Cornous Biology, Volume:1, Issue: 3, Pages: 9-16
https://doi.org/10.37446/corbio/cr/1.3.2023.9-16
Case Report

Surgical management of auricular keloids: technique and considerations

Jorge A. Espinosa-Reyes[1], Juan Carlos Ochoa Alvarez[2], Johanna Ximena Valderrama-Penagos[3], Diego Andrés Corredor-Zuluaga[4], Mariana Espinosa Nieto[5], Álvaro José Martinez Santacruz[6]

Received: 5 July 2023 / Accepted: 15 November 2023 / Published: 31 December 2023

[1]Facial Plastic Surgeon, Department of Otolaryngology, Calle 127a # 7- 53 cons 3005, Bogotá, Colombia, E-mail: jorgespinosa@gmail.com
[2]ENT, Facial Plastic Surgery fellowship – The Face & Nose Institute, Bogotá, Colombia, E-mail: facialplasticsjo@gmail.com
[3]ENT resident, Universidad Militar Nueva Granada, Bogotá, Colombia, E-mail: jxvalderrama@hotmail.com
[4]ENT, Facial Plastic Surgery fellowship, Bogotá, Colombia, E-mail: diegoandrescorredor@gmail.com
[5]Third-Year Medical Student, School of Medicine, Universidad del Rosario, Bogotá, Colombia, E-mail: mespinosanieto@gmail.com
[6]Fourth-Year Medical Student, School of Medicine, Universidad del Rosario, Bogotá, Colombia, E-mail: alvarojos.martinez@urosario.edu.co

[*]**Correspondence**
Juan Carlos Ochoa Alvarez
facialplasticsjo@gmail.com

Background: Auricular keloids present a significant therapeutic challenge due to their propensity for high recurrence rates and the potential for both aesthetic and functional deformities. Although numerous adjuvant treatments have been proposed, recurrence remains prevalent when factors such as tension, contour preservation, and vascularity are not adequately addressed.

Case presentation: This study presents a surgical technique that emphasizes the complete excision of keloids while preserving the overlying skin as a fillet flap for reconstruction. Following methylene blue marking and local anesthetic infiltration, the keloid core is excised, ensuring the maintenance of cartilaginous integrity to preserve the auricular contour. The preserved skin flap is then repositioned for layered wound closure, achieving a tension-free repair. A bolster dressing is applied to prevent hematoma formation and eliminate dead space. Adjuvant therapies, including intralesional corticosteroids, 5-fluorouracil, and laser therapy, were considered as complementary modalities to further reduce the risk of recurrence.

Conclusion: The fillet flap technique offers a reliable reconstructive option following auricular keloid excision, ensuring adequate vascularity and contour preservation. This approach provides improved cosmetic outcomes and a lower recurrence rate compared to excision alone. Careful postoperative management and individualized adjuvant therapy remain essential for optimizing long-term results.

Keywords: *auricular keloids, keloid therapy, surgery of auricular keloids, fillet flap, keloid recurrence, keloid excision*

Introduction

Skin wound healing occurs in distinct phases: first, the coagulation and hemostasis phase, followed by the inflammatory phase, then the proliferative or granulation phase, and finally the remodeling or maturation phase (Mohammadi et al., n.d). An imbalance between catabolism and anabolism during this process can result in pathological outcomes due to aberrant tissue repair (Sobec et al., 2013). Keloids are pathological scars resulting from a disruption in the normal wound healing process after cutaneous injury, characterized by excessive deposition of connective tissue in the dermis. They extend beyond the original wound margins and do not regress over time (Mohammadi et al., n.d; Lee et al., 2001; Häussler et al., 2022). Keloids were first described by Alibert in 1817, distinguishing them from neoplastic overgrowths. The term derives from the Greek word chele, meaning “claw of a crustacean” (Lee et al., 2001). They initially present as nodular, firm lesions covered by a thin, glossy, thickened layer of skin (Froelich et al., 2007); the auricular area is the most commonly

