

Surgical Techniques in Otoplasty for Correction of the Prominent Ear: A Contemporary Review

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ABSTRACT

Prominent ear is the most frequent congenital deformity of the external ear, affecting approximately 5% to 10% of the population, and remains a recognised source of psychosocial distress in children and adults. More than a century of surgical innovation has produced an extensive armamentarium of corrective procedures, yet no single technique has proved universally superior. This review synthesizes contemporary evidence on otoplasty surgical technique. It examines the anatomical basis and normative measurements that govern operative planning, the timing of intervention, and the technical detail of the two dominant families of procedures: cartilage-sparing suture techniques, exemplified by the Mustardé conchoscaphal and Furnas conchomastoid sutures, and cartilage-modifying techniques based on anterior scoring, incision or excision. Adjunctive refinements are appraised, including postauricular fascial and dermofascial flaps designed to prevent suture extrusion and relapse, conchal reduction, lobule repositioning and reduction otoplasty for the coexisting macrotic ear. Minimally invasive alternatives, comprising incisionless suture otoplasty, laser-assisted cartilage reshaping, electromechanical reshaping and implantable clip systems, are discussed alongside neonatal auricular molding. Pooled contemporary data indicate a mean reduction of the mastoid-to-helical rim distance of approximately 12 mm, a cumulative complication rate close to 14%, a pooled recurrence rate of 2.8% and a revision rate of 2.1%, with suture extrusion the single most common adverse event. Cartilage-sparing approaches, particularly modified Mustardé–Furnas methods reinforced by a vascularized postauricular flap, currently offer the most favorable balance of durability and morbidity, whereas anterior scoring remains safe and reliable in high-volume units with disciplined case selection. Technique selection should be anatomically driven and individualized, dictated by the deformity and by cartilage pliability rather than by surgeon habit

KEYWORDS: Otoplasty; prominent ear; Mustardé suture; Furnas conchomastoid suture; cartilage-sparing technique; anterior cartilage scoring; postauricular fascial flap.

ARTICLE DETAILS

Published On:
12 October 2026

Available on:
<https://ijmscrs.com>

I. INTRODUCTION

The prominent or protruding ear, is the most common congenital malformation of the external ear. Contemporary estimates place its prevalence at approximately 5% of the Caucasian population and between 5% and 10% of the global population, with appreciable variation across demographic and ethnic groups [1,2]. Inheritance follows an autosomal dominant pattern with variable penetrance, and a positive family history is documented in a substantial minority of surgical series [2,6].

The deformity is anatomically heterogeneous. It arises from one or a combination of three elements: underdevelopment or absence of the antihelical fold, hypertrophy or excessive depth of the conchal bowl, and an obtuse conchoscaphal or conchomastoid angle exceeding 90 degrees [3,4]. In a ten-year pediatric series comprising 2333 ear corrections, absence of the antihelical fold was the documented cause in 73% of cases, a deep conchal bowl in 8%, and a mixed pattern in 16% [6]. Prominence of the lobule, frequently overlooked during assessment, may coexist with any of these and must be identified before operation if a harmonious result is to be achieved.

Although the prominent ear carries no functional penalty, its psychosocial consequences are well documented. Teasing and self-consciousness were the stated reasons for referral in 59% and 24% of pediatric cases respectively in the largest published series [6], and a systematic review of the psychological, social and educational impact of prominent ears has confirmed measurable effects on self-esteem and social interaction [5]. Otoplasty improves body image and reduces social anxiety in children and adults alike [1].

More than a century of innovation has produced hundreds of described procedures, and no consensus exists regarding their comparative effectiveness or long-term durability [1,6]. The present review examines the surgical techniques currently in use, their anatomical rationale, their reported outcomes and complications, and the emerging alternatives that are reshaping practice. The intention is to provide the general plastic surgical readership with a structured, evidence-based framework for technique selection rather than an endorsement of any single method.

II. HISTORICAL EVOLUTION OF OTOPLASTY

Surgery of the protruding ear is described in the Vedas and in the Sushruta Samhita, ancient Indian texts in which repair of the earlobe using cheek flaps is attributed to the potter caste [1,2]. Modern operative management begins in the nineteenth century. In 1845 Dieffenbach reported suture fixation of the conchal bowl to the mastoid periosteum with postauricular skin excision for the post-traumatic protruding ear, and in 1881 Ely described resection of postauricular skin together with a crescentic cartilage strip and conchomastoid fixation, performed as a staged bilateral procedure [2].

In 1910 Lockett identified the deficient antihelical fold as the anatomical essence of the deformity and proposed its restoration by skin and cartilage excision along the fold combined with horizontal mattress suturing [7]. Becker subsequently described a cartilage-tubing technique to produce a more rounded antihelix [2]. The biomechanical foundation of cartilage-modifying surgery was established by Gibson and Davis, who demonstrated that cartilage warps away from a scored or incised surface [8]. This principle was applied independently by Stenström and by Chongchet in 1963, each describing anterior scoring of the scaphal cartilage to create a self-sustaining antihelical fold [9,10]. Converse and Wood-Smith, in the same year, described full-thickness cartilage incisions with formation of a tubed antihelical strip [11].

The suture era was inaugurated by Mustardé, who in 1963 showed that permanent conchoscaphal mattress sutures could create an antihelical fold without incising cartilage, producing softer contours and avoiding sharp edges [12]. In 1968 Furnas introduced conchomastoid suture fixation to reduce excessive conchal height and correct the cephalauricular angle [13]. Tolhurst refined the anterior scoring approach in 1972 [14], and Pitanguy popularized the island technique of cartilage excision, reporting a twenty-five-year survey of its results [15].

Contemporary practice therefore inherits two broad families of operations: cartilage-sparing techniques, in which the cartilaginous framework is repositioned by sutures alone, and cartilage-modifying techniques, in which the framework is scored, incised or excised. Hybrid approaches combining both are widely used. In a recent systematic review of eighteen studies comprising 1590 patients and 3060 ears, cartilage-sparing techniques accounted for 77.8% of the published operative experience [1].

