An Investigation of the Dental Occlusion in Children with Juvenile Rheumatoid Arthritis

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Juvenile rheumatoid arthritis was first documented as a chronic disease in 1897 by George F. Still.[21] It is estimated that in the United States today it affects approximately 175,000 children and is considered by many to be the most chronic and progressive crippling disease of childhood.[6-13]

The most important manifestation of this disease is chronic synovitis at the articulations, which is characterized by proliferation of the epithelium, increase of synovial fluid, and the presence of inflammatory infiltrate. Thus, the articular cavity is full and distended, periarticular inflammation is present and blood supply to the area is increased. Arthralgia may be noticed when the articulation is moved. Synovial inflammation progressively can damage the cartilage and the subchondral bone, and this may bring changes in the articular parts. The rheumatoid factor and the rheumatoid nodules are usually not found in the child. The joints initially involved in children are often the large ones, e.g., knees, hips, elbows. Ankles, shoulders, and cervical spine may also be affected. The etiology of the disease is still not known although infection, autoimmunity, heredity, and psychological stresses have been mentioned as possible factors. Epidemiological studies have shown that the disease occurs in damp temperate climates as well as in warm areas.[7-11] It affects females more frequently than males in a ratio of 3:1. JRA often has an unpredictable course and usually a low mortality rate. Its prognosis is favorable if early diagnosis is made and proper management is instituted.

The temporomandibular articulation, like any other articular portion of the body, can be a site for chronic synovial inflammation. Since the condyle is the center of mandibular growth, it can induce pathological changes in the articular parts as well as in the size and form of the mandible. Therefore, chronic inflammation may conceivably influence the final development of the lower third of the face and the position of the lower denture.

In a study by Russell and Bayles[17] of 100 arthritic adults and children the incidence of rheumatoid arthritis affecting the TMJ was found to be 51 per cent. These investigators felt that hypoplasia of the mandible is the result of disease at the growth center of the condyle. They indicated that the lack of proper function of the bone and the presence of misplaced teeth also may have an effect on the development of the mandible.

Martel and Holt[15] in a radiographic study found a discrepancy between the degree of growth retardation and joint destruction. They theorized that even minimal arthritis of the TMJ can affect the growth center if it occurs early in life, and temporary cessation in condylar growth is not compensated.

Hatch[12] in a study of adults and children concluded that TMJ involvement is more common than reported. He suggests, however, that because the symptoms are often transient, residual dysfunction of this articulation is rare.

In a clinical report of 152 children with JRA, Ansel and Bywaters[2] found maldevelopment of the mandible was not necessarily associated with permanent involvement of this articulation. This conclusion was based on the observation that these children were able to open their oral cavities with almost no impediment.

Sairanen[19] in a survey of 33,000 school children in Finland found only one case of micrognathia that was not related to JRA or other deformity. He concluded that micrognathia in JRA is related to the disease at the level of this articulation. Bache[3] studied the dental occlusion of 19 subjects who had the onset of the disease before age 15; he reported marked tendency for Class II malocclusion, anterior open bite, wide dental arch and incisor protrusion of one or both dental arches. Slusar[20] did a cephalometric evaluation of 8 JRA patients; his measurements were statistically significant in reporting a decrease in ramus height and ramus length, a steep mandibular plane, and a large Y axis angle.

The present study was undertaken with the following objectives: 1) To determine the distribution of occlusal patterns in patients with JRA as compared with a control sample. 2) To determine whether the radiographic and clinical symptoms of JRA in the TMJ are correlated in severity with a particular type of occlusion and with cephalometric evidence of mandibular growth retardation. 3) To determine what percentage of patients with JRA in the sample show any TMJ involvement. 4) To determine whether severity of the involvement is correlated with severity of the disease in the patient.

Methods and Materials

All subjects of this study were JRA patients at the University of Washington Hospital and the Children's Orthopedic Hospital and Medical Center in Seattle, Washington. While the disease was active in some patients, it was generally in remission. A total of 27 children, 6 males and 21 females, were available for the study with ages ranging from 3 years 8 months to 18 years 7 months. Each child underwent the following procedures: oral examination for the type of occlusion using Angle's classification, the extent of midline deviation, the degree of crowding in lower anterior teeth, oral opening measuring the distance between the incisal borders of the maxillary and mandibular anterior teeth, any anterior open bite and the signs and symptoms of any TMJ dysplasia.

