THE USE OF ACOUSTIC STIMULATION TO INSPECT THE FETAL MOUTH

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The normal neonatal response to sound stimulus consists of a generalized paroxysmal startle reflex. We recently noted an increase in fetal movements, head turning, mouth opening, tongue protrusion, cheek motion, hand to head movement and fetal eye blinking to subsequent to fetal vibroacoustic stimulation. These movements are thought to represent portions of a startle response.

Evaluation of the fetal face is an essential part of routine sonographic examination

- The complexity of the face in combination with suboptimal positioning may make it difficult to obtain adequate images of the fetal mouth.
- The fetal mouth is especially difficult to examine if it remains closed.
- It appeared to us that approximately 50% of the time, fetuses may be seen touching their face and head with their hands.
- This action may make evaluation of the face more difficult because of the shadowing caused by the overlying bones of the hands.
We hypothesized that if vibroacoustic stimulation brings about fetal mouth movement and opening and/or withdrawal of the fetal hand from the mouth, it may facilitate anatomic evaluation for cleft lip and palate.
Objective

This study was designed to determine whether acoustic stimulation of the fetus would cause it to move its mouth and/or withdraw its hand from its mouth.
Study design (I)

- 109 women with uncomplicated pregnancies between 20 and 39 weeks gestation.
- Fetal mouth was observed for 5 minutes before and after vibratory acoustic stimulation.
- Stimulation was accomplished with a 74 dB sound source for 3 seconds.
Study design (II)

- Fetal mouth movement classified
  - none
  - rhythmic lip movement
  - rhythmic jaw movement
  - mouth opening

- Statistical analysis was performed by the Mann-Whitney U-test.
Fetuses were monitored by means of a real time ultrasound scanner (ATL HDI 5000 with a 5MHz curvilinear probe, Bothel, WA).

The acoustic stimulator (Corometrics 146, Wallingford, CT) was applied to the maternal abdomen near the fetal head and stimulation was accomplished with a 3 second sound pulse.

Movements of the mouth were visualized on a coronal scan including the fetal mouth.
The exact number of individual movement patterns was counted in each 5-minute period before and after acoustic stimulation.

The time to first fetal mouth opening after acoustic stimulation was observed.

Withdrawal of the fetal hand from the mouth was noted.
Exclusion criteria

- Diabetes
- Hypertension
- Suspected intrauterine growth restriction
- Substance use
- Multiple gestation
- Suspected congenital anomalies
- Oligohydramnios
Fetal response to vibroacoustic stimulation

<table>
<thead>
<tr>
<th>Gestational age (weeks)</th>
<th>N</th>
<th>Before acoustic stimulation (per 5 min.)</th>
<th>After acoustic stimulation (per 5 min.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Rhythmic lip</td>
<td>Rhythmic jaw</td>
</tr>
<tr>
<td>20-23</td>
<td>14</td>
<td>2.6±1.9</td>
<td>4.1±3.5</td>
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<tr>
<td>24-27</td>
<td>13</td>
<td>4.7±2.9</td>
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<td>28-31</td>
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<td>32-35</td>
<td>23</td>
<td>3.9±3.4</td>
<td>1.5±2.1</td>
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<tr>
<td>36-39</td>
<td>17</td>
<td>3.1±2.6</td>
<td>1.3±1.4</td>
</tr>
</tbody>
</table>

N; Numbers of study population
*P < 0.05, **P < 0.01 (comparing pre-versus post-stimulus)
Results (III)

- None of the studied fetuses exhibited no mouth movement.
- The average time to the first fetal mouth opening after acoustic stimulation was 78 seconds with a range of 3 to 290 seconds.
- Hand withdrawal occurred in 64% during the 5 minutes after acoustic stimulation compared with 43% observed in the 5 minutes prior to acoustic stimulation.
**Figure 1.** Comparison of fetal mouth before and after acoustic stimulation. In this case fetal mouth closed before acoustic stimulation. But after acoustic stimulation fetal mouth completely opened immediately.
Figure 2. Comparison of fetal mouth before and after acoustic stimulation. In this case, assessment was very difficult because of fetal occiput posterior position without mouth opening or movement. After acoustic stimulation mouth opening and movement facilitated assessment.
Figure 3. Comparison of fetal cleft lip and palate before and after acoustic stimulation. In this case, fetal cleft lip was suspected before acoustic stimulation. But only after acoustic stimulation could it be diagnosed definitely.
Figure 4. Comparison of fetal mouth with hand before and after acoustic stimulation. In this case, fetal face assessment was impossible due to hand contact with face prior to acoustic stimulation. After acoustic stimulation, hand withdrawal occurred and assessments could be made.
Conclusion

Acoustic stimulation increases the frequency of fetal mouth movement thus likely facilitating anatomic evaluation for cleft lip and palate.