

Jost Cartilage-Remodelling Otoplasty for Prominent Ears: A 10-Case Series and Review of the Literature

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Abstract

Original Research Article

Background: Prominent ear is the most common auricular malformation, affecting about 5% of the population. It combines an underdeveloped antihelical fold, conchal hypertrophy and auricular valgus, and carries a well-documented psychosocial burden in children. Suture-based techniques remain exposed to recurrence through suture resorption, failure or extrusion. The technique described by Jost relies on pure cartilage remodelling, with no suture placed on the helix or the antihelix. **Objective:** To describe our experience with Jost otoplasty, to detail its technical rules and to analyse morphological outcomes, complications and patient satisfaction. **Methods:** A retrospective, descriptive, single-centre study was conducted in the Department of Plastic, Reconstructive and Aesthetic Surgery of the Oued Eddahab Military Hospital, Agadir, Morocco, between June 2025 and May 2026. Ten consecutive patients operated on for prominent ears using the Jost technique were included. Demographic data, anatomical components of the deformity, mastoid-to-helical rim distance at three levels, operative data, early and late complications and satisfaction on a four-point scale were recorded. **Results:** Mean age was 20 years (range 8–30), with six males and four females (sex ratio 1.5). Involvement was bilateral in nine patients and unilateral in one. Mean operative time was 68 minutes. No haematoma and no infection occurred; six patients reported simple postoperative pain and four a transient oedema. At a mean follow-up of six months, no recurrence was observed and the mean mastoid-to-helical rim distance decreased from 24 mm to 16 mm. Six patients were “very satisfied” and four “satisfied”. **Conclusion:** At the cost of a learning curve and a longer operative time, the Jost technique provides accurate and natural moulding of the antihelix. The complete absence of cartilage sutures removes the most frequent causes of recurrence and of material-related complications. Longer follow-up is required to confirm the definitive stability of the result.

Keywords: Prominent ears, otoplasty, Jost technique, cartilage remodelling, antihelix, recurrence, plastic surgery.

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INTRODUCTION

Prominent ear, or protruding ear, is the most common congenital malformation of the auricle. It affects about 5% of the general population and is most often transmitted in an autosomal dominant pattern with variable penetrance [1,2]. Morphologically, it results from the association, to varying degrees, of three anomalies: an underdeveloped fold of the antihelix and of its superior crus, conchal hypertrophy and an excessively open conchomastoid angle responsible for auricular valgus. Lobular protrusion is frequently associated and must be analysed separately, otherwise a dissociated result will be left behind [3,4].

The auricle reaches almost its definitive size at the age of 6 to 7 years, which classically defines the

minimum operative age, a period that also coincides with school entry and the onset of teasing. The psychological, social and educational impact of this deformity has been confirmed by a recent systematic review reporting a significant impairment of self-esteem and quality of life, reversible after surgical correction [5]. In adults, the request stems from a long-standing and often long-deferred aesthetic concern, with a comparable psychological benefit [6].

Since the first otoplasty reported by Ely in 1881 [7], more than two hundred procedures have been described [8]. They can be schematically divided into two large families. Cartilage-sparing techniques rely on plication sutures, with Mustardé horizontal mattress sutures to create the antihelix [9] and Furnas conchomastoid sutures to reduce valgus, and have the

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advantages of simplicity and reversibility. Cartilage-remodelling techniques, initiated by Converse [10] and refined by Stenström [11], exploit the principle of interlocked cartilage stresses described by Gibson and Davis: cartilage scored on one of its surfaces spontaneously curls away from the scored side [12]. The two families differ in their complication profiles: the former expose to suture extrusion, failure and resorption, with a recurrence rate reaching 7 to 10% in historical series [13] and up to 29.6% in the long term in a recent comparative series [14]; the latter expose to excessive weakening of the cartilage, edge irregularities and more marked oedema.

Described by Jost in 1988 [15], the technique we report belongs to the second family but differs from it by two requirements: complete exposure of both surfaces of the cartilage, anterior and posterior, and above all the total absence of cartilage sutures, the curling of the antihelix being obtained solely by anterior thinning performed under direct vision. Although not widely used, because of its technical demands and longer operative time, it is the technique adopted exclusively by our team.

The aim of this work is to report our experience with Jost otoplasty in a series of ten consecutive patients, to describe precisely its operative steps and safety rules, and to analyse its morphological outcomes, complications and patient satisfaction in the light of current literature data.