Correlated study casts were prepared and full face and profile photographs were obtained (Fig. 1). Radiographic examination of both temporomandibular articulations were taken using Updegrave's[22] technique in closed and open mouth positions. These records were studied for bone pathology and alterations in the configurations of the joint (Fig. 2). Lateral cephalograms were obtained and traced upon matted acetate paper. Angular measurements were recorded. In the mandible, linear measurements of body length, ramus width, ramus height and depth of antegonial notch were recorded.

The medical history of each child was supplied by the Pediatric Department—Rheumatology clinics of the U. W. Hospital and the COHMC. A control sample of 27 children matched for race, sex and age within acceptable limits for growth changes was drawn from the files of the Child Study Clinic of the University of Oregon and from random samples of children at the pedodontic and orthodontic clinics of the U. W. School of Dentistry. None of these children had a history of JRA.

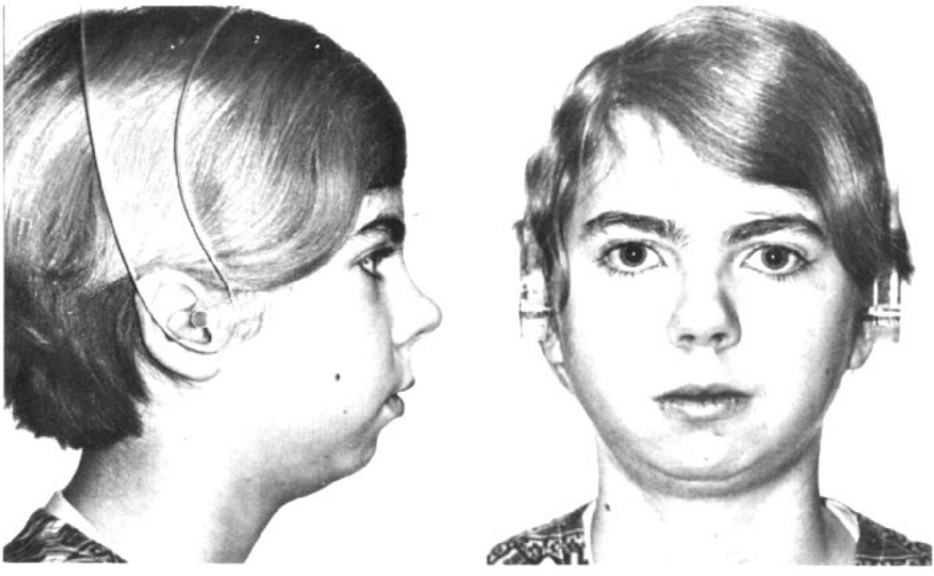

Fig. 1

Results

Twenty-seven children, diagnosed as suffering from JRA, were compared with 27 children of the same age and sex but who were free from the disease.

Thirty-three per cent of the JRA group had bilateral Class II malocclusion, 19 per cent had unilateral Class II malocclusion, while 48 per cent had bilateral normal occlusion. Anterior open bites and crowed lower anterior teeth were not found in significant numbers. Utilizing the student "t" test in the cephalometric evaluation of the maxilla, there were no significant differences in size and anterior position. The mandible had all of its dimensions reduced with the ramus height being the most severely affected. The position of the mandible was retrognathic as indicated by the ANB angle being greater than the control. GoGn-SN was increased as a result of a steep mandibular plane which is a result of a decrease in the height of the ramus.