affected site in the head and neck region. Although they do not undergo malignant transformation, keloids can significantly impact the quality of life (Häussler et al., 2022). Histologically, they demonstrate dense and disorganized bundles of type I and III collagen arranged in horizontal bands within the upper reticular dermis. Keloids are relatively hypocellular in the center and exhibit reduced fibroblast apoptosis (Bermueller et al., 2010; Jones et al., 2017). The incidence of keloids in individuals of African descent ranges from 4.5% to 16%, which is approximately 15 times higher than that in Caucasian populations. They typically develop between the ages of 10 and 30 years, with no significant sex predilection (Carvalhaes et al., 2015). In the auricle, particularly the lobe and helix, the incidence is approximately 2.5% (Tran et al., 2022). Genetic associations have been reported with HLA-B14, HLA-B21, HLA-BW16, HLA-BW35, HLA-DR5, HLA-DQW3, and blood type A (Thierauf et al., 2017). The exact etiology of keloids remains unknown (Jones et al., 2017). In terms of pathophysiology, keloid formation involves a prolonged inflammatory phase that contributes to its expansive nature. Keloid scars show a predominance of inflammatory cells and increased expression of transforming growth factor beta (TGF-β1 and TGF-β2), along with decreased levels of TGF-β3 and matrix metalloproteinases, resulting in extracellular matrix accumulation. A Th2-driven immune response promotes fibrosis, whereas a Th1 response attenuates fibrotic tissue development (Sobec et al., 2013). Additionally, increased expression of the p63 gene, associated with fibroblast activity and reduced collagen degradation, has been observed (Mohammadi et al., n.d.; Carvalhaes et al., 2015).
Patients with keloids commonly report pruritus, pain, and aesthetic concerns (Carvalhaes et al., 2015; Chen et al., 2022). In individuals with lighter skin tones, the lesions appear erythematous and telangiectatic, whereas in individuals with darker skin, they tend to be hyperpigmented. In the auricular region, triggers include skin trauma caused by surgery, burns, body piercings, folliculitis, and acne. Most lesions develop within the first three months following trauma but may also appear up to one year after injury (Sobec et al., 2013; Carvalhaes et al., 2015; Tran et al., 2022; Hung et al., 2022).
Auricular keloids are typically assessed using photographic documentation and can be classified using the modified Chang-Park system (Hung et al., 2022):

Type I: pedunculated lesions
Type II: sessile with a solitary nodular pattern
Type III: sessile with a multinodular pattern
Type IV: buried (hidden) type
Type V: mixed-type lesion.

Currently, no standardized guidelines exist for determining the most effective treatment (Tran et al., 2022). Surgical management is indicated in cases of large, disfiguring auricular keloids; however, recurrence rates are high without proper technique, and adjuvant therapy is essential (Hung et al., 2022). Several surgical techniques have been described, including wedge excision with primary closure, full-thickness skin grafting, and central debulking excision (Kwek et al., 2019). Three fundamental factors contribute to successful surgical outcomes: precise and delicate excision, tension-free wound closure, and strict early postoperative follow-up to minimize the risk of recurrence (Mohammadi et al., n.d). In general, incisions should follow relaxed skin tension lines and avoid crossing them. A subcuticular or intradermal suture technique is preferred (Froelich et al., 2007). For small keloids, simple excision with undermining and primary closure is recommended. In larger lesions, excision may result in significant skin deficits, for which full-thickness skin grafting may be advisable. It is important to note that in predisposed patients, additional trauma from graft harvesting should be avoided in the future. Local flap coverage, particularly using retroauricular tissue, may be more favorable than distant donor sites (Froelich et al., 2007).

The proposed technique is based on excision of the keloid with the primary goal of auricular reconstruction.