PATIENTS AND METHODS

Study design and population

This was a retrospective, descriptive, single-centre study conducted in the Department of Plastic, Reconstructive and Aesthetic Surgery of the Oued Eddahab Military Hospital, Agadir, Morocco, over a one-year period between June 2025 and May 2026. All patients were operated on by the same surgical team according to a single operative protocol.

Inclusion criteria were: a clinical diagnosis of prominent ear, isolated or associated with lobular protrusion; correction by otoplasty using the Jost technique; a complete clinical record; standardised preoperative and postoperative photographic documentation; and a minimum postoperative follow-up of three months.

Exclusion criteria were: otoplasties performed using another technique; revision surgery after previous otoplasty; complex or syndromic auricular malformations (microtia, cryptotia, Stahl ear, cup ear) [16]; and incomplete records or patients lost to follow-up before the end of the study period.

Data collection

Data were extracted from the medical records using a standardised data collection form including: age,

sex, medical and surgical history, smoking, unilateral or bilateral involvement, anatomical components of the deformity (underdeveloped antihelical fold, conchal hypertrophy, lobular protrusion), type of anaesthesia, operative time, length of hospital stay, early complications (occurring within the first fourteen days) and late complications, follow-up duration and level of satisfaction.

Morphological assessment

Assessment was based on standardised photographs taken under the same views (frontal, right and left profiles, posterior occipital view), at constant focal length, subject-to-sensor distance and lighting, preoperatively and then on day 5 and at one, three and six months. The mastoid-to-helical rim distance was measured by a single operator at the three levels of the auricle: superior pole of the helix, external acoustic meatus and lobule. The morphological result was assessed according to the McDowell criteria [17]: correction of the antihelical fold over its whole height, absence of a sharp or visible cartilage edge, visibility of the helix beyond the antihelix in the frontal view, regularity of the retroauricular sulcus and symmetry of the two auricles, the tolerated bilateral difference being less than 3 mm.

Patient satisfaction

Satisfaction was recorded at the last follow-up visit by a structured interview and rated on a four-level ordinal scale: very satisfied, satisfied, slightly satisfied, not satisfied. In minors, the opinion of the child and that of the parents were recorded separately.

Statistical analysis

Quantitative variables are expressed as mean $\pm$ standard deviation with range, and qualitative variables as numbers and percentages. Given the small sample size, pre- and postoperative mastoid-to-helical rim distances were compared using the non-parametric Wilcoxon signed-rank test, with the significance threshold set at $p < 0.05$.

SURGICAL TECHNIQUE

Positioning and anaesthesia

The patient is placed supine with the head in a neutral position. Both auricles are included in the operative field, an essential condition for permanent control of symmetry; the drapes are arranged so as to leave the vertex accessible for intraoperative comparative views. The procedure is performed under local anaesthesia in adults and cooperative older children, by infiltration of 1% lidocaine with epinephrine, and under general anaesthesia in younger children. Subcutaneous infiltration covers the whole retroauricular surface to be undermined as well as the retroauricular sulcus; it facilitates undermining by hydrodissection and reduces intraoperative bleeding. A delay of eight to ten minutes is observed before the incision to allow vasoconstriction to take effect.

Marking and skin incision

The desired position of the future antihelix is determined preoperatively, with the patient seated, by digital folding of the auricle, and is then transferred with a skin marker. The outline of the skin incision is variable: it extends more or less far down onto the lobule depending on whether or not a lobular protrusion has to be corrected (Figure 4). A racket-shaped incision is made, designed to resect the excess skin that will appear after folding. The amount of skin resected must be calculated as accurately as possible: insufficient resection leaves a residual skin fold, whereas excessive resection creates tension on the suture line, a source of scar widening and secondary deformity (Figure 5a).

Undermining and exposure

After skin resection, undermining is carried out in the supraparichondrial plane. The posterior surface of the auricle is widely exposed, up to the free edge of the helix, with complete release of the tail of the helix, whose freeing conditions the correction of the lower third (Figure 5b). The posterior auricular muscle is identified and then divided (Figure 5c,d): it constitutes a permanent factor of valgus and a recognised cause of recurrence. Haemostasis is achieved with bipolar forceps on a bloodless field, an essential safety condition before approaching the cartilage.