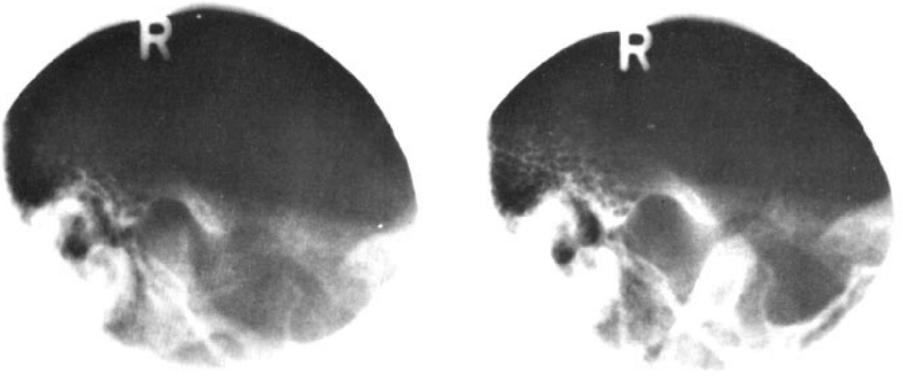

Fig. 2

TABLE I

MEANS AND SIGNIFICANCE OF MEAN DIFFERENCES

VARIABLE		STUDY	CONTROL	DIFFERENCE		
Crowded lower anterior teeth	mm	1.52	1.74	-0.22	-0.0	NS
Midline deviation to right	mm	0.60	0.37	0.22	0.1	NS
Midline deviation to left	mm	0.48	0.15	0.33	1.7	NS
Anterior open bite	mm	1.28	0.78	0.50	1.2	NS
NPo-FH	(°)	82.22	84.48	-2.25	-1.6	NS
SN-Po	(°)	75.65	77.48	-1.83	-1.6	NS
A-N-B	(°)	6.68	4.43	2.26	2.9	**
S-N-A	(°)	82.00	81.04	1.00	1.1	NS
NA-FH	(°)	88.28	88.20	0.08	0.1	NS
"Y" Axis	(°)	62.89	60.74	1.15	1.4	NS
GoGn-SN	(°)	36.57	33.07	3.50	1.9	*
GoGn-FH	(°)	29.69	26.46	3.22	1.6	NS
Length of Mandible	mm	66.80	71.00	-4.20	-2.4	**
Width of Ramus	mm	31.37	32.85	-1.48	-2.2	*
Ramus Height	mm	38.70	42.61	-3.91	-3.3	***
Antegonial Notch	mm	2.39	1.78	0.61	1.6	NS

NS $p > .05$
* $p < .05$
** $p < .01$
*** $p < .001$

However, the Y axis remained within normal limits (Table I).

The incidence of TMJ involvement was 12 or 44 per cent and seemed to be associated with polyarticular and systemic types of JRA especially when the disease was manifested in its more severe form (Table II).

Radiographic evidence of TMJ pathology was found in eight children, six of whom had a history of clinical involvement of this articulation (Fig. 3). Limited translatory movements of the condyle were found in two. Erosion in the posterior area of the fossa was seen in one child while osteoporotic changes in the condyle appeared in three children. Small, flat, poorly developed condyles were seen in four children.

The changes brought upon the mandible in size and shape in those patients where the disease process affected the TMJ are probably subject to variables

TABLE II

DISTRIBUTION OF SUBJECTS ACCORDING TO TYPE OF JUVENILE RHEUMATOID ARTHRITIS, SEVERITY OF DISEASE AND TEMPOROMANDIBULAR JOINT INVOLVEMENT

No.	*%*	*Type of JRA*	*Severity*	*TMJ Involvement*
4	15	Systemic	2 Severe	—
			2 Moderate	—
3	11	Systemic and Polyarticular	2 Severe	1
			1 Moderate	1
13	47	Polyarticular	7 Severe	7
			6 Moderate	3
7	26	Pauciarticular	6 Moderate	—
			1 Mild	—