III. ANATOMICAL BASIS, NORMATIVE ANALYSIS AND TIMING

A. Auricular anatomy and normative measurements

The auricle, external auditory canal and middle ear derive from the first two branchial arches by the fourth week of gestation, and incomplete fusion of the hillocks of His accounts for the prominent, lop and Stahl ear phenotypes [1]. The adult auricle measures 5.5 to 6.5 cm in length, with a width equal to 50% to 60% of length [2]. Approximately 85% of ear length is achieved by three years of age [16], while width reaches maturity at about seven years in boys and six years in girls [17]; roughly 90% of total auricular growth is complete by eleven to twelve years [1].

Conchal depth is normally less than 1.5 cm and the scaphoconchal angle usually exceeds 90 degrees [2]. The axis of the auricle lies approximately 20 degrees posterior to the vertical and often parallels the slope of the nasal dorsum, the base of the tragus lies about one ear length lateral to the lateral orbital rim, and the top of the helical rim is roughly

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level with the lateral brow [2]. Protrusion is quantified as the distance from the mastoid scalp to the helical rim, conventionally 10 to 12 mm at the superior pole, 16 to 18 mm at the mid-third and 20 to 22 mm at the cauda helices, with an auriculomastoid angle of 15 to 30 degrees [2,18]. The mean auriculocephalic angle has been reported as 25 degrees in males and 21 degrees in females [17].

Cartilage mechanics are equally decisive. Auricular stiffness increases through childhood, peaks at approximately 35 years and declines thereafter, which explains why bending and suturing are effective in the paediatric ear whereas weakening maneuvers are frequently required in adults [1,19]. Finally, asymmetry greater than 3 mm is present in 19.3% of otherwise normal ears, a finding that should temper any attempt to impose rigid millimetric symmetry at operation [20].

TABLE I. NORMATIVE AURICULAR MEASUREMENTS RELEVANT TO OTOPLASTY

Parameter	Normative value
Auricular length (adult)	5.5–6.5 cm
Auricular width	50%–60% of length
Conchal depth	< 1.5 cm
Scaphoconchal angle	> 90°
Auriculomastoid angle	15°–30°
Helix–mastoid, superior pole	10–12 mm
Helix–mastoid, mid-third	16–18 mm
Helix–mastoid, cauda helices	20–22 mm
Growth of auricular length	≈ 85% by 3 y; 90% by 11–12 y

Values compiled from references [1,2,16–20].

B. Timing of intervention

Because ear growth is largely complete in early childhood and self-awareness begins with school socialization, correction is commonly recommended between three and six years of age [2]. Other units prefer to operate from six or seven years onward, arguing that a child mature enough to desire the operation and to cooperate with postoperative care experiences a smoother recovery [21]. In the Belfast series the mean age at surgery was nine years, with a range of two to fourteen years [6]. Timing practices differ substantially between populations and health systems [22]. For neonates, auricular molding within the first weeks of life exploits the transient cartilage plasticity conferred by circulating maternal estrogens and can obviate surgery altogether in appropriately selected infants [23]. Conversely, older patients with stiffer cartilage achieve smaller reductions in helix–mastoid distance and report lower satisfaction, which argues for age-specific technique selection [1,19].

C. Preoperative evaluation

Assessment should be systematic and documented. Conchal bowl depth, helix–mastoid distance at the superior, middle and inferior thirds, the scaphoconchal angle, the degree of antihelical development, the position of the lobule and the overall auricular dimensions are recorded bilaterally [2]. The quality and stiffness of the cartilage must be assessed by digital folding, since this determines whether bending and suturing will suffice or whether weakening maneuvers are required. Asymmetry is documented and correction customarily begins with the more prominent ear, the contralateral side then being matched [2]. A subunit-based analysis dividing the ear into helical–scaphal, antihelical, conchal and lobular components provides a reproducible framework and has been validated in a twenty-one-year series with high satisfaction and low complication rates [24].

Motivation and expectations of both the child and the parents should be explored. The informed consent discussion should specifically include suture extrusion, hypertrophic and keloid scarring, asymmetry, recurrence and the possibility of revision surgery, since these are the events most likely to generate dissatisfaction [2].

IV. CARTILAGE-SPARING SUTURE TECHNIQUES

Cartilage-sparing otoplasty reshapes the auricular framework without violating cartilage continuity. Its principal advantages are the avoidance of sharp ridges, contour irregularity and cartilage necrosis, and the reversibility of an unsatisfactory intraoperative result. Its characteristic failure modes are suture extrusion and relapse driven by cartilage memory [1,2].

A. Mustardé conchoscaphal sutures

Mustardé-type mattress sutures are indicated when the antihelical fold is underdeveloped. In children the procedure is performed under general anaesthesia, the ears analyzed and measured, and local anaesthetic containing adrenaline infiltrated into the postauricular region and along the line of the planned antihelical fold. The desired fold is produced by gentle digital folding of the auricle and tattooed with methylene blue through a 30-gauge needle, which allows the skin excision and suture placement to be planned accurately [2].

A dumbbell-shaped postauricular incision approximately 3 cm long is designed midway between the postauricular crease and the antihelical fold; over-resection of skin must be avoided because it produces tension and hypertrophic scarring. Anterior and posterior flaps are raised in a



Figure 1.- Mustarde suture

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supraperichondrial plane sufficient to visualize the tattooed fold. Conservative posterior cartilage scoring may be performed to reduce cartilage memory. The horizontal mattress sutures travel approximately 16 mm transversely, 8 mm on either side of the fold, with 10 mm of vertical travel and 2 to 3 mm between successive sutures; three to five sutures are usually required, and a 4-0 clear nylon on a 19 mm needle achieves the necessary transverse travel reliably [2,12].