Marking of the cartilage and chondrotomies

The exact line of cartilage section is transferred onto the posterior surface of the auricle by a series of transfixing needles whose tips are dipped in methylene blue, producing an exact and reproducible outline of the future antihelix. Anterior and posterior chondrotomies are then performed according to the principles described by Jost, imperatively preserving the continuity of the anterior perichondrium at the crest of the future antihelix [3,15] (Figure 5d,e).

Anterior cartilage thinning

The cartilage is exposed on both its surfaces, posterior and anterior. This bifacial exposure is the key point of the technique: it allows progressive anterior thinning of the scaphoconchal slope, with a cold blade or a rasp, under direct vision. The release of the internal stresses of the cartilage, according to the principle described by Gibson and Davis [12], leads to a spontaneous, regular and natural curling of the antihelix, the extent of which is checked step by step by manual folding. Thinning must be stopped as soon as the desired curvature is obtained: excessive thinning exposes to

weakening of the cartilage and to permanent edge irregularities.

Final check and closure

No suture is placed on the cartilage, neither on the helix nor on the antihelix: this is the specific feature of the technique and the essence of its advantage over plication procedures. Before closure, a comparative check of both auricles is performed from the front, from behind and from above, if possible with the patient sat up, in order to verify symmetry, regularity of the curl and visibility of the helix beyond the antihelix (Figure 6a). Skin closure is performed with 5-0 PDS, by interrupted sutures or an intradermal running suture, without tension (Figure 6b).

Dressing and postoperative care

A moulding dressing is applied, keeping the auricle in its corrected position during the healing phase and exerting gentle, uniform compression that prevents auricular haematoma. It is left in place for five days (Figure 7). It is then replaced by a headband worn at night for four to six weeks. Analgesia relies on step 1 analgesics; antibiotic prophylaxis is given according to the departmental protocol. Discharge is allowed on the same day or at the twenty-fourth hour. Patients are reviewed on day 5 for removal of the dressing, then at one, three, six and twelve months.

RESULTS

Demographic data

Ten patients were included, six males and four females, giving a sex ratio of 1.5. Mean age at surgery was 20.0 ± 7.8 years (range 8–30); four patients were children under 16 years of age. Seven patients had no particular medical history; three were chronic smokers and had stopped smoking one month before surgery.

Clinical data

All patients presented with prominent ears of varying degrees. Involvement was bilateral in nine patients (90%) and unilateral in one patient (10%). An underdeveloped antihelical fold was present in all ten patients, conchal hypertrophy in four, and an associated lobular protrusion in one patient. The mean preoperative mastoid-to-helical rim distance was 24 ± 2.5 mm at the superior pole, 23 ± 2.3 mm at the middle level and 20 ± 2.2 mm at the lobule. Typical preoperative appearances are illustrated in Figures 1 to 3.



Figure 1: Preoperative appearance in an adult patient: (a) frontal view showing bilateral prominence, both auricles being visible in front of the plane of the skull; (b) right profile showing effacement of the superior crus of the antihelix and opening of the conchomastoid angle; (c) posterior occipital view allowing assessment of the mastoid-to-helical rim distance and of the symmetry of the two sides



Figure 2: Preoperative appearance in a paediatric patient: (a) frontal view; (b) right profile; (c) left profile. Involvement is bilateral and broadly symmetrical, with a predominant underdevelopment of the antihelical fold



Figure 3: Preoperative appearance in a second paediatric patient: (a) frontal view showing bilateral prominent ears with an underdeveloped antihelical fold and an open conchomastoid angle, both auricles projecting well beyond the plane of the skull; (b) left profile showing the absence of the antihelical fold and of its superior crus, with a smooth, unfolded scapha

Operative data

All patients underwent otoplasty using the Jost technique. Seven procedures were performed under local anaesthesia and three under general anaesthesia. Mean operative time was 68 ± 11 minutes (range 50–90

minutes) for a bilateral correction. Mean length of hospital stay was one day. No technical conversion and no intraoperative incident were recorded. Preoperative marking and the operative steps are illustrated in Figures 4 to 7.



