobbies were relatively unaffected by TMJ pain/discomfort, which might be explained by hobbies being chosen specifically to keep pain as little as possible. However, the inter-individual variation was large also for this kind of activity.

In this study, difficulties performing physical exercise and other daily activities reported to be due to TMJ pain/discomfort were associated with a high level of erythrocyte sedimentation rate. This was probably due to an association between elevated levels of acute phase reactants and high general disease activity in some of the patients (17, 18) which in turn influence TMJ pain (19). The low median levels of rheumatoid factor and C-reactive protein in this study could partly be explained by the relatively long duration of RA (median 9 years), but more so by the long-lasting treatment by non-steroidal anti-inflammatory drugs, glucocorticoids as well as disease-modifying anti-rheumatic drugs leading to suppression of inflammatory markers and mediators.

RA is often accompanied by local joint pain that is increased during movements performed in different forms of physical exercise, such as walking, bicycling, and jogging. Pain in the neck is frequent in RA (20) and may cause referral pain in the TMJ. A functional coupling between the human TMJ and the craniocervical region has also been shown (21). These previous findings indicate that pain in the TMJ and neck may potentiate each other, which could be one reason for the impact by TMJ pain on physical activity in the present study.

According to this study, TMJ pain/discomfort in RA patients seems to further limit the patients' daily activities and thereby influence their well being and quality of life. TMJ pain intensity during movement in our study was related to difficulties in socializing with family and friends, performing daily work, performing daily household chores, sitting in company and performing hobbies. Our findings also confirm that TMJ pain can cause work disability, which is a frequent problem for patients with RA (22).

To confirm that the pain influencing the ADL originated from the TMJ, the relation of the ADL score to TMJ resting pain and hyperalgesia/allodynia was investigated. TMJ resting pain intensity was not signifi-

cantly correlated to the impact on any ADL item, in contrast to TMJ movement pain, tenderness to digital palpation and pressure pain threshold. It therefore seems that some patients can carry out their daily activities despite considerable TMJ resting pain, while others have difficulties with low pain intensities. The difference might also be because resting and other pain modalities are different entities modulated by different receptors and neural mechanisms (23).

Tenderness to palpation and pressure pain threshold were recorded to validate the origin of TMJ resting pain, but also in order to analyze local hyperalgesia as a factor limiting daily activities. Lateral tenderness to palpation and lowered pressure pain threshold over the TMJ area were associated with difficulties carrying out many daily activities and it could then be said that these difficulties were caused by activation of sensitized nociceptors in the TMJ. TMJ resting and movement pain intensity as well as tenderness to palpation and pressure pain threshold all express different aspects of pain in the TMJ. The fact that high TMJ movement pain intensities, tenderness to palpation and low-pressure pain threshold were associated with difficulties of many daily life activities confirms local TMJ pain as a partial cause of the disability.

Assessment of the restrictions of activities of daily living with the ADL scale may be an important tool for evaluating treatment of patients with RA involving the TMJ, since it covers the important aspect of well being.

In conclusion, this study indicates that pain from the TMJ in patients with RA has a significant negative impact on activities of daily living.

Acknowledgements.—We thank Dr Vivian Heek in the Department of Clinical Chemistry, University of Tartu for skilful laboratory work. This study was financially supported by the Joint MSc/PhD Program between the Medical Faculty, University of Tartu, Estonia and Karolinska Institutet (KEMP) as well as the Institute of Odontology, Karolinska Institutet, and Estonian Science Foundation Grant No. 4374.

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Received for publication 28 February 2003
Accepted 20 August 2003