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The Cartilage-Sparing Versus the Cartilage-Cutting Technique: A Retrospective Quality Control Comparison of the Francesconi and Converse Otoplasties

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Abstract. From a total of 281 patients with protruding ears who underwent a bilateral otoplasty between 1990 and 2001, a group of 28 (10%) was selected for a retrospective quality control study. The goal was to compare two methods of otoplasty, the Francesconi, a cartilage-sparing technique, and the Converse, a cartilage-cutting technique, in terms of objectively measurable and subjectively discernable differences in results. Objective parameters included measurement of the three cephaloauricular distances and the conchoscapal angle. An independent plastic surgeon performed the evaluation by means of a systematic evaluation system for rating cosmetic surgical procedures and a 5-point visual analog scale for rating satisfaction. The patients' subjective rate of satisfaction also was investigated using the 5-point scale. The mean medial and inferior cephaloauricular distances were significantly smaller in the Francesconi group. The concoscaphal angle was 90°, or less in all the patients of the Francesconi group, but more than 90° in eight patients (57%) of the Converse group ($p = 0.041$). Accordingly, the independent surgeon found adequate correction of protrusion in 86% of the Francesconi group and 50% of the Converse group ($p = 0.050$). His satisfaction rate was significantly in favor of the Francesconi technique ($p = 0.006$). Not unexpectedly, the patients' satisfaction rate was comparably high in both groups, and there was no statistical difference between them. In conclusion, the quality control led to a clear preference of the Francesconi over the Converse otoplasty. In addition, the assessment of the postoperative results with the systematic evaluation system offered an excellent information base by which to judge the results of otoplasty. Consequent use of this evaluation system will lead to progress in the surgical procedure.

Key words: Otoplasty—Protruding ears—Quality control—Evaluation of surgical results

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Protruding ears are the most common congenital ear deformity, with a frequency of 13.5% and a well-known hereditary component [13,39]. Such a deformity can lead to serious psychosocial disturbances from childhood onward. Operation is encouraged even before the child is school-age because 85% of the auricular growth is complete by the age of 3 years [1] and the cartilaginous portions of the ears have nearly reached their permanent dimensions by the time the child is 6 to 7 years old [12,16].

Otoplasty is a demanding procedure, as witnessed by the multitude of (>40) currently used techniques [21]. The question as to which method is the most appropriate has mainly been approached subjectively to date. Currently, one of the most popular group of techniques is that of the Converse procedure and its numerous modifications [2,4,5,10]. The Converse procedure involves reconstructing an antihelix with its cartilaginous curvature by incising the outlines of the antihelix, folding it back, and tubing it upon itself with buried sutures, and/or correcting the excessive cupping of the concha by excising a strip of conchal cartilage via a dorsal excision of an ellipse of skin.

Because of the impression at our clinic that these techniques resulted in "unnatural" ears, we began increasingly to favor the Francesconi otoplasty [7], a noncartilage incising method that combines two well-known techniques: the frontside subperichondral cartilage scoring technique of Stenström [16] and the

dorsal buried, permanent mattress suture technique of Mustarde [11]. As many others, Francesconi found that Mustarde's mattress suture technique alone did not address the problem of conchal hyperplasia, and when using it for correction of an absent antihelix, he quite often recognized a certain degree of reprotrusion. In aiming at a complete and permanent correction, he added to the mattress sutures the superficial scratching of the anterior aspect of the cartilage. The superficial scratching and the mattress suture technique can be extended to the helical tail in case the ear lobe also is protruding.

We were further encouraged in our use of the Francesconi technique by the results of Weinzweig's [19] studies with rabbits, in which he compared the techniques of Converse, Mustarde, and Stenström, adding dorsal mattress sutures, but without naming this technique the "Francesconi" procedure. His results showed that the antihelical fold maintained its shape best when the Francesconi method was used and the anterior perichondrium was rasped. This maneuver initiated a cartilage regeneration process over the convex surface of the newly created fold. The fibrocartilaginous cap thus formed appeared to reinforce, stabilize, and smooth the antihelical fold. With the Francesconi technique, both main problems of protruding ears [15], namely, an insufficient folding of the antihelix and an excessive cupping of the concha, can be corrected equally well.