Figure 4: Preoperative marking. Retroauricular outline of the racket-shaped skin excision drawn with a skin marker on the posterior surface of the auricle, after determination of the future antihelix by digital folding with the patient seated; the lower limit of the marking is adapted to the degree of lobular protrusion to be corrected

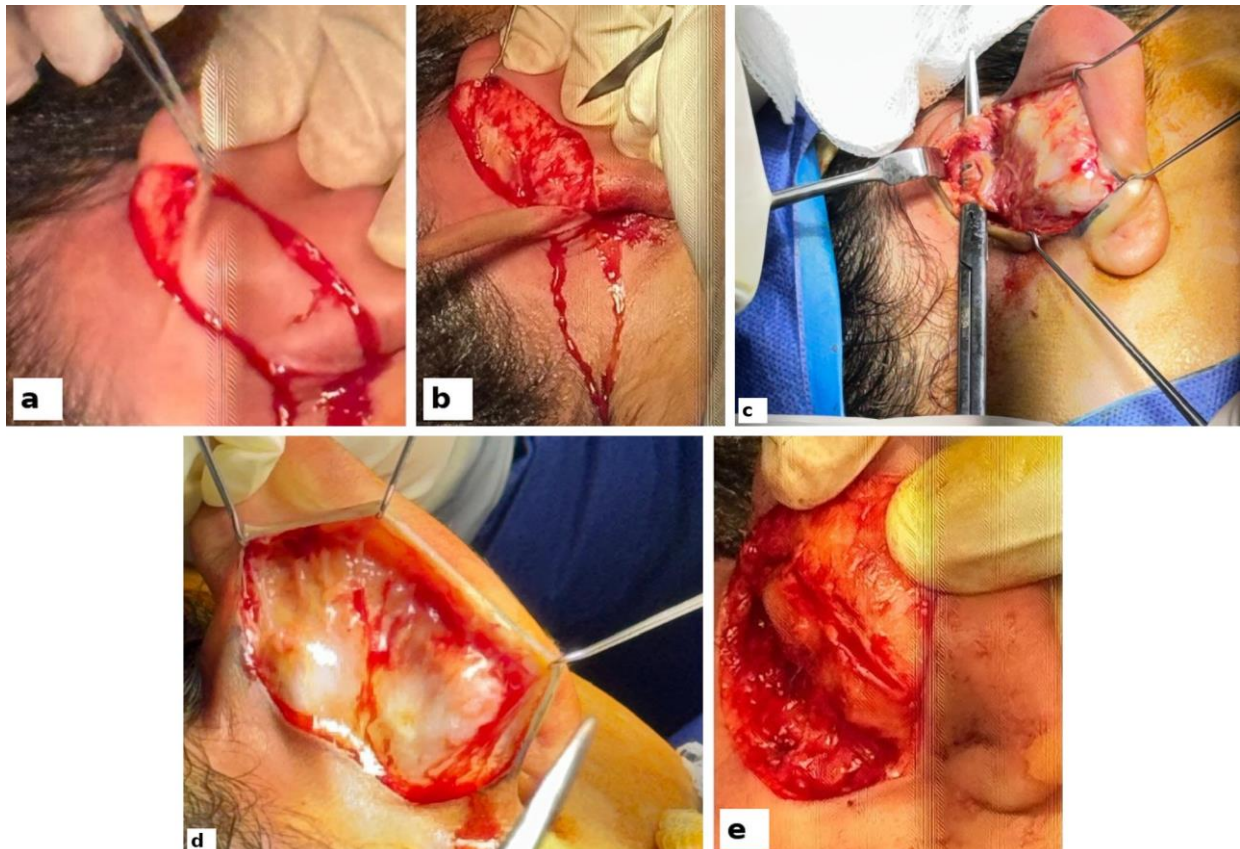


Figure 5: Operative steps: (a) racket-shaped retroauricular skin incision after infiltration of 1% lidocaine with epinephrine; (b) wide exposure of the posterior surface of the auricle after supraparichondrial undermining up to the free edge of the helix, with release of the tail of the helix; (c) identification and clamping of the posterior auricular muscle before its division; (d) posterior surface of the auricular cartilage after division of the posterior auricular muscle, with the posterior chondrotomy performed along the line of the future antihelix; (e) bifacial exposure of the cartilage allowing progressive anterior thinning under direct vision.

