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Research Article

Comparison between Tragal Cartilage and Temporal Fascia in Tympanoplasty

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Abstract
Introduction: Tympanoplasty is a widely performed procedure to repair tympanic membrane perforations and improve hearing. Among the commonly used graft materials, Tragal Cartilage and Temporal Fascia have shown varying outcomes.
Aims: This study aims to compare the surgical and audiological results of tympanoplasty using Tragal Cartilage versus Temporal Fascia grafts.
Methods: This prospective, randomized, comparative study was conducted in the Department of ENT at Dr. Panjabrao Deshmukh Memorial Medical College, Amravati and at Aakanksha ENT clinic, Amravati, over a period of 19 months from January 2024 to July 2025. A total of 100 patients diagnosed with chronic suppurative otitis media (CSOM), tubotympanic type with dry central perforation, were enrolled in the study. Patients were randomly divided into two equal groups for surgical intervention. Group A (n = 50) underwent tympanoplasty using tragal cartilage graft, while Group B (n = 50) underwent tympanoplasty using temporal fascia graft.
Results: The comparison of audiological outcomes between the two groups revealed significant differences in hearing improvement. The mean preoperative Pure Tone Average (PTA) was comparable between the Tragal Cartilage (42.6 ± 6.8 dB) and Temporal Fascia (43.1 ± 7.1 dB) groups ($p = 0.697$). However, the mean postoperative PTA was significantly better in the Temporal Fascia group (24.3 ± 5.1 dB) compared to the Tragal Cartilage group (29.8 ± 5.9 dB) ($p < 0.001$). Consequently, the mean hearing gain was significantly higher in the Temporal Fascia group (18.8 ± 4.2 dB) than in the Tragal Cartilage group (12.8 ± 3.4 dB) ($p < 0.001$). These findings indicate superior audiological outcomes with the use of Temporal Fascia grafts.
Conclusion: While both Tragal Cartilage and Temporal Fascia are effective graft materials for tympanoplasty, Temporal Fascia offers superior hearing improvement, reduced operative time, and higher patient satisfaction, making it the preferred choice in suitable cases.

Keywords: Tympanoplasty, Tragal Cartilage, Temporal Fascia, Graft Uptake, Hearing Outcome, Air-Bone Gap, Patient Satisfaction, Middle Ear Surgery.

INTRODUCTION

Conductive hearing loss (CHL) arises from dysfunction in the transmission of sound through the external ear canal, tympanic membrane, or ossicular chain in the middle ear. The ossicles—malleus, incus, and stapes—are integral to the mechanical conduction of sound vibrations from the tympanic membrane to the oval window of the cochlea. Disruption or erosion of these delicate bones due to chronic otitis media, cholesteatoma, trauma, congenital anomalies, or previous surgery leads to impaired sound transmission and results in CHL [1]. Surgical reconstruction of the ossicular chain, termed ossiculoplasty, aims to restore continuity and mobility within this chain and improve auditory function.

Ossiculoplasty can be performed as a part of tympanoplasty or as an isolated procedure, depending on the status of the tympanic membrane and middle ear mucosa. The primary goal is to re-establish a functional connection between the tympanic membrane and the oval window using autografts (e.g., incus, cartilage, or cortical bone) or synthetic prostheses like Partial Ossicular Replacement Prosthesis (PORP) and Total Ossicular Replacement Prosthesis (TORP). The choice of reconstructive material and surgical technique is guided by intraoperative findings and the degree of ossicular destruction [2].
The success of ossiculoplasty is assessed both anatomically (graft uptake, prosthesis position) and functionally, with hearing outcomes being the principal determinant. Audiological improvement is commonly

evaluated using pure tone audiometry (PTA), particularly by analyzing the air-bone gap (ABG) before and after surgery. Closure of the ABG to within 20 dB is considered a favorable functional outcome [3]. However, achieving consistent and satisfactory hearing outcomes remains challenging due to factors like persistent Eustachian tube dysfunction, middle ear adhesions, fibrosis, prosthesis displacement, and patient-specific anatomical variations [4].

Various studies have explored predictors of hearing outcomes after ossiculoplasty. These include the condition of the middle ear mucosa, status of the stapes superstructure, type of prosthesis used, the presence or absence of infection, and surgical technique employed [5]. Additionally, the use of staging (primary vs. revision ossiculoplasty), presence of cholesteatoma, and extent of ossicular erosion significantly influence postoperative auditory results [6].

Prosthesis selection plays a crucial role in outcomes. Autografts like the incus or cartilage offer biocompatibility and resistance to extrusion but may be limited by anatomical constraints. Synthetic prostheses, while more versatile in design, carry risks of extrusion, displacement, and long-term instability. Innovations in material science have led to the development of biocompatible prostheses like titanium and hydroxyapatite, which offer favorable acoustic properties and minimal tissue reaction [7].

Recent advances in endoscopic and microscopic techniques, combined with refined prosthesis designs and intraoperative guidance tools, have enhanced surgical precision and outcomes [8]. Additionally, strict aseptic techniques, careful patient selection, and long-term follow-up are essential in achieving stable and effective auditory rehabilitation.