Case Presentation

To conduct the resection of a keloid on the auricle, the lesion is initially delineated using methylene blue. Figures 1-2 depict the marking of the lesión. Local infiltration is subsequently performed using 1% lidocaine in combination with 1:100,000 epinephrine to facilitate hydrodissection and achieve hemostasis at the surgical site (Figure 3). Local infiltration is subsequently performed using 1% lidocaine in combination with 1:100,000 epinephrine to achieve hydrodissection and hemostasis at the surgical site (Figure 3). Following a latency period of five minutes, an incision is made, and the keloid is excised. Care is taken to preserve the surrounding epidermis to facilitate tension-free wound closure (Figure 4). During dissection, it is essential to preserve the cartilaginous segments to prevent any anatomical distortion or deformity of the auricle (Figure 5). Following the excision of the lesion, a layered closure is executed. The suturing process commences at the wound angles, facilitating precise contouring of the tissue. Interrupted 6-0 Prolene sutures are employed to ensure optimal approximation of the skin edges (Figure 6). A bolster dressing, known as capitone, is applied using petrolatum-

impregnated gauze, which is secured with 4-0 Prolene sutures. This technique serves to eliminate dead space and mitigate the risk of postoperative hematoma. The bolster is typically removed 48 to 72 hours following surgery, coinciding with the initial postoperative follow-up.

Figure 1. Classification of auricular keloids using the modified Chang-Park system. Type II keloid, characterized by a sessile, solitary nodular lesion on the auricle

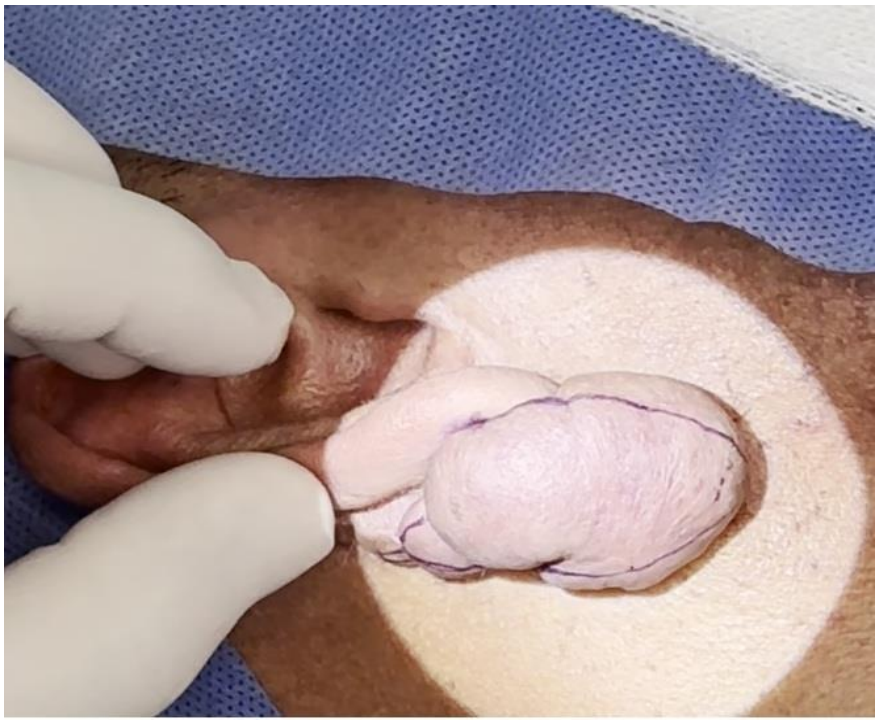

Figure 2. Delineation of the auricular keloid lesion using methylene blue prior to surgical resection

