A COMPUTED TOMOGRAPHIC ANALYSIS OF CONDYLE-FOSSA RELATIONSHIP IN NORMAL CLASS I VERTICALLY GROWER MALES & ITS CORRELATION WITH MANDIBULAR MORPHOLOGY & DENTAL PARAMETERS

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Abstract : Introduction : This study was designed to investigate the condyle-fossa relationship in temporomandibular joint (TMJ) in normal Class I cases as well as to study its correlation with mandibular morphology & dental parameters.

Materials and Methods : Vertical grower Class I normals were selected on various cephalometric criterias like angle SNA, angle SNB, angle ANB, wits appraisal, going angle, and mandibular Plane Angle. All the selected cases were analyzed with the help of C.T. Scan to assess & measure the temporomandibular joint. C.T. scan slides were taken to evaluate TMJ in both axial & coronal sections in centric occlusion.

Results & Conclusion : The findings indicated that the mandibular morphology, intercanine width, intermolar width & overjet are independent of anteroposterior & mediolateral width of condyle, position of condyle in fossa & glenoid fossa width in Class I vertically Grower males.

Key Words : TMJ, C.T. Scan, condyle-fossa relationship

INTRODUCTION

From the last few years, orthodontists have increased emphasis on relationship of T.MJ & malocclusion, as it plays an important role in planning orthodontic treatment. However not much research has been done to assess the morphological variations associated with T.MJ & its relation to occlusion.

The influence of occlusion on joint morphology is still not completely understood. Opinions also differ as to the important of occlusion on the condyle-fossa relationship. Studies by Myers et al1, Mongini2, Mongini&Schmid3, Pullinger et al4, O’Byrn et al5, & Schudy 6 showed a significant correlation between these variables. However, Cohlmia et al7 reported no relationship between them. Most orthodontists agree that larger the discrepancy between the seated condyle and tooth intercusption, the more difficult is to achieve the desired result post treatment as said by R. Andrew Girardot8.

There is definite relationship of form & function. The position of condyle in fossa might affect mandibular morphology (ramus height & width, length of body of mandible) & thus on occlusion (intermolar width & intercanine width).

Assessing the T.MJ is not an easy task due to lack of scientific tools. Many researchers have tries to diagnose T.MJ problems with the help of radiography but the success was limited because of lot of limitations like
superimposition, magnification etc. Danforth et al stated that such difficulty might be eliminated by the use of CT, which allows precise visualization of anatomic details. Thus, reliable data concerning morphology, & condyle-fossa relationship can be obtained with the help of C.T. Scan. Thus, the present study was undertaken in the department of orthodontics, Govt. College of Dentistry to investigate the condyle-fossa relationship in temporomandibular joint (TMJ) in normal Class I cases as well as to study its correlation with mandibular morphology & dental parameters.

MATERIALS AND METHODS

The present study was conducted in Government Dental College, Indore, in co-ordination with department of radiology, CHL-Apollo Hospitals, Indore. Cases were selected from the out-door patients of Government Dental College & students of BDS, MBBS of Government Dental College & Mahatma Gandhi Medical College, Indore.

Criteria for selecting the cases:

1. Total 15 cases were selected within the age group of 18 to 24 yrs.
2. Complete case history & Clinical examination was conducted to assess occlusion & facial asymmetry and to exclude those with history of TMJ disorders & pain.
3. Occlusal state was evaluated on study models to exclude dentition with cross-bite, rotations, & absence of teeth.
4. Cephalometric analysis was conducted to categorize the growth pattern.

Informed consent was taken for exposure to C.T scan as well as for lateral cephalogram.

Cephalometric criteria used for selection were:

1. Angle SNA 82 ± 2°
2. Angle SNB 80 ± 2°
3. Angle ANB 2 ± 2°
4. Wits appraisal -1 mm
5. Gonial angle > 135°
6. Mandibular plane angle > 30°

All the above selected cases were analyzed with the help of C.T. Scan to assess & measure the temporomandibular joint.

C.T. Scan was conducted on LIGHTSPEED VCT C.T. Scan machine at 140 Kv & 220 mA in the department of radiology, CHL-Apollo Hospitals, Indore.

C.T. scan slides were taken to evaluate TMJ in both axial & coronal sections in centric occlusion. Sections of .6 mm thickness were taken.

Axial sections (Figure 1) were taken parallel to the Frankfort Horizontal plane. Axial sections having maximum condyle width within the glenoid fossa was used for measurement. Coronal sections were taken parallel to Nptog line. Coronal section (Figure 1) showing maximum mediolateral width in the glenoid fossa was taken for measurement.

Measurements were done directly on C.T. scan machine.

