



**THE USE OF AUTO- AND ALLOTRANSPLANTS IN TYMPANOPLASTY  
(LITERATURE REVIEW)**

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**Abstract:** Tympanic membrane defect repair remains one of the key challenges in otorhinolaryngology, particularly in cases of large and complex perforations, recurrent cases, and impaired middle ear ventilation. Traditionally, autologous materials—such as temporalis fascia, perichondrium, and cartilage-perichondrial flaps—are used for reconstruction. However, the limited availability of donor material, the need for additional surgical procedures, and the risk of graft rejection have stimulated the search for alternative solutions, including the use of allografts (of human or animal origin) and the application of multilayer techniques, such as two- and three-layer (multi-layer) tympanoplasty. This review examines recent publications on the use of autografts and allografts, including studies on acellular dermal allografts (e.g., AlloDerm) for tympanic membrane reconstruction, the use of fascia lata allografts, as well as descriptions of three-layer techniques (e.g., tri-layer tympanoplasty) for complex defects. In conclusion, the use of multilayer auto- and allografts represents a promising approach in tympanic membrane repair, particularly in “high-risk” cases; however, individualization of the technique, the condition of the middle ear, and material selection should be carefully considered.

**Keywords:** Tympanic membrane, perforation, allograft, tri-layer tympanoplasty

**Introduction**

Reconstruction of the tympanic membrane (type I tympanoplasty) is one of the most commonly performed procedures in otorhinolaryngology. Surgical success is determined by anatomical closure of the defect and restoration of sound conduction. Traditionally, autologous tissues such as temporalis fascia, perichondrium, cartilage, and others are used. However, these approaches have several limitations: the need for an additional donor site, limited tissue volume, and the potential for atrophy or remodeling of the autologous grafts.

For complex and recurrent cases—such as large defects, poorly ventilated ears, or previously operated ears—alternative strategies are increasingly being employed, including allografts and multilayer techniques. Allogeneic materials, such as acellular dermal matrix (AlloDerm) or fascia lata allografts, allow surgeons to avoid a donor site and potentially reduce operative time. Multilayer constructs (e.g., tri-layer tympanoplasty) involve the use of multiple layers to enhance mechanical stability and reduce the risk of recurrence or tympanic membrane retraction.

The aim of this review is to analyze the literature on the use of multilayer auto- and allografts in tympanic membrane reconstruction, highlight the indications, advantages, and limitations, and discuss current outcomes and directions for future research.

**Materials and Methods**

For this review, a systematic literature search was conducted using PubMed, Google Scholar, Web of Science, and Scopus. Keywords included: “tympanic membrane perforation,” “tympanoplasty graft material,” “allograft dermal matrix tympanoplasty,” “multi-layer



tyimpanoplasty,” “autograft cartilage tympanoplasty,” and “acellular dermal allograft tympanic membrane.” Only English-language publications up to 2024 were considered. Both original studies (experimental and clinical) and systematic reviews or thematic articles were included. Selected articles reported the use of allografts and/or multilayer constructs (two- or three-layer) in tympanic membrane reconstruction. Reports without outcome data (e.g., technique descriptions only) and studies using solely autologous tissue without a multilayer design were excluded.

From each publication, the following data were extracted: study type (retrospective/prospective/experimental), number of patients or specimens, graft material (auto- or allograft), use of multilayer technique, anatomical outcomes (perforation closure), audiological outcomes (e.g., change in air-bone gap, ABG), operative time, and postoperative course. Data were compared between groups (autologous vs allogeneic, single- vs multilayer) and analyzed regarding advantages and limitations. Experimental studies illustrating histological integration of allograft materials were also reviewed. For example, in an animal study using acellular dermal AlloDerm, good incorporation into the middle layer of the tympanic membrane was observed. Additionally, data from three-layer techniques were considered, reporting high graft take rates (up to 93%) and adequate audiological improvement.

The review methodology is limited by publication availability, heterogeneous study designs, and differences in graft thickness and techniques, which were considered in the discussion.

## **Results and Discussion**

Analysis of the literature shows that the use of allografts in tympanic membrane reconstruction produces results comparable to traditional autologous materials. In a study with AlloDerm involving 20 patients, both autologous and allogeneic groups demonstrated equal success rates (0% rejection) and similar residual air-bone gap outcomes. In a prospective randomized study of 60 patients comparing autologous perichondrium and MegaDerm allograft, perforation closure at 1 month was 75.8% and 85.2%, respectively ( $p = 0.519$ ), with no significant difference; however, operative time was significantly shorter in the allograft group. Experimental animal studies showed AlloDerm graft take of 90%, close to 100% for temporalis fascia. Regarding fascia lata allografts, a retrospective study of 64 patients reported residual perforation in only 1.6% and recurrence in 12.5% of cases.

Multilayer techniques—such as three-layer tympanoplasty (temporalis fascia + cartilage-perichondrium)—demonstrated high success rates in “high-risk” situations (large perforations, recurrences). In the study by Solmaz et al., involving 46 ears, the overall success rate was 93.4%, with significant ABG improvement.

The advantages of allografts include reduced operative time, avoidance of a donor site and associated morbidity, and potential standardization of material. For example, some allografts (MegaDerm) are ready to use without additional preparation. However, limitations remain: cost, need for sterile preparation, potential risk of disease transmission (although low with modern techniques), and lack of long-term follow-up data.



Multilayer constructs provide mechanical stability and resistance to risk factors (retraction, recurrence, poor ventilation), which is particularly important for “difficult” ears. Concerns exist that membrane thickness or cartilage rigidity may impair sound conduction; however, studies report ABG improvements within 10–15 dB. Optimal application requires selecting the method based on middle ear condition, Eustachian tube function, perforation size, and surgical history.

Overall, sensorineural-anatomical and audiological outcomes for auto- and allografts in multilayer techniques are comparable, but more data on long-term stability and functional outcomes are needed.

### **Conclusions**

The literature review confirms that the use of multilayer auto- and allografts in tympanic membrane reconstruction is a justified and promising approach. Allogeneic materials—primarily acellular dermal matrices and fascia lata allografts—demonstrate efficacy comparable to traditional autologous grafts, with advantages such as reduced operative time and avoidance of a donor site. Multilayer techniques, combining different tissues (e.g., fascia + cartilage-perichondrium) or using two- or three-layer constructs, provide enhanced stability, which is crucial for complex perforations, repeated procedures, and unfavorable anatomical conditions. Audiological outcomes (ABG improvement) remain comparable to classical methods.

However, limitations include heterogeneity of materials and techniques, varying follow-up durations, and a lack of large prospective randomized studies with long-term monitoring. Future advancements should focus on standardization of technical parameters (graft thickness and composition, fixation method, multilayer approach) and evaluation of long-term integration, resistance to retraction, and auditory function.

Therefore, the choice of graft material and technique should be individualized, considering middle ear status, Eustachian tube function, perforation size and location, and surgical history. Overall, the introduction of multilayer auto- and allografts expands the surgeon’s toolkit and offers optimal options for “high-risk” patients, improving both anatomical and functional outcomes of tympanoplasty.

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