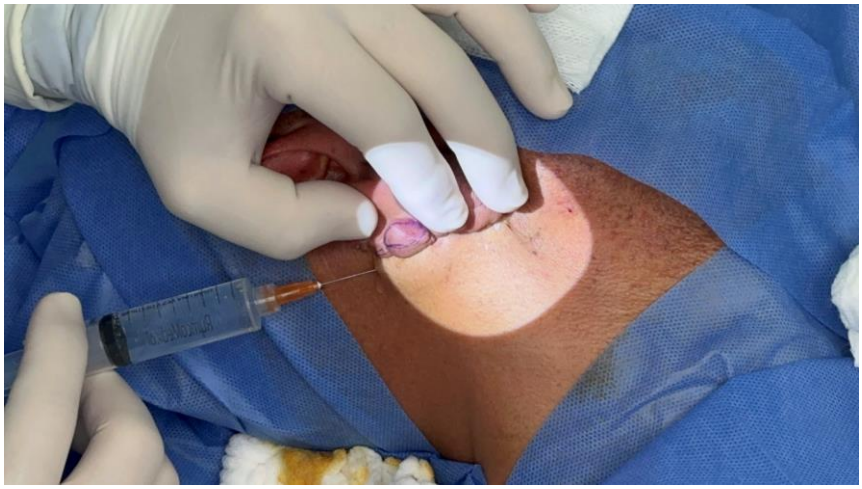

Figure 3. Local infiltration with 1% lidocaine and 1:100,000 epinephrine is performed to achieve hydrodissection and hemostasis at the surgical site

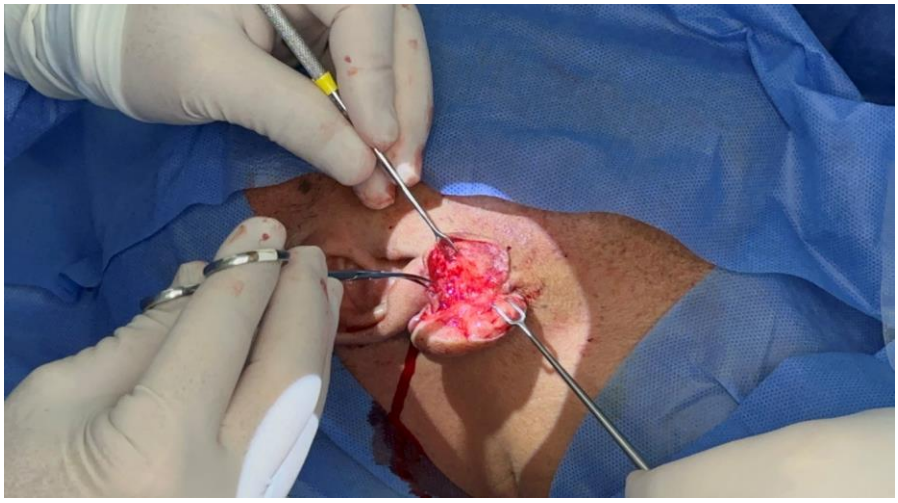

Figure 4. Following a 5-minute latency period, an incision is made and the keloid is excised. Care is taken to preserve the surrounding epidermis to facilitate tension-free wound closure

Figure 5. Intraoperative view during dissection. Preservation of cartilaginous structures is critical to avoid anatomical distortion or deformity of the auricle

Figure 6. Layered closure following keloid excision. The suturing begins at the wound angles to facilitate precise tissue contouring. Interrupted 6-0 Prolene sutures are used for accurate approximation of skin edges

