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A Case of Anterior Open Bite Developing During Adolescence

KAZUHIRO YAMADA[1], D.D.S., Ph.D.

YUUSUKE SATOU[1], D.D.S.

KOOJI HANADA[1], D.D.S.

TAKAFUMI HAYASHI[2]

JUSUKE ITO[2]

Departments of [1]Orthodontics and [2]Oral and Maxillofacial Radiology, Niigata University Faculty of Dentistry, Japan

Abstract. *Imaging studies have reported on the relationship between temporomandibular joint (TMJ) degeneration and facial deformity. These studies have suggested that mandibular growth is affected by TMJ degeneration, resulting in altered skeletal structure as mandibular retrustion. However, there are very few longitudinal case reports on TMJ osteoarthrosis (OA).*

Progressive open bite occurred in an adolescent patient with TMJ OA. Cephalometric analysis showed a downward and backward rotated mandible, and a labial inclination of the upper incisor. Magnetic resonance imaging showed internal derangement without reduction and erosion in the right and the left condyles. Although the cause of open bite is unclear in this case, tongue thrusting, and internal derangements in the temporomandibular joint were suspected as causes of the open bite.

Index words: Magnetic Resonance Imaging, Open Bite, Temporomandibular Joint Osteoarthrosis, Tongue Thrusting.

Introduction

The relationship between temporomandibular joint (TMJ) degeneration and facial deformity has been noted by imaging studies (Schellhas *et al*., 1993; Nebbe *et al*., 1997; Yamada *et al*., 1999). These studies suggest that TMJ degeneration in children might potentially alter mandibular growth and lead to an altered skeletal structure such as mandibular retrusion. These studies further suggest that since disk displacement can be seen as a loss of harmony between functional TMJ components, it may be considered a local environmental disturbance with the potential to affect condylar development.

However, there have been very few longitudinal case reports (Dibbets and van der Weele, 1992; Susami *et al*., 1992) with TMJ osteoarthrosis (OA), especially in young patients. Although Dibbet van der Weele (1992), and Susami *et al*. (1992) have reported cases showing mandibular rotation with condylar resorption, the pathology of TMJ derangement has remained unclear due to the lack of detailed imaging diagnosis such as magnetic resonance imaging (MRI).

The purpose of this article is to present a case report on a patient who acquired an open bite with tongue thrusting and bilateral OA during adolescence. Morphological and growth change analyses were also completed.

Correspondence: Kazuhiro Yamada, Department of Orthodontics, Faculty of Dentistry, Niigata University, 2-5274 Gakkocho-dori, Niigata 951-8514, Japan. Tel: +81-25-227-2906. Fax: +81-25-223-5230. E-mail: kazuhiro@dent.niigata-u.ac.jp

Case Report

An 11-year 9-month-old girl had complained of lateral incisor spacing. Her facial profile was slightly concave and no asymmetry was observed (Figure 1). She had edge to edge bite with Angle Class III molar relation. Overjet and overbite were 0·5 and 0 mm, respectively, and the lower right lateral incisor was congenitally missing. Facets were seen in the upper and lower molar teeth.

Cephalometric analysis indicated a skeletal Class III and high angle tendency with a relatively retruded maxilla and protruded mandible, and large mandibular plane angle (Figure 1). The maxillary and mandibular incisors showed labial and lingual tipping, respectively. Patient had tongue thrusting and bruxism habits, but no temporomandibular joint symptoms. The condylar morphology was normal in the transcranial projection (Figure 2).

Plan of Treatment

Since the mandible showed a Skeletal Class III tendency and she had a tongue thrusting habit, the first treatment of choice was thought to be tongue training exercise and observation of her growth during adolescence. The Class III correction would be addressed with full orthodontic treatment and possibly orthognathic surgical treatment if her craniofacial morphology indicated surgical treatment after completion of her growth.

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FIG. 1 Photographs and lateral cephalogram at first examination (age 11 years, 9 months).