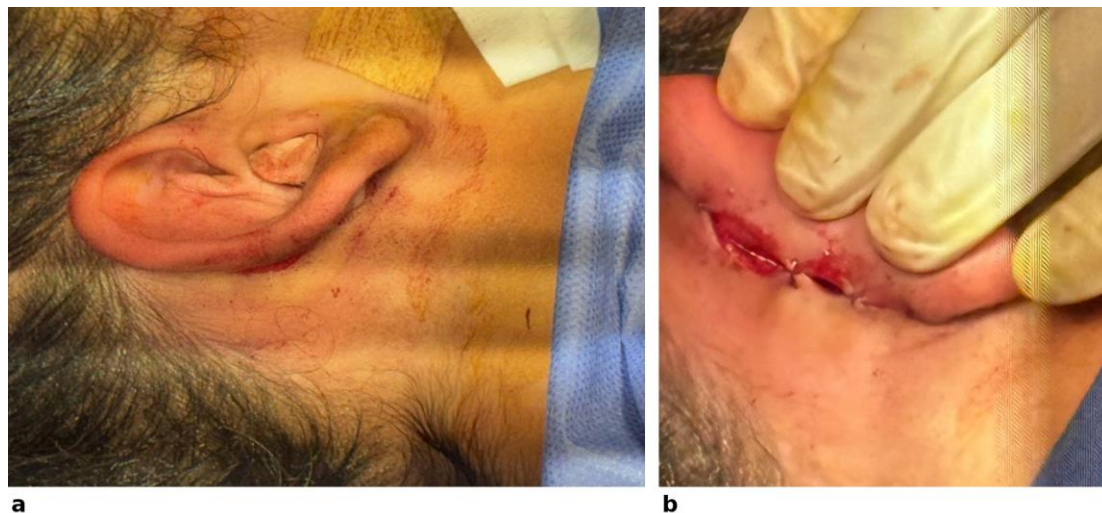


Figure 6: End of the procedure: (a) spontaneous curling of the antihelix obtained by anterior cartilage thinning alone, with no suture on the helix or the antihelix; note the regularity of the curvature and the absence of any sharp cartilage edge; (b) tension-free retroauricular skin closure with 5-0 PDS



Figure 7: Immediate postoperative appearance in a paediatric patient operated on under general anaesthesia: moulding head dressing applied at the end of the procedure, maintaining both auricles in their corrected position and exerting gentle, uniform compression; the dressing is left in place for five days

Postoperative course and complications

The postoperative course was uneventful in all ten patients. Postoperative pain, controlled by step 1 analgesics, was reported by six patients. Postoperative oedema, usual with this technique, was noted in four patients and resolved within one week. No haematoma and no auricular haematoma were observed. No surgical site infection, no skin necrosis and no chondritis occurred. No facial nerve complication was observed. Transient hypoaesthesia in the territory of the great auricular nerve was reported by one patient and resolved spontaneously. No hypertrophic or keloid scar was noted at the end of follow-up.

Morphological outcome

The result was judged satisfactory according to the McDowell criteria in all ten patients. The mean mastoid-to-helical rim distance decreased from 24 mm preoperatively to 16 mm at the last follow-up visit ($p = 0.002$, Wilcoxon signed-rank test). The difference in symmetry between the two auricles was less than 3 mm in nine patients. With a mean follow-up of 5.7 ± 1.8 months (range 3–9), no partial or complete recurrence was reported and no revision surgery was required. The results are illustrated in Figures 8 to 10. Individual patient characteristics are detailed in Table 1.

