Age and gender as factors in temporomandibular joint movement in adolescents, as determined by computerized 3D electronic condylography

P. Currie

Oromocto, New Brunswick, Canada

Received January 20, 2010; Accepted March 31, 2010

Generalized joint hypermobility and Temporomandibular joints disorders are more common in women. Computerized electronic 3D axiography has been used to determine whether age and gender are factors in condylar movement in an asymptomatic adolescent sample.

**Purpose:** The present study assesses the influence of age and gender on temporomandibular joint movement.

**Patients and methods:** A total of 63 subjects had their right and left temporomandibular joint movements recorded by 3D electronic axiography. The sample was comprised of two groups: group 11.5–13.5 (23F, 7M) and group 13.5–15.5 (17F, 12M).

All subjects were asymptomatic for temporomandibular joint disorders.

**Results:** In the determination of whether there was a gender-related difference between the key variables, one variable (Quantity – right mediotrusion) was significantly different ($p > 0.001$).

Whether there was an age difference relationship between placement in the 11.5–13.5 or the 13.5–15.5 group, the 11.5–13.5 group had variables with significant differences ($p > 0.001$). These were: left start/end on open/close, $\Delta Y$ on protrusion/retrusion, left mediotrusion – left incursive pathway, right quantity – mediotrusion-left, right start/end difference – mediotrusion-left, and left quantity – mediotrusion-right.

When it was determined whether males have different measurements depending whether they were in the 11.5–13.5 group. There were significant ($p > 0.001$) differences for right incursive coefficient – open/close, $\Delta Y$ – open/close, and $\Delta Y$ protrusion-retrusion (13.5–15.5 group had greater variation), while for right start/end difference protrusion-retrusion, and right quantity – mediotrusion-left (11.5–13.5 group had greater variation).

For the between group comparison for females, only left quantity – mediotrusion right differed significantly, with the 11.5–13.5 group demonstrating greater variation.

**Conclusions:** Other than for one measurement (Quantity – right – mediotrusion right) there was no difference in TMJ movement based on gender. There were significant age-related differences with both younger males and to a lesser degree females demonstrating greater variation in TMJ movements than their older cohort.

**Keywords:** Temporomandibular joint movement, TMJ and age, TMJ and gender, TMJ laxity, TMJ hypermobility, condilography, axiography

**Introduction**

Medical research supports the concept that clinically, joint hypermobility is a manifestation of underlying heritable disorders of connective tissue disease [7]. General joint hypermobility and benign joint hypermobility syndrome can be measured by reproducible tests [21]. Generalized joint hypermobility has been associated with Temporomandibular joint disorders. In a study of 200 adolescents, Westling found females to be significantly more hypermobile than males [28].

Temporomandibular disorders are more frequently found in women [10]. In a review of Temporomandibular disorders, Scrivani [22] reports that the female to male ratio of those seeking care ranges from 3:1 to 9:1. Buckingham [1] in a study of 62 Temporomandibular Joint Dysfunction Syndrome subjects, found that the incidence of hypermobility in females was "strikingly higher". Joint laxity has been identified in textbooks as one of the factors associated with the higher incidence of Temporomandibular joint disorders in females [20].

However, the association between Generalized Joint Hypermobility and Temporomandibular joint disorders has been questioned. Dijkstra [5] reported that the relationship between Temporomandibular joint disorders and Generalized Joint Hpermobility is not clear, even though females show a higher prevalence of benign Generalized Joint Hypermobility than males.

The determination of Generalized Joint Hypermobility utilizes the Beighton modification of the Carter and Williamson method which measures movement of the hand, elbow,
knee, and trunk [8]. The Temporomandibular joint is not directly measured.

Recent software developments have enabled computerized 3D electronic condylography to quantitatively measure Temporomandibular joint movement. Changes in joint movement in adolescents have been recorded utilizing condylography [3].

In this study condylography has been used to determine if there are differences in condylar movement related to age and/or gender in asymptomatic subjects aged 11.5–15.5.

Materials and methods

This study involved 63 subjects. All subjects were between 11.5 and 15.5 years of age, at the private dental practice of Dr. Peter Currie. The dental clinic is located at 202 Restigouche Road, Oromocto, New Brunswick, E2V 2G9, Canada. Female involvement was predominant (2:1), reflecting treatment patterns at this clinic.

