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Brief Report

Frequency of temporomandibular joint osteoarthritis and related symptoms in a hand osteoarthritis cohort

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SUMMARY

Objective: The prevalence of osteoarthritis (OA) in the temporomandibular joints (TMJs) in hand OA patients is largely unknown. Our aims were to explore (1) The frequency of TMJ-related symptoms and clinical findings; (2) The TMJ OA frequency defined by cone beam computed tomography (CBCT); and (3) The relationship between TMJ-related symptoms/clinical findings and CBCT-defined TMJ OA, in a hand OA cohort.

Methods: We calculated the frequencies of TMJ-related symptoms, clinical findings and diagnosis of TMJ OA by CBCT and clinical examination in 54 patients from the Oslo hand OA cohort (88% women, mean (range) age 71 (61–83) years). Participants with and without CBCT-defined TMJ OA were compared for differences in proportions (95% confidence interval (CI)) of symptoms and clinical findings. Sensitivity and specificity of the clinical TMJ OA diagnosis were calculated using CBCT as reference.

Results: Self-reported symptoms and clinical findings were found in 24 (44%) and 50 (93%) individuals (93%), respectively, whereas 7 (13%) had sought healthcare. Individuals with CBCT-defined TMJ OA (n = 36, 67%) reported statistically significantly more pain at mouth opening (22%, 95% CI 4–40%), clicking (33%, 95% CI 14–52%) and crepitus (25%, 95% CI 4–46%). By clinical examination, only crepitus was more common in TMJ OA (33%, 95% CI 29–77%). Clinical diagnosis demonstrated low sensitivity (0.42) and high specificity (0.93).

Conclusions: CBCT-defined TMJ OA was common in hand OA patients, suggesting that TMJ OA may be part of generalized OA. Few had sought healthcare, despite high burden of TMJ-related symptoms/findings. Clinical examination underestimated TMJ OA frequency.

Introduction

In osteoarthritis (OA) research and patient management, little focus is given to temporomandibular joint (TMJ) OA, although it may lead to substantial joint pain, dysfunction, dental malocclusion and reduced health-related quality of life[1]. Pain and/or dysfunction in the masticatory apparatus represent a public health problem affecting 5–12% of the population[2]. Clinically it may be challenging to differentiate TMJ OA from other TMJ-related conditions, which may occur in combination with OA. The presence of crepitus that clinically defines TMJ OA can be absent, and the clinical definition of TMJ OA is consistently reported to have low sensitivity when using radiological diagnosis as gold standard[2]. Furthermore, radiological findings and TMJ symptoms are poorly correlated[3].

The imaging diagnosis of TMJ OA is most reliably assessed by computed tomography (CT)[4]. The definition is based on evaluation of bony surfaces including erosions, subcortical cysts, osteophytes, and/or sclerosis[4]. Cone beam CT (CBCT), which has lower radiation exposure than CT, is similarly accurate for detecting TMJ OA[3].

Proposed risk factors for TMJ OA are in line with those suggested for other joints; age, sex, genetics, infection/inflammation, congenital and developmental abnormalities[1]. Hand OA is often considered a marker of a generalized susceptibility of OA, leading to

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an increased risk of knee and hip OA[5]. However, the prevalence of TMJ OA in patients with OA in other joints has been explored in few studies only, of which the majority is summarized by Wolf *et al.*[6] Most previous studies show no clear association, but the TMJ OA prevalence is likely underestimated due to insensitive imaging modalities. No previous studies have explored the frequency of TMJ OA by CT or CBCT in hand OA patients.

Hence, our aims were to explore (1) The frequency of self-reported TMJ-related symptoms and clinical examination findings; (2) The frequency of CBCT-defined TMJ OA; and (3) The relationship between TMJ-related symptoms/clinical findings and CBCT-defined TMJ OA, in a hand OA cohort.

Methods

Oslo hand OA cohort

At baseline (2001–03), 209 hand OA patients from the rheumatology outpatient clinic at Diakonhjemmet Hospital were examined. Follow-up examinations were performed in 2008–2009 ($n = 128$) and 2013 ($n = 87$)[7]. Patients with diagnoses of inflammatory joint disease were not invited for participation and excluded if later detected[7]. All examinations were approved by Regional Ethics Committee. Written informed consent was provided by all patients.

In 2013, we included a questionnaire about facial symptoms and a clinical examination of the TMJs and related muscles. Voluntary CBCT examinations of the TMJs were completed by 55/87 non-selected patients, of whom 54 were included in the current study (participants) (Online Supplementary Fig. I).

