Journal of Cranio-Maxillo-Facial Surgery 42 (2014) 1802–1807

Contents lists available at ScienceDirect

Journal of Cranio-Maxillo-Facial Surgery

journal homepage: www.jcmfs.com

Pathological changes in the TMJ and the length of the ramus in patients with confirmed juvenile idiopathic arthritis

B. Koos [a, *], V. Gassling [b], S. Bott [c], N. Tzaribachev [d], A. Godt [e]

[a] Department of Orthodontics, University Hospital of Schleswig-Holstein, Arnold-Heller-Strasse 3, Haus 26, 24105 Kiel, Germany
[b] Department of Oral and Maxillofacial Surgery, University Hospital of Schleswig-Holstein, Campus Kiel, Kiel, Germany
[c] Department of Orthodontics, University of Tübingen, Tübingen, Germany
[d] Pediatric Research Institute Bad Bramstedt, Bad Bramstedt, Germany
[e] Department of Oral Radiology, University of Tübingen, Tübingen, Germany

ARTICLE INFO

Article history:
Paper received 11 April 2014
Accepted 10 June 2014
Available online 19 June 2014

Keywords:
JIA
TMJ arthritis
Growth disturbances
Cone beam tomography
Temporomandibular joint
Facial asymmetry

ABSTRACT

Introduction: Juvenile idiopathic arthritis (JIA) is characterized by a progressive destruction of the joints. The temporomandibular joints (TMJ) are especially likely to be affected. The often undetected arthritis in the TMJ in particular can cause significant destruction and craniofacial developmental abnormalities. The aim of this study was to analyze the destructive impact of JIA on TMJ and mandibular development.
Material and methods: We analyzed a total of 92 joints and mandibular rami using digital cone-beam tomography (CBT) and compared 23 consecutively treated JIA patients with 23 healthy controls, matched for age and gender. We evaluated ramus length, vertical depth of the articular fossa, anterior–posterior dimensions of the mandibular head and condylar process. The statistical analysis was performed using non-parametric Wilcoxon and Kruskal–Wallis Rank Sum tests.
Results: The JIA patients exhibited significantly more pronounced asymmetries. However, we were unable to detect significant differences in the metric measuring distances. The different JIA subtypes exerted no statistically significant influence.
Conclusions: The possible destruction arising as a result of JIA concerns the TMJ and the length of the mandibular ramus. These craniofacial anomalies demonstrate the central importance of sufficiently early detection and timely treatment in the prevention of such growth disturbances.

1. Introduction

Juvenile idiopathic arthritis (JIA) is an autoimmune disease that, depending on the subtype, can lead to inflammation of multiple joints at a young age, often complicated by destruction and growth disturbances, also in the craniofacial region (Fjeld et al., 2010; Koos et al., 2013; Twilt et al., 2006). Based on a review of 34 epidemiological studies on JIA, Manners and Bower. (2002) reported a disease prevalence of 0.07–4.01 per 1000 children. The annual incidence is reported as 0.008–0.226 per 1000 children. Studies based truly in the community reported the highest prevalence. Based on these numbers, the frequency of JIA is comparable to that of other diseases with high craniofacial impact, such as cleft lip/palate, the incidence of which varies between 0.69 and 2.35 per 1000 newborns where a multidisciplinary treatment approach has been established successfully (Grabowski et al., 2006; Gundlach & Maus, 2006). In the case of JIA, such an approach is still lacking, but urgently required. The possible therapeutic measures for JIA patients with TMJ involvement are currently still at a clinical level of evidence; generally applicable recommendations or treatment guidelines from an orthodontic or surgical point of view are not yet in place (von Bremen & Ruf, 2012).

The temporomandibular joints are frequently affected in children with JIA. Depending on the examination method, reports on the prevalence of TMJ arthritis have varied widely (from 17% to 91%), with more recent results based on the acceptably sensitive method of Gadolinium-enhanced magnetic resonance imaging (Gd-MRI) accounting for higher numbers of between 63% and 91% (Arvidsson et al., 2010a, 2010b; Larheim & Haanaes, 1981; Mussler et al., 2010; Pedersen et al., 2001; Stoll et al., 2012; Twilt et al., 2007; Weiss et al., 2008). However, since temporomandibular joint arthritis is asymptomatic in about two-thirds of all patients, it is

* Corresponding author. Tel.: +49 431 597 2883; fax: +49 7071 597 2955.
E-mail addresses: koos-b@kfo-zmk.uni-kiel.de, bernd.koos@me.com (B. Koos).

http://dx.doi.org/10.1016/j.jcms.2014.06.018
1010-5182/

often recognized very late (Tzaribachev et al., 2010). The danger in such cases is that the progressive course of the temporomandibular joint arthritis may already have caused considerable joint damage at the time of diagnosis (Arabshahi & Cron, 2006; Gonner-Ozkan et al., 2010). TMJ arthritis has the potential to be severely destructive, since a major growth zone of the lower jaw located in the condyles affects the growth of the mandible, the dentition, and the facial skeleton (Arabshahi & Cron, 2006; Sommer et al., 2003; Twilt et al., 2006). These symmetrically located growth centers are in direct proximity to the inflamed synovial membrane due to their superficial proliferative zone in the articular cartilage and are thus particularly susceptible to growth disturbances, as compared with the rather wide intervals between the synovial membrane and growth zones in peripheral joints. Typical craniofacial maldevelopments in which JIA can result include micrognathia and retrognathia of the mandible, skeletal open bite, malocclusions, and, in the case of unilateral joint involvement, facial asymmetries with deviation of the chin (Arvidsson et al., 2010a, 2010b; Hu et al., 2009; Ringold et al., 2009; Twilt et al., 2008). The latter is particularly common in the case of unilateral TMJ involvement (Fig. 1a, b), since the symmetrical growth of the facial skeleton requires symmetrical growth of the temporomandibular joints (Gundlach & Holtje, 2013). However, asymmetries in temporomandibular joint structures or portions of the lower jaw may also occur in healthy individuals. Liukkonen et al. (2005) observed partly significant asymmetries in the length of the Ramus ascendes (ascending branch) of the mandible in healthy seven- and sixteen-year olds.

