Objective Assessment of Perceived Age Reversal and Improvement in Attractiveness After Aging Face Surgery

A. Joshua Zimm, MD; Milad Modabber, MSc; Vinay Fernandes, MD; Kian Karimi, MD; Peter A. Adamson, MD, FRCSC

IMPORTANCE  Primary reasons why patients pursue aesthetic facial surgery are to look younger and more attractive; however, there is minimal literature about the effect of aesthetic facial surgery on perceived age and attractiveness.

OBJECTIVES  To objectively and quantitatively evaluate the degree of perceived age change and improvement in attractiveness following aesthetic facial surgical procedures.

DESIGN  Prospective evaluation by independent raters of preoperative and postoperative photographs of 49 consecutive patients who underwent aesthetic facial surgery between July 4, 2006, and July 22, 2010. The photographs of these patients were presented to 50 blinded raters, each of whom was randomly assigned to 4 rater groups. Raters were asked to estimate the age of each patient in the photographs presented and to rate the patient’s attractiveness on a scale of 1 to 10.

SETTING  Facial plastic surgery private practice in Toronto, Ontario, Canada.

PARTICIPANTS  Patient inclusion criteria consisted of primary facial surgical procedures with a minimum 6-month follow-up period, use of standardized photographs, and no cosmetic procedures in the intervening period. Raters were chosen from the province of Ontario, randomly assigned to 1 of 4 rater groups, and blinded to the objectives of the study.

MAIN OUTCOMES AND MEASURES  The mean “years saved” (true age minus guessed age) and change in attractiveness scores after facial aesthetic surgery.

RESULTS  The mean overall years saved following aesthetic facial surgery was 3.1 years (range, −4.0 to 9.4 years). There was a small but insignificant increase in attractiveness scores in postprocedural photographs relative to preprocedural photographs ($P > .54$).

CONCLUSIONS AND RELEVANCE  In this study, aesthetic facial surgery was effective in reducing the apparent age of patients but did not consistently improve their attractiveness.

LEVEL OF EVIDENCE  4.
The main factors influencing a patient’s decision to seek aesthetic facial surgery are to look younger and, by inference, more attractive. Aesthetic facial surgeons typically communicate to their patients that they will look “more refreshed” and “less tired.” However, because of a lack of stringent data across the literature, facial surgeons often do not directly state that patients will look significantly younger or more attractive to avoid creating false or unrealistic expectations. Previous studies have examined change in apparent age after aging face surgery, but none have objectively analyzed apparent changes in attractiveness. It has been previously determined that there are 4 components of facial attractiveness. These are averageness (koinophilia), sexual dimorphism (masculinity or femininity), youthfulness or neoteny, and symmetry. Therefore, it may be theorized that by looking more youthful one will also appear more attractive. Our objective herein was to objectively quantify the degree of perceived age change and improvement in attractiveness following aesthetic surgical procedures as a follow-up study to a previous publication by one of us (P.A.A.), which examined changes in perceived age alone.

Methods

Patients undergoing aesthetic facial surgery by one of us (P.A.A.) during the 48-month period between July 4, 2006, and July 22, 2010, were initially reviewed for eligibility in this study. The inclusion criteria were as follows: (1) primary facial surgical procedures, such as face-lift and neck-lift, upper or lower blepharoplasty, and brow-lift (alone or in combination); (2) patient consent for public viewing of photographs; (3) minimum of 6 months’ follow-up data with photographs after surgery; (4) standardized photographs (frontal and lateral) without makeup and jewelry; (5) no cosmetic procedures in the intervening period between the before-and-after photographs, including dermal fillers, botulinum toxin, or laser treatment; and (6) no concomitant rhinoplasty at the time of the original surgery or in the intervening follow-up period.