During a phase in which both methods for correction of protruding ears (the Converse method and the Francesconi method) were being used at our clinic, we conducted a quality control study of our otoplasty patients to discover whether subjective or objective differences between the two methods were detectable, and to determine which of the techniques gave less the impression of unnatural ears with evidence of surgery.

Patients and Method

From 281 patients whose protruding ears had been corrected either by the Francesconi or the Converse technique between 1990 and 2001, a sample of 28 patients with a primary bilateral otoplasty (i.e., 56 ears) were chosen for the quality control study. Group 1 comprised 14 otoplasties performed by the Francesconi method and group 2 consisted of 14 Converse otoplasties. All the patients had conchal hyperplasia, either alone or in addition to an unfurled antihelix. No prophylactic antimicrobacterials were used in the operations. All the patients had surgery under local anesthesia or under a combination of local anesthesia and an oral premedication (clonidine [3]). The study excluded patients with congenital or acquired ear anomalies other than protruding ears, those with unilateral ear correction, and those with a follow-up period of less than half a year. The retrospective study involved a review of the patient's records, a review of the digitally stored photographic data, and a personal examination by an independent plastic surgeon. The following objective measurements of the ear (Fig. 1) were compared: the physiognomic length and breadth of the ear; the superior, medial, and inferior cephaloauricular distances [20]; and the conchoscaphal angle.

The incidences of all early complications, such as hematoma, seroma, wound dehiscence, wound infection, and necrosis (skin edges and cartilage [8]) were noted from the patients' records. Similarly, all unsatisfactory results or imperfections including problems of symmetry, contour (overcorrection, helix behind the antihelix, undercorrection, telephone deformity, protruding upper pole, protruding ear lobe, sharp edges, unrounded antihelix and superior crus, and other cartilage irregularities), and scars were graded according to a system for the evaluation of cosmetic surgical results [6,14,17,18]. These imperfections were further subdivided into the categories "noticable," "obvious," and "deforming" by the independent surgeon. The satisfaction of the patients and the examiner was rated by a visual 5-point analog scale ranging form 1 (excellent) to 5 (bad).

The results were analyzed using SPSS 11.0 (SPSS, Chicago, IL, USA). Continuous variables were summarized as mean ± standard deviation and compared between the groups using the Mann–Whitney test. Nominal variables were presented as n (%) and the differences were compared using Fisher's exact test. Comparisons of the left and right ears in terms of operative method and genders were performed using the Wilcoxon test. A comparison of the two groups with a population of individuals with "normal" ears was performed using the sign test. A p value of 0.05 was considered significant.

Results

The two groups of 14 patients each included 16 males and 12 females. The groups were comparable in their demographic data. The mean age was 10.5 years in both groups (range, 4–21 years; median, 8 years in group 1 [mode 7] and 10 years in group 2 [mode 10]. The mean physiognomic ear length (mean of both sides) was 62.5 mm (range, 50–70 mm) and the mean physiognomic ear breadth was 27 mm (range, 19–34 mm) for both groups. There were no significant differences between the earlobe dimensions on the left and right sides of individual patients, nor between the female and male patients.

Although the mean superior cephaloauricular distance was similar in both groups, the mediale and inferior cephaloauricular distances were smaller in the Francesconi group. The mean values and ranges are listed in Table 1 and compared with a reference group of 1,000 normal subjects [20]. The concoscaphal angle was 90° or less in all the patients in the Francesconi group, but more than 90° in eight patients (57%) in the Converse group ($p = 0.041$).