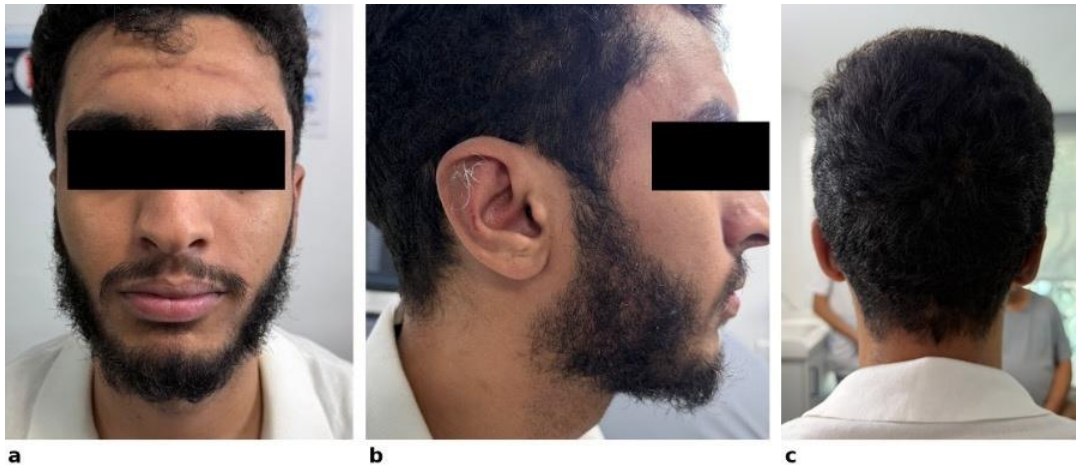


Figure 8: Postoperative result in the patient of Figure 1: (a) frontal view; (b) right profile showing an antihelix regularly folded over its whole height, with the helix remaining visible behind the antihelix and a concealed retroauricular scar; (c) posterior occipital view showing the symmetry of the correction

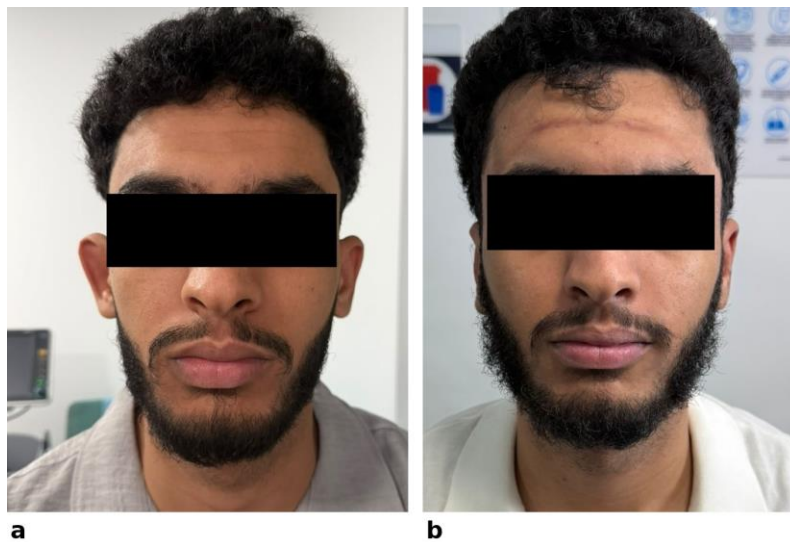


Figure 9: Comparative frontal result in the adult patient: (a) preoperative appearance; (b) postoperative appearance with the same framing. Note the correction of the valgus and the symmetrical approximation of both auricles to the mastoid plane



Figure 10: Comparative frontal result in the paediatric patient of Figure 2: (a) preoperative appearance; (b) postoperative appearance. The definitive result is assessed at six months on photographs taken under the same views

Satisfaction

At the last follow-up visit, six patients declared themselves “very satisfied” and four “satisfied” with the final result, giving an overall satisfaction rate of 100%.

No patient declared themselves “slightly satisfied” or “not satisfied”. In minors, the parents’ assessment was concordant with that of the child in all four cases.

Table 1: Individual characteristics of the ten patients who underwent otoplasty using the Jost technique

No.	Age (years)	Sex	Side	Anaesthesia	Operative time (min)	Complications	Follow-up (months)	Satisfaction
1	30	M	Bilateral	Local	60	Oedema	9	Satisfied
2	15	M	Bilateral	General	70	Pain	6	Satisfied
3	28	M	Bilateral	Local	90	–	6	Very satisfied
4	26	F	Bilateral	Local	70	Oedema, pain	5	Very satisfied
5	8	F	Bilateral	General	60	Pain	7	Very satisfied
6	10	F	Bilateral	General	60	–	6	Very satisfied
7	23	M	Bilateral	Local	80	Oedema, pain	6	Satisfied
8	20	M	Bilateral	Local	70	Oedema	3	Very satisfied
9	14	M	Unilateral	Local	50	Pain	3	Very satisfied
10	26	F	Bilateral	Local	70	Pain, hypoaesthesia	6	Satisfied

M: male; F: female. Satisfaction rated on a four-level scale (very satisfied, satisfied, slightly satisfied, not satisfied).

