Surgical Design and Algorithm for Correction of Earlobe Ptosis and Pseudoptosis Deformity

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A previously described classification system for earlobe ptosis and criterion for earlobe pseudoptosis deformity was based on height measurements of the two earlobe components: the free caudal segment and the attached cephalic segment. The "ideal" ear lobule free caudal segment was found to be between 1 and 5 mm (grade I ptosis), and the "ideal" attached cephalic segment was 15 mm or less. Earlobe pseudoptosis was defined by an attached cephalic segment measuring greater than 15 mm. Previous studies revealed an association between the elongated free caudal segment and increasing patient age and between the elongated attached cephalic segment and rhytidectomy. Sixteen fresh cadaver earlobes were used to design surgical patterns that would differentially reduce the free caudal segment, the attached cephalic segment, or both. A horizontal, medially based triangular excision pattern was designed. Triangular excisions limited to the attached cephalic segment resulted in 98 ± 5 percent reduction of excision height from the attached cephalic segment but also resulted in an unexpected 32 ± 2 percent augmentation of the excision height in the free caudal segment. Triangular excisions limited to the free caudal segment resulted in 88 ± 4 percent reduction of the excision height from the free caudal segment and negligible reduction of 4 ± 4 percent of excision height in the cephalic attached segment. An algorithm for correction of earlobe ptosis and pseudoptosis was subsequently derived and implemented in a clinical case. The authors propose that surgical treatment of patients with pseudoptosis be dependent on the ptosis grade. If the ptosis is grade I (1 to 5 mm), then excision of only the attached cephalic segment is recommended. If the ptosis is grade II or higher (more than 5 mm), then a combined attached cephalic and free caudal segment excision is recommended. In cases of isolated ptosis grade II or higher without pseudoptosis, then excision location of only the free caudal segment is recommended. The above simple algorithm and surgical designs will enable plastic surgeons to differentially correct earlobe ptosis and pseudoptosis. (*Plast. Reconstr. Surg.* 115: 290, 2005.)

To date, several techniques of earlobe reduction have been described involving excisions of the anterior skin[1–3] and excisions of the posterior skin,[4–6] yet none of these surgical techniques differentially addresses the two earlobe components. The lobule components include the attached cephalic segment, intertragal to otobasion distance, and the free caudal segment, the otobasion inferius to subaurale dis-

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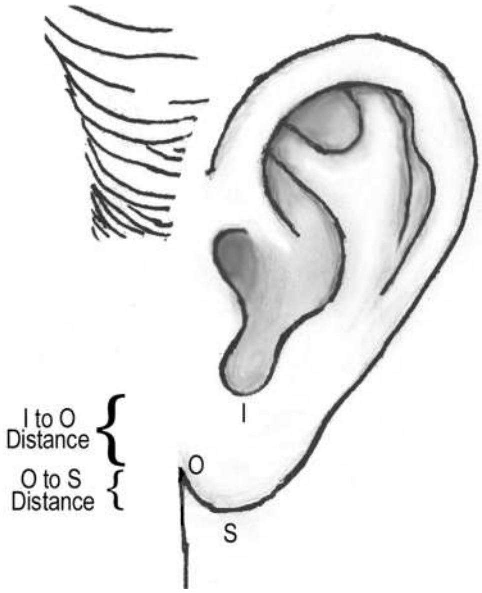

FIG. 1. The three anatomic landmarks used to define ear lobule height: the intertragal notch (*I*), the otobasion inferius (*O*; the most caudal anterior attachment of the earlobe to the cheek skin), and the subaurale (*S*; the most caudal extension of the earlobe free margin). These landmarks allow for differentiation of two earlobe components, the attached cephalic segment (*I to O distance*) and the free caudal segment (*O to S distance*).

tance (Fig. 1). By not acknowledging the separate segments of the ear lobule, one may inadvertently reduce a specific segment inappropriately while attempting to reduce total height.

The previously described classification system for earlobe ptosis (Table I) and the established criterion for earlobe pseudoptosis deformity (Table II) are based on height measurements of the two earlobe components.[7] The "ideal" ear lobule free caudal segment was found to be between 1 and 5 mm (grade I ptosis) and the "ideal" attached cephalic segment was 15 mm or less.[7] Earlobe pseudoptosis was defined by an attached cephalic segment measuring greater than 15 mm.[7] Previous studies revealed an association between the elongated free caudal segment and increasing patient age and between the elongated attached cephalic segment and rhytidectomy.[8,9] It was hypothesized that to effectively correct earlobe ptosis and pseudoptosis, surgical excision techniques would be required to differentially affect the attached cephalic segment or the free caudal segment.

