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COMPARISON OF TEMPORALIS FASCIA VERSUS FULL-THICKNESS CARTILAGE GRAFTS IN TYPE 1 TYMPANOPLASTIES

Dr Maheen Asghar[*1], Prof. Dr Muhammad Amer Nadeem[2], Dr Muhammad Sharif Shahid[3], Dr Amber Irfan[4]

[*1]maheenasghar14@gmail.com

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Corresponding Author: *
Dr Maheen Asghar

Abstract

Objective:
To compare the anatomical and functional outcomes of full-thickness tragal cartilage grafts versus temporalis fascia grafts in patients undergoing type 1 tympanoplasty.

Methods:
A randomized controlled trial was conducted with 110 patients, randomly allocated into two groups of 55 each. Group A received temporalis fascia grafts, and Group B received full-thickness tragal cartilage grafts. Anatomical success (graft take rate) and functional success (post-operative air-bone gap ≤20 dB) were assessed at six-month follow-up using otoscopy and pure-tone audiometry. Statistical analysis was performed using SPSS version 23.

Results:
The cartilage graft group demonstrated a significantly higher anatomical success rate (89.1%) compared to the fascia group (69.1%) (p=0.011). Both groups showed significant hearing improvement, with no statistically significant difference in post-operative air-bone gaps (p=0.331) or in the proportion of patients achieving a functional success (ABG ≤20 dB) (p=0.270). Subgroup analyses based on age, duration of chronic suppurative otitis media (CSOM), and gender revealed no significant differences in outcomes.

Conclusion:
Full-thickness tragal cartilage grafts provide superior anatomical reliability compared to temporalis fascia in type 1 tympanoplasty, with a significantly higher graft take rate. However, both graft materials yield comparable and satisfactory functional hearing outcomes. Cartilage should be considered a preferable grafting material, especially in high-risk or revision cases, due to its enhanced structural durability.

INTRODUCTION

A tympanoplasty is a surgical procedure to close a tympanic membrane perforation and reconstruct the tympanic membrane and hearing, commonly after chronic otitis media and trauma.[1] In the literature, reconstructing a tympanic membrane perforation was first described by Berthold in 1878.[2] A tympanic membrane perforation is frequently present as a sequela of middle ear infections, trauma, and iatrogenic causes.[3] A tympanoplasty is fundamentally a tissue transference procedure. Various graft materials have been used to close tympanic membrane perforations.[4] These graft materials include temporalis fascia muscle, cartilage, perichondrium, periostea, dura mater, vein tissue, fat, and skin.[5] Many previous studies have compared anatomical and functional outcomes of various graft materials.[6] Anatomical success is typically defined as an intact graft and dry ear on the operated side.

The functional definition of a successful graft is an air-bone gap (ABG) ≤20 dB.[7] Today, the most commonly used graft material is temporalis fascia muscle.[8] Recently, a cartilage graft has begun to be used to reconstruct perforations of the tympanic membrane.[9] Cartilage is resistant to retraction and infection and preserves its viability and shape for a long time in the presence of middle ear pathologies.

Yegin Y et al enrolled 78 patients who underwent type 1 tympanoplasties (40 in temporalis fascia group and 38 in cartilage group). They observed that the graft success rate was 92.1% for the cartilage group compared with 65.0% for the temporal fascia group. In the fascia group, the preoperative and post-operative air-bone gap was 33.68 ±11.44 dB and 24.25±12.68 dB respectively. In the cartilage group, the preoperative and post-operative air-bone gap was 35.68±12.94 dB and 26.11±12.87 dB.[10] Muhammad N et al performed a similar comparative study on 100 patients (50 in each group). They found that pre-operative ABG was 37.28±6.29 in group A while 38.66±4.06 in group B. Post-operative ABG was 15.76±5.3 in group A while 16.56±6.5 in group B. Fascial group had successful graft in 68.6% patients compared to 88% in cartilage group.[11]

We have planned this study to assess anatomical and functional outcomes of full thickness tragal cartilage and fascia in type 1 tympanoplasties in patients with tympanic membrane perforations presenting at our local setting. The study will give an idea regarding outcome (graft success and hearing improvement) of either procedure so that the most suitable method can be practiced in our setting considering local results. The study will also be an addition to the scanty local literature on this comparative analysis.

Methodology:

The study was conducted as a Randomized Controlled Trial at the Department of Otorhinolaryngology, Nishtar Hospital Multan. The trial compared graft success rates between two tympanoplasty techniques over a period of nine months following approval of the synopsis. A total sample size of 110 participants, with 55 in each group, was determined using the WHO sample size calculator based on hypothesized graft success rates of 68.6% in the temporalis fascia group and 88% in the cartilage group, with a 95% confidence level and 80% study power. Participants were selected through non-probability consecutive sampling.

Eligible patients included those aged 18 to 45 years, of either gender, scheduled for type 1 tympanoplasty due to chronic suppurative otitis media lasting three months or longer. Exclusion criteria comprised conditions such as tympanosclerosis, cholesteatoma, cases combined with mastoidectomy or ossiculoplasty, and revision surgeries. After obtaining ethics committee approval and informed consent, patient demographics, duration of CSOM, and baseline audiometric data including air-bone gap were recorded. Participants were randomly assigned to either Group A, receiving temporalis fascia grafts, or Group B, receiving full-thickness tragal cartilage grafts, using a sealed opaque envelope lottery method.

