A Morphological Study of the Mandibular Condyle from an Orthodontic Point of View
—With Particular Reference to Mentovertex Cephalometry—

by

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1. Introduction

Although there is a fair body of published literature on the morphology of the mandibular fossa and condyle from anthropological and anatomical standpoints, they are mainly based on the dry skulls. Many points still remain to be explicated regarding the positional relationship between the fossa and condyle or the movement pattern of the latter in vital bodies.

From a clinical orthodontic point of view, in particular, an adequate understanding of these matters is requisite in that they are closely connected with differences of the normal occlusal subjects from the abnormal patients, orthodontic diagnosis, comparison between pre- and post-operative findings, and a necessary retention.

A radiography of the mandibular joint was improved by SAIRENJI and YANAGISAWA by an introduction of mentovertex cephalography[1] and, subsequently, it was modified by TORIUMI in an effort for better analysis of the morphology and movement of mandibular joint[2].

The present report deals with a comparison between respective morphologies of normal and abnormal occlusal subjects from an orthodontic point of view by use of this mentovertex cephalography. There were obtained some interesting results on the morphology of malocclusal patients in different Angle malocclusal classes.

2. Material and Method

For purposes of the study, 20 normal occlusal subjects free from any previous orthodontic care and no muscular trauma were selected from among the dental students at Nihon University, Tokyo, and 40 malocclusal patients diagnosed as either Angle Class II div. 1 or Class III. The total number of 60 subjects were all males and they ranged in age from 19 to 26 years. In taking cephalographs of these subjects, the following conditions were adhered to: 1) the distance between X-ray source and film was set at 1770 mm, 2) the distance of film F.H. planes was 230 mm, 3) the voltage was 80 kVp, 4) electric current was 200 mA per minute, 5) Lisholmblende grid ratio was 5:1, 6) sensitized paper was polaroid FS, 7) the film used was Dupon Chronex 11, and 8) for developments of the films, an automatic developing fluid designated by Dupon was used (Fig. 1).

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The cephalograms taken under these uniform conditions were traced on acetate films twice at different intervals by use of a view box for the purpose of overlapping them to avoid a possibility of tracing errors.

The morphology of the mandibular condyles thus obtained was classified into 7 patterns as proposed by Toriumi (Table 1).

With these materials, 6 items were measured as follows by using a calipers with 1/20 mm vernier.

1. Long breadth of the condyle: the largest length of mandibular condyles.
2. Short breadth of the condyle: the longest length crossing a vertical length.
3. Distance between the lateral aspects of mandibular condyles.
4. The condylar breadth angle: an angle formed by extending the largest breadths of two mandibular condyles.

Table 1. Seven morphological patterns of the mandibular condyle

<table>
<thead>
<tr>
<th>Pattern</th>
<th>Normal subjects</th>
<th>class II</th>
<th>class III</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R.</td>
<td>L.</td>
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</tr>
<tr>
<td>Elliptical</td>
<td>8</td>
<td>6</td>
<td>8</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>Trapezoid</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Dumb bell</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
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<td>10</td>
<td>10</td>
<td>7</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>Triangular</td>
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<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Rectangular</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Pentagonal</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
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3. Findings

1. The morphology of mandibular condyles.

As given in Table 1, the kidney-shaped pattern accounted for 47 out of 120 (39%), followed by 46 horizontal elliptical form (38%), 22 trapezoid (19%), 4 rectangular (3%), and only 1 triangular (1%). There were not calculated any statistical differences among these different patterns.

2. Distance and angle measurements.

Table 2 gives the mean values as well as standard deviations of the three different groups. They were modified by an expansion rate of 1.13% (Table 2).

   i. Long breadth of the mandibular condyle.
      Differences among the normal occlusal subjects, Class II and Class III patients regarding the right and left sides were not statistically significant.

   ii. Short breadth of the mandibular condyle.
      Here again, there was no significant difference among the three groups regarding the right and left sides.

   iii. Distances between lateral aspects of long condylar breadth.
      Although there was no statistical difference between the normal occlusal subjects and Class II patients, there was a finding that, between the normal occlusal
subjects and Class III patients, there was a significant difference in terms of mean values at a risk level of 1% attesting to the Class III group being smaller.

iv. Angles between the long condylar breadths.