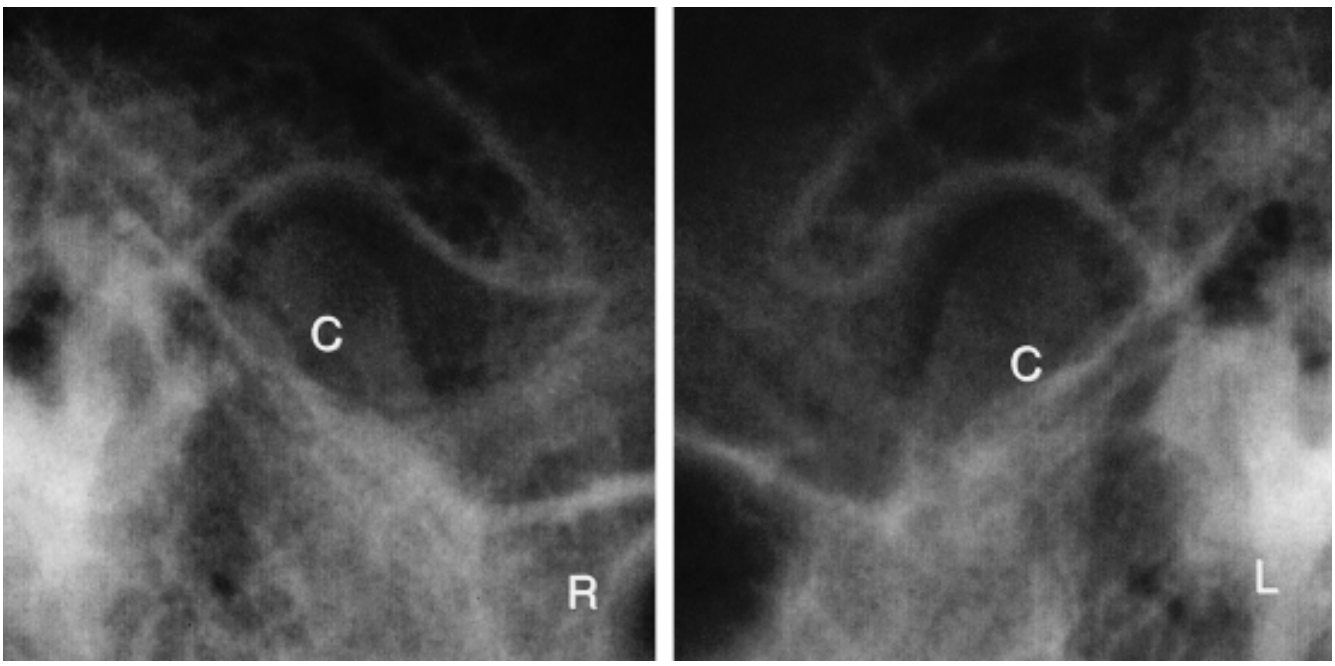

FIG. 2 Transcranial X-rays taken at first examination (age 11 years, 9 months; C: condyle).

FIG. 3 Occlusion at 6 months after first examination (age 12 years, 3 month).