In axial section following measurement were taken: (Figure 2, Table I)

- Condylar angulation with the mid sagittal plane
- Anterior space (Space anterior to the condyle in the glenoid fossa)
- Posterior space (Space posterior to the condyle in the glenoid fossa)
- Medial space (Space medial to the condyle in the glenoid fossa)
- Mediolateral width of Condyle
- Anteroposterior width of Condyle
- Anteroposterior width of Glenoid-fossa
- Intercondylar width (distance between geometric centre of condyles)

In coronal section following measurement was taken: (Table I)

Superior joint space or vertical depth. (Space superior to the condyle in the glenoid fossa)

Condylar position in glenoid fossa was determined with the help of formula suggested by Pullinger et al 4:

\[
\text{Posterior joint space - anterior joint space} \times 100
\]

\[
\text{Posterior joint space + anterior joint space}
\]

This formula represents condylar position as percent displacement from absolute concentricity, whereby a perfectly centered condyle would be expressed as 0%. A positive value indicates an anterior condylar
positioning & a negative value would indicate posterior condylar positioning.

Intermolar width & intercanine width in millimeters were measured on the mandibular study models of skeletal class I cases to find out their correlation with intercondylar distance.

Overjet: the linear distance in millimeters from the facial surface of the mandibular permanent incisors to the incisal edge of the most protrusive maxillary permanent central incisor was used to gauge overjet.

Length of mandible was determined by measuring the distance form Gonion to pogonion (projected perpendicularly to the mandibular plane) & ramus height by measuring the distance from Condylion to Gonion on lateral Cephalograms to find out their correlation with various TMJ variables measured on C.T. scan is axial & coronal section.

STATISTICAL ANALYSIS

Descriptive statistics including arithmetic mean and standard deviation were calculated for different variables. Different variables were compared between two sides by t test to check the difference. Probability value (p-value) of < 0.05 was considered as statistically significant level. The relationship between two variables was calculated with the help of correlation coefficient 'r'.

RESULTS

Table II shows comparison of various TMJ characters on right & left sides in Class I normals. No significant difference was observed in between right & left side of TMJ in relation to anterior space, posterior space, medial space, superior joint space, mediolateral condylar width & glenoid fossa width except on right side condyle was more angulated. Table III shows correlation of dental parameters with various TMJ characters in class I normals but no significant correlation was noticed. Table IV shows correlation of mandibular morphology with various TMJ characters but it was not significant.

DISCUSSION

There is definite relationship of form & function. The position of condyle in fossa, condylar dimensions & glenoid fossa width might affect mandibular morphology (ramus height & width, length of body of mandible) & thus on occlusion (intermolar width & intercanine width). Thus, the present study was undertaken to find out the position of condyle in glenoid fossa & correlation of condyle-fossa relationship with dental parameters & mandibular morphology with the help of C.T. Scan as no such types of study has been done previously.

All the previous methods (Cephalometric Laminography, Corrected Lateral Cephalometric Laminography, Frontal Tomography, Corrected tomography etc.) had the drawback due to superimposition & magnification of images. In 1970's Computerized Tomographic Scan (C.T. Scan) was first introduction by Hounsfield. According to H.R. Cohen, Stuart Ross, Richard E. Gordon & Allan M. Deutsch and K Tsiklakis, Syriopoulos and H. C. Stamatakis C.T. scan of T.M.J. provides a detailed description of bone structure at different planes & shows 100% agreement between images & surgical findings. Computed Tomography allows very accurate evaluation of skeletal anatomy details. This technique has an advantage over the rest, as right & left sides of TMJ can be compared on the same image at the same time. Also by taking sections in sagittal, coronal and axial planes, one can visualize the complete T.M.J. Thus it provides a better tool as it avoids superimposition, distortion and magnification of images. It also makes possible to measure the actual dimensions of the T.M.J. spaces, condylar angulations, condylar width and glenoid fossa width in different planes. It also helps to evaluate the area at different depths while scanning the area. This study is carried out in axial and coronal sections, which were found to be vital in determining the condylar position within the glenoid fossa.

The samples for the study were selected from Out-door Patients and students of BDS and MBBS of Government College of Dentistry & Mahatma Gandhi Medical College, Indore within the age group of 18 yrs to 24 years. Significance of selecting this age group in present study is constant relationship of condyle in glenoid fossa. As age advances variations in TMJ may occur due to occlusal abrasion, malocclusion or edentulism. In a fully grown person, the TMJ has very minimal corrective remodeling in response to malocclusion but there occurs adaptive remodeling. Usually physiologic adaptation to condylar displacement occurs by this age.

The cases selected for the study were cephalometrically evaluated and categorized as Class I. To standardize the results & to minimize the variations due to sex & growth pattern, only males with vertical growth pattern were selected.

C.T. scan was carries out on these selected samples in the Department of Radiology CHI Apollo Hospitals on LightSpeed VCT C.T. Scan machine.
Coronal section of TMJ were taken. Measurement was done directly on C.T. scan machine.

This study showed that in skeletal class I cases, on right side condyle were more angulated (Table II). This result co-relates with the studies of Donald D. Blaschke and Thomas J. Blaschke. They concluded that there was a great variation in the condylar position in the glenoid fossa in centric occlusion in normal asymptomatic group also. Cohlima et al suggested that the asymmetric position of the condyles as a characteristic of the normal population.