During placement the anterior helix is inspected to confirm that no suture has passed through or immediately beneath the anterior skin, a precaution that reduces extrusion and infection. The sutures are tagged, then tied serially from superior to inferior, taking care that skin and fascia are not incorporated into the knot. Symmetry of the cephaloauricular angle is compared at the upper, middle and lower thirds before the second ear is closed. Closure uses



Figure 2.- Furnas suture

buried 5-0 poliglecaprone dermal sutures and a tension-free cutaneous layer [2].

B. Furnas conchomastoid setback

The Furnas technique addresses the overdeveloped conchal bowl by lowering and flattening the concha and

shortening the distance between the conchal cartilage and the mastoid prominence [13]. When performed without Mustardé sutures the incision is placed closer to the postauricular crease, since dissection must reach the mastoid. The posterior auricular muscles are divided and the posterior flap raised as a musculo-areolar-cutaneous layer, creating a concave bed for the set-back concha by conservative excision of mastoid fascia. Sufficient periosteal and supraperiosteal fascia must be preserved to hold suture tension; inadequate fascial purchase is a recognized cause of early relapse [2].

Permanent sutures are passed full thickness through the posterior conchal cartilage without penetrating the epidermis of the cavum. Suture vector is critical. Placement too far anteriorly narrows the external auditory canal, the most feared functional complication of the technique; placement too far posteriorly widens the transverse dimension of the concha; placement too cephalic over-flattens the bowl, and placement too caudal renders the suture ineffective [2]. When both techniques are combined, the Mustardé sutures are completed and tied before the conchomastoid sutures are cinched down. Spira and Stal described a laterally based conchal cartilage flap sutured to the mastoid periosteum as a modification intended to reduce meatal stenosis and late anterior contour irregularity [25].

C. The combined modified Mustardé–Furnas approach

Several contemporary units employ an exclusively cartilage-suturing technique that combines both principles without scoring or excision. Marking begins by folding the auricle medially to identify the V-shaped bifurcation of the antihelix into the antitragus medially and the cauda helix laterally; this point is reflected onto the posterior surface and defines the site of the first Mustardé-type suture, which is the key structure for correcting lobule protrusion. Dissection extends superiorly to the cartilage of the upper helix and triangular fossa and inferiorly to the tail of the helix. Mustardé-type sutures are then placed between concha and scapha in a caudocephalic sequence along a curvilinear line representing the desired antihelix, followed by three Furnas-type sutures between the posterior conchal wall and the mastoid soft tissues [21,26].

D. Suture selection

Suture choice materially influences outcome. Non-absorbable material offers greater durability and a lower recurrence rate than absorbable material [27], and polydioxanone has been associated with a marked increase in recurrence [26]. Across the pooled literature, 4-0 polypropylene and 4-0 braided polyester are the most frequently used fixation sutures, each accounting for 26.3% of reported cases, while 5-0 polypropylene is the commonest skin closure suture; 4-0 polypropylene showed the lowest pooled recurrence rate of 2.0% and revision rate of 2.9%, whereas 3-0 polypropylene was associated with a higher revision rate of 7.5% [1]. Clear monofilament reduces suture visibility through thin postauricular skin, whereas braided polyester provides softer knots and blunter ends that are less likely to erode through the skin envelope [2,26].

V. CARTILAGE-MODIFYING TECHNIQUES

Cartilage-modifying operations exploit the Gibson and Davis principle that cartilage bends away from the cut surface [8]. By abolishing cartilage memory they address the principal cause of late relapse, at the cost of irreversibility and of a risk of visible ridges if the modification is inexpertly executed.

A. Anterior scoring

Anterior scoring remains the predominant technique in some high-volume units. In the Belfast protocol, the planned limits of the scaphal cartilage incision are tattooed, inferiorly at the antitragal junction with the future antihelical fold and superiorly near the upper end of the future superior crus, as visualized by folding the ear posteriorly. Tumescant infiltration of the anterior auricular skin with bupivacaine 0.25% and adrenaline 1:200,000 facilitates subsequent anterior dissection. A posterior dumbbell-shaped skin excision with a narrow middle third provides access while reducing the risk of telephone ear deformity that follows over-resection with a standard ellipse [6].

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A full-thickness cartilage incision is designed as an anteriorly facing curve between the two tattooed points and a plane is developed between the anterior surface of the scaphal cartilage and its soft-tissue attachments. A 1 to 2 mm rim of the scaphal cartilage complex is excised so that the repositioned cartilage is accommodated within its skin envelope without overlapping the helical rim. Multiple shallow, largely longitudinal scores are then made with a number 15 blade, each as superficial as possible to avoid visible indentation and cartilage breaks; scoring is guided by palpation of residual recoil and directed at the areas palpably resistant to posterior folding. If recoil persists, a single 4-0 poliglecaprone suture may tack the cartilage in its new position. Skin closure with an unknotted running subcuticular absorbable suture permits egress of any postoperative hematoma without suture removal [6].

The published outcomes of this approach are instructive. Over ten years, 1199 otoplasties were performed for a total of 2333 ear corrections; 68% underwent anterior scoring alone, 19% combined scoring and suturing, 9% suture only, and 3% conchal cartilage reduction. All-cause reoperation was significantly lower after anterior scoring than after suture-only correction, 2.73% versus 6.51%, and no case of cartilage necrosis occurred. Hematoma rates did not differ significantly between the two groups, and overall patient, parent and surgeon satisfaction reached 96% [6]. These figures are consistent with an earlier consecutive series of 500 anterior scoring cases [28] and compare favorably with the historical morbidity of 562 consecutive cases in which bleeding occurred in 8%, skin necrosis in 1.4% and residual deformity in 8%, complications attributed largely to the design of the cartilage incisions [29]. Rasping variants, including the modified anterior scoring technique using a double-ended rasp with standardized long-term measurement [30] and controlled anterior cartilage tunnelling with a fine-tooth rasp in 375 patients [31], represent contemporary refinements of the same principle.