Initially, 204 patients who had undergone the above-described facial surgical procedures during the study period between July 4, 2006, and July 22, 2010, were considered for eligibility. Among these patients, 49 (24.0%) met the inclusion criteria and were included for further analysis. Of the excluded patients, 91 (44.6%) had inadequate follow-up data or photographic documentation, 31 patients (15.2%) had intervening injectable treatments, 16 patients (7.8%) had secondary or other aging face surgery, 9 patients (4.4%) did not provide consent for public use of their photographs, and 8 patients (3.9%) had undergone concomitant rhinoplasty.

Our study design used 50 unique raters, each randomly assigned to 1 of 4 rater groups, with each group comprising 12 or 13 raters. The raters consisted of laypersons recruited from the community and hospital workers, all blinded to the objective of our study. Rater selection excluded physicians and residents with expertise in facial plastic surgery.

The 49 patients contributed a total of 196 photographs (4 photographs per patient, preoperative and postoperative, with frontal and right lateral views for each). To minimize rater bias, the photographs were randomized into 4 separate binders, with each rater being responsible for viewing 49 paired sets of photographs (a frontal and lateral view of each patient) in the binder randomly assigned to him or her. Half of the photographs were taken before the procedure, and half were taken after the procedure. The order of the photographs remained the same for every rater in each binder. The 4 binders were split into 2 pairs of mirrored binders, such that each binder had a preoperative or postoperative photograph of a particular patient but not both. Hence, no rater saw the before-and-after photographs of the same patient.

Raters were asked to estimate and record the age of the patient appearing in each set of photographs. They were also asked to rate the patient’s attractiveness on a scale of 1 to 10 on a 20-point scale (ie, 0.5 scores were allowed), with 1 being the most unattractive and 10 being the most attractive. These data were recorded and kept in a confidential log. Before distribution, the photographs were numbered, and each number correlated with a number in a separate spreadsheet file containing actual age and identifying data that could then be examined for statistical purposes. Data analysis was performed using commercially available statistical software (SAS, version 9.2; SAS Institute, Inc.).

Perceived age difference was defined as the difference between the chronological age and the perceived age of the patients, as estimated by the raters. In this experiment, 50 raters guessed the age (guessed age) of 49 patients as seen in photographs before and after surgery. For each guessed age, we calculated the difference from the patient’s true age (true age minus guessed age) and called this variable “years saved.” For each patient, we compiled the collective years saved data from each rater. The mean years saved (hereafter years saved) was the outcome variable in this analysis. We constructed a mixed model (Proc mixed, SAS, version 9.2) to evaluate the effect of surgical procedure and time (before vs after surgery) on years saved; surgical procedures included upper blepharoplasty, lower blepharoplasty, brow-lift, and face-lift and neck-lift. The combination of upper and/or lower blepharoplasty and/or brow-lift was designated as upper facial rejuvenation, face-lift and neck-lift as lower facial rejuvenation, and a combination of the 2 as upper and lower facial rejuvenation. Patient sex and age at surgery were also included in the model to control for their possible effects on the outcome. Initial models included interactions between the predictors. Nonsignificant interactions were removed if they were not statistically significant (P > .05).

The mixed model (Proc mixed, SAS, version 9.2) was used to assess rater differences and predictor variables that may influence attractiveness scores, including rater age and sex, photograph order, and experimenter (binders 1 and 2 vs binders 3 and 4), as well as patient age at surgery, photograph type (before vs after surgery), and patient procedure (upper facial rejuvenation, lower facial rejuvenation, or upper and lower facial rejuvenation). Because raters and patients contributed multiple observations to this data set, a correlation within rater observations and patients was expected. To control for this, rater identification was included in the model as a repeated
factor, and patient identification was treated as a random factor. This kind of model is similar to a repeated-measures analysis of variance, and the results in this case were identical to what repeated-measures analysis of variance would produce.