DISCUSSION

Place of the Jost technique among otoplasties

Prominent ears are a frequent reason for consultation in plastic surgery, particularly in children. The multiplicity of techniques described – Converse, Stenström, Mustardé, Furnas, anterior approaches and incisionless techniques – reflects the fact that none of them has established itself as universally superior [9–11,18–20]. The choice therefore depends on the preoperative anatomical analysis, on the accepted complication profile and on the experience of the team. Although less commonly used, the Jost technique is the one adopted by our team, for reasons that the present series makes explicit.

Biomechanical rationale

Auricular cartilage is subject to a system of internal stresses distributed symmetrically between its two surfaces. Gibson and Davis demonstrated that disruption of this balance, obtained by unilateral scoring, causes the cartilage to curl spontaneously away from the scored surface [12]. Stenström derived from this a technique of anterior thinning through a posterior approach, performed blindly [11]. Jost’s contribution consists in completely exposing both surfaces of the cartilage, which turns a manoeuvre performed by feel into a moulding carried out under direct vision: the surgeon sees the curvature appear as thinning progresses and can adjust its extent and regularity step by step [15]. The result is an antihelix with a continuous outline, free

of the angular crest and sharp edge sometimes produced by suture plication techniques.

Recurrence and stability of the result

The main cause of recurrence after otoplasty is related to the suture material: resorption, secondary failure or extrusion of the sutures release the cartilage, which gradually returns to its initial shape. This is why partial recurrence is classically reported in 7 to 10% of cases after the Mustardé technique [13], and in up to 29.6% in the comparative series by Kepekçi of 365 patients followed from 2017 to 2023 [14]. Recent systematic reviews give more favourable but not negligible pooled figures: 5% of recurrence or revision surgery in 3,493 patients for Sadhra *et al.*, [2], and 2.8% of recurrence with 5.4% of suture extrusion in the meta-analysis by Kaleeny and Janis [21].

In the Jost technique, no suture is placed on the cartilage: the main mechanism of recurrence is therefore eliminated by design. Our series reports no recurrence, a result consistent with that of Khaled *et al.*, who likewise observed no recurrence in twenty patients operated on with the same technique and followed for one year [22]. This finding must nevertheless be qualified. Cartilage retains a shape memory, and late recurrences have been described on average three to seven years after surgery [23]. With the follow-up available to us, our series therefore cannot establish the definitive stability of the result, but only the absence of early recurrence, which is precisely the recurrence most directly attributable to suture material. The main comparative data from the literature are summarised in Table 2.

Table 2. Recurrence and complication rates reported in the literature according to the technique used

Series (author, year)	Technique	n	Mean follow-up	Recurrence (%)	Main complications
Sadhra <i>et al.</i> , 2017 [2]	Systematic review, all techniques	3,493	Variable	5.0	Haematoma 2.5%; infection 0.8%; suture problems 1.8%
Kaleeny & Janis, 2026 [21]	Meta-analysis (18 studies)	1,590	24.5 months	2.8	Suture extrusion 5.4%; revision 2.1%
Kepekçi, 2025 [14]	Mustardé	71	≥ 12 months	29.6	Suture extrusion, granuloma
Kepekçi, 2025 [14]	Fascioperichondrial flap	232	≥ 12 months	6.5	Lower overall complication rate
AlAwadh <i>et al.</i> , 2022 [24]	Mixed techniques	44	≥ 12 months	9.1 (per patient)	Overall complications in 20% of ears
Khales <i>et al.</i> , 2021 [22]	Jost	20	12 months	0	Transient facial paresis (1 case)
Present series	Jost	10	6 months (3–9)	0	Transient great auricular nerve hypoaesthesia (1 case); no haematoma, no infection

Definitions of recurrence and follow-up durations differ from one series to another, which limits the direct comparability of the reported rates.

Complications

The complication profile observed in our series is consistent with the literature [2,25–27]. Postoperative oedema, more marked and longer-lasting than after a plication technique, is the usual price of bifacial exposure of the cartilage; it must be announced to the patient, otherwise it is experienced as an early failure. Haematoma and auricular haematoma, the main feared early complications, are reported in 1.5 to 3% of cases depending on the series and in 2.5% in the meta-analysis by Sadhra *et al.* [2]; their prevention relies on rigorous bipolar haemostasis and on the quality of the moulding dressing. Surgical site infection, with a pooled incidence of 0.8% [2], must be treated without delay because of the risk of chondritis, a rare but potentially mutilating complication [26,28].