B. Cartilage-cutting and excisional techniques

Full-thickness cartilage incision with creation of a tubed antihelical strip, as described by Converse and Wood-Smith, and the island technique of Pitanguy remain of historical and occasionally of practical importance in the rigid adult ear [11,15]. Where conchal hypertrophy dominates the deformity, chondrocutaneous conchal resection has been advocated as the cornerstone of correction, since suture set-back alone cannot adequately reduce an excessively deep bowl [32]. Techniques that dispense with cartilage manipulation altogether have also been described, notably the dermal anchor technique, which relies on dermal adhesion to maintain the corrected position and reported a recurrence rate of 2.63% [33].

C. Comparative outcomes

Comparative data generally favor cartilage-sparing methods. In a retrospective analysis of 1060 ears, cartilage-

deforming techniques were associated with an increased risk of postoperative shape deformity while cartilage-sparing techniques produced better aesthetic results, although the overall complication rate of 20% did not differ significantly between groups [34]. A study of 203 cases reported an 11% recurrence rate and an 8.8% reoperation rate after scoring [35]. Pooled meta-analytic data indicate a recurrence rate of 2.9% and a revision rate of 1.3% for cartilage-sparing techniques, against 4.6% and 6.7% respectively for cartilage-cutting techniques, and a recurrence rate of 3.1% for posterior approaches compared with 5.3% for anterior approaches [1].

These aggregate figures should nevertheless be interpreted alongside the Belfast experience, in which anterior scoring outperformed suture-only correction within the same institution [6]. The discrepancy suggests that operator volume, standardized technique and disciplined case selection influence outcome at least as much as the categorical choice between sparing and modifying the cartilage.

VI. POSTAURICULAR FASCIAL AND DERMOFASCIAL FLAPS

Suture extrusion is the most common complication of cartilage-sparing otoplasty, reported at a pooled rate of 5.4% [1]. It arises because permanent knots lie immediately beneath a thin postauricular skin closure, frequently directly under the scar. The logical remedy is to interpose a vascularized layer between the knots and the skin, and a substantial literature now supports this maneuver.

The postauricular fascial flap was introduced as an adjunct to Mustardé and Furnas otoplasty in 2001, providing vascularized protection that reduced extrusion and recurrence while preserving aesthetics [36]. Long-term follow-up of posterior suturing combined with a postauricular fascial flap confirmed durable medialization with high satisfaction [37], and a prospective outcome study of 227 patients reported comparable findings [38]. A laterally based postauricular dermal flap combined with cartilage-sparing techniques produced significant improvement in helix-mastoid distance and conchomastoid angle at one and twelve months with no recurrences [39].

The most explicit demonstration of the protective effect comes from a series of 100 consecutive patients in whom a de-epithelialised postauricular dermofascial flap was added to a combined modified Mustardé and Furnas technique. A rugby-ball-shaped skin ellipse is marked on the posterior auricular surface, its medial border positioned so that the scar will not lie in the retroauricular sulcus and its lateral border parallel to the helical rim. The ellipse is de-epithelialised with the dermis left intact and the flap raised to the immediate supraperichondrial plane, medially based in primary cases and laterally based in revision cases where the previous scar compromises medial vascularity. After the cartilage sutures are tied, the flap is advanced and tacked

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over them with a rapidly absorbing suture, and the skin is closed in a single layer, the lower 5 to 8 mm being left unsutured to allow drainage. No suture extrusion and no recurrence occurred, compared with 8.5% extrusion in the authors' earlier cohort of 200 patients treated without the flap [21,26].

A comprehensive review of fascial flaps in otoplasty distinguishes fascial, fascioperichondrial and dermofascioperichondrial designs and notes the trade-off involved: including perichondrium may improve flap vascularity and robustness but weakens the underlying cartilage and renders it liable to rupture when Mustardé and Furnas sutures are inserted [40]. Perichondrio-adipo-dermal flap variants, including narrow laterally based designs [41], flaps combined with conchal excision [42] and three-layer designs combined with conventional sutures [43], have all reported improved auricular dimensions and patient satisfaction.

VII. ADJUNCTIVE AND COMPLEMENTARY MANEUVERS

A. Lobule prominence

Prominence of the lobule is present in a substantial proportion of patients presenting with prominent ears and, if uncorrected, produces an unbalanced result in which the upper two-thirds are set back while the lobule continues to project [44]. Correction is individualized and may involve fish-tail or elliptical excision, Z-plasty, repositioning of the tail of the helix or fibrofatty tissue resection [45]. In combined suture techniques the most caudal Mustardé-type suture placed at the tail of the helix is the principal instrument of lobule control [26].

B. Conchal reduction

Where excess conchal width rather than conchal depth drives over-projection, particularly in the adult ear with a well-defined but non-pliable antihelical fold, conchal cartilage resection is preferable to conchomastoid suture set-back, which in this setting risks narrowing the external auditory meatus [6,32].

C. Reduction otoplasty for the macrotic ear

A clinically important subgroup presents with prominence of an ear that is also excessively large. In a consecutive three-year series of 84 otoplasty procedures, 30 patients, or 35.7%, required some degree of scaphal reduction as a component of the operation, and 6% additionally underwent earlobe shortening [46]. Incisions are made both in the retroauricular sulcus and just inside the helical rim on the lateral surface. The lateral incision extends through the cartilage while preserving the medial skin, in the manner of an Antia-Buch advancement, and a crescent-shaped segment of scapha is excised. The exposure so obtained also permits placement of conchoscaphal and triangular fossa-scaphal mattress sutures to reshape the upper third. A triangular wedge of helical rim and posterior

skin is then excised to match the shortened scapha, the rim being approximated with precise horizontal mattress sutures [46].

Scaphal reduction can shorten the ear by up to 7 mm, and by up to 1.2 cm when combined with lobule reduction. The limitation is aesthetic rather than technical: excessive scaphal reduction leaves an upper third disproportionately small for the lower two-thirds, and patients whose ears are uniformly large, including the concha, are not well served by scaphal reduction alone [46,47]. In the series cited, complications were limited to a single suture protrusion and no patient required reoperation [46].