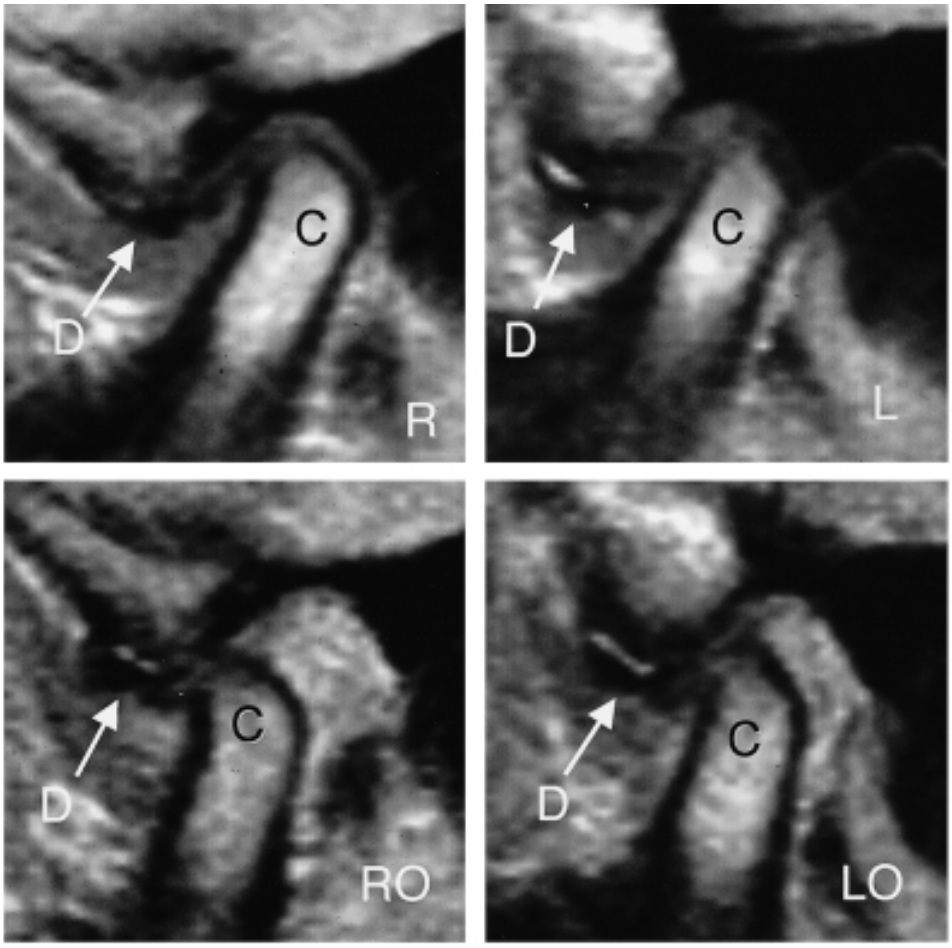

FIG. 4 Magnetic resonance image photographs at 12 month after first examination (age 12 years, 9 months). The articular disks located in front of the both condyles (white arrows). Continuity of cortical bone was lacking on the top of condyles (black arrows). Erosive bone change was suspected. (D: disk, E: erosion, RC: right closed, LC: left closed, RO: right open, LO: left open).

During Observation

Upon the recall of the patient 6 months after initial visit without involving any treatment, the overbite became negative presenting an anterior open bite with TMJ clicking, pain, and difficulty of mouth opening (Figure 3). Since she refused splint treatment, we were only able to treat her through control of foods and habits. TMJ pain and difficulty of mouth opening gradually decreased, and finally disappeared 18 months after the first visit. MRI findings at 12 months after the first visit showed TMJ OA, that is, internal derangement without reduction and erosion in the right and the left condyles (Figure 4).

There were no particular findings suggesting systemic bone disease, infection, or rheumatoid arthritis in haematological examination.

Forty Months after the First Visit

Her facial profile had changed to a straight type (Figure 5). Overbite and overjet changed abnormally to −8 and 1 mm, respectively. Cephalometric analysis revealed that the mandible had rotated downward and backward, and the mandibular plane and ANB angles had increased (Table 1 and Figure 6). The maxillary incisors were tipped more

FIG. 5 Photographs and lateral cephalogram at 40 months after first examination (age 15 years, 1 month).

labially. Right and left condylar ratios (Kjellberg *et al.*, 1995) in panoramic radiography had decreased from 42·4 to 34·4% in the right condyle and from 33·9 to 28·3% in the left condyle. Helical computed tomograph (CT) images showed flattening, that is, covered by cortical bone, in both condyles (Figure 7).