TABLE I
Classification of Earlobe Ptosis Based on Analysis of Preferred Otobasion Inferius to Subaurale Distances

Ptosis Grade	Free Caudal Segment (O to S distance)
O	0 mm
I	1–5 mm
II	6–10 mm
III	11–15 mm
IV	16–20 mm
V	>20 mm

O, otobasion inferius; S, subaurale.

TABLE II
Designation of Pseudoptosis Based on Analysis of Preferred Intertragal Notch to Otobasion Inferius Distances

Pseudoptosis	Attached Cephalic Segment (I to O distance)
Positive	>15 mm
Negative	≤15 mm

I, intertragal notch; O, otobasion inferius.

METHODS

Sixteen fresh cadaver earlobes were examined to define the attached cephalic segment (intertragal to otobasion distance) and the free caudal segment (otobasion inferius to subaurale distance) heights. After initial measurements, a simple surgical excision pattern was developed to differentially alter the attached

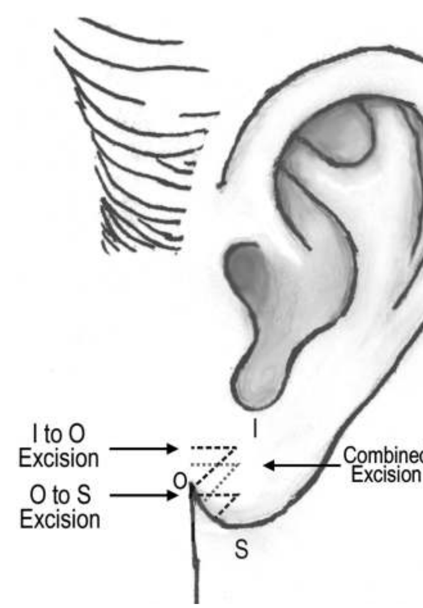

FIG. 2. The medially based triangular excisions allowing for differential reduction of the attached cephalic segment [intertragal notch (*I*) to otobasion inferius (*O*) interval] versus the free caudal segment [O to subaurale (*S*) interval] by placement of the excision triangle over either the I to O (*cephalic dashed line*) or the O to S (*caudal dashed line*) component. A combined excision design spanning variably over the I to S segments will reduce both segments (*dotted line*).

TABLE III
Cadaver Earlobe Measurements before and after Excisions Using Surgical Design and Algorithm for Correction of Earlobe Ptosis and Pseudoptosis Deformity

	Before Excision (mm)		Excision (mm)		After Excision (mm)	
Cadaver Ears	I:O	O:S	I:O	O:S	I:O	O:S
1	5	20	0	15	5	6
2	11	12	0	7	11	6
3	12	13	0	9	12	5
4	19	0	9	0	10	3
5	22	0	12	0	11	4
6	11	15	0	12	10	5
7	12	17	0	14	11	4
8	20	1	10	0	10	4
9	20	1	10	2	11	1
10	12	6	3	3	9	4
11	14	5	6	3	8	4
12	14	8	6	6	9	5
13	11	12	3	8	8	6
14	15	7	6	6	10	5
15	12	8	3	6	10	4
16	10	13	5	10	5	6

I, intertragal notch; O, otobasion inferius; S, subaurale.

cephalic segment verses the free caudal segment. A transverse, medially based triangular excision pattern was developed that could be differentially based over the intertragal to otobasion segment, otobasion inferius to subaurale segment, or over both segments (Fig. 2). Excision heights, excision location (over intertragal to otobasion, otobasion inferius to subaurale, or both segments), and pre-excision and postexcision lobule segment (intertragal to otobasion and otobasion inferius to subaurale distances) heights were measured. Effects of excision location and excision height on the attached cephalic segment (intertragal to otobasion distance) and the free caudal segment (otobasion inferius to subaurale distance) were determined. Reductions of segments were calculated as the percentage of the excision height and expressed as mean ± SD. Finally, a simple algorithm for surgical correction of earlobe ptosis and pseudoptosis was derived.

RESULTS

Cadaver earlobe measurements were completed before and after excisions using surgical design and algorithm for correction of earlobe ptosis and pseudoptosis deformity (Table III). Triangular excisions limited to the attached cephalic segment resulted in 98 ± 5 percent reduction of excision height from the attached cephalic segment but also resulted in an unexpected 32 ± 2 percent augmentation of the excision height in the free caudal segment (Fig. 3 and Table III). Triangular excisions limited to the free caudal segment resulted in 88 ± 4 percent reduction of the excision height from the free caudal segment and negligible reduction of 4 ± 4 percent of excision height in the cephalic attached segment (Fig. 4) (Table IV). Of note, excision designs spanning over both the attached cephalic and free caudal segments resulted in cumulative changes of each of the earlobe segments in accord with changes described above (Table III).

