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Condylographic evaluation in orthodontics: study of condylar rotation in patients with juvenile idiopathic arthritis

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Purpose: Juvenile idiopathic arthritis (JIA) is a rheumatic disease characterized by chronic joint inflammation, also involving the temporomandibular joint (TMJ) from the first years of life [1]. Inflammation of the TMJ can lead to painful symptoms, reduced mouth opening, asymmetrical growth, and development of malocclusion. Therapeutic approach includes early recognition, prevention or blocking of the progression of pathological mechanisms of the disease. Currently, the management of TMJ complications is based on a combination of pharmacological, orthodontic, physiotherapeutic and surgical treatments. The radiological exams for diagnosis and monitoring are CT and MRI [2]. Condylography is an instrumental method that allows to simultaneously record and compare paths of both right and left condyles in the three dimensions of space. In this preliminary study, condylography was applied for the qualitative evaluation of the joint function of these patients in the condylar rotation movement (GAMMA angle).

Materials and Methods: 16 patients suffering from JIA aged between were recruited at the Orthodontic ward of IRCCS Ca' Granda Policlinico Hospital Foundation of Milan. Patients with a history of facial trauma, previous orthognathic treatments or prosthetic rehabilitations were excluded. Data on symptoms and clinical pictures were collected: presence of pressure pain or spontaneous, joint noises and reduced oral opening. A series of arbitrary recordings was performed by means of the computerized axiograph CADIAX compact 2 system. This means that the registration of the movement of the mandibular joint was made on one point of the axis anatomically identified hinge. The reference coordinates of the system originate from the central point between the condyles, where the hinge axis, in the zero (centric) position, intersects with the median-sagittal plane. A kinematic face bow (Condylograph) was used for the recordings. All the recordings in their entirety, including the preparation phases and the determination of the hinge axis, were performed by the same operator. A complete axiographic exam was performed [3] but a selection of non-guided open/close curves was tracked for the analysis. Each record therefore included: 1) Electronically recorded jaw movement tracks; 2) Measurement of the condylographic position (CPM); 3) X / Y / Z coordinates of the tips of the cusps of the teeth of the mandible. The registration data was exported to GAMMA Dental Software and subsequently processed with CADIAX Analyzer. The evaluation of the relationship between translation and rotation is useful only for open/close movements. This relationship is expressed by the γ angle which is defined as rotation in relation to the maximum distance and allows to evaluate the uniformity of the rototraslation and the maximum opening of the mouth obtained in individual movements. The γ angle values were gathered for each curve and compared to the average values reported in the literature (Figure 1 and 2).

Results and Conclusions: This investigation was performed in frankly dysfunctional patients, therefore the presence of an alteration of movement was foreseeable. Our data show an average γ angle value at 3 mm of $12.445^\circ \pm 5.498^\circ$ (Table I). In conclusion, the results of this preliminary study should be verified in a larger population, however condylographic examination could be a valid support for the classification and monitoring of joint pathology as well as for the study of function during orthodontics treatments in JIA patients, thanks to its non-invasiveness, precision and reproducibility.

	Gamma Angle (°)
Mean	12,44596163
Std error	1,374652977
Median	13,27893594
Std dev	5,498611907
Var	30,2347329
Interval	21,80384226
Min	0,6744186047
Max	22,47826087

Figure 1. Graphic representation of γ angle in a JIA subject with bilateral TMJ dysfunction. Note the decoupling of rotation and translational components.

Figure 2. Graphic representation of γ angle in a JIA subject with unilateral TMJ dysfunction. Note the decoupling of rotation and translational components.

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