Discussion

The treatment of keloids remains a clinical challenge due to high recurrence rates and the potential for functional and cosmetic sequelae. Management strategies encompass both surgical and conservative approaches, including intralesional corticosteroid injections, 5-fluorouracil, radiation therapy, verapamil, mitomycin C, imiquimod, cryotherapy, pressure therapy, and pulsed dye laser (Häussler et al., 2022; Tran et al., 2022; Hung et al., 2022). The variability in treatment selection is attributed to the absence of standardized protocols for auricular keloids, individual patient expectations, and the surgeon's expertise (Häussler et al., 2022). The best outcomes in terms of recurrence are typically achieved through combination therapy, such as surgery with adjuvant radiotherapy (recurrence rates of 10–22%) or surgery followed by intralesional corticosteroids (8–50%) (Häussler et al., 2022). Among the available options, intralesional corticosteroid injections are among the most widely accepted treatments, both as a first-line therapy and as an adjuvant following surgical excision to reduce recurrence rates (Häussler et al., 2022). They have been used since 1965 due to their proven efficacy, with triamcinolone being the corticosteroid of choice, although its exact mechanism of action remains unclear (Carvalhaes et al., 2015). Corticosteroids act during the inflammatory and proliferative phases by modulating macrophage phagocytic activity and altering fibroblast function in collagen synthesis (Carvalhaes et al., 2015; Tran et al., 2022). Laser therapy is another alternative that has demonstrated promising outcomes in keloid treatment. Its mechanism involves the modulation of abnormal tissue growth; however, results depend on multiple variables such as exposure time, laser type, and lesion location (Carvalhaes et al., 2015). Auricular keloid management also includes 5-fluorouracil, which has shown potential due to its antiproliferative properties. This pyrimidine analog functions as an antimetabolite that inhibits the proliferation of fibroblasts and myofibroblasts. Its adverse effects commonly include injection-site pain, purpura, temporary hyperpigmentation, and occasionally ulceration (Froelich et al., 2007). Surgical resection of auricular keloids requires careful preservation of the three-dimensional contour of the auricle due to limited tissue laxity (Hung et al., 2022). One surgical technique involves advancing the helical rim, where cartilage approximation reduces skin tension and lowers the risk of recurrence. However, this approach may result in a significantly smaller neoauricle, and it is therefore recommended that lesions be limited to a maximum size of 2 cm to preserve anatomical landmarks and achieve a near-normal appearance. In cases where the scaphoid fossa is involved, a semilunar excision may improve postoperative aesthetics (Kwek et al., 2019). Mohammadi et al. described a surgical technique beginning with local infiltration of 1% lidocaine with 1:100,000 epinephrine. An incision is made within the borders of the keloid while elevating the overlying marginal skin. Fibrous keloid tissue is excised, and tension-reducing maneuvers are applied during wound closure. If a tension-free closure is not feasible, an intralesional excision is preferred. Closure is performed with 6-0 sutures, and a pressure dressing is applied for 48 hours postoperatively (Mohammadi et al., n.d). Ziccardi reported a technique using a full-thickness skin graft harvested from the excised auricular keloid tissue itself. To prevent postoperative contracture of the earlobe, Hakoto et al. proposed a pedicled island subcutaneous flap from the posterior surface of the auricle (Froelich et al., 2007). Kim et al. outlined the technique we propose, which involves preserving and elevating the keloid skin as a "fillet flap," followed by the complete excision of the keloid core and utilizing the preserved skin for reconstruction (Kim et al., 2004; Froelich et al., 2007). Fillet flaps ensure adequate vascular supply and minimize the risk of flap necrosis. The procedure begins with the infiltration of local anesthesia, followed by the dissection of the overlying skin as a fillet flap.

The keloid is then completely enucleated, with palpation confirming its full removal. Hemostasis is achieved using monopolar electrocautery. The flap is pedicled and axially based a technique originally developed for traumatic amputations employing adjacent tissue for reconstruction. After keloidectomy, the wound is reconstructed with this flap, excess skin is trimmed, and the margins are approximated with 6-0 sutures (Hung et al., 2022). This surgical technique allows for the complete dissection of the lesion while preserving relaxed skin for tension-free closure (Madura et al., 2021). In 2021, Madura et al. reported on a series of 30 patients with 45 auricular keloids, of which 32 were managed surgically. Despite achieving an 83.3% cure rate, the surgical technique was not used in isolation (Madura et al., 2021). In the report by Kim et al., a 50% recurrence rate was observed in patients treated with this technique (Kim et al., 2004). Overall, for large keloids, surgical excision followed by plastic reconstruction is recommended as a primary surgical treatment for auricular lesions (Froelich et al., 2007). Multiple studies have reported recurrence rates ranging from 45% to 100% following excision alone (Froelich et al., 2007; Tran et al., 2022). However, using the technique described in this article which focuses on skin reconstruction rather than keloid size recurrences are significantly reduced, and cosmetic outcomes are satisfactory (Figure 7-10).