Results

Patients in this study ranged in age from 42 to 73 years at the time of surgery, with a mean age of 57 years (Table 1). There were 37 female patients and 12 male patients. The mean duration between before-and-after photographs was 13.2 months (range, 6-36 months). Rater description data revealed 38 female raters (mean [SD] age, 46 [12] years; median [range], 48 [22-65] years) and 12 male raters (mean [SD] age, 47 [17] years; median [range], 45 [25-76] years), and their mean ages did not differ significantly ($P = .74$). Overall, the mean rater age was 46 years.

On average, raters estimated their patients’ ages to be about 2.1 years younger than their chronological age before surgery and 5.2 years younger than their chronological age after surgery (Table 2 and Figure 1). We referred to this variable as years younger given that most patients were judged to be younger than their actual age even before surgery. Differences in years younger before and after surgery (years saved) reflected the tendency for patients to look younger than their real age to a greater extent after surgery than before surgery. The mean overall years saved following aesthetic facial surgery was 3.1 years (range, −4.0 to 9.4 years). Rater group, experimenter, photograph order, patient and rater sex, and patient and rater age were insignificant variables (data not shown).

Sixty percent of all attractiveness scores chosen by raters were within scores of 4 to 6 on a scale of 1 to 10 (75% within the 4-7 range) (Figure 2). Nevertheless, certain trends of variance...
tion within and between raters were observed. Scores decreased slightly with patient age and increased slightly with rater age, albeit not reaching statistical significance. Female raters scored patients higher than male raters. Although a negative trend in the attractiveness score was noted for photograph order, this was not statistically significant. There was a small and nonsignificant increase in attractiveness scores in postprocedural photographs relative to preprocedural photographs. Raters who gave high and low patient scores tended to do so consistently to all patients regardless of before or after surgery. Therefore, potential biases were equally shared among the before-and-after photographs.

Attractiveness scores (the means for each patient before and after surgery) were significantly inversely related to patient age. However, attractiveness scores did not change with surgery even after controlling for patient age and procedure. No differences were observed in attractiveness scores across procedures (upper facial rejuvenation, lower facial rejuvenation, and upper and lower facial rejuvenation as previously described). Changes in the mean attractiveness scores generally ranged ±1.00 U on the rating scale (Figure 3). It may be that patient attractiveness improves with surgery but that the rating scale is insufficient to detect changes. The greatest limitation with this scale is the low variability in assigned scores because 75% of photographs were rated between 4 and 7 (Figure 2).

Based on our above-described mixed model, interactions between the described predictors were initially explored, but all were ultimately removed because none were statistically significant. The final reduced model is summarized in Table 3. A mean score increase of 0.06 U was observed for every year increase in rater age, and a similar decrease was found for every year increase in patient age. Women tended to rate patients higher than men by 0.8 U. Raters tended to give slightly higher attractiveness scores (0.08 U) to patients after surgery compared with before surgery. There was also a trivial tendency for scores to decline with photograph order (with the highest scores given to photographs seen earlier), potentially indicative of rater fatigue. Although most of the predictors were significant or approached significance, not all the effects were important because this model is based on a large sample size of observations, which can potentially amplify even small effects. Results of this model confirm that surgery had no effect on the mean overall attractiveness of patients in this study but that patient age affects the mean attractiveness score.

Table 3. Results of a Mixed Model for the Effect of Several Predictors on Rater Attractiveness Scores

<table>
<thead>
<tr>
<th>Predictor</th>
<th>F Score</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rater age</td>
<td>15.1</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Patient age</td>
<td>74.1</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Rater sex</td>
<td>3.5</td>
<td>.06</td>
</tr>
<tr>
<td>Before or after surgery</td>
<td>3.7</td>
<td>.06</td>
</tr>
<tr>
<td>Experimenter</td>
<td>5.6</td>
<td>.02</td>
</tr>
<tr>
<td>Photograph order</td>
<td>14.3</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Procedure</td>
<td>0.8</td>
<td>.22</td>
</tr>
</tbody>
</table>

Figure 4. Raters Tended to Score Younger Patients as More Attractive Than Older Patients

The trend is the same in before-and-after surgery photographs.