FIG. 3. This cadaveric dissection demonstrates the excision pattern designed for intertragal notch to otobasion inferius reduction. (*Left*) Pre-excision parameters demonstrate an intertragal to otobasion distance of 20 mm and an otobasion inferius to subaurale distance of 1 mm; planned excision of 10 mm from the intertragal to otobasion segment is shown. (*Center*) Excision of 10 mm from the intertragal to otobasion segment has been performed. (*Right*) Postexcision parameters demonstrate a reduced intertragal to otobasion distance of 10 mm and autorotation of the caudal earlobe increasing the otobasion inferius to subaurale distance to 4 mm.

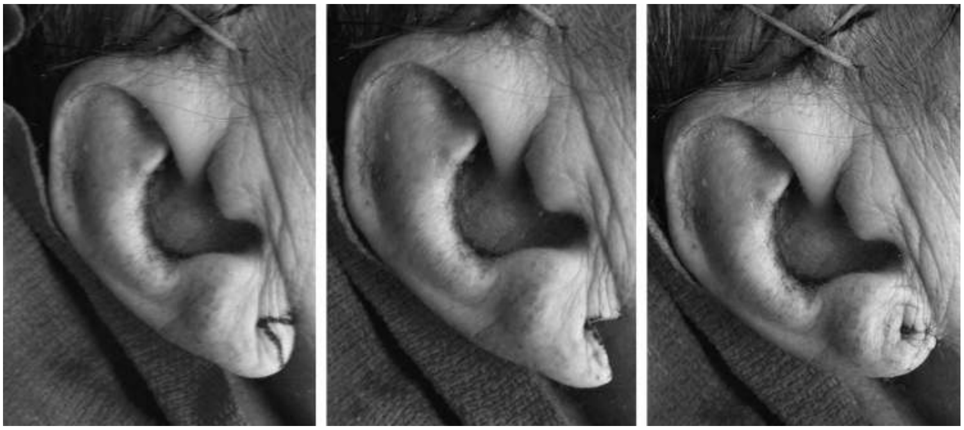

FIG. 4. This cadaveric dissection demonstrates the excision pattern designed for otobasion inferius to subaurale reduction. (*Left*) Pre-excision parameters demonstrate an intertragal notch to otobasion distance of 12 mm and an otobasion inferius to subaurale distance of 13 mm. (*Center*) Planned excision of 9 mm from the otobasion inferius to subaurale segment is shown. (*Right*) Postexcision parameters demonstrate an unchanged intertragal to otobasion distance of 12 mm and a reduced otobasion inferius to subaurale distance of 4 mm.

TABLE IV

Effects of Excision Location and Height on the Attached Cephalic Segment (I to O distance) and the Free Caudal Segment (O to S distance)

Excision Location	Effect on I to O Distance (% of excision height)	Effect on O to S Distance (% of excision height)
I to O segment	Decrease by 98% ± 5%	Increase by 32% ± 2%
O to S segment	Decrease by 4% ± 4%	Decrease by 88% ± 4%

I, intertragal notch; O, otobasion inferius; S, subaurale.

DISCUSSION

An acquired deformity resulting from aging involves the elongation or ptosis of the earlobe that has been attributed to attenuation of elastic fibers and gravitational pull.[4] The free caudal segment (otobasion inferius to subaurale distance) is significantly prone to elongation from age-related changes whereas the attached cephalic segment (intertragal to otobasion distance) is not.[8] In contrast, the attached cephalic segment (intertragal to otobasion distance) is more vulnerable to elongation secondary to rhytidectomy whereas the free caudal segment (otobasion inferius to subaurale distance) is relatively spared.[9] Significant increases in intertragal to otobasion distances after rhytidectomies correlated with increased incidence of earlobe pseudoptosis as observed

TABLE V

Algorithm for Surgical Correction of Earlobe Ptosis and Pseudoptosis

Pseudoptosis	Ptosis	Excision: Location Segment*	Excision: Height Ratio Reduction (segment height reduction per excision height reduction)
Positive (>15 mm)†	Grade I (1–5 mm)	I to O segment	1:1 reduction of I to O and 0.3:1 increase in O to S
Positive (>15 mm)†	Grade II (>5 mm)‡	Combined:	
		I to O segment	1:1 reduction of I to O and 0.3:1 increase in O to S
		+	+
		O to S segment	0.9:1 reduction in O to S
Negative (<15 mm)	≥Grade II (>5 mm)	O to S segment	0.9:1 reduction in O to S

I, intertragal notch; O, otobasion inferius; S, subaurale.

* Segment locations were identified by the attached cephalic segment designated by the I to O interval and the free caudal segment designated by the O to S interval.