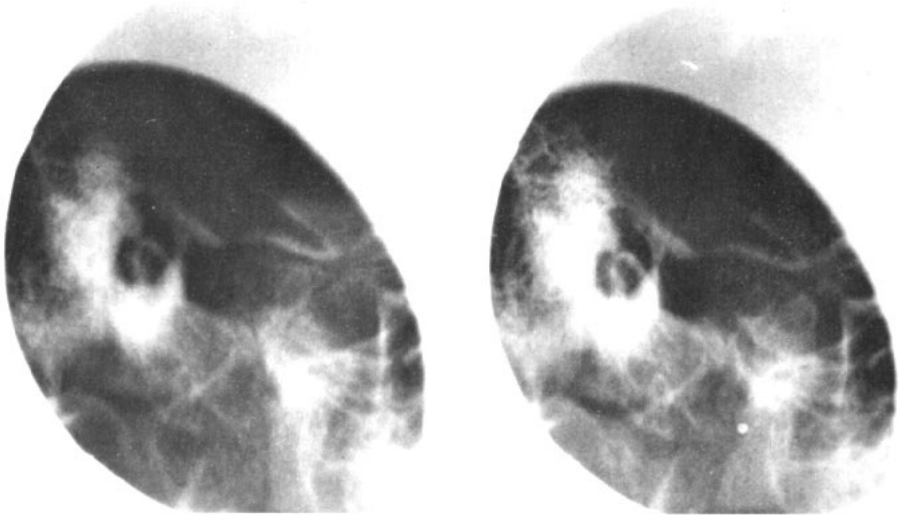

FIG. 3

such as age at onset, duration and severity of the disease. Difficulty in obtaining good radiographs of the TMJ were mainly attributed to the location of this articulation. Radiographic changes in the area appeared to be subtle as there are problems in securing good definition with today's techniques.

DISCUSSION

Attempts to diagnose TMJ alterations in the JRA patient from radiographs alone do not appear feasible. Radiographic interpretation without a good case history is rather unreliable. Martel et al.[15] have remarked that evidence of radiographic changes in children may be frequently delayed. Therefore, in looking for radiographic changes two factors should be kept in mind: severity of the attack and duration.

Corticosteroids are often used in the treatment of the arthritic patient. Forsslund[10] pointed out that extensive absorption of the condyles may be the result of the administration of this kind of drug. The medical history of all children who showed osteoporotic and poorly defined condyles had several years of continued administration of Prednisone (R).

There were four children in this study who had a history of TMJ problems but in whom no radiographic evidence of pathological change was found. Hatch[12] stated that sometimes the symptoms in this articulation can be transient and no sequelae will remain.

The molar classification of the study group showed a tendency towards a Class II malocclusion. It parallels Bache's[3] reports. Even among those known to have TMJ problems this type of occlusion was not definitive.

Crowding of the lower anterior teeth and the anterior open bite findings concurred with Engle et al.[8] and Slusar[20] but do not substantiate Marback and Spiera[14] who suggested anterior open bite as the first step in the development of malocclusion at the initial stages of the TMJ involvement.

The maxilla remains intact and continues its normal growth because the primary sites for its growth are at the sutures by proliferation of fibrous connective tissue. Taking into considera-

tion the sex difference, it is estimated that the maxilla probably ceases growth in the late teens, but the mandible may continue for several more years. Exact figures for the latter have not been established; however, the growth cartilage is still present till 27 to 30 years[16] and, therefore, the maxilla attains its full potential growth before the mandible does. This is recognized in cephalometric observations of young individuals where a tendency toward skeletal Class II relation often exists because of the incomplete development of the mandible.

Observations of the mandible in this study are very much in accord with Engle et al. and Slusar inasmuch as the rheumatoid group had smaller linear measurements than the control group. The present investigation found the ramus width to be, at .05 of confidence, narrower than the control group. The reduced height of the ramus is reflected in a greater GoGn-SN angular value, consequently, the mandibular plane is steep. From observing the mean value for NPo-FH and SN-Po it can be concluded that the research group (82.22, 75.65) had a more receding mandible than the control group (84.48, 77.48) though the statistics did not reach the exact level of significance.

Appositional secondary growth of the chin area takes place as the individual approaches adulthood; this adds a few millimeters to the total length of the mandible. This represents horizontal growth, but there is no change in the space to accommodate teeth. However, it tends to straighten the facial angle, thus altering the profile.

An unexpected finding was the non-significance of the Y axis, the mean angular values of the rheumatoid and the control group being very much alike. Only on those individuals who appeared to have arrested growth of the mandible was it possible to observe a more obtuse Y axis angle. The same observation can be applied to the antegonial notch as it was found to be prominent only on those whose mandibles were obviously small and distorted.

It is apparent that children with a history of JRA should have periodic dental examinations since it is likely that they will require orthodontic treatment. The growth of the mandible cannot be altered but tooth position can sometimes be guided.

Conclusions

The dental occlusions of 27 children with JRA were studied and it was found that they have a tendency toward Class II malocclusion, anterior open bite, and crowded lower anterior teeth.

Children with JRA who have TMJ involvement do not necessarily have a malocclusion.

All children with JRA were found to have a receding mandible with overall dimensions reduced, height being affected the most.

The incidence of the TMJ involvement in this study was found to be 44 per cent.

TMJ involvement appears to be associated with systemic and polyarticular types of JRA.

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