

# Facial morphology in children and adolescents with juvenile idiopathic arthritis and moderate to severe temporomandibular joint involvement

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**Introduction:** The aims of this study were to (1) assess lateral facial morphology in children and adolescents with juvenile idiopathic arthritis and moderate to severe temporomandibular joint (TMJ) involvement, (2) compare the lateral facial morphology of these subjects with and without TMJ involvement using cephalograms and 3-dimensional (3D) facial photographs, and (3) compare and correlate the results of the 3D photographic and cephalometric analyses. **Methods:** Sixty patients with juvenile idiopathic arthritis were included and grouped as follows: group 1, juvenile idiopathic arthritis patients without TMJ involvement; group 2, juvenile idiopathic arthritis patients with moderate to severe unilateral TMJ involvement; and group 3, juvenile idiopathic arthritis patients with moderate to severe bilateral TMJ involvement. Lateral cephalograms were used to assess and compare lateral facial morphologies between the groups. Lateral projections of oriented 3D photographs were superimposed on the lateral cephalograms. The results of the lateral 3D photographic analysis were correlated with those of lateral cephalometric analysis. **Results:** Group 3 showed the most severe growth disturbances, including more retrognathic mandible and retruded chin, steep occlusal and mandibular planes, and more hyperdivergent type ( $P < 0.01$ ). Group 2 showed similar growth disturbances, but to a lesser extent than did group 3. Photographic variables were significantly correlated with the soft tissue and skeletal variables of cephalograms ( $0.5 < r < 0.9$ ;  $P < 0.001$ ). **Conclusions:** Subjects with juvenile idiopathic arthritis and unilateral or bilateral moderate to severe TMJ involvement had significant growth disturbances. Early intervention is recommended for these patients to prevent unfavorable facial development. Furthermore, with proper orientation, 3D photographs can be used as an alternative to conventional lateral cephalograms and 2-dimensional photographs. (*Am J Orthod Dentofacial Orthop* 2016;149:182-91)

Juvenile idiopathic arthritis is a chronic autoimmune, inflammatory joint disease. It may affect the temporomandibular joint (TMJ) and cause severe growth disturbances such as mandibular micrognathia, retrognathia, steeper mandibular plane angle, and increased facial convexity.<sup>1-7</sup> Although several researchers have

reported the typical facial morphologic characteristics in children with juvenile idiopathic arthritis, most of them did not consider TMJ involvement while assessing lateral facial morphology; moreover, dentofacial morphology has been found to vary widely in these studies because of the extreme heterogeneity of

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**Table I.** Demographics of the subjects

|               | Group 1    | Group 2    | Group 3    | Total      | P                  |
|---------------|------------|------------|------------|------------|--------------------|
| Sex, n (%)    |            |            |            |            |                    |
| Male          | 7 (35)     | 5 (25)     | 3 (15)     | 15 (25)    | 0.344*             |
| Female        | 13 (65)    | 15 (75)    | 17 (85)    | 45 (75)    |                    |
| Age (y)       | 12.7 ± 3.6 | 12.8 ± 3.4 | 12.5 ± 2.9 | 12.7 ± 3.2 | 0.963 <sup>†</sup> |
| Age range (y) | 4.3-18.3   | 4.7-17.5   | 8.0-18.5   | 4.3-18.5   |                    |

Data are listed as means and standard deviations, except where otherwise indicated.

Group 1, juvenile idiopathic arthritis without TMJ involvement; group 2, juvenile idiopathic arthritis with moderate to severe unilateral TMJ involvement; group 3, juvenile idiopathic arthritis with moderate to severe bilateral TMJ involvement.

\*Chi-square test; <sup>†</sup>ANOVA test.

the samples.<sup>1-4</sup> In addition, in most of these studies, the children with juvenile idiopathic arthritis were compared with healthy children with normal occlusions or Class II malocclusions.<sup>1-3,5-7</sup> To our knowledge, thus far, no study has evaluated lateral facial morphology in children and adolescents with juvenile idiopathic arthritis and moderate to severe TMJ involvement, and compared their morphologic characteristics with those of children and adolescents with juvenile idiopathic arthritis but without discernable condylar lesions. A better understanding of the impact of moderate to severe TMJ involvement on lateral facial morphology in children with juvenile idiopathic arthritis may help to determine the prognosis of their growth impairment.

Advances in technology have ushered craniofacial researchers into the era of 3-dimensional (3D) imaging. Among the various 3D imaging methods, 3D photographs have become more readily available and can be used to record 3D facial morphology. The advantages include small method errors, quick image capture (in a millisecond), high spatial resolution, and no ionizing radiation.<sup>8-10</sup> These properties make it well suited for longitudinal documentation of facial morphology, especially in children.<sup>11</sup> Our previous work has shown that use of 3D photographs is a good method to assess and quantify facial asymmetry in patients with juvenile idiopathic arthritis.<sup>12</sup> In addition, 3D photographs might also be suitable for evaluating and comparing facial profiles in the sagittal and vertical dimensions, as an alternative to the more commonly used 2-dimensional cephalograms and lateral photographs that are already well established and widely accepted. At present, no routinely used reference system exists for an appropriate orientation of 3D photographs when comparing lateral facial morphology in 3 dimensions. A comparison and correlation between the results of 3D photographic and cephalometric analyses could provide a reference system and elucidate the advantages and limitations of using 3D photographs to assess facial profiles.

The purposes of this study were to (1) assess lateral facial morphology in children and adolescents with

juvenile idiopathic arthritis without and with moderate to severe TMJ involvement, (2) compare lateral facial morphology between these groups using lateral cephalograms and lateral 3D facial photographs, and (3) compare and correlate the results of the photographic and cephalometric analysis.

## MATERIAL AND METHODS

This retrospective study included children and adolescents with juvenile idiopathic arthritis (mean age, 12.7 ± 3.2 years; range, 4-18.5 years; Table I) attending annual TMJ examinations at the School of Dentistry, Faculty of Health and Medical Sciences at the University of Copenhagen in Denmark between 2008 and 2014. The inclusion criteria were as follows: (1) juvenile idiopathic arthritis diagnosed and treated medically according to the guidelines of the Department of Pediatric Rheumatology at Copenhagen University Hospital Rigshospitalet; (2) cephalometric and panoramic films and 3D photographs available at the same visit; (3) no history of maxillofacial surgery; and (4) no genetic diseases, syndromes, or other congenital deformities.

The diagnosis of the TMJ involvement was confirmed by both clinical and radiographic findings. The TMJs were scored on a 4-point scale on the panoramic radiographs as follows: no involvement (score 0), slight erosion or breakdown of the superficial cortical bone of the condyle (score 1), manifest erosion and flattening of the condyle (score 2), or complete destruction of the condyle (score 3).<sup>13</sup> The TMJs were scored twice by 2 examiners (Y-J.H., S.K.). Conferring between the examiners was not allowed, and the final score for each panoramic film was agreed by consensus between the 2 examiners.

Twenty children and adolescents with juvenile idiopathic arthritis and without TMJ involvement were consecutively enrolled into group 1 (bilateral TMJ involvement, score of 0). Twenty children and adolescents with juvenile idiopathic arthritis and a unilateral TMJ involvement score of 2 or 3 (the other side scored 0) were enrolled into group 2, and 20 children and adolescents with

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