Temporomandibular Joint Disorder (TMD)

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The Temporomandibular Joint

The TMJ is where the lower jaw meets the skull.

The socket

The condyle is the round end of the lower jaw.

Jaw muscles open and close the jaw when you chew and talk.

A proper bite allows smooth and effective chewing.

Closed Jaw

The disk fits in the socket when the jaw is closed.

Ligament

The condyle fits in the socket when the jaw is closed.

Open Jaw

The disk slides forward as the jaw opens.

The condyle moves forward as the jaw opens.
What is TMD?

Most common between the ages of 20-40 years old

Thought to be due to different levels of hormones and stress

The Temporomandibular Joint (TMJ) is the joint that connects your jaw to the bones of your skull.

When you suffer from painful problems with this joint (and the muscles that control it), the condition is known as a Temporomandibular Joint Disorder (TMD).

10 MILLION Americans may have TMD, which is roughly equal to the entire population of Nevada, Utah, Idaho, Montana, South Dakota, North Dakota, & Wyoming combined.

Women are 4 TIMES more likely to suffer from TMD than men.
Normal Jaw Rotation without Translation

Normal Jaw Movement
Disc displacement with reduction (Jaw Clicking)

Disc Displacement without reduction (Jaw Locking)
Temporomandibular joint (TMJ)

Jaw closed

Normal disc position

Disc displacement with jaw clicking (with reduction)

Disc displacement with jaw locking (without reduction)

Jaw open
\[ F_i = \frac{(F_{\text{max}}/n_i)}{e-1} \left( e^{\frac{P_i}{P_{\text{max}}}} - 1 \right), \]
<table>
<thead>
<tr>
<th>Loading Condition</th>
<th>Applied load (N)</th>
<th>Max. von Mises Stress (Pa)</th>
<th>Location of Max. von Mises stress</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Left side</td>
<td>Right side</td>
<td></td>
</tr>
<tr>
<td>Balanced</td>
<td>400</td>
<td>400</td>
<td>0.884E+05</td>
</tr>
<tr>
<td>Unbalanced</td>
<td>250</td>
<td>400</td>
<td>2.30E+05</td>
</tr>
<tr>
<td>Teeth grinding</td>
<td>400(vert)</td>
<td>500(vert)</td>
<td>2.79E+05</td>
</tr>
<tr>
<td></td>
<td>300(trans)</td>
<td>300(trans)</td>
<td></td>
</tr>
<tr>
<td>Clenching</td>
<td>600</td>
<td>600</td>
<td>8.96E+05</td>
</tr>
</tbody>
</table>
Fig. 6. Maximum von Mises stress developed over the mandibular 3D model during finite element simulation of teeth loading under four different bite conditions.
Methods of Treatment

● Therapy
  ○ Oral splint/Mouth guards
  ○ Physical Therapy
  ○ Counseling

● Medications
  ○ Pain Relievers
  ○ Muscle Relaxants

● Surgery
  ○ Arthrocentesis (needles)
  ○ Injections (botox)
  ○ TMJ arthroscopy
  ○ Modified condylotomy (mandible)
  ○ Open-joint surgery
Proposed Study

- Biomechanical observation of around 250 dental patients with reports of **Clicking** or **Locking**
- Three groups:
  - Control
  - Cerezen
  - Bite Splint
Proposed Study

MRI’s, X-rays, and motion capture technologies will be used with each group to evaluate the motion and image of the jaw. This will reveal how the biomechanics of the jaw change over time.
Cerezen

- Hollow insert that fits into the ears
- Applies subtle pressure to the jaw joint to return it to relaxed position
- Can be worn day and night and doesn’t impact eating, breathing, or hearing
Bite Splint

- Prevents stress on TMJ due to clenching or grinding to allow for relaxation
- Worn primarily at night to prevent teeth shifting
Measurements

- Timeline for evaluation:
  - 1 week after start
  - 1 month after start
  - 2 months after start
  - Then every 3 months for 5 years
- Force with reaction forces
- Motion and moments
- Pain and sounds that the patient are experiencing
Desired Outcome

- Realignment of the disk to relieve pain
- Observe what each device does to the biomechanics of the jaw to see why they work
Cost

Expenses for trial:
Motion Capture technology $1,000-15,000
MRI/CT scan $550-800
Cerezen $1900
Bite Splint $300-500
References

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Questions?