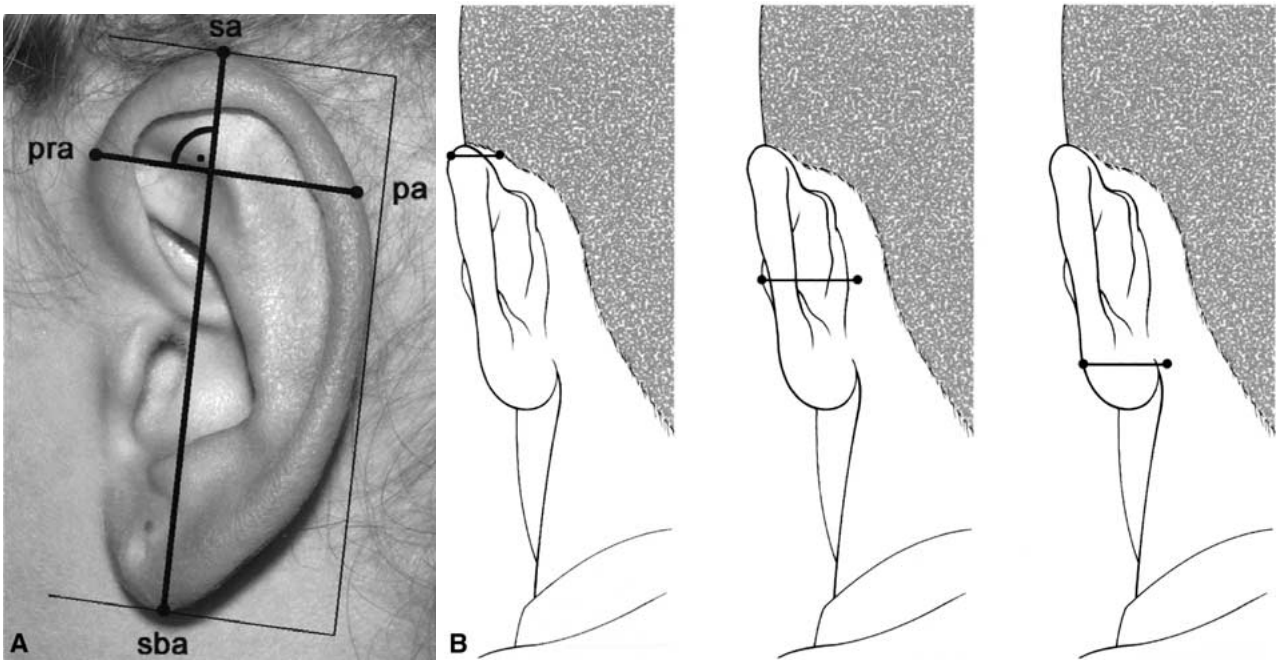

Fig. 1. Auricular measurements according to guidelines of anthropometry: (**a**) The physiognomic length of the ear is the linear distance between the superaurale (sa) on the helical rim and the subaurale (sba) on the earlobe. The physiognomic breadth is the linear distance between the preaurale (pra) at the helical basis and the postaurale (pa) on the lateral helical rim, perpendicular to the physiognomic length of the ear (ear from Figure 3). (**b**) The superior, medial, and inferior cephaloauricular distances [20] are measured from the ''norma frontalis'' (i.e., the dorsal view). The superior cephaloauricular distance (auriculateralion superior) is the distance from the most lateral point of the helical apex to the mastoid. The medial cephaloauricular distance (auriculateralion mediale) is the distance from the most lateral point of the middle of the ear to the mastoid (either the border of the helix or antihelix) and lies in the line of the physiognomic breadth of the ear. The inferior cephaloauricular distance (auriculateralion inferior) is the distance from the most lateral point of the lobule (immediately before it begins to round toward its insertion on the skull) to the mastoid.

With regard to complications, there was only one hematoma. This occurred in the Converse group and could be treated conservatively.

Unsatisfactory results or imperfections were rated very strictly using the aforementioned grading system [17] (Table 2). The most frequently encountered imperfections in the Francesconi group were asymmetries, a protruding upper pole, and sharp edges (14%). In the Converse group, asymmetry was noticed in 80%, general undercorrection in 50%, a protruding upper pole in 57%, and a protruding ear lobe in 29% of the patients. One hypertrophic scar and one keloid were detected in each group.

The examiner's satisfaction rate was significantly in favor of the Francesconi method ($p = 0.006$; Table 3). The patients assessed the result as excellent or good in the Francesconi group. In the Converse group, the satisfaction ranged from excellent to fair, but the mean satisfaction rate was not significantly different from that of group 1.