Eighteen patients underwent upper facial rejuvenation, 3 patients underwent lower facial rejuvenation, and 28 patients underwent upper and lower facial rejuvenation.
(Figure 4). Figure 5 is consistent with the model, showing no evidence that surgery improves attractiveness differently among patients undergoing various procedures. No sex differences were observed either, as shown in Figure 6.

A subgroup analysis was then performed, looking at change in attractiveness scores by procedure (Table 4). The mean changes in attractiveness scores were 0.02 in those undergoing upper facial rejuvenation, 0.34 in those undergoing lower facial rejuvenation, and 0.08 in those undergoing upper and lower facial rejuvenation. The mean overall change in attractiveness scores was 0.08. None of these changes were statistically significant. We then divided the patients into those whose attractiveness score increased (n = 25) compared with those whose attractiveness score did not increase (n = 2) or decreased (n = 22). These 2 groups of patients were surprisingly similar in all respects except the mean attractiveness scores before and after surgery. Patients whose attractiveness improved after surgery had a statistically significant lower mean (SD) attractiveness score before surgery (4.80 [0.71]) than those whose attractiveness did not improve after surgery (5.57 [0.55]), whereas this trend was reversed after surgery. Therefore, these data suggest that there is no relationship between attractiveness after aging face surgery and perceived age reversal by raters.

**Table 4. Attractiveness Score Gains Among 49 Patients by Procedure**

<table>
<thead>
<tr>
<th>Procedure</th>
<th>No. of Patients</th>
<th>Attractiveness Score Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper facial rejuvenation</td>
<td>18</td>
<td>0.02 (8.90)</td>
</tr>
<tr>
<td>Lower facial rejuvenation</td>
<td>3</td>
<td>0.34 (0.50)</td>
</tr>
<tr>
<td>Upper and lower facial rejuvenation</td>
<td>28</td>
<td>0.08 (0.90)</td>
</tr>
</tbody>
</table>

*Mean difference in attractiveness score after surgery compared with before surgery. None of these changes were statistically different from zero (P > .54).*

*The combination of upper and/or lower blepharoplasty and/or brow-lift was designated as upper facial rejuvenation, face-lift and neck-lift as lower facial rejuvenation, and a combination of the 2 as upper and lower facial rejuvenation.*

**Discussion**

The drive to maintain a youthful appearance and attractiveness has been an important motivating factor leading patients to seek aesthetic facial surgery. Not only has this desire been intrinsic to our evolution, but also the youthful energetic look has been portrayed as a potential competitive advantage in the modern workplace. Nevertheless, challenges and limitations exist that temper our goal toward reversing age-related changes. The combined effects of hair and skin changes, soft-tissue atrophy, bony remodeling, and photoaging represent formidable obstacles for the facial rejuvenation surgeon. However, while we often have used the descriptors “more youthful” and “more refreshed” in our discussions with patients, many facial rejuvenation surgeons have often postulated that aging face surgery can make patients appear not only more youthful but also more attractive. This notion seems intuitive and was reinforced in work by Etcoff and Symons relating to the 4 components of attractiveness. Therefore, a logical conclusion might be derived that if one looked more youthful he or she would also appear more attractive.

To our knowledge, only 2 previous studies have examined objective reductions in perceived age after aging face surgery, and none have looked at effects on attractiveness after facial rejuvenation surgery. Hence, we designed a follow-up study to a previous investigation by one of us (P.A.A.) to analyze objective age reduction and improvement in attractiveness after aging face surgery. Although an all-inclusive study would have been ideal, inclusion and exclusion criteria had to be introduced to limit confounding variables. These include the use of makeup and jewelry, the previously described benefit of rhinoplasty on perceived age, and the effects of surgical swelling on early postoperative photographs (a minimum 6-month time frame between photographs has been supported previously) and the effects of injectable treatments during the period between before-and-after photographs. We used consecutive patients to limit selection bias; however, many patients were excluded because of the aforementioned inclusion criteria.