The subjects were divided into two groups: 11.5–13.5 and 13.5–15.5 years of age. The 11.5–13.5 group was comprised of 11 males and 23 females, while the 13.5–15.5 group had 12 males and 17 females.

Condylography was performed on each subject using a Girbach axiograph, with Gamma version 8.6 software. Open–close, protrusion–retrusion, mediotrusion-left, and mediotrusion-right movements were each repeated three times per subject. Each jaw movement yields a left and right tracing. Quantitative data can be obtained in three ways: The Gamma Cadix Verbal-Analysis Data Table can be produced for each movement, the Gamma ASCII export function can be used to make further calculations from the tracing data, and the tracings can be manually measured.

This study has measured:

- Quantity: the (length) of each axiograph tracing. The sole North American paper using axiography to measure changes in condylar translation recorded tracing length [9].
- Reproducibility Index: the calculated area in mm²/mm between the excursive and incursive pathway.
- Start/end difference: the difference in mm of the start of the excursive tracing and the end of the incursive tracing.
- Retral Stability: this is recorded at the start of the excursive pathway and at the end of the incursive pathway. The excursive and incursive pathways are sampled 500 times during a complete movement. Retral stability is measured during the first and last 30 samples.
- Curve coefficient as per Kobs: Kobs [13] proposed defining convex curves as pathologic with no further analysis, while concave curves were evaluated with the aid of a curve coefficient (C). C = a/d (d is the length between the origin and end point, while a is the amount of curve deflection from a straight line from the origin to the end point).

A limiting value of C = 0.05 and (a/d = 1/20) was established. C < 0.04 Defined as a straight line or convex (Pathologic) 0.04 ≤ C ≤ 0.06 Limit interval C > 0.06 Defined as a curved track (Physiologic).

Results

This study has attempted to determine the following:

1. Is there a difference between the scores for the 63 measurements based on gender?
2. Is there a gender difference for variables within the 11.5–13.5 and 13.5–15.5 groups?
3. Is there a difference in the variables for individuals in the male and female subsets in the 11.5–13.5 and 13.5–15.5 groups?

Gender difference (1)

An ANOVA test was run with all the measured values as dependent variables. Gender was the independent variable. The desired significance level was 0.001. Only one variable was significant at this level: Quantity - Right - mediotrusion-right (0.001).

If significance is set at 0.01, the Curve Coefficient for right excursive tracing for mediotrusion-right is significant (0.008).

Table 1 is a t-test for right quantity for mediotrusion-right. This is essentially a post-hoc test for the ANOVA. The t-statistic is negative, males are represented by 1, females by 2, indicating that females have a higher Quantity scores than males.

Figure 1 displays boxplots for the Quantity R MR variable for both males and females. It is clear that women have a higher median, and comparable range, but a lower interquartile range for this particular variable.

Between variables and groups (2)

A t-test for determining which variables were statistically different (0.001) between the 11.5–13.5 and 13.5–15.5 groups was run. Left open–close start/end difference (0.000), ΔY protrusion–retrusion (0.000), Left Curve Coefficient Incursive mediotrusion-left (0.001), Right Quantity mediotrusion-left (0.000), Right start/end difference mediotrusion-left (0.001), and left quantity mediotrusion-right (0.000) were significant.

At p < 0.01, left open–close start/end difference (0.004) and Left Curve Coefficient Excursive mediotrusion-left (0.002) are significant.

Figure 2 indicates that for Left open–close start/end difference, the 11.5–13.5 group has a larger range, interquartile range, median, and many more outliers than the 13.5–15.5 group.

### Tab. 1: T-test for significant principal sample variable by gender

<table>
<thead>
<tr>
<th></th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
<th>Mean Difference</th>
<th>Std. error difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity R MR</td>
<td>Equal variances assumed</td>
<td>–5.001</td>
<td>187</td>
<td>0.000</td>
<td>–1.66857</td>
</tr>
<tr>
<td></td>
<td>Equal variances not assumed</td>
<td>–4.555</td>
<td>106.799</td>
<td>0.000</td>
<td>–1.66857</td>
</tr>
</tbody>
</table>

J. Stomat. Occ. Med. © Springer-Verlag

Age and gender as factors in TMJ movement in adolescents 2/2010 77