The range of maximum mouth opening, as measured between upper and lower incisor edge, was 45 mm, and mouth opening movement was not restricted. There was no apparent history of facial trauma or infection during the observation period.

TABLE 1 *Cephalometric summary*

	First visit		Forty months after first visit	
	11Y9M	Mean ± SD	15Y1M	Mean ± SD
SNA (degree)	81	80·8 ± 3.6	82·5	80·7 ± 3·4
SNB (degree)	82	77·9 ± 4·5	82·5	77·8 ± 4·4
ANB (degree)	−1	2·9 ± 2·4	0	2·9 ± 2·3
Mp angle (degree)	39·5	30·6 ± 3·6	41	30·1 ± 1·8
Goinal angle (degree)	135	122·8 ± 5·3	134	122·5 ± 2·6
U1-SN (degree)	121·5	106·0 ± 8·7	125·5	105·6 ± 4·4
L1-Mp (degree)	85·5	93·4 ± 6·8	88	93·0 ± 6·0
FMIA (degree)	55	56·0 ± 8·1	50	54·2 ± 6·8
Ar-Go (mm)	43·5	46·4 ± 3·3	46·5	50·3 ± 4·5
Go-Me (mm)	68	70·6 ± 4·1	71	74·0 ± 4·2

Discussion

A relationship between TMJ degeneration and facial deformity has been noted through MRI (Schellhas *et al.*, 1993; Nebbe *et al.*, 1997) and CT (Yamada *et al.*, 1999). It has been thought that disk displacement causes the abrasion of cartilage and finally leads to degenerative remodelling during the process of OA (Schellhas *et al.* 1992; Katzberg *et al.*, 1983). We suggest that progressive condylar resorption may be suspected in this case because disk displacement without reduction and erosion was seen.

Regarding condylar bony changes, Arnett *et al.* (1996a) identified two categories of TMJ remodelling: (1) functional remodelling and (2) dysfunctional remodelling. Dysfunctional remodelling is distinguished by TMJ morphological change (decreased condylar head volume), decreased ramus height, progressive mandibular retrustion (adult) or decreased growth rate (juvenile). Arnett *et al.* (1996a,b) speculated that this condition might be characterized by excessive or sustained physical stress to the articular