We included all aging face surgical procedures alone or in combination (ie, upper and lower blepharoplasty, all types of brow-lifts, and face-lift and neck-lift). The senior author previously studied 3 groups of patients, all of whom underwent face-lift and neck-lift surgery; that study showed an overall perceived age reduction of 7.2 years. The perceived age reduc-
tion of only 4.3 years overall for patients undergoing upper and lower blepharoplasty in the present study can be partially explained by the inclusion of upper facial rejuvenation procedures alone.

Our study found no statistically significant change in attractiveness scores following surgery, despite an overall perceived age reduction. On the surface, this seems to be a contradictory finding; however, several limitations and confounding factors may have had a role in this apparent inconsistency. With most raters scoring the patients within a narrow range (75% of photographs were rated between 4 and 7), this would make it difficult to observe statistically significant improvement in attractiveness. A larger patient sample size may be needed to show an overall statistically significant improvement in attractiveness scores. Moreover, rating attractiveness is perhaps more subjective than guessing one’s age. Another potential limitation is that of patient self-selection; the patient population seeking aesthetic surgery may not be representative of the population at large, and the results may not be generalizable. There is also the role of rater fatigue, supported by the fact that the raters on average gave lower scores to later photographs.

In addition, our study may demonstrate that once an age is ascribed to someone others associate that age with a certain level of attractiveness. Specifically, younger people are generally gauged as being more attractive. However, because a person’s age is perceived as younger following aging face surgery, his or her attractiveness level is also intuitively perceived to be better, commensurate with the apparent age reduction. From this study, it seems that the attractiveness level will remain the same, regardless of age. As long as a person ascribes a correct age to someone else, that person will perceive the other’s attractiveness with his or her assigned age in mind. If true, this will allow one to predict that an attractive child will become an attractive adult and vice versa. In the future, we may consider performing an attractiveness study alone without age estimation. Alternatively, the role of laser skin resurfacing and volumization with soft-tissue fillers or fat transfer in conjunction with aging face surgery may be explored.

In conclusion, the subjective nature of facial rejuvenation surgery presents a challenge in the assessment of successful results. The present study sought to assess objective changes in perceived age and attractiveness after aging face surgery in a consecutive group of patients undergoing various aging face surgical procedures alone or in combination. Our data demonstrate that aging face surgery is effective in reducing the apparent age of patients but does not consistently improve a patient’s attractiveness. The age reduction is more substantial when the number of surgical procedures is increased, but this did not significantly improve overall attractiveness. Given the limitations of the attractiveness component of this study as described herein, further investigation is warranted to verify these findings.

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Author Affiliations: Division of Facial Plastic and Reconstructive Surgery, Department of Otolaryngology-Head and Neck Surgery, University of Toronto School of Medicine, Toronto, Ontario, Canada (Zimm, Adamson); currently with the Division of Facial Plastic Surgery, Department of Otolaryngology, Lenox Hill Hospital and Manhattan Eye, Ear & Throat Institute, New York, New York (Zimm); currently a medical student at McMaster University DeGroote School of Medicine, Hamilton, Ontario, Canada (Modabber); Department of Otolaryngology-Head and Neck Surgery, University of Toronto School of Medicine, Toronto, Ontario, Canada (Fernandes); currently in private practice, Santa Monica, California (Karimi).

Author Contributions: Study concept and design: Zimm, Modabber, Karimi, Adamson.
Acquisition of data: Zimm, Modabber, Fernandes.
Analysis and interpretation of data: Zimm, Modabber.
Drafting of the manuscript: Zimm, Modabber.
Critical revision of the manuscript for important intellectual content: All authors.
Administrative, technical, and material support: Zimm, Adamson.
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REFERENCES