All surgical procedures were performed by a consultant surgeon using an over-underlay grafting technique. Patients were observed for 24 hours postoperatively, discharged with antibiotic coverage, and advised to avoid water exposure in the ear. Follow-up assessments via otoscopy, tympanometry, and pure tone audiometry were conducted at three and six months. Data were analyzed using SPSS version 23, with continuous variables expressed as mean and standard deviation and categorical variables as frequencies and percentages. Graft success rates were compared using the chi-square test, while air-bone gap differences were assessed with an independent samples t-test. Stratified analysis by age, CSOM duration, and gender was also performed, with a p-value of ≤ 0.05 considered statistically significant.

Results

A total of 110 patients were enrolled and randomized into two groups of 55 patients each. All participants completed the six-month follow-up period.

Table 1: Baseline Demographic and Clinical Characteristics

Characteristic	Temporalis Fascia Group (n=55)	Tragal Cartilage Group (n=55)	p-value
Age (years), Mean ± SD	32.4 ± 6.8	31.9 ± 7.2	0.702
Gender, n (%)			0.843
Male	28 (50.9%)	27 (49.1%)	
Female	27 (49.1%)	28 (50.9%)	
Duration of CSOM (months), Mean ± SD	14.2 ± 5.6	15.1 ± 6.3	0.421
Pre-operative Air-Bone Gap (dB), Mean ± SD	36.4 ± 10.2	37.1 ± 11.5	0.735

Table 2: Anatomical Success (Graft Take Rate) at 6 Months

Outcome	Temporalis Fascia Group (n=55)	Tragal Cartilage Group (n=55)	p-value
Successful Graft, n (%)	38 (69.1%)	49 (89.1%)	**0.011***
Graft Failure, n (%)	17 (30.9%)	6 (10.9%)	

***Statistically significant ($p \leq 0.05$)*

Table 3: Functional Outcome (Air-Bone Gap)

Air-Bone Gap (dB)	Temporalis Fascia Group (n=55)	Tragal Cartilage Group (n=55)	p-value
Pre-operative, Mean ± SD	36.4 ± 10.2	37.1 ± 11.5	0.735
Post-operative (6 months), Mean ± SD	18.9 ± 9.8	17.2 ± 8.5	0.331
Mean Improvement (dB), Mean ± SD	17.5 ± 7.3	19.9 ± 8.1	0.104

Table 4: Functional Success (Post-operative ABG ≤20 dB) at 6 Months

Outcome	Temporalis Fascia Group (n=55)	Tragal Cartilage Group (n=55)	p-value
ABG ≤20 dB, n (%)	39 (70.9%)	44 (80.0%)	0.270
ABG >20 dB, n (%)	16 (29.1%)	11 (20.0%)	

Subgroup Analysis

Stratified analysis by age (<30 vs ≥30 years), duration of CSOM (<12 vs ≥12 months), and gender showed no statistically significant differences in graft success rates or post-operative ABG between the two surgical groups within any subgroup (all p-values >0.05).

Discussion:

This study further strengthens the evidence that full-thickness tragal cartilage grafts offer superior anatomical reliability compared with temporalis fascia in type I tympanoplasty. Cartilage demonstrated a markedly higher graft uptake rate, a finding that mirrors multiple earlier studies emphasizing the biomechanical advantages of cartilage, including its rigidity, resistance to negative middle-ear pressure, and reduced susceptibility to postoperative retraction or atrophy [12, 13, 14]. These properties make cartilage particularly valuable in ears with unfavorable conditions such as chronic eustachian tube dysfunction, adhesive otitis media, or revision scenarios. In contrast, temporalis fascia, though widely used and acoustically compliant, may undergo postoperative shrinkage, contributing to comparatively lower graft stability.

Despite this anatomical superiority, both graft types resulted in significant improvement in hearing thresholds, and no statistically significant difference was observed between the two groups in terms of postoperative air-bone gap closure. This aligns with previous work suggesting that the acoustic superiority of fascia is often clinically comparable to that of cartilage, especially when the cartilage is

sculpted to a thin, flexible plate that preserves its vibratory properties [12, 14]. These findings highlight that while cartilage excels in structural durability, both materials are capable of achieving satisfactory functional outcomes.

When comparing our results with other referenced studies, it becomes evident that findings across the literature are not entirely uniform. One referenced study reported no significant difference between cartilage and fascia in either anatomical or hearing outcomes, which contrasts with our data showing significantly higher graft success with cartilage [13]. This discrepancy may be attributed to variations in surgical technique, graft thickness, patient selection, or follow-up duration. Conversely, another study supports our results, reporting better graft integration and audiological outcomes with cartilage-based grafts [14]. Meanwhile, comparison with pediatric data revealed partial agreement: although hearing outcomes were similar to ours, the pattern of graft success differed, likely due to anatomical and physiological differences unique to the pediatric population [15].

Overall, the consistency of improved anatomical stability with cartilage across several studies, including our own, suggests that cartilage grafting should be strongly considered—particularly in high-risk or revision tympanoplasty. The comparable functional outcomes between the two graft materials further reinforce that cartilage does not compromise hearing restoration. Collectively, these findings support the continued integration of cartilage grafting into standard otologic practice and highlight its value as a dependable, versatile grafting option in modern tympanoplasty.

Conclusion

The findings of this study demonstrate that while both full-thickness tragal cartilage and temporalis fascia grafts provide significant and comparable hearing improvement in type 1 tympanoplasty, the cartilage graft offers a statistically superior anatomical success rate, with a graft take rate of 89.1% compared to 69.1% for fascia. This superior structural reliability, attributed to cartilage's resistance to retraction and infection, supports its consideration as the preferable graft material, particularly in high-risk or revision cases, without compromising functional auditory outcomes.

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