Clinical assessment of TMJ and related muscles

Eighty-seven patients completed a questionnaire about facial symptoms the last 30 days, including experience of pain (at rest, mouth opening and chewing), jaw locking and noise (clicking or crepitus) on jaw movement ("yes", "no" and "no, but earlier in life"). The questions were not side specific. A question about previous contact with the healthcare system due to jaw dysfunction and/or facial pain was answered ("yes"/"no"). The questionnaire was developed by the authors based on questions from the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) Patient History Questionnaire from the International RDC-TMD Consortium[8].

One dentist (AKA) performed the clinical examination according to the "Complete specifications (protocol) for Diagnostic Criteria for Temporomandibular Disorders (DC/TMD)" (version: 2013)[9] including bilateral assessment of masseter/temporalis muscle pain at palpation, TMJ pain at palpation and TMJ noises (clicking, crepitus) and maximum unassisted mouth opening. Reduced mouth opening was defined as <40 mm, including vertical overbite. The DC-TMD was used to define clinical TMJ OA[2], which requires presence of crepitus registered by both examiner and patient (Online Supplementary Table I).

CBCT of TMJ

CBCT was performed at the Department of Maxillofacial Radiology using a ProMax Mid 3D CBCT unit (Planmeca Oy, Helsinki, Finland) (field of view 200 × 60 mm; voltage 90 kV; tube current 10 mA; spatial resolution 200 μm). Reconstructed images in axial, oblique sagittal and oblique coronal planes were analyzed in Sectra PACS viewer IDS 5 version on 20 inch monitors. The examinations were interpreted by three maxillofacial radiologists (MK, LZA, TAL) with 3–30 years of relevant experience.

The radiologists performed a pre-evaluation of 12 joints and the results were discussed until consensus was met. Each radiologist then interpreted all 54 CBCT examinations independently, blinded to clinical information except age and sex. The TMJs were classified as OA, no OA or indeterminate for OA according to Ahmad *et al.* (Online Supplementary Table II)[4]. After 16 weeks 30 joints were re-evaluated. For reliability analysis, joints registered as indeterminate for OA and no OA were pooled. Average kappa values were calculated and evaluated[10]. Inter-observer disagreement was discussed until consensus was met and each joint got a final imaging diagnosis.

Statistical analysis

Using independent samples *t*-tests and Chi Square tests, we compared, age, body mass index (BMI), TMJ-related symptoms and clinical examination findings between participants and non-participants and between participants with CBCT-defined TMJ OA (uni-or bi-lateral) and participants with no/indeterminate for OA. Differences in proportions of TMJ-related symptoms and clinical examination findings in participants with CBCT-defined TMJ OA vs no/indeterminate for OA were calculated with 95% confidence intervals (CIs). We calculated sensitivity and specificity of the clinical diagnosis using CBCT as reference. Analyses were performed using IBM SPSS version 22.0.

Results

Most participants were women ($n = 48/54$, 88%) and mean (range) age was 71.3 (61.0–83.0) years. Mean (SD) BMI was 27.6 (6.0). The 33 non-participants were slightly older than the participants ($P = 0.04$), with a mean (range) age of 73.9 (64.0–83.0) years. We found no other statistically significant differences in symptoms/clinical examination findings.

Frequency of TMJ-related symptoms and clinical examination findings

Self-reported symptoms were present in 24 individuals (44%, 95% CI 31–57%) with facial pain at rest ($n = 17$, 31%) and joint sounds (clicking/crepitus) (both $n = 15$, 28%) being the most common. Seven (13%) individuals reported previous contact with the healthcare system due to jaw dysfunction and/or facial pain. Clinical TMJ-related examination findings were observed in 50 participants (93%, 95% CI 86–100%) with masticatory muscle pain at palpation ($n = 43$, 80%) and crepitus ($n = 31$, 57%) being most frequent. The mean (range) mouth opening was 51.2 (39–65) mm. One individual (2%) had a reduced mouth opening (39 mm). The criteria for a clinical TMJ OA diagnosis were fulfilled in 22 individuals (41%, 95% CI 28–54%).

Frequency of CBCT-defined TMJ OA

Average kappa values for pairwise inter- and intra-observer agreement for CBCT-defined TMJ OA were 0.67 (range 0.61–0.74) and 0.62 (range 0.54–0.66), respectively, representing substantial reliability.

CBCT-defined TMJ OA was present in 36 participants (67%, 95% CI 54–79%), of whom 17 (31%) had bilateral OA. The 19 (35%) individuals with unilateral TMJ OA, had either no OA ($n = 6$) or were classified as indeterminate for OA ($n = 13$) in the contralateral joint. No TMJ OA was found in 10/54 (18%, 95% CI 8–29%) individuals, whereas 8/54 (15%, 95% CI 5–24%) were categorized as indeterminate for OA ($n = 5$ bilaterally and $n = 3$ unilaterally with no OA in the contralateral joint).