Discussion

The objective, measurable results in our quality control study showed that adequate correction of protruding ears was achieved for significantly more patients by the Francesconi technique than by the Converse method ($p = 0.050$). The mean values of the medial and inferior cephaloauricular distances, representing the successful correction of protrusion, were smaller in this group. In both groups, these distances were slightly shorter than in a normal population, as indicated by data from Wodak [20]. Patients often wish for a slight overcorrection, also encountered in other retrospective reviews; one review reported overcorrection of 4.7% [9]. However, the border between overcorrection and a normal ear is unclear, defined solely according to the visual impression. In contrast, the border between ''normal'' and ''undercorrected'' ears has been defined as a cepaloauricular distance of 20 mm [10].

Our patients' satisfaction rate was comparably high in both groups. The high satisfaction rate is not surprising because the opinion concerning the aesthetic results of otoplasties usually is high on the part of the patient and family members. Independent medical examiners usually have more stringent requirements [9,10]. The ultimate goal of patients seeking otoplasty is correction of their prominent ears and not the achievement of a harmonious earlobe and fold structure. Nonetheless, subjective assessment of the results

Table 1. Mean values and extremes of the three cephaloauricular distances (otolateralion superior, medial, and inferior[a]) in otoplasty patients who underwent surgery using the Francesconi and Converse methods (groups 1 and 2, respectively) in comparison with values from 1,000 "normal" reference measurements [20][b].

	Francesconi group		Converse group			Reference values [20]	
	Right	Left	Right	Left	*p* Value	Right	Left
Otolateralion superior (mm)	17 (13–21)	18 (13–19)	18 (12–24)	19 (16–22)	r = 0.15 l = 0.20	17	18
Otolateralion mediale (mm)	19 (16–23)	18 (14–20)	22 (18–28)	22 (18–25)	r = 0.014 l = 0.00	20	20
Otolateralion inferior (mm)	17 (16–21)	17 (15–22)	19 (15–22)	19 (16–21)	r = 0.027 l = 0.019	19	18

[a] See Fig. 1.
[b] The difference between the right and left ears was not significant in either group. Between the two groups, the mean medial and inferior cephaloauricular distances were significantly different in favor of the Francesconi group, yet as compared with the "normal" reference values, there was no significant difference in either group between left (l), and right (r).

Table 2. Imperfections noticed in patients after otoplasty for prominent ears for group 1 (Francesconi technique) and group 2 (Converse technique)[a]

	Group 1 (Francesconi) (%)			Group 2 (Converse) (%)			
	a	b	c	a	b	c	*p* Value
Asymmetry[b]	7	—	— (50)	12	—	— (86)	0.059
Undercorrection	2	—	— (14)	6	1	— (50)	0.050
Overcorrection	2	—	— (14)	1	—	— (7)	0.401
Protruding upper pole	5	—	— (36)	8	—	— (57)	0.178
Protruding ear lobe	1	—	— (7)	4	—	— (29)	0.130
Telephone deformity	1	—	— (7)	1	—	— (7)	0.982
Sharp edges (antihelix) and cartilage irregularities	2	1	— (25)	0	3	— (25)	0.635
Scars	1	1	— (14)	1	1	— (14)	1.000

[a] There were 14 patients in each group. All examined parameters were further divided into (a) noticeable, (b) obvious, and (c) deforming, according to the Strasser evaluation system [17].
[b] The high rate of asymmetries was attributable not only to the surgical correction, but also involved previous asymmetries in the relief of the ear.

Table 3. Rate of satisfaction with the overall result of the otoplasty according to a visual analog scale ranging from 1 (excellent) to 5 (bad) as judged by an independent observer surgeon and by the patients

	Francesconi group					Converse group					*p* Value
Satisfaction Scale	1	2	3	4	5	1	2	3	4	5	
Surgeon	3	5	5	—	1	—	3	3	3	4	0.006
Patient	10	4	—	—	—	6	4	4	—	—	0.104

by patients and their satisfaction rate are of particular importance, and therefore have always been justified as a part of quality control. The same applies to subjective assessment by independent medical examiners because aesthetic judgment of otoplasty goes beyond measurable data to include aspects of harmony in the dimensions of the ear relative to the face and head. As expected, our examiner's satisfaction rate was lower than that of the patients themselves. The examiner concluded that the aesthetic results of the Francesconi technique were significantly better than those of the Converse method.

