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Morphologic, functional, and occlusal characterization of mandibular lateral displacement malocclusion

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Introduction: Mandibular lateral displacement (MLD) is clinically characterized by deviation of the chin, facial asymmetry, dental midline discrepancy, crossbite in the posterior region, and high prevalence of internal derangement of the temporomandibular joint. Morphologic and functional characteristics of MLD should be clarified to correct and prevent this malocclusion. **Methods:** We examined the morphologic features, occlusal scheme, and functional behavior of MLD in 116 patients. Facial morphology was examined with posteroanterior cephalograms, occlusion guidance on the articulator after face-bow transfer, and condylar movement with the condylograph. **Results:** The superiorly inclined occlusal plane was associated with mandibular deviation in the same direction. The posterior occlusal plane on the shifted side was significantly steeper than that on the nonshifted side. Functional analysis of condylar movement showed a close relationship between the direction of MLD and the direction of condylar lateral shift during opening and closing, and protrusion and retrusion. The occlusal guidance inclination in the buccal segment of the nonshifted side was steeper than that in the shifted side. **Conclusions:** The results suggested that reduced vertical height of the dentition on 1 side induced mandibular lateral adaptation with contralateral condylar shift (asymmetry); this leads to condylar lateral shift during functional movement. (Am J Orthod Dentofacial Orthop 2010;137:454.e1-454.e9)

Mandibular lateral displacement (MLD) is relatively common in patients with malocclusion. The occurrence of MLD is of particular interest, since most types of malocclusion involve some facial asymmetry. MLD is characterized by mandibular deviation to 1 side evidenced by deviation of the chin from the facial midline, crossbite in the posterior region, and dental and skeletal midline discrepancies.[1-4] It was also reported that MLD patients with facial asymmetry have internal derangement of the temporomandibular joint (TMJ).[5-7] For the clinicians, MLD is a challenging anomaly and can sometimes be compromised in its results, because it is difficult to treat orthodontically, even with orthognathic surgery because of the asymmetry of the skeletal frame. This might be attributed to a lack of understanding of the morphologic and functional characteristics of this malocclusion.

In recent craniofacial biology research, the general consensus seems to be that the adaptation of skeletal and dentoalveolar elements of the face after functional displacement of the mandible leads to reestablishment of the structural and functional balance of the orofacial region.[8] It was been suggested that the dentofacial complex is obviously adaptable to the functional demand in occlusal configuration and the change of occlusal function in growing facial bones.[9,10] It was also pointed out by Petrovic and Stutzman[11] that the cant of the maxillary occlusal plane is an important factor contributing to mandibular positioning.

As we reported earlier, the cant of the occlusal plane is closely associated with various dentoskeletal frames during craniofacial growth and development.[12-15] It was speculated that horizontalization or flattening of the maxillary occlusal plane induces functional forward adaptation of the mandible followed by active transformation of the TMJs. Our previous investigation[3,5] indicated that the cant of the frontal occlusal plane

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Supported by grants-in-aid for open research from the Japanese Ministry of Education, Culture, Sports, Science and Technology.
The authors report no commercial, proprietary, or financial interest in the products or companies described in this article.
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Submitted, April 2009; revised and accepted, October 2009.
0889-5406/$36.00

doi:10.1016/j.ajodo.2009.10.031

(OP) in MLD malocclusion tilted superiorly to the side to which the mandible was shifted, often with TMJ symptoms on the side with the shifted condyle. In this context, it must be considered that the vertical and transverse positions of the mandible associated with the vertical height of the posterior teeth (posterior vertical dimension) are important to understand MLD malocclusion, although the interrelationship among occlusal plane deviation, MLD, and functional disturbances still remains to be elucidated.

These previous findings led us to reevaluate MLD patients to consider a therapeutic functional approach based on occlusal plane control by reestablishing the appropriate occlusal vertical dimension on the affected side; this is an effective treatment for the correction of the facial asymmetry due to MLD, with consequent improvement of occlusal and articular functions.

In this study, the morphologic, occlusal, and functional characteristics and orthodontic approach to MLD malocclusion are discussed.