VIII. MINIMALLY INVASIVE AND EMERGING TECHNIQUES

Incisionless otoplasty, in which percutaneous mattress sutures are placed through needle punctures after anterior cartilage abrasion, offers reduced operative time and avoids a postauricular scar [48]. Randomized comparison of two incisionless modifications demonstrated equivalent reduction of auriculocephalic distance with high patient satisfaction [49]. The technique is not without cost: pooled data report higher rates of blistering, at 22.6%, and suture extrusion, at 21.9%, than conventional approaches, and a comparative study found a 96% success rate for a consolidative open technique against 72% for incisionless otoplasty at thirteen months, attributed to the greater structural support provided by conchal cartilage resection and Mustardé sutures [1,50].

Laser-assisted cartilage reshaping applies controlled thermal energy to relax cartilage stress and permit reshaping without incision. Prospective long-term follow-up of 32 procedures reported stable reshaping with few complications [51], and adjunctive cryogen cooling preserves the overlying skin and improves patient satisfaction [1]. Electromechanical reshaping, which uses low-voltage direct current to produce localized, reversible changes in cartilage mechanics, has demonstrated durable auricular changes with minimal injury in animal models and is a plausible future alternative for selected deformities [52]. Implantable clip systems, in which a shape-memory nitinol clip is inserted through a small anterior incision under local anesthesia, have been evaluated for safety in 403 patients and offer an office-based option in adults with a pliable antihelix [53]. Neonatal auricular molding remains the only truly non-operative solution and should be considered in every infant identified in the first weeks of life [23].

IX. POSTOPERATIVE MANAGEMENT

Postoperative protocols are strikingly heterogeneous, reflecting an absence of standardized guidance. Immediate measures range from occlusive and bolster dressings to Penrose drains and simple gauze applications, with removal between one and ten days; extended care predominantly consists of headband use for one to six weeks, typically

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transitioning from full-time to nocturnal wear [1]. A representative protocol applies antibiotic ointment, non-adherent gauze and a mastoid-type pressure dressing for three days, followed after the first wound check by an athletic headband for six weeks to reduce the risk of recurrent protrusion [2]. Others remove the dressing at two to four days, prescribe a nighttime headband and prohibit contact sports for three months [21].

Evidence that prolonged compression confers benefit is weak. Head bandaging beyond the first 24 hours may add no advantage and could increase complications, including pressure necrosis of the thin anterior skin [54]. In the Belfast series, head bandage compliance was 97% with a mean duration of seven days [6]. A pragmatic position is to use a light, pressure-free dressing for two to five days, followed by a soft nocturnal headband for four to six weeks, with early removal of any dressing if unilateral pain suggests hematoma.



Figure 3.- Before and after back view

X. COMPLICATIONS AND THEIR PREVENTION

The cumulative complication rate across contemporary series averages 14.4%, with suture extrusion the most common single event at 5.4%, followed by infection and wound healing problems at 2.6%, asymmetry at 2.1%, hematoma at 1.3% and suture breakage at 1.3%. Severe complications occur in fewer than 1% of cases [1]. Grading with the Clavien-Dindo classification permits meaningful comparison between series [55].

A. Early complications

Auricular hematoma, although reported in only 0% to 2.2% of cases, is the most feared early event because untreated collections progress to skin and cartilage necrosis with permanent deformity [2,56]. Prevention begins at consultation with a history of bleeding diathesis or anticoagulant and supplement use, continues intraoperatively with judicious haemostasis in a richly vascularized field, and is completed by an appropriate pressure dressing. The herald symptom is unilateral pain out of proportion to examination; in that circumstance the dressing should be removed and the ear inspected without delay [2].

Wound infection typically manifests between the third and fifth postoperative days with increasing pain, erythema, warmth and discharge. Prompt treatment is essential to avoid perichondritis, characteristically caused by

Pseudomonas aeruginosa, which requires systemic antipseudomonal therapy and, if improvement is slow, debridement or opening of the incision. Neglected perichondritis leads to cartilage necrosis and irreversible deformity [2].

B. Late complications and recurrence

Hypertrophic and keloid scarring follows closure under tension and is more frequent in patients with darker skin pigmentation, with keloid formation reported in 1.2% to 2.5% of cases. Early treatment with pressure dressings, silicone barriers and serial intralesional triamcinolone or 5-fluorouracil is recommended, and an isolated keloid should be excised and treated promptly [2]. Suture extrusion should form part of the consent discussion for any permanent-suture technique; early extrusion requires suture removal and may mandate revision, whereas delayed extrusion in an ear that has retained its corrected shape can often be managed by simple trimming [2].

Recurrence reflects cartilage memory and has been reported in up to 24% of suture-only techniques in historical series, although the pooled contemporary recurrence rate is 2.8% with a revision rate of 2.1% [1,2]. Scoring and excision techniques reduce recurrence at the cost of a greater risk of contour irregularity along the new antihelical rim [1]. Systematic reviews of prominent ear correction confirm this reciprocal relationship between relapse and deformity [57,58], and a meta-analysis confined to cartilage-sparing otoplasty reports a similar distribution of adverse events [59].

C. Aesthetic and iatrogenic deformities

Over-aggressive correction flattens the auricle against the scalp and produces the hidden helix deformity. Telephone ear results from overcorrection of the middle third, typically after an overzealous conchal set-back, while the reverse telephone deformity follows overcorrection of the upper and lower thirds with inadequate treatment of mid-third conchal protrusion. Cartilage buckling develops when mattress sutures are spaced too widely, and abnormal auricular ridges are associated with cutting and scoring techniques. Narrowing of the external auditory canal and meatus follows aggressive conchal set-back with conchomastoid sutures placed too far anteriorly and may be mitigated by posterior suture placement, partial conchal cartilage excision or a laterally based conchal flap [2,25,60]. Inadequate correction, by contrast, almost always reflects an error of preoperative diagnosis: an overdeveloped conchal bowl will not be corrected by Mustardé sutures alone, and a deficient antihelical fold will not be corrected by a Furnas set-back alone [2]. Revision should follow a structured algorithm that re-establishes the anatomical diagnosis before any operative maneuver is selected [61].