Higher complication rates or unsatisfactory results also have been reported with the Converse method. Härtel and Bonitz [9], who compared the otoplasty of Converse with the method of Haecker/Joseph in a retrospective, subjectively judged control study with 147 patients (70 Converse and 77 Haecker procedures), found an unsatisfactory result in 12.9% of the Converse operations but in only 2.6% of cases for which the

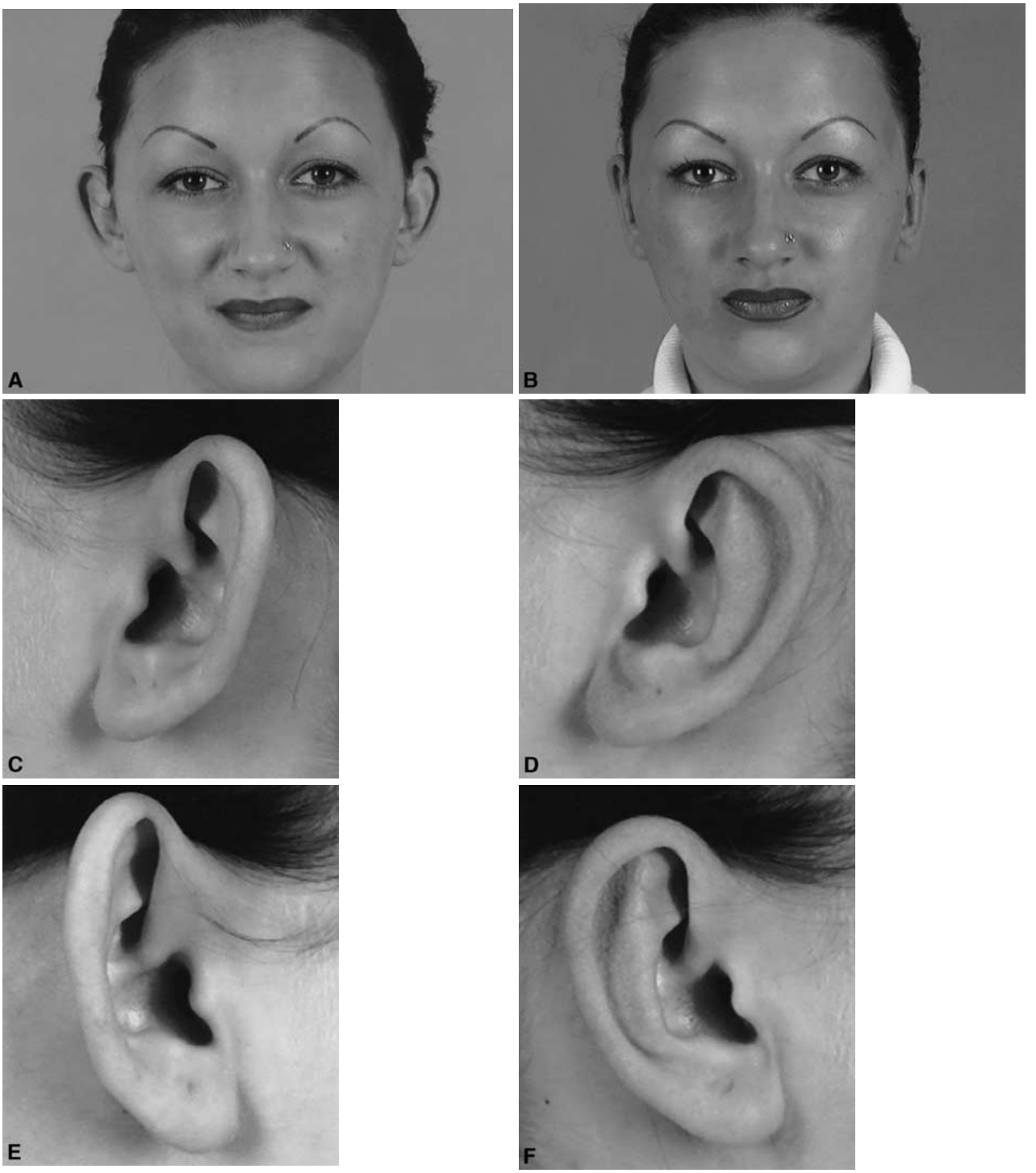

Fig. 2. Evaluation of the cosmetic result of a Francesconi otoplasty using the grading system of Strasser [17] for a 20-year-old woman. There is no malposition, no distortion, and no asymmetry. There is a small, fine scar and a slight contour deformity on the superior crus, which falls into the classification of "slightly noticable imperfection." The result still was classified as 1 (excellent) by the observer and the patient. Frontal overview. (**a**) Preoperatively with an insufficient folding of the antihelix and the superior crus, and slight cupping of the concha. (**b**) Nine months postoperatively. Detailed side view of both earlobes. (**c** and **e**) Preoperatively. (**d** and **f**) postoperatively. The superior crus on both sides has too narrow a basis thus giving the impression of a very slightly tapered edge (aggravated through the shadow of the light on the left side).