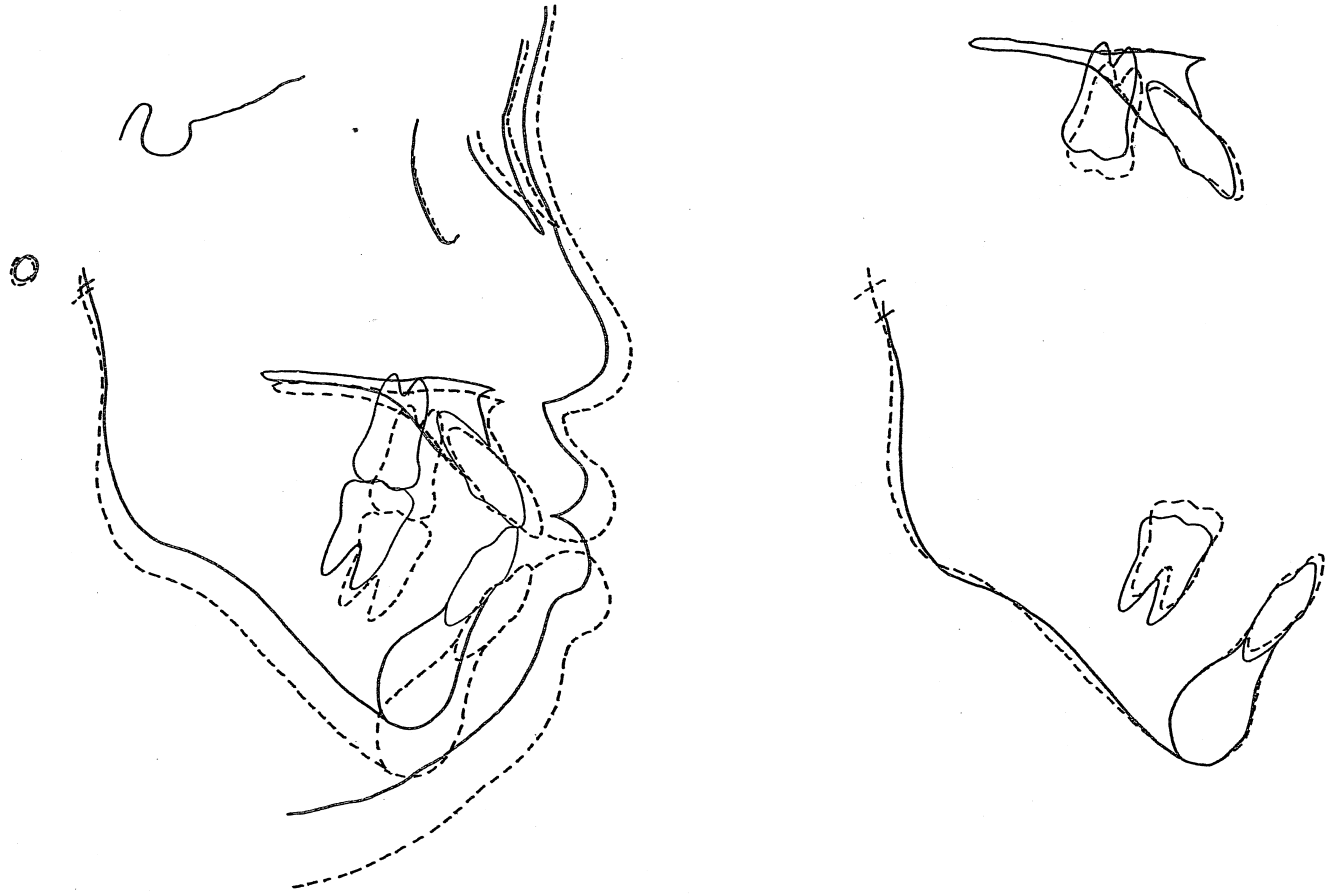

FIG. 6 Facial and dental changes between first and 40 months after first examination. Cephalometric tracings were superimposed on the structures in the anterior cranial base, the maxillary base and the mandibular plane.