The research question of the present study was whether there are detectable structural differences between JIA patients and subjects in an age- and gender-matched control group. The detailed analysis included measurements of absolute metric lengths and diameters as well as percentage differences in individual relative comparisons between right and left: ramus lengths, depth of the articular fossa, anterior–posterior diameter of the mandibular condyle and the condylar process. Finally, we examined whether differences existed between the individual JIA patient subgroups.

The hypothesis was that the group of JIA patients would exhibit significantly shorter lengths and more pronounced asymmetries in right-left comparison.

2. Material and methods

A total of 92 joints were examined in 46 patients, 23 consecutively treated juvenile patients (40% male, 60% female, average age 13.1, SD = 2.7, min. 8, max. 17.5 years) with confirmed juvenile idiopathic arthritis (distributed across the following subtypes: enthesitis-related arthritis 17.4%, extended oligo 39.1%, persistent oligo 17.4%, RF negative polyarticular 17.4%, RF positive polyarticular 0%, psoriatic arthritis 8.7%) and a control group of 23 healthy patients of matching age and gender on whom a cone-beam tomography (CBT) was performed on the basis of another justifying indication (diagnosis of tooth impactions). None of the patients in the control group showed evidence of a rheumatic disease in their personal or family medical history. Exclusion criteria in the control group included traumatic events involving the mandible or another general disorder (e.g., cleft lip, jaw, and palate diseases or syndromic diseases) associated with a growth disorder.

In all patients, the CBT was performed using the 3D-Exam CBT (KaVo Dental GmbH, Biberach, Germany) with a 180° sequence and a field of view of 130 (corresponding to 13 × 10 cm^2) voxel size 0.4 mm at 120 KV and a radiation-on time of 2 s.

All 92 temporomandibular joints were evaluated on the basis of structural measurements in the CBT. In the rheumatic patients, the CBT images were captures as part of their treatment; in healthy individuals the imaging was justified by the need to clarify the position and possible surgical exposure and orthodontic adjustment of an impacted tooth. None of the patients in the control group exhibited evidence of temporomandibular joint problems.

The evaluation and measurement was carried out using ExamVision (KaVo Dental GmbH, Biberach, Germany) in uncompressed DICOM datasets. Before the measurement was initiated, all images were calibrated to Natural Head Position (Weber et al., 2013).

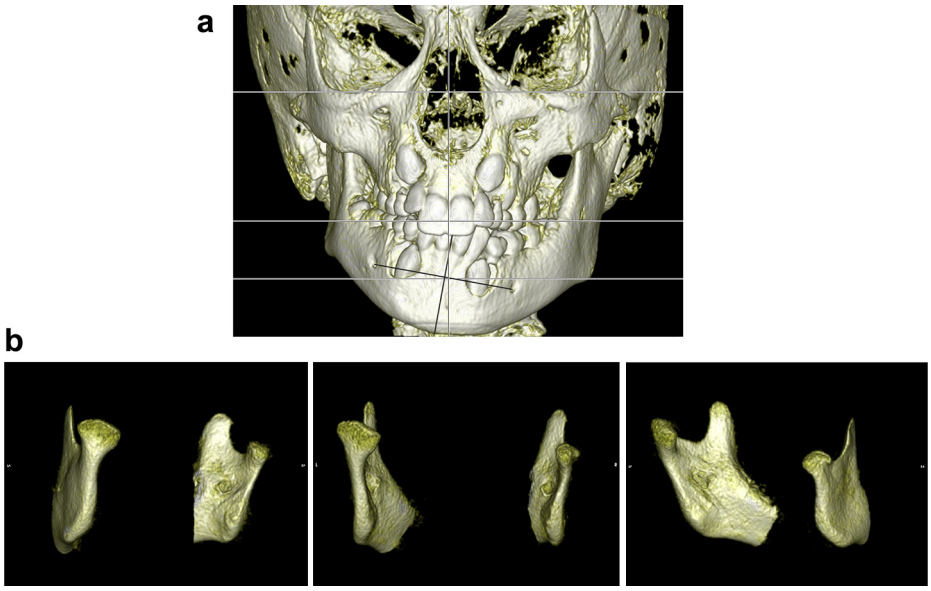

Fig. 1. 1a: Craniofacial asymmetry in a 10-year-old female patient with JIA (extended oligoarthritis) in three-dimensional volume reconstruction. The gray lines are reference lines and indicate the center of the face (nasion to Spina nasalis ant. (anterior nasal spine) and the horizontal reference line of the orbital margin). The mandibular deviation to the right (black lines), the shortening of the right mandibular ramus, and the cranial tilting of the right maxilla are clearly visible. 1b: isolated representation of the asymmetric development of the mandible in a comparison of left and right from dorsal-lateral left, dorsal and dorsal-lateral right. The hypoplasia of the condylar head and the ramus length is clearly visible.