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TABLE II. REPORTED RATES OF THE PRINCIPAL COMPLICATIONS

Complication	Reported rate
Cumulative complication rate	14.4%
Suture extrusion	5.4% (0%–3% with flap)
Infection / wound healing	2.6%
Asymmetry	2.1%
Hematoma	1.3% (range 0%–2.2%)
Suture breakage	1.3%
Keloid / hypertrophic scar	1.2%–2.5%
Pooled recurrence	2.8%
Pooled revision rate	2.1%
Recurrence, cartilage-sparing	2.9%
Recurrence, cartilage-cutting	4.6%

Data compiled from references [1,2,56,57].

XI. OUTCOMES AND QUALITY OF LIFE

Objective outcome reporting in otoplasty centres on the mastoid-to-helical rim distance. Across the pooled literature this measurement decreased from a preoperative mean of 27.1 ± 3.3 mm to a postoperative mean of 15.4 ± 2.8 mm, a mean reduction of 11.7 ± 3.0 mm, with a mean follow-up of 24.5 months [1]. Subjective outcomes are equally favourable: overall patient, parent and surgeon satisfaction reached 96% across all techniques in the largest pediatric series [6].

Patient-reported outcomes confirm that the benefit is psychological as much as morphological. Otoplasty improves emotional, physical and social wellbeing in children and adults, enhancing body image and reducing social anxiety [62], and prospective evaluation of adults undergoing correction of prominent ears has documented measurable psychological improvement after operation [63]. These findings justify the procedure in patients whose complaint is genuinely their own rather than their parents', and they underscore the importance of a child-focused rather than parent-driven consultation [6].

XII. TECHNIQUE SELECTION: A PRACTICAL FRAMEWORK

No single operation suits every prominent ear. Three variables determine the choice: the anatomical component or components responsible for the prominence, the pliability of the cartilage, and the surgeon's own volume and familiarity with the technique.

A deficient antihelical fold in a child with pliable cartilage may be addressed either by Mustardé-type sutures or by anterior scoring; both are well supported, and the decision may reasonably rest on institutional experience. A deficient fold in an adult with stiff, non-compliant cartilage is better served by suture correction, since anterior scoring will exaggerate the fold but will not achieve medialization in

a fixed framework. An excessively deep concha requires Furnas conchomastoid set-back, and an excessively wide concha requires cartilage resection rather than set-back. Lobule prominence requires a dedicated maneuver. Macrotia demands reduction otoplasty in addition to set-back, failing which the upper third will remain prominent or be over-corrected [6,46].

Regardless of the framework technique selected, the evidence now supports the routine interposition of a vascularized postauricular flap over permanent cartilage sutures, which effectively eliminates the commonest complication of contemporary otoplasty without measurable additional morbidity [21,39,40].

TABLE III. TECHNIQUE SELECTION BY PREDOMINANT ANATOMICAL ABNORMALITY

Abnormality	Preferred technique	Comment
Deficient antihelical fold, pliable cartilage	Mustardé sutures or anterior scoring	Both validated; choose by unit experience
Deficient fold, stiff cartilage (adult)	Suture correction $\pm$ weakening	Scoring alone will not medialize a fixed fold
Deep conchal bowl	Furnas conchomastoid set-back	Avoid anterior suture vector (meatal stenosis)
Wide conchal bowl	Conchal cartilage resection	Set-back alone risks meatal narrowing
Prominent lobule	Caudal Mustardé suture; lobule excision	Diagnose preoperatively
Coexisting macrotia	Scaphal reduction with set-back	Up to 7 mm shortening; avoid disproportion
Permanent sutures used	Add postauricular dermofascial flap	Reduces extrusion and relapse

Compiled from references [1,2,6,21,32,40,46].

XIII. CONCLUSIONS

Otoplasty is a mature operation with a low complication rate and a high level of patient satisfaction, yet the persistence of more than a hundred described techniques testifies to the absence of a universally superior solution. Cartilage-sparing suture techniques, particularly modified Mustardé-Furnas combinations, dominate contemporary practice and deliver low recurrence and revision rates; their principal weakness, suture extrusion, is now largely soluble by interposing a vascularized postauricular fascial or dermofascial flap over the permanent knots. Anterior scoring, long criticized for perceived risks of hematoma, necrosis and irreversible contour deformity, performs safely

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and durably in high-volume units with disciplined case selection, and should not be discarded from the surgical repertoire.

The essential determinants of a good result are not the brand of the operation but the accuracy of the preoperative anatomical diagnosis, respect for cartilage pliability and vascularity, meticulous soft-tissue handling, avoidance of both under- and overcorrection, and a consent process that establishes realistic expectations. Adjunctive procedures for the prominent lobule and for coexisting macrotia should be part of every surgeon's planning, since their omission accounts for a recognizable proportion of dissatisfied patients presenting for revision. Future work should priorities prospective, long-term studies with standardized measurement and validated patient-reported outcome instruments and should further evaluate minimally invasive and energy-based reshaping methods, which at present remain promising but insufficiently substantiated for routine adoption.