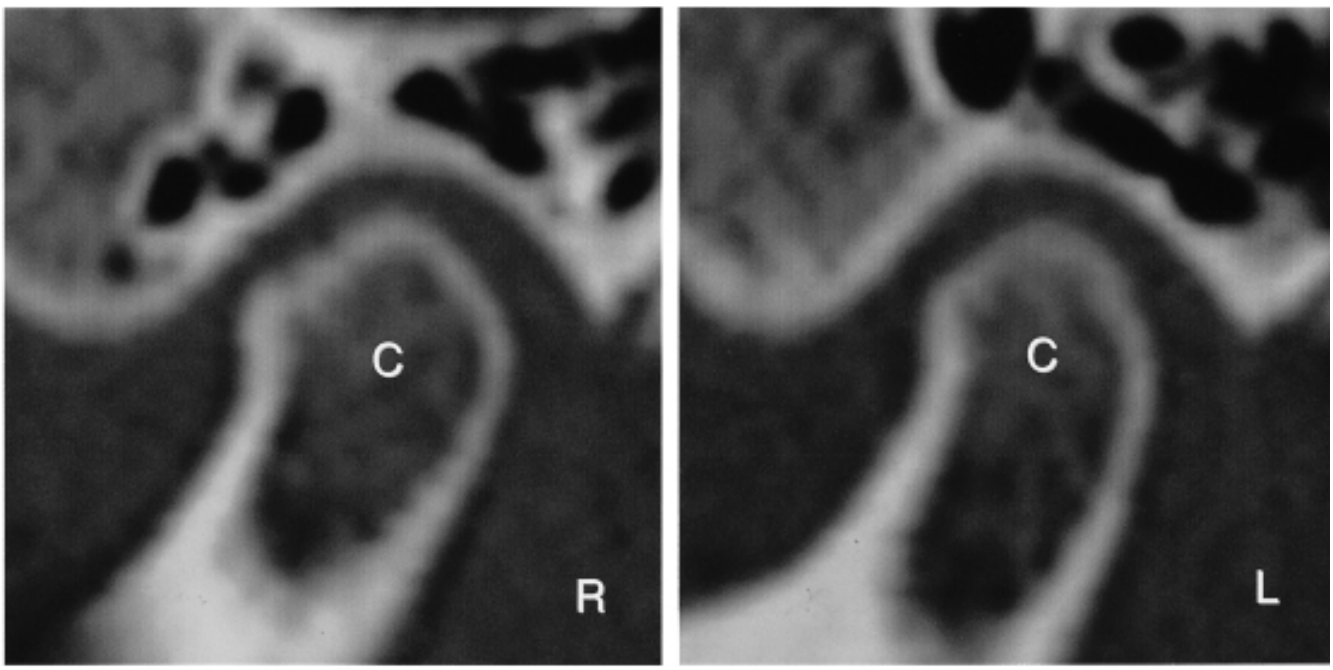

FIG. 7 Sagittal reconstruction images of axial helical CT scans at 40 months after first examination (age 15 years, 1 month).

structures that exceeds the normal adaptive capacity or exceeds a decreased adaptive capacity.

This case showed a sudden occurrence of a negative overbite during adolescence, due to a rotated mandible with TMJ OA and a labial inclination of the upper incisors. Although open bite with tongue thrusting usually occurs in infants and changes to skeletal open bite during adolescence, the sudden occurrence of open bite in adolescence is very rare. In this case, at the first visit, a balance of growth in maxilla and mandible may had kept edge to edge bite, despite the tongue thrusting. Condylar resorption with internal derangement and decrease of condylar ratio were seen during the observation period. It might be speculated that the posterior rotation of the mandible due to the condylar resorption resulted in a negative overbite. Also tongue thrusting might have contributed to accelerate the negative overbite because of the labial tipping of the upper incisors. Forty months after first visit, because both codyles were covered by cortical bone, orthodontic treatment could be started. However, habits and lifestyle, which load to condyle, have to be control.

It has been reported that patients with TMJ dysfunction tend to swallow with their teeth apart, and with excessive vertical and lateral mandibular movements (Williamson *et al.*, 1990). Williamson and associates speculate that noxious stimuli caused by mechanoreceptors in the periodontal ligament, and by internal derangements in the TMJ might cause a posturing of the tongue between the teeth and an open rotation of the mandible. They suggested that this posture may act as a protective mechanism, since occluding the teeth might tend to load both the teeth and the joints, and thus cause pain.

On idiopathic progressive condylar resorption, Arnett and associates (1996a) presented two theories of condylar resorption:

(1) in adults, the mandible recedes after growth completion;
(2) in juveniles, potential mandibular growth rate is diminished.

The connection of condylar resorption with deficient mandibular growth is far less clear. Multiple variables, including genetic coding, developmental factors (such as airway, allergies, and habits), and condylar resorption, may produce deficient mandibular growth (Arnett *et al.*, 1996a). Although, the causes of condylar resorption remain unclear in this case, tongue thrusting, and internal derangements in the TMJ have been suspected as causes of open bite. A longitudinal study of craniofacial development and condylar resorption will be needed.

Summary

A case report has been presented of anterior open bite developing during adolescence. Cephalometric analysis showed a downward and backward rotated mandible, and a labial inclination of the upper incisor. TMJ OA and tongue thrusting have been suspected as causes of open bite.

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