The Correlation between Surface Electromyography and Bite Force of Mastication Muscles in Asian Young Adults

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Nothing to Disclose
Background

• Surgical indication
  – Functional
    • EOM, diplopia, trismus,
    • malocclusion
  – Aesthetic
    • asymmetry
Outcome assessment

• Functional
  – Sensory
    – V1, V2, V3
    – Light touch, pain, 2-PD
  – Motor
    • Occlusion, MMO, diet
Previous studies

• Different recording system
  – No detail information about the device
• Small series (case<30)
• Not quantitative
• Gender limitation
• Not comprehensive evaluation
Purpose

• Clinically applicable, reliable, quantitative and noninvasive system
• Jaw movement and function
• Normal population
45 young adults

4 could not perform whole movements

41 healthy adults

24 male
17 female
Inclusion/exclusion criteria

- **Inclusion criteria**
  - young adult, 20~35 years old
  - fair dentition, normal occlusion

- **Exclusion criteria**
  - craniofacial anomalies
  - previous facial trauma/surgeries, orthodontic treatment
  - symptoms or signs of TMDs
Kinetic and sEMG
EMG

- The sEMG machine (Zebris, Germany)

Allegation of Masticatory Electromyographic Activity and Stability of Orthognathic Surgery in Patients With Skeletal Class III Malocclusion

Ellen Wen-Ching Ko, DDS, MS, * Chiung Shing Huang, DDS, PhD, † Lun-Jou Lo, MD, ‡ and Yu-Ray Chen, MD

- Temporalsis, masseter

Bite force
Modify protocol

• Bite as hard as possible for 2 seconds
• With bite force for 2 seconds
• Firing pattern
  – increasing force gradually for 10 seconds
• Fatigue test
  – Bite in full strength for 10 seconds
Statistical analysis

- SPSS package version 20.0
- Mann-Whitney U test
- Wilcoxon signed ranks test
- Statistically significant at p<0.05
RESULTS
Results

No significant difference of EMG signal between right and left, female and male

No significant difference of bite force between right and left, female and male
EMG vs. bite force

Temporalsis

Massetere
Case report
Case report

- 22 year-old man, motorcycle accident
- Left zygoma closed fracture
- Open reduction and fixation five days later
- Post-op followed-up at 1, 3, 6 months
Post-op follow-up

Jaw movement

<table>
<thead>
<tr>
<th></th>
<th>CPL_R</th>
<th>CPL_L</th>
<th>CRL_R</th>
<th>CRL_L</th>
<th>IRL_R</th>
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<tbody>
<tr>
<td>post-op 1m</td>
<td>1.2</td>
<td>1.7</td>
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<td>8.8</td>
<td>1.2</td>
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<td>12.6</td>
<td>12.7</td>
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<td>post-op 6m</td>
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<td>13.6</td>
<td>1.5</td>
<td>3.4</td>
<td>12.7</td>
<td>14.5</td>
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EMG

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<th>RMAS</th>
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<td>49.5</td>
<td>65.5</td>
<td>45.8</td>
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<td>post-op 3m</td>
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<td>86.1</td>
<td>119.3</td>
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<td>post-op 6m</td>
<td>124.9</td>
<td>157.3</td>
<td>163</td>
<td>255.9</td>
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Correlation

- Slopes of the EMG activity versus bite-force for a given biting situation were reliable for temporalis and masseter muscles.

Variability

• Inter-measurement variability was low

• Intra-subject and Inter-subject variability
  – Use one side more than the other?
  – No significant difference between right and left

• Unilateral craniofacial deformity or facial trauma
<table>
<thead>
<tr>
<th>Advantage</th>
<th>Disadvantage</th>
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<tr>
<td>Non-invasive</td>
<td>Hard for Old people or children</td>
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<tr>
<td>Not time-consuming (40 minutes)</td>
<td>Edentulous people</td>
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<td>Not heavy</td>
<td>Only for alert patient</td>
</tr>
<tr>
<td>Easy to understand</td>
<td></td>
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<td>Instant Visual feedback</td>
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<td>Testing and educating</td>
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Conclusion

- Reliable, quantitative and noninvasive system
- Dynamic, continuously, biofeedback
- No significant difference between female and male, and bilateral condylar and incisal movement, EMG and bite force in young adults
- The mouth opening and closing ratio is about 6:4
- EMG and bite force has positive correlation
- Comprehensive evaluation of jaw function in kinematic, kinetic and functional way