Figure 7. Preoperative (A) and 6-month postoperative (B) views of a patient with a nodular keloid located behind the lobule of the right auricle. Complete surgical excision with tension-free closure was performed. Postoperative result demonstrates a restored auricular contour with no evidence of recurrence

Figure 8. Preoperative (A) and 9-month postoperative (B) images of a patient with two keloid lesions: a large mass located behind the helical rim and a smaller lesion at the antitragus of the left auricle. Both lesions were excised with meticulous undermining and primary closure. At follow-up, the auricle demonstrates preserved anatomy, a flat, well-healed scar, and no evidence of keloid recurrence

Figure 9. Preoperative (A) and 18-month postoperative (B) photographs of a Black patient with a very large, recurrent keloid located behind the lobule of the left auricle, secondary to ear piercing. Surgical excision was performed with adjunctive therapy. At long-term follow-up, the auricle shows excellent contour, no hypertrophy, and no evidence of recurrence

Figure 10. Preoperative (A) and 18-month postoperative (B) views of the same Black patient shown in Figure 9, now presenting with a similarly positioned, large keloid behind the lobule of the right auricle, also secondary to ear piercing. Surgical excision with layered closure and adjuvant intralesional corticosteroids was performed. The postoperative outcome demonstrates a symmetric, well-contoured auricle with no recurrence and minimal scarring

Conclusion

The surgical management of auricular keloids presents unique challenges due to the complex anatomy and limited tissue availability in the ear region. This technique, focusing on skin reconstruction rather than keloid size, offers promising results in terms of reduced recurrence rates and improved cosmetic outcomes. By preserving and elevating the keloid skin as a "fillet flap," complete excision of the keloid core is achieved while maintaining adequate tissue for reconstruction. The method allows for tension-free closure, which is crucial in preventing recurrence. While recurrence rates remain a concern, this approach, combined with appropriate adjuvant therapies, provides a valuable option for managing large, disfiguring auricular keloids. Further research and long-term follow-up studies are needed to fully evaluate the efficacy of this technique and optimize treatment protocols for auricular keloids.

Acknowledgement

None.

Author contributions

Jorge A. Espinosa-Reyes, MD: Conceived the study, developed the surgical technique, performed all clinical procedures, and provided the primary data and initial manuscript draft.
Juan Carlos Ochoa Alvarez, MD: Critically revised the manuscript for intellectual and scientific content and refined the structure and clarity of the final version.
Johanna Ximena Valderrama-Penagos, MD: Contributed to the literature review, data collection, and formatting of the manuscript.
Diego Andrés Corredor-Zuluaga, MD: Assisted with literature research, data verification, and manuscript preparation.
All authors read and approved the final manuscript.

Conflict of interest

The authors declare no conflict of interest.

Ethics approval

This study did not involve animals. Institutional ethics committee approval was not required, as the work reports clinical cases managed according to established standards of care.

Ethical concern and informed consent

All patient information was handled with strict confidentiality. Written informed consent was obtained from the patients for the use of their clinical data and images for publication in this case report. Written informed consent was obtained from all patients for the use of clinical photographs in this publication.

References

Mohammadi, A. A., Kardeh, S., Motazedian, G. R., & Mohammadi, S. (n.d.). Management of ear keloids using surgical excision combined with postoperative steroid injections. *World Journal of Plastic Surgery, 8*(3), 338. https://doi.org/10.29252/wjps.8.3.338

Sobec, R., Dobreanu, C., Fodor, L., Şomcutean, A., Tichil, I., & Cosgarea, M. (2013). Ear keloids: A review and update of treatment options. *Clujul Medical, 86*(4), 353–358.