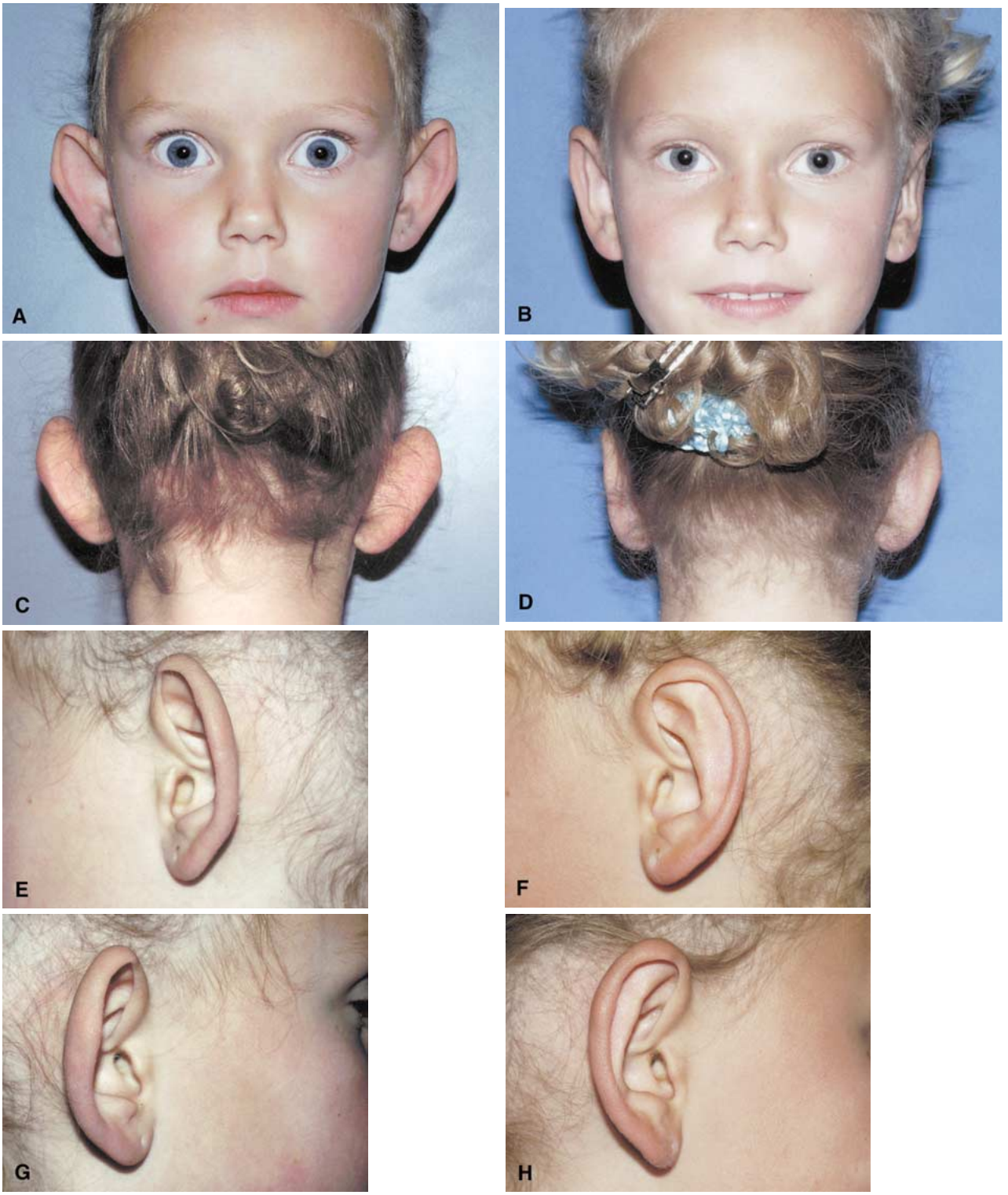

Fig. 3. "Obvious" imperfection in a Converse otoplasty using the Strasser [17] grading system for a 6-year-old girl. (**a**) Frontal overview preoperatively. The deformity was mainly attributable to a missing antihelix and a superior crus. (**b**) Frontal overview 24 months postoperatively. Obvious asymmetry with a slight overcorrection on the left side (all cepaloauricular distances were < 15 mm) compared with a relatively adequate corrected protrusion on the right side, with the exception of the earlobe (superior and medial cepaloauricular distances 17 and 16 mm, respectively, and a inferior cephaloauricular distance of 20 mm). (**c** and **d**) Corresponding dorsal views. (**e** and **g**) Preoperative detailed side view of both earlobes. (**f** and **h**) Postoperative detailed side view of both earlobes. There are sharp edges on both antihelices. On the left side, the antihelix is not round, but forms an open angle with the antitragus, and at the superior crus is insufficiently corrected. The satisfaction rate of the patient and her parents was 1 (excellent), and that of the observer was 4 (sufficient).