Between the normal occlusal group and Class III, Class II and Class III groups, there were observed definite statistical differences at a risk level of 1%, with Class III group showing larger angles in all the cases. No significance prevailed between normal and Class II groups.

v. Right and left auricular points and angles between the long condylar breadths.

In common to the three groups, there was found no statistical difference as regards the right and left sides. However, a difference was detected among the mean values between Class II and Class III groups at a risk level of 1%.

vi. The rear rim of mandibular condyle and distance to the anterior bone wall of external auricular meatus.

Although there was not found a statistical difference between the right and left sides, a difference prevailed in terms of mean values between the normal and Class III groups at a 1% risk level.

On the other hand, there was found a statistical difference between Class II and Class III groups at a 5% risk level, the latter registering larger values.

4. Discussion

In the present study, a seven-pattern classification of the mandibular condyle as proposed by UEDA[5] was adopted.

Within the scope of this study, there was not found any dumb-bell or pentagonal pattern in all the groups examined.
The kidney-shaped pattern was the majority, accounting for as large as 50.0% in the normal subjects and 42.5% in Class III group. The above finding is in agreement with that of UEDA, in which he gives 32.5% of kidney-shaped pattern and 28.3% of horizontal elliptical pattern as compared with the author's 34.2% and 32.5% respectively.

As regards a statistical difference between long and short breadths of the mandibular condyle in terms of right and left sides, none was detected. However, in comparison with the previously published data by TORIUMI, KOYAMA, IHARA and OOMORI[6] the findings of the present author reveal a somewhat smaller tendency (Table 3).

In particular, difference of data between the author and TORIUMI is due to the fact that while the author selected F.H. plane as a landmark, the latter used the Campbell plane for his purpose.

As given in Table 2, there was observed no statistical difference between the right and left auricular points and condylar long breadth. But among the three groups, a statistical difference prevailed between Class II and Class III groups at a risk level of 5%. This implies that the mandibular condyle of Class III patients is positioned more anteriorly to the bone wall of external auricular meatus.

OISHI, in his study based on fresh cadavers[7], reported on the positional relationship between the temporomandibular fossa and condyle but future research is required for a better explication of this positional relationship in vital bodies.

In the present study in which the mentovertex cephalometry was applied, the author was able to establish that certain peculiar differences existed on the part of Class III patients as compared with other groups.

However, a three-dimensional observation needs to be further developed by adding other dimensions or criteria for the solution of the problem.

5. Conclusions

As a result of the foregoing study, the author arrived at the following conclusions:

1. The morphological contours of the mandibular condyles were found to be more or less similar to those reported by UEDA[5]. The majority of cases were kidney-shaped (39.2%), followed by horizontal elliptical (38.3%) and trapezoid (about 18.3%).

2. Of the distance and angle measurement items, the following were found to be statistically significant.

   i. Differences were observed between normal subjects and Class III patients.
as regards the distance between lateral aspects of mandibular condylar long breadth, its rear rim and anterior bone wall of external acoustic meatus.

These findings indicate that, in Class III patients, the intercondylar distance is shorter than that of normal occlusal subjects and that the condyle is positioned more anteriorly in relation to the bone wall of external acoustic meatus.

ii. Statistical differences were found between normal occlusal subjects and Class II and Class III patients as regards the distance between mandibular condyle large breadths, right and left auricular points and mandibular condyle maximum angle. This angle was measured far larger in Class III patients than other groups and, inversely, other two items were smaller in value.

iii. Based on these findings, it is to be concluded that there is no abnormal jaw morphology peculiar to Class III patients.

References