REFERENCES

- I. Kaleeny JD, Janis JE. Otoplasty surgical techniques and clinical outcomes: a practical review. *Plast Reconstr Surg Glob Open*. 2026;14(1):e7404.
- II. Hoshal SG, Morisada MV, Tollefson TT. Reducing surgical risks for otoplasty. *Facial Plast Surg Clin North Am*. 2023;31(2):253-261.
- III. Kelley P, Hollier L, Stal S. Otoplasty: evaluation, technique, and review. *J Craniofac Surg*. 2003;14(5):643-653.
- IV. Janis JE, Rohrich RJ, Gutowski KA. Otoplasty. *Plast Reconstr Surg*. 2005;115(4):60e-72e.
- V. Jones ES, Gibson JAG, Dobbs TD, Whitaker IS. The psychological, social and educational impact of prominent ears: a systematic review. *J Plast Reconstr Aesthet Surg*. 2020;73(12):2111-2120.
- VI. McGarry KM, Khadim MF, McBride M, Martin S, Moorehead A, Rashid A, et al. Otoplasty: the Belfast experience. A 10-year review of 2333 ear outcomes. *Plast Reconstr Surg*. 2023;151(3):388e-397e.
- VII. Luckett WH. A new operation for prominent ears based on the anatomy of the deformity. *Surg Gynecol Obstet*. 1910;10:635-637.
- VIII. Gibson T, Davis WB. The distortion of autogenous cartilage grafts: its cause and prevention. *Br J Plast Surg*. 1957;10:257-274.
- IX. Stenström SJ. A "natural" technique for correction of congenitally prominent ears. *Plast Reconstr Surg*. 1963;32:509-518.
- X. Chongchet V. A method of antihelix reconstruction. *Br J Plast Surg*. 1963;16:268-272.
- XI. Converse JM, Wood-Smith D. Technical details in the surgical correction of the lop ear deformity. *Plast Reconstr Surg*. 1963;31:118-128.
- XII. Mustardé JC. The correction of prominent ears using simple mattress sutures. *Br J Plast Surg*. 1963;16:170-178.
- XIII. Furnas DW. Correction of prominent ears by conchamastoid sutures. *Plast Reconstr Surg*. 1968;42(3):189-193.
- XIV. Tolhurst DE. The correction of prominent ears. *Br J Plast Surg*. 1972;25(3):261-265.
- XV. Pitanguy I, Müller P, Piccolo N, Piccolo MS, Piccolo MT. The treatment of prominent ears: a 25-year survey of the island technique. *Aesthetic Plast Surg*. 1987;11(2):87-93.
- XVI. Adamson JE, Horton CE, Crawford HH. The growth pattern of the external ear. *Plast Reconstr Surg*. 1965;36(4):466-470.
- XVII. Farkas LG, Posnick JC, Heczko TM. Anthropometric growth study of the ear. *Cleft Palate Craniofac J*. 1992;29(4):324-329.
- XVIII. Becker DG, Lai SS, Wise JB, Steiger JD. Analysis in otoplasty. *Facial Plast Surg Clin North Am*. 2006;14(2):63-71.
- XIX. Ozturan O, Dogan R, Ozucer B, Yildirim YS, Yenigun A. Dynamometric analysis of normative auricular stiffness and comparison with operated prominent ears. *J Craniofac Surg*. 2015;26(7):2155-2159.
- XX. Driessen JP, Borgstein JA, Vuyk HD. Defining the protruding ear. *J Craniofac Surg*. 2011;22(6):2102-2108.
- XXI. Bulstrode NW, Ronde EM, Mazeed AS. Further refinements in otoplasty surgery: a modified approach to prevent suture extrusion in cartilage-suturing otoplasty using a postauricular dermofascial flap. *Plast Reconstr Surg*. 2024;154(6):1191e-1199e.
- XXII. Kajosaari L, Pennanen J, Klockars T. Otoplasty for prominent ears: demographics and surgical timing in different populations. *Int J Pediatr Otorhinolaryngol*. 2017;100:52-56.
- XXIII. Sulibhavi A, Reddy SP, Butts SC, Rosenberg TL. Ear molding in children: timing, technique, and follow-up. A systematic review. *Facial Plast Surg Aesthet Med*. 2024;26(6):730-739.
- XXIV. Siliprandi M, Battistini A, Agnelli B, Vinci V, Klinger F, Klinger M. Algorithm-assisted decision making in otoplasty. *Aesthetic Plast Surg*. 2022;46(1):207-219.
- XXV. Spira M, Stal S. The conchal flap: an adjunct in otoplasty. *Ann Plast Surg*. 1983;11(4):291-298.
- XXVI. Mazeed AS, Bulstrode NW. Refinements in otoplasty surgery: experience of 200 consecutive

Surgical Techniques in Otoplasty for Correction of the Prominent Ear: A Contemporary Review

cases using cartilage-sparing technique. *Plast Reconstr Surg.* 2019;144(1):72-80.