Häussler, D., Hüttemann, S., Brom, J., Rotter, N., & Sadick, H. (2022). Long-term results of a multimodal treatment regimen in patients with auricular keloids. *Ear, Nose & Throat Journal.* https://doi.org/10.1177/01455613221133202

Lee, Y., Minn, K. W., Baek, R. M., & Joo Hong, J. (2001). A new surgical treatment of keloid: Keloid core excision. *Plastic and Reconstructive Surgery, 108*(6), 1460–1464.

Froelich, K., Staudenmaier, R., Kleinsasser, N., & Hagen, R. (2007). Therapy of auricular keloids: Review of different treatment modalities and proposal for a therapeutic algorithm. *European Archives of Oto-Rhino-Laryngology, 264*(12), 1497–1508. https://doi.org/10.1007/s00405-007-0383-0

Bermueller, C., Rettinger, G., & Keck, T. (2010). Auricular keloids: Treatment and results. *European Archives of Oto-Rhino-Laryngology, 267*(4), 575–580. https://doi.org/10.1007/s00405-009-1059-8

Jones, M. E., McLane, J., Adenegan, R., Lee, J., & Ganzer, C. A. (2017). Advancing keloid treatment: A novel multimodal approach to ear keloids. *Dermatologic Surgery, 43*(9), 1164–1169. https://doi.org/10.1097/DSS.0000000000001145

Carvalhaes, S. M., Petroianu, A., Ferreira, M. A. T., de Barros, V. M., & Lopes, R. V. (2015). Avaliação do tratamento de queloide do lóbulo da orelha com infiltração de triancinolona, retirada cirúrgica e compressão da cicatriz. *Revista do Colégio Brasileiro de Cirurgiões, 42*(1), 9–13. https://doi.org/10.1590/0100-69912015001003

Tran, J. V., Lultschik, S. D., Ho, J. S., Sapra, S., Dong, K., & Gusic, K. (2022). Concomitant therapy of surgical shave excision and intralesional injections for ear keloids: Early results from a retrospective cohort study. *Scars, Burns & Healing, 8*, 205951312210985. https://doi.org/10.1177/20595131221098531

Thierauf, J., Walther, M., Rotter, N., Scheithauer, M. O., Hoffmann, T. K., & Veit, J. A. (2017). Treatment of ear keloids: Algorithm for a multimodal therapy regimen. *European Archives of Oto-Rhino-Laryngology, 274*(11), 3859–3866. https://doi.org/10.1007/s00405-017-4714-5

Chen, F., Kuo, Y. R., Huang, C. J., Tang, J. Y., Chiang, C. H., & Huang, M. Y. (2022). Lesion site is the key prognostic factor for keloid patients receiving surgery with adjuvant radiotherapy. *Annals of Plastic Surgery, 89*(6), 626–630. https://doi.org/10.1097/SAP.0000000000003315

Hung, Y. T., Lin, S. M., Tzeng, I. S., & Ng, C. Y. (2022). Optimizing surgical outcome of auricular keloid with a novel multimodal approach. *Scientific Reports, 12*(1), 1–9. https://doi.org/10.1038/s41598-022-07255-8

Kwek, J. W. M., Lee, T. S., & Loh, I. C. Y. (2019). Helical rim advancement – A technique to avoid keloid recurrence. *JPRAS Open, 19*, 61–66. https://doi.org/10.1016/j.jpra.2018.12.006

Kim, D. Y., Kim, E. S., Eo, S. R., Kim, K. S., Lee, S. Y., & Cho, B. H. (2004). A surgical approach for earlobe keloid: Keloid fillet flap. *Plastic and Reconstructive Surgery, 113*(6), 1668–1674. https://doi.org/10.1097/01.PRS.0000117199.47891.4F

Madura, C., Nayak, P. B., Raj, P. R., & Chandrashekar, B. S. (2021). Surgical approach in the management of ear keloids: Our experience with 30 patients. *International Journal of Dermatology, 60*(12), 1553–1560. https://doi.org/10.1111/ijd.15761