The normal position calculated by percentage of posterior to anterior joint space formula showed nearly showed nearly centric position of condyle in fossa as value was 1% very close to 0%.

In the present study correlation of dental parameters (intermolar width, intercanine width & overjet) were identified with various TMJ variables measured on CT scan. (Table III). But no significant correlation was observed. Similarly mandibular morphology (ramus height & length of mandible) showed no significant correlation to various TMJ variables, which were measured on CT scan in axial & coronal sections. (Table IV) Earlier this type of correlation has not been studied. In the future, if we try to correlate these variables in severe malocclusion groups & with different growth patterns, it might be possible that some significant correlation may be observed.

CONCLUSIONS

Based on the recorded data & statistical analysis, the following conclusions were drawn:

1. Condyle was centrically positioned in glenoid fossa.
2. There was no significant correlation of dental parameters (intermolar width, intercanine width, overjet) with various TMJ variables measured on CT scan axial & coronal sections.
3. There was no significant correlations of mandibular morphology with various TMJ variables measured on CT scan in axial & coronal sections.

Thus, the mandibular morphology, intercanine width, intermolar width & overjet are independent of anteroposterior & mediolateral width of condyle, position of condyle is fossa & glenoid fossa width in Class I vertically growing males.

REFERENCES

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<th>Rights side</th>
<th>Left side</th>
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<tr>
<td></td>
<td>1</td>
<td>2</td>
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<tr>
<td>Condylar Angulation</td>
<td>78.3</td>
<td>68.0</td>
</tr>
<tr>
<td>Anterior Joint Space</td>
<td>4.1</td>
<td>4.5</td>
</tr>
<tr>
<td>Posterior Joint Space</td>
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<td>4.0</td>
</tr>
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<td>Medial Joint Space</td>
<td>4.7</td>
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<tr>
<td>Vertical Depth</td>
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<td>2.3</td>
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<td>6.7</td>
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<tr>
<td>Condylar Width(ML)</td>
<td>14.3</td>
<td>16.9</td>
</tr>
<tr>
<td>Glenoid Width</td>
<td>15.6</td>
<td>16.4</td>
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Measurements in millimeter
Table II: Comparison of various TMJ characters on right & Left sides in skeletal class I normal

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Character</th>
<th>Right</th>
<th>Left</th>
<th>P- Value</th>
<th>Significance</th>
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<tbody>
<tr>
<td>1</td>
<td>Condylar Angulation</td>
<td>74.4</td>
<td>76.9</td>
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<td>2</td>
<td>Anterior Joint Space</td>
<td>3.4</td>
<td>3.8</td>
<td>0.420</td>
<td>P &gt; 0.05</td>
</tr>
<tr>
<td>3</td>
<td>Posterior Joint Space</td>
<td>3.2</td>
<td>3.5</td>
<td>0.315</td>
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</tr>
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<td>4</td>
<td>Medial Joint Space</td>
<td>5.2</td>
<td>4.7</td>
<td>0.235</td>
<td>P &gt; 0.05</td>
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<tr>
<td>5</td>
<td>Vertical Depth</td>
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<td>3.1</td>
<td>0.407</td>
<td>P &gt; 0.05</td>
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<td>6</td>
<td>Condylar Width (AP)</td>
<td>7.8</td>
<td>7.9</td>
<td>0.931</td>
<td>P &gt; 0.05</td>
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<tr>
<td>7</td>
<td>Condylar Width (ML)</td>
<td>16.4</td>
<td>16.5</td>
<td>0.624</td>
<td>P &gt; 0.05</td>
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<tr>
<td>8</td>
<td>Glenoid Width</td>
<td>15.8</td>
<td>16.2</td>
<td>0.240</td>
<td>P &gt; 0.05</td>
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Table III: Correlation of dental parameters with various TMJ characters in normal class I cases

<table>
<thead>
<tr>
<th>Characters</th>
<th>Intercanine Width</th>
<th>Intermolar Width</th>
<th>Overjet</th>
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<tr>
<td>Inter molar width</td>
<td>0.60**</td>
<td>-0.55*</td>
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<td>Inter condylar width</td>
<td>0.06</td>
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<td>Condylar Angulation</td>
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<td>0.26</td>
<td>-0.21</td>
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<tr>
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<td>-0.06</td>
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<tr>
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<td>-0.11</td>
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<td>-0.39</td>
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<tr>
<td>Glenoid Width</td>
<td>-0.19</td>
<td>0.17</td>
<td>-0.10</td>
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Table IV: Correlation of Mandibular morphology with various TMJ characters in normal Class I cases

<table>
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<tr>
<th>S. No.</th>
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<td>Glenoid Width</td>
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<td>-0.42</td>
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</table>

Fig. 1: C.T Scan showing axial & coronal sections
Fig. 2: Diagrammatic representation of various characters measured on C.T. Scan