- XXVII. Maslauskas K, Astrauskas T, Viksraitis S, Rimdeika R, Samsanavicius D. Comparison of otoplasty outcomes using different types of suture materials. *Int Surg.* 2010;95(1):88-93.
- XXVIII. Caouette-Laberge L, Guay N, Bortoluzzi P, Belleville C. Otoplasty: anterior scoring technique and results in 500 cases. *Plast Reconstr Surg.* 2000;105(2):504-515.
- XXIX. Calder JC, Naasan A. Morbidity of otoplasty: a review of 562 consecutive cases. *Br J Plast Surg.* 1994;47(3):170-174.
- XXX. Schlegel-Wagner C, Pabst G, Müller W, Linder T. Otoplasty using a modified anterior scoring technique: standardized measurements of long-term results. *Arch Facial Plast Surg.* 2010;12(3):143-148.
- XXXI. Ors S. Prominent ear correction with anterior rasping. *J Craniofac Surg.* 2020;31(5):1408-1411.
- XXXII. Bauer BS, Song DH, Aitken ME. Combined otoplasty technique: chondrocutaneous conchal resection as the cornerstone to correction of the prominent ear. *Plast Reconstr Surg.* 2002;110(4):1033-1040.
- XXXIII. Mutaf M, Temel M. A new cartilage-sparing procedure for correction of the prominent ear deformity: dermal anchor technique. *Ann Plast Surg.* 2020;85(3):221-228.
- XXXIV. Smittenberg MN, Marsman M, Veeger NJGM, Moues CM. Comparison of cartilage-scoring and cartilage-sparing otoplasty: a retrospective analysis of complications and aesthetic outcome of 1060 ears. *Plast Reconstr Surg.* 2018;141(4):500e-506e.
- XXXV. Mandal A, Bahia H, Ahmad T, Stewart KJ. Comparison of cartilage scoring and cartilage sparing otoplasty: a study of 203 cases. *J Plast Reconstr Aesthet Surg.* 2006;59(11):1170-1176.
- XXXVI. Horlock N, Misra A, Gault DT. The postauricular fascial flap as an adjunct to Mustardé and Furnas type otoplasty. *Plast Reconstr Surg.* 2001;108(6):1487-1490.
- XXXVII. Schaverien MV, Al-Busaidi S, Stewart KJ. Long-term results of posterior suturing with postauricular fascial flap otoplasty. *J Plast Reconstr Aesthet Surg.* 2010;63(9):1447-1451.
- XXXVIII. Sinha M, Richard B. Postauricular fascial flap and suture otoplasty: a prospective outcome study of 227 patients. *J Plast Reconstr Aesthet Surg.* 2012;65(3):367-371.
- XXXIX. Basat SO, Ceran F, Askeroglu U, Sirinoglu H, Sarac M, Ceran C. Preventing suture extrusion and recurrence in Mustardé and Furnas otoplasties by using laterally based postauricular dermal flap: long-term results. *J Craniofac Surg.* 2016;27(6):1476-1480.
- XL. Tas S. Prominent ear correction: a comprehensive review of fascial flaps in otoplasty. *Aesthet Surg J.* 2018;38(7):695-704.
- XLI. Ersen B. A modification of the posterior perichondrio-adipo-dermal flap for protruding ear correction: a customized technique. *Ann Plast Surg.* 2019;83(5):500-506.
- XLII. Ciloglu NS, Cin B, Keskin E. Efficacy of using perichondrio-adipodermal flap with combined techniques in prominent ear correction. *J Craniofac Surg.* 2022;33(5):1458-1461.
- XLIII. Duran A, Cörtük O, Eroğlu S. Prominent ear correction: three flap technique combined with conventional otoplasty. *Turk J Plast Surg.* 2023;31(2):55-60.
- XLIV. Ungarelli LF, de Andrade CZ, Marques EG, Farina JA Jr. Diagnosis and prevalence of prominent lobules in otoplasty: analysis of 120 patients with prominent ears. *Aesthetic Plast Surg.* 2016;40(5):645-651.
- XLV. Gosain AK, Recinos RF. A novel approach to correction of the prominent lobule during otoplasty. *Plast Reconstr Surg.* 2003;112(2):575-583.
- XLVI. Sinno S, Chang JB, Thorne CH. Precision in otoplasty: combining reduction otoplasty with traditional otoplasty. *Plast Reconstr Surg.* 2015;135(5):1342-1348.
- XLVII. Yuen A, Coombs CJ. Reduction otoplasty: correction of the large or asymmetric ear. *Aesthetic Plast Surg.* 2006;30(6):675-678.
- XLVIII. Fritsch MH. Incisionless otoplasty. *Laryngoscope.* 1995;105(5 Pt 3):1-11.
- XLIX. Haytoglu S, Haytoglu TG, Bayar Muluk N, Kuran G, Arikan OK. Comparison of two incisionless otoplasty techniques for prominent ears in children. *Int J Pediatr Otorhinolaryngol.* 2015;79(4):504-510.
- L. Edafe O, Argyriou K, Thevasagayam MS. Outcomes and complications of incisionless otoplasty: a retrospective observational study and a review of the literature. *Int J Pediatr Otorhinolaryngol.* 2020;137:110246.
- LI. Leclère FM, Trelles M, Mordon SR. Cartilage reshaping for protruding ears: a prospective long-term follow-up of 32 procedures. *Lasers Surg Med.* 2011;43(9):875-880.
- LII. Badran KW, Manuel CT, Loy AC, Conderman C, Yau AY, Lin J, et al. Long-term in vivo electromechanical reshaping for auricular reconstruction in the New Zealand white rabbit model. *Laryngoscope.* 2015;125(9):2058-2066.
- LIII. Kang NV, Sojitra N, Glumicic S, Chauhan N, Gibbons S. Earfold implantable clip system for

Surgical Techniques in Otoplasty for Correction of the Prominent Ear: A Contemporary Review

- correction of prominent ears: analysis of safety in 403 patients. *Plast Reconstr Surg Glob Open*. 2018;6(2):e1623.
- LIV. Norris JM, Mabvuure NT, Cumberworth A, Kelley E, Jayaram S. Are head bandages required post-pinnaplasty? *Int J Surg*. 2012;10(7):330-333.
- LV. Dindo D, Demartines N, Clavien PA. Classification of surgical complications: a new proposal with evaluation in a cohort of 6336 patients and results of a survey. *Ann Surg*. 2004;240(2):205-213.
- LVI. Limandjaja GC, Breugem CC, Mink van der Molen AB, Kon M. Complications of otoplasty: a literature review. *J Plast Reconstr Aesthet Surg*. 2009;62(1):19-27.
- LVII. Sadhra SS, Motahariasl S, Hardwicke JT. Complications after prominent ear correction: a systematic review of the literature. *J Plast Reconstr Aesthet Surg*. 2017;70(8):1083-1090.
- LVIII. Binet A, El Ezzi O, De Buys Roessingh A. A retrospective analysis of complications and surgical outcome of 1380 ears: experience review of paediatric otoplasty. *Int J Pediatr Otorhinolaryngol*. 2020;138:110302.
- LIX. Alanazi H. Complications of cartilage sparing otoplasty: a systematic review and meta-analysis. *J Craniofac Surg*. 2024;35(3):874-878.
- LX. Handler EB, Song T, Shih C. Complications of otoplasty. *Facial Plast Surg Clin North Am*. 2013;21(4):653-662.
- LXI. Nathan K, Nathan B. Revision otoplasty: an algorithm. *Plast Reconstr Surg*. 2013;131(4):639e-640e.
- LXII. Papadopoulos NA, Niehaus R, Keller E, Henrich G, Papadopoulos ON, Staudenmaier R, et al. The psychologic and psychosocial impact of otoplasty on children and adults. *J Craniofac Surg*. 2015;26(8):2309-2314.