Transient facial paresis has been described after otoplasty under local anaesthesia; it most often results from diffusion of the local anaesthetic towards the trunk of the facial nerve at its exit from the stylomastoid foramen and resolves within hours to days, which must be distinguished from direct nerve injury [22,26]. Hypoaesthesia in the territory of the great auricular nerve is frequent, regularly under-reported and usually resolves within a few months. In the long term, hypertrophic and keloid scars are the most worrying complication, all the more so as compression by silicone gel or sheeting is difficult to achieve in this location, except at the lobule; treatment then relies on intralesional injections of depot corticosteroids [4].

One complication specific to remodelling techniques deserves emphasis: excessive anterior thinning weakens the cartilage and may produce edge irregularities, an angular fold or, in extreme cases, a cartilage fracture. The rule is therefore to stop thinning as soon as the desired curvature is obtained, and to prefer slight under-correction to over-correction.

Advantages and limitations of the technique

The advantages of the Jost technique are threefold. The first is the quality of the moulding: the antihelix is shaped under direct vision, which gives a regular, continuous and natural-looking result. The second is the absence of foreign material, which eliminates suture extrusion – the most frequent complication of plication techniques, at 5.4% in the most recent meta-analysis [21] – as well as the main mechanism of recurrence. The third is the possibility of performing the procedure under local anaesthesia in adults, as a day case.

Its limitations are real and must be acknowledged: the learning curve is long, the operative time is longer than that of plication techniques, and the manoeuvre, being irreversible, does not forgive excessive thinning, whereas a misplaced suture can be redone during the same procedure. These constraints explain the limited uptake of the technique, even though its results are favourable.

Limitations of the study

Our work has several limitations. The sample size is small, and the retrospective, single-centre design exposes to selection and information bias. The absence of a control group operated on with another technique precludes any comparative conclusion; the data in Table 2 come from heterogeneous series and only allow the results to be put into perspective. Morphological assessment was performed by the surgeons themselves, without an independent blinded panel, which is a recognised assessment bias in this field. The follow-up was short and heterogeneous; three patients having been reviewed for less than six months. Finally, satisfaction was measured with a simple ordinal scale rather than a validated instrument; the use of a validated quality-of-life score such as the Glasgow Benefit Inventory, and of

a scar scale such as the POSAS, would be desirable in future work.

Perspectives

These limitations outline the design of a prospective study: a minimum follow-up of five years to document late recurrences related to cartilage memory, standardised anthropometric measurements at the three levels of the auricle, photographic assessment by an independent blinded panel, and the use of validated patient-reported questionnaires. A randomised comparative study of the Jost technique versus a plication technique, with a primary endpoint centred on recurrence at five years, would provide the level of evidence currently lacking in this field.

CONCLUSION

The Jost technique remains little practised because of its technical difficulty and prolonged operative time. It nevertheless offers two decisive advantages: moulding of the antihelix under direct vision, hence accurate and natural in appearance, and above all the total absence of cartilage sutures, which eliminates by design the main mechanism of recurrence and the complications related to suture material. In our series of ten patients, it achieved satisfactory morphological results and a high satisfaction rate, without major complication or recurrence at the end of follow-up. These results, consistent with the few published series, justify the adoption of this technique by our team, provided that it is performed rigorously and followed up over the long term to assess the stability of the result.

DECLARATIONS

Conflicts of interest. The authors declare that they have no conflict of interest related to this article.

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Ethical approval. The study was conducted in accordance with the Declaration of Helsinki and was approved by the local ethics committee of the Oued Eddahab Military Hospital, Agadir.

Consent. Written informed consent was obtained from all patients, or from their legal guardians for minors, for the procedure and for the publication of photographs. All photographs were anonymised by masking the orbital region; the auricles, which are the subject of the study, were left fully visible.

Author contributions. S. Kerroumi: study design, data collection, drafting of the manuscript. R. Boulgsoa, K. Benmoussa, Y. Sabri, A. Ouadi: surgical procedures, critical revision. S. Kerroumi, A. Ouadi: data analysis, iconography. A. Ouadi: supervision and validation of the final version. All authors have read and approved the final version of the manuscript.

Data availability. Anonymised data are available from the corresponding author on reasonable request.

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