Facial Reanimation Surgery Restores Affect Display

Jacob K. Dey, BS; Masaru Ishii, MD, PhD; Kofi D. O. Boahene, MD; Patrick Byrne, MD; Lisa E. Ishii, MD, MHS

Department of Otolaryngology – Head and Neck Surgery
Johns Hopkins University School of Medicine, Baltimore, Maryland, USA

BACKGROUND

• Human face is of paramount importance for our identity, and ability to interact with others.
• Facial paralysis diminishes facial movements and causes facial asymmetry, which limit facial expression and impair affect display, the external display of one’s emotions.
• Affect expression is a primary channel of communication, and core affects and emotions are universal.
• Proper affect display is essential in one’s ability to function and thrive in society.
• Facial paralysis patients often experience adverse psychological and social outcomes leading to a decreased quality of life.
• Primary treatment modality for facial paralysis is facial reanimation surgery.
• “Facial Reanimation Surgery” is a broad term that encompasses numerous reconstructive surgical procedures aiming to restore facial function, symmetry, and cosmesis.
• A paucity of data for assessing affect display in patients with facial paralysis.
• Facial reanimation surgery to restore intended affect display in patients with facial paralysis.

OBJECTIVES

• Objective 1: Characterize how lay observers perceive the affect display of faces with facial paralysis before and after reanimation surgery.
• Objective 2: Compare how lay observers characterize the affect display of postoperative paralyzed faces vs. faces of normal individuals.

METHODS

Study Design
Randomized controlled experiment

Participants
• 122 observers recruited from around the U.S.A with online survey, 32 failed to fully complete the survey, leaving n=90 (39 men & 51 women) with ages from 19 to 70 (mean age 31 ± 13) whose data were analyzed

Exclusion Criteria:
1) Younger than 18 years old
2) Unable to speak, read, and understand English
3) Unable to use a computer
4) Persons with an affective psychiatric condition (schizophrenia, autism, or related spectrum disorders)

Data Collection

Instrument:
4 mutually exclusive REDCap surveys
• Images selected at random from our clinical archive
• Pre-op paralyzed faces: House-Brackman grade between IV and VI
• Normal images chosen to demographically match paralyzed images with respect to age, gender, race

RESULTS

Figure 2: Representative image set from a facial paralysis patient in our study.

Figure 3: Predicted probabilities of latent class membership as a function of operative status for paralyzed faces with comparison to normal faces.

Table I: Patient Demographics

<table>
<thead>
<tr>
<th>Paralysis</th>
<th>Repose (n=20)</th>
<th>Pre-op</th>
<th>Post-op</th>
<th>Repose</th>
<th>Pre-op</th>
<th>Post-op</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>55%</td>
<td>52.5%</td>
<td>62.8%</td>
<td>62.8%</td>
<td>55%</td>
<td>55%</td>
</tr>
<tr>
<td>Male</td>
<td>45%</td>
<td>47.5%</td>
<td>37.2%</td>
<td>37.2%</td>
<td>45%</td>
<td>45%</td>
</tr>
<tr>
<td>Age</td>
<td>53 ± 13</td>
<td>43 ± 16</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>80%</td>
<td>45%</td>
<td>55%</td>
<td>55%</td>
<td>80%</td>
<td>80%</td>
</tr>
<tr>
<td>African American</td>
<td>5%</td>
<td>12.5%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table II: Hypothesis Tests

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Affect Classification Probabilities</th>
<th>95% CI for Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repose: PostOp vs Normal</td>
<td>PostOp (%)</td>
<td>Normal (%)</td>
</tr>
<tr>
<td>Positive</td>
<td>27.7</td>
<td>22.2</td>
</tr>
<tr>
<td>Neutral</td>
<td>53.4</td>
<td>62.8</td>
</tr>
<tr>
<td>Negative</td>
<td>18.9</td>
<td>15.0</td>
</tr>
<tr>
<td>Smiling: PostOp vs Normal</td>
<td>PostOp (%)</td>
<td>Normal (%)</td>
</tr>
<tr>
<td>Positive</td>
<td>60.0</td>
<td>91.3</td>
</tr>
<tr>
<td>Neutral</td>
<td>28.2</td>
<td>5.0</td>
</tr>
<tr>
<td>Negative</td>
<td>11.7</td>
<td>3.7</td>
</tr>
</tbody>
</table>

* Statistically significant. Confidence intervals corrected for multiple comparisons.

CONCLUSIONS

• Facial reanimation surgery improves affect display in patients with facial paralysis by decreasing negative and increasing positive and neutral affect classifications.
• Reanimation surgery restores affect display to normal levels for faces when in repose, and improves affect display when smiling.
• These results provide evidence to support the use of facial reanimation surgery to restore affect display, minimize psychosocial dysfunction, and improve quality of life.

IMPLICATIONS

• Patients: Reanimation surgery can improve the ability to display emotion, which may mitigate some of the adverse psychological and social outcomes of facial paralysis.
• Providers: Reanimation surgery improves affect display, and there is opportunity to achieve the ultimate goal of fully restoring function and aesthetics to completely normalize affect display.
• Healthcare System: This study provides tangible, statistically supported evidence that reanimation surgery provides a significant benefit to patients with facial paralysis.

FUTURE RESEARCH

• Break Down Reanimation Surgery:
  This was a pilot study. Due to the multitude of reanimation procedures, we did not analyze the efficacy of individual procedures. Future studies will look at how specific reanimation surgery methods alter perceived affect display.
• Videos: Video recordings of patients to show a wider range of functionality and facial expression, better able to simulate real life social interactions.

Acknowledgements

* Dr. Leonard Derogatis: use of the Derogatis Affects Balance Scale, a well-established research instrument for assessing affect display.
* Dr. Kelly Gebo: advisement throughout the Scholarly Concentrations Program.
* Andre Hackman: REDCap support.

Statistical Analysis:
OBJECTIVE 1 → Latent Class Analysis: performed in R using poLCA package
  helped establish 3 latent classes from our 9 affect measures (Figure 4)
  Latent Regression Model: determined probability of latent class membership predicted by two covariates: operative status and smiling (Figure 3)
  Bootstrap Method: estimated standard errors for the predicted probabilities

OBJECTIVE 2 → Hypothesis Testing: compared post-op to normal predicted probabilities (Table II)
  Bootstrap Method: determined 95% confidence intervals for the difference of predicted probabilities
  Assumes difference is statistically significant if 95% confidence interval did not contain 0
  Bonferroni Method: corrected for multiple comparisons, i.e., adjust 95% confidence intervals
  Experiment wide α set at 0.05