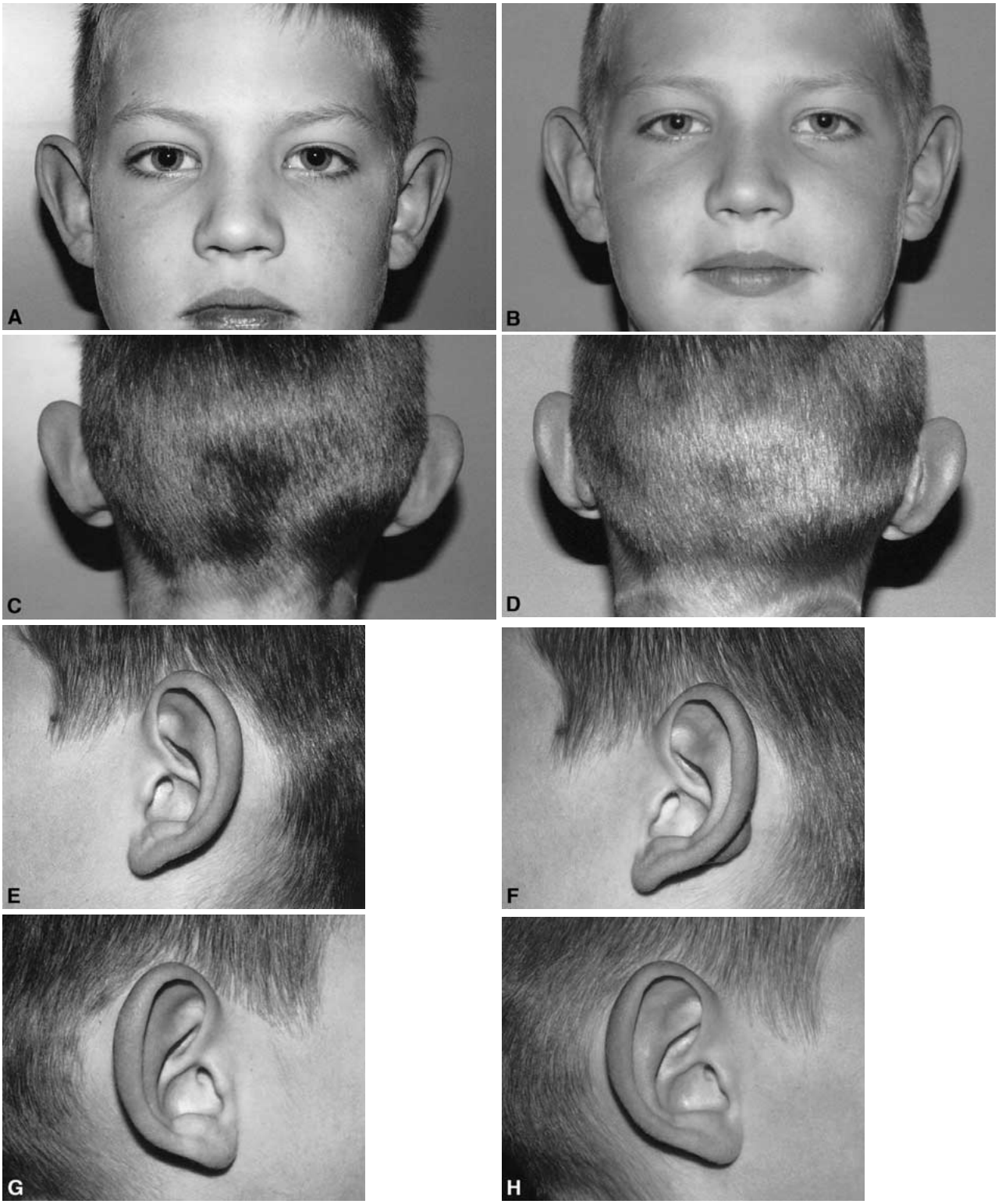

Fig. 4. "Deforming" imperfection in a Converse otoplasty using the Strasser [17] grading system for a 9-year-old boy. (**a**) Frontal overview preoperatively. The deformity was mainly attributable to a cupping concha and a missing superior crus. (**b**) Frontal overview 22 months postoperatively. Insufficiently corrected conchal hyperplasia on the boths sides (all cepaloauricular distances are >20 mm). (**c** and **d**) Corresponding dorsal views with a deforming keloidal scar on the left side and a hypertrophic scar on the right side. (**e** and **g**) Preoperative detailed side view of both earlobes. (**f** and **h**) Postoperative detailed side view of both earlobes. The postoperative relief is nearly the same as the preoperative one, with the exception of the visible keloid. The satisfaction rate of the patient was 4 (sufficient), and that of the observer was 5 (bad).

latter method was used. Similarly, in a study based on the satisfaction of patients and surgeons Goode et al. [8] reported less postoperative protrusion and later recurrence with the mattress-suture, cartilage-sparing technique (4.8% of 126 patients) than with the cartilage-cutting techniques (13.6% of 44 patients).

Generally, postoperative success rates range from two-thirds unsatisfactory [9] to 100% satisfactory results. This enormous spread is mainly attributable to different evaluating systems and the general difficulty of evaluating aesthetic results. When the Strasser [18] grading system for the evaluation of cosmetic surgical results was applied to our study, 14% of patients who underwent the Francesconi method showed residual postoperative earlobe protrusion, as compared with a 50% recurrence rate after the Converse method. The grading system, developed as an objective evaluation system, aims to