MATERIAL AND METHODS

The Human Research Ethics Board at Kanagawa Dental College approved this study, and informed consent was read and signed by each participant.

Initial records of patients with nonhereditary craniomandibular asymmetry before, during, and after orthodontic treatment at the orthodontic department of Kanagawa Dental College were selected. A total of 116 patients (average age, 20.8 ± 7.8 years; 35 males: age, 20.7 ± 6.8; 81 females: age, 20.9 ± 8.3 years) diagnosed as having MLD without pathologic conditions that affect the TMJs, including congenital disorders such as hemifacial microsomia, condylar hyperplasia, rheumatoid arthritis, and osteoarthritis, participated in this study. These patients' facial morphology was examined by using posteroanterior cephalograms, occlusion guidance on the articulator after face-bow transfer, and condylar movement with a condylograph. All patients were treated or intended to be treated for their MLD malocclusion according to the treatment protocol at Kanagawa Dental College based on vertical dimension and occlusal plane control.

The morphologic characteristics of MLD were studied on the cephalograms as shown in Figure 1. The midfacial reference plane to assess facial asymmetry was a line running through crista galli and anterior nasal spine. The angle between the midfacial plane and the line running through anterior nasal spine and menton was defined as the degree of MLD. A positive value indicated MLD to the left side and a negative value to the right side. The angle between the perpendicular line of the midfacial plane and the line running through the occlusal surface of the bilateral maxillary first molars was defined as the OP. The angle between the perpendicular line of the midfacial plane and the line connecting the right and left antegonial notches was defined as the frontal mandibular plane (AG). The angle between the perpendicular line of the midfacial plane and the line connecting the right and left mastoid processes of the temporal bone was defined as the frontal mastoid plane. Positive values of OP and AG indicated that these planes inclined superiorly toward the left side.

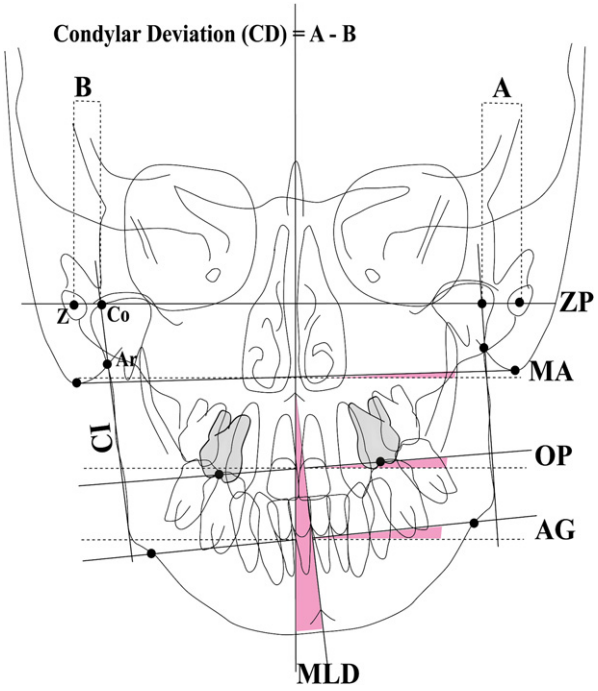

Fig 1. Measurements on posteroanterior cephalograms in MLD subjects: *OP*, frontal occlusal plane; *AG,* frontal mandibular plane; *MA*, mastoid plane; *CI*, condylar inclination; *ZP*, zygomatic plane; *Z*, point at lateral border of center of zygomatic arch; *Co*, condylion: most posterosuperior point of condylar process; *Ar*, articulare: point of intersection of the dorsal contour of the mandibular condyle and the temporal bone.

Since the condyle follows the growth of the whole ramus, to evaluate condylar deviation, the lateral ramus line, which was the tangent line from the cross point of the condylar process tracing and the tracing of the mastoid process to the lateral shape of gonial tracing, was drawn as an indicator of condylar inclination.[16] Then, the central points of the oval shape of right and left zygomatic arches were connected as the zygomatic plane. The distance between the zygomatic arches and the cross point of the zygomatic plane and the condylar