† Borderline pseudoptosis (≅15 mm) and simultaneous rhytidectomy put the patient at risk to develop increased pseudoptosis because of forces intrinsic to rhytidectomy.

‡ Borderline grade I (≈5 mm) ptosis is prone to augmentation into a nonideal ptosis grade because of autorotation after excision and insetting of the attached cephalic segment.

FIG. 5. These intraoperative views of a face lift patient demonstrate correction of a pseudoptosis deformity of the right earlobe. (*Above, left and center*) Pre-excision parameters demonstrate an intertragal notch to otobasion inferius distance of 13 mm and otobasion inferius to subaurale distance of 3 mm from the right earlobe and an intertragal to otobasion distance of 16 mm and an otobasion inferius to subaurale distance of 1 mm for the left earlobe. (*Above, right*) Planned excision of 3 mm from the intertragal to otobasion segment of the left earlobe is shown. (*Below, left and center*) Excision of 3 mm from the left earlobe intertragal to otobasion segment has been performed and rhytidectomy completed. The postexcision earlobe parameters demonstrate satisfactory symmetry of earlobe with a reduced left earlobe intertragal to otobasion segment of 13 mm and autorotation of the otobasion inferius to subaurale segment to 2 mm and no change in the right earlobe. (*Below, right*) Close-up view of left earlobe after excision and insetting.

in 17.3 percent of postoperative patient earlobes compared with 12.3 percent of preoperative earlobes.[9] Furthermore, because the otobasion inferius to subaurale distance (ptosis) worsens with age but is not significantly changed by rhytidectomy, numerous postoperative earlobes (63.0 percent) demonstrated persistent nonoptimal, older-appearing free lobular ptosis.

By not acknowledging the separate segments of the ear lobule, one may inadvertently reduce a specific segment inappropriately while attempting to reduce total height. Only by considering both earlobe segments (attached cephalic segment and the free caudal segment) and the aesthetic lobule parameters can objective and accurate surgical correction of earlobe deformities be accomplished. The results of the cadaver studies provided information for developing an algorithm to accurately correct ptosis and pseudoptosis (Table V). We propose that surgical treatment of patients with pseudoptosis be dependent on the ptosis grade. If the ptosis is grade I (1 to 5 mm), then excision of only the attached cephalic segment is required. If the ptosis is grade II or higher (greater than 5 mm) or if borderline ptosis grade I (approximately 5 mm) was present, then a combined attached cephalic and free caudal segment excision is recommended. Pseudoptosis accompanied by borderline grade I (approximately 5 mm) ptosis should be treated with a combined excision because of the propensity for free caudal segment height augmentation from autorotation following attached cephalic segment excision and insetting. Also, patients with borderline pseudoptosis (intertragal to otobasion ≌ 15 mm) who are undergoing rhytidectomy should be treated as if pseudoptotic because of the tendency for earlobes to undergo elongation of the attached cephalic segment. Therefore, a combined attached cephalic and free caudal segment excision is recommended. In cases of isolated ptosis grade II or higher without pseudoptosis, then excision location of only the free caudal segment is recommended. The above simple algorithm and surgical designs will enable plastic surgeons to differentially correct earlobe ptosis and pseudoptosis.

As an example, the first clinical case utilizing the presented algorithm is detailed. A 54-yr-old female desiring facial rejuvenation surgery was evaluated for age-related changes of the face and ears. Her right ear demonstrated grade I ptosis [free caudal segment (otobasion inferius to subaurale) = 3 mm] without pseudoptosis [attached cephalad segment (intertragal to otobasion) = 13 mm], and her left ear demonstrated grade I ptosis (otobasion inferius to subaurale = 1 mm) and pseudoptosis (intertragal to otobasion = 16 mm) (Fig. 5, *above, left*). It was elected to excise a medially based triangle 3 mm in height from the attached cephalic segment to reduce the attached cephalic segment and to augment the free caudal segment by approximately 1 mm from the autorotation effect (30 percent of excision height) (Fig. 5, *above, center*). The postoperative parameters demonstrate improved symmetry of the earlobes with reduced intertragal to otobasion distance of 13 mm and increased otobasion inferius to subaurale distance of 2 mm of the left earlobe (Fig. 5, *above, right*).

CONCLUSIONS

For the first time, component lobular reduction surgical designs are described that can differentially reduce ptotic or pseudoptotic earlobes. Cadaver studies revealed the effects of excision on the remaining lobule component heights and were instrumental in developing the algorithm and indications for surgical correction of ptosis and pseudoptosis. Lastly, a clinical case was presented that illustrates the importance of evaluating the earlobes in patients desiring a more youthful appearance. We present a simple surgical design and algorithm that can be used to perform objective and accurate earlobe rejuvenation surgery.

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