eliminate subjective bias in judging cosmetic results. A perfect result is defined by the absence of imperfections. Imperfections are categorized under the headings of malposition, distortion, asymmetry, contour deformity, and scars. These are further subdivided in terms of whether they are "noticeable," "obvious," or "deforming."

In addition to examining residual protrusion, as mentioned earlier, we also used the grading system to categorize deformities in the contour of the ear. We examined the precise folding of the earlobe relief, the harmonious contouring of the antihelix with a well-rounded fold, and the occurrence of sharp edges and other cartilage irregularities (Figs. 2–4).

Although subjective bias can never be completely eliminated in the judging of cosmetic surgical results no matter what evaluation system is used, and although such evaluations are far from being "evidence based," such quality control studies involving a critical outcome analysis of postoperative complications, imperfections, and unsatisfactory results are highly beneficial. Surgeons can accurately appraise the quality of their work and examine the effects of adapting new techniques. Using such studies, they can identify the causes of imperfections, thus enabling their correction and prevention [8].

Although our sample sizes were small, it was possible to identify significant objective differences between the Francesconi and Converse methods. The method of Francesconi led to a higher rate of adequate correction of protrusion, both objectively and subjectively, and to a higher satisfaction rate by the surgeon. Although the method of Francesconi seems better suited for the correction of otoplasties in our hands, we noticed that there still is room for future improvement of this technique.

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