**Tri-axial Accelerometric Analysis of Dynamic Patterns of Mandibular Movements**

**Language:** English

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**Introduction**

Accelerometric analysis represents a simple and unique method for acquiring specific dynamic data of mandibular movement which can be used for determining physiological as well as pathological dynamics' patterns.

**Material and Methods**

This pilot study included a healthy subject without any signs or symptoms of temporomandibular disorders which was determined using RDC/TMD examination protocol and computerized analysis of dental occlusion (T-Scan ®II, Tekscan, USA). Accelerations were measured by tri-axial MEMS wireless acceleration sensor (GLinkTM, Microstrain, USA) with range of ±10G and freely selected sweep rate of 1 kHz. Sensor was mounted on custom-made holder firmly fixed to subject's mandibular teeth to avoid soft tissues' movement artefacts. Acquisition of acceleration data was performed during mouth opening-closing cycles (OC), protrusive (P) and right and left laterotrusive movements (RL, LL) with predetermined pace and amplitude. By means of accelerometric data mean vertical and horizontal velocities of the mandible during movements were calculated. The comparison of acceleration values during mandibular movements was performed using analysis of variance (ANOVA) and pair wise comparisons (post-hoc Scheffe test).

**Results**

Raw tri-axial accelerometric data recorded during mandibular opening-closing cycles are showed in Figure 1. Similar data were recorded during left and right laterotrusive as well as during protrusive movements of mandible. Analysis of acceleration and calculated velocity data during protrusive and laterotrusive movements also reveal regular, repetitive and recognizable patterns. Acceleration and calculated respective velocities in Y-axis (frontal plane) of opening and closing cycles demonstrate smooth, repetitive and distinctive patterns of mandibular movements (Figure 2). For the purpose of this study Y-axis (vertical) accelerometric values for different mandibular movements (Table 1) were analysed. The analysis of variance showed that acceleration values of performed mandibular movements were significantly different (P<0.05). The post-hoc Scheffe tests (Table 2) showed that differences were found between OC and three other mandibular movements (RL, LL and P) (P<0.05). There was no significant difference between RL and LL (P>0.05).

<table>
<thead>
<tr>
<th>Movement</th>
<th>Mean</th>
<th>SD</th>
<th>SE</th>
<th>95% Confidence Interval for Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>OC</td>
<td>4,79</td>
<td>3,56841</td>
<td>0,79792</td>
<td>3,1199 - 6,4601</td>
</tr>
</tbody>
</table>

\[\text{Mean} \quad \text{SD} \quad \text{SE} \quad \text{Lower Bound} \quad \text{Upper Bound}\]
Table 1: Descriptive statistics for acceleration values [m/s²] in Y-axis for different mandibular movements (OC, LL, RL and PR).

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Sig.</th>
<th>95% Confidence Interval for Mean</th>
<th></th>
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<tbody>
<tr>
<td></td>
<td>Lower Bound</td>
<td>Upper Bound</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OC</td>
<td>3,598</td>
<td>&lt;0.001</td>
<td>1,8542</td>
<td>5,3418</td>
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<tr>
<td>RL</td>
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<td>&lt;0.001</td>
<td>1,9547</td>
<td>5,4423</td>
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<tr>
<td>PR</td>
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<td>0.039</td>
<td>0.0612</td>
<td>3,5488</td>
<td></td>
</tr>
<tr>
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</tr>
<tr>
<td>LL</td>
<td>0,1005</td>
<td>0.999</td>
<td>-1,6433</td>
<td>1,8443</td>
<td></td>
</tr>
<tr>
<td>PR</td>
<td>-1,793</td>
<td>0.041</td>
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<tr>
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</table>

Table 2: Comparison of acceleration values [m/s²] in Y-axis for different mandibular movements (ANOVA and post-hoc Scheffe test).

Conclusions

Acceleration and velocity during mouth opening-closing cycles demonstrate repetitive and distinctive dynamics patterns. They are significantly different (P<0.05) from patterns of protrusive and laterotrusive movements which also demonstrate repetitive and regular form. Those data could be used as the basis for time and spectral domain attribute description of regular and pathological mandibular movements. Accelerometric measurements could be applicable as diagnostic tool in analysis of mandibular movements.

Literature


Abbreviations

Abreviations in Table 1 and Table 2:
OC opening-closing
RL right laterotrusion
LL left laterotrusion
PR protrusion
SD Standard deviation
SE Standard error

This Poster was submitted by Dr. Ivica Pelivan.

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OBJECTIVES

The dynamics of mandibular movements is determined by factors such as dental arches, bone density at alveolar process, and nervous control mechanisms. The present study was designed to examine if dynamic features of mandibular movements differ between subjects with different dental arch conditions. The aim of the study was to compare mandibular movement patterns in healthy subjects and patients with different arch conditions.

METHODS

The study involved 30 healthy subjects divided into two groups: Group A (with a normal arch) and Group B (with an impacted third molar). In both groups, 15 subjects were included. The study included full mouth opening and closing movements, as well as anterior-posterior movements. The movements were recorded using a tri-axial accelerometer. The data was processed using a computer-based system to analyze the movement patterns.

RESULTS

The results showed significant differences in the movement patterns between the two groups. The normal arch group exhibited smoother and more uniform movement patterns compared to the impacted third molar group. The movement patterns were analyzed using statistical methods, and the results were compared to previously published data.

CONCLUSION

The study concluded that the dynamics of mandibular movements differ significantly between subjects with normal arches and those with impacted third molars. These differences can be used as a basis for further research into the correlation between arch conditions and mandibular movement patterns.

REFERENCES