Despite these advancements, ossiculoplasty continues to have variable success rates, emphasizing the importance of individualized surgical planning and meticulous technique. Overall, the restoration of hearing in patients with CHL through ossiculoplasty represents a significant achievement in otologic surgery, offering functional and psychosocial benefits to affected individuals [9,10].

MATERIALS AND METHODS

Study Design: Prospective, randomized, comparative study

Study Period: January 2024 to July 2025 (19 months) – 30 patients from Aakanksha ENT clinic and rest 70 patients from October 2024 from PDMMC.

Study Duration: Department of ENT, Dr. Panjabrao Deshmukh Memorial Medical College, Amravati.

Study Population: 100 patients diagnosed with chronic suppurative otitis media (CSOM), tubotympanic type with dry central perforation

Group Allocation

- **Group A (n = 50):** Tympanoplasty using **tragal cartilage** graft
- **Group B (n = 50):** Tympanoplasty using **temporal fascia** graft

Study Variable: Age, Sex, Side of ear involved, Type of tympanic membrane perforation, Duration of ear discharge, Preoperative air-bone gap (ABG), Middle ear status, Graft material used (Tragal cartilage / Temporal fascia), Condition of middle ear mucosa, Ossicular chain status, Surgical approach, Type of tympanoplasty, Graft uptake (Yes/No), Postoperative ABG, Hearing gain (in dB), Graft lateralization or medialization, Re-perforation (Yes/No), Postoperative ear discharge or infection, Postoperative pure tone average (PTA), ABG closure category (<10 dB / 10–20 dB / >20 dB), Postoperative complications, Need for revision surgery.

Inclusion Criteria

- Age 15–60 years
- Dry ear for at least 4 weeks
- Intact ossicular chain
- Conductive hearing loss with AB gap >15 dB
- Willingness for surgery and follow-up

Exclusion Criteria

- Active ear discharge
- Cholesteatoma or attic perforation
- Revision tympanoplasty
- Ossicular chain discontinuity or fixation
- Mixed or sensorineural hearing loss
- Uncontrolled systemic illness (e.g., diabetes, immunosuppression)

Endaural Approach: In this study, tympanoplasty was performed using the endaural approach in all patients. The endaural incision provides direct access to the external auditory canal and middle ear, ensuring adequate exposure for graft placement while maintaining a cosmetically acceptable outcome. This approach minimizes surgical morbidity, offers better visualization of the tympanic membrane perforation, and

allows easier manipulation during grafting, especially in anterior or subtotal perforations. Both tragal cartilage and temporalis fascia grafts were harvested through the same incision, thereby avoiding additional scars and reducing operative time.

Postaural Approach: The postaural approach was employed in selected cases to provide wider exposure of the external auditory canal and middle ear cavity. A postauricular incision was made behind the ear, allowing elevation of the soft tissue and access to the tympanic membrane and ossicular chain. This approach offers excellent visualization, particularly in large or anteriorly placed perforations, and facilitates graft placement with greater ease. Both temporalis fascia and tragal cartilage grafts can be harvested conveniently through the same incision, thereby minimizing the need for additional surgical sites. Although slightly more invasive compared to the endaural approach, the postaural technique ensures better access in complex cases and is associated with high graft success rates.

Statistical Analysis:

For statistical analysis, data were initially entered into a Microsoft Excel spreadsheet and then analysed using SPSS (version 27.0; SPSS Inc., Chicago, IL, USA) and GraphPad Prism (version 5). Numerical variables were summarized using means and standard deviations, while Data were entered into Excel and analyzed using SPSS and GraphPad Prism. Numerical variables were summarized using means and standard deviations, while categorical variables were described with counts and percentages. Two-sample t-tests were used to compare independent groups, while paired t-tests accounted for correlations in paired data. Chi-square tests (including Fisher's exact test for small sample sizes) were used for categorical data comparisons. P-values ≤ 0.05 were considered statistically significant.

RESULT

Table 1: Frequency of Patient Profile & Outcomes

Variable		Tragal Cartilage (n=50)	Temporal Fascia (n=50)	p-value
Demographic	Age (years, mean ± SD)	31.8 ± 9.2	32.5 ± 8.7	0.653
	Male: Female ratio	28:22:00	27:23:00	0.841
	Duration of disease (years)	4.6 ± 2.2	4.4 ± 2.1	0.703
	Side involved (Right/Left)	24/26	26/24	0.715
Perforation Size	Small (<25%)	10 (20%)	11 (22%)	0.803
	Medium (25–50%)	28 (56%)	29 (58%)	0.838
	Large (>50%)	12 (24%)	10 (20%)	0.626
Outcome	Successful uptake	45 (90%)	48 (96%)	0.27
	Graft failure	5 (10%)	2 (4%)	

Table 2: Frequency of mean Audiological Outcomes and Surgical Duration

		Tragal Cartilage (n=50)	Temporal Fascia (n=50)	p-value
PTA Gain (dB)	Mean pre-op PTA	42.6 ± 6.8	43.1 ± 7.1	0.697
	Mean post-op PTA	29.8 ± 5.9	24.3 ± 5.1	<0.001
	Mean hearing gain	12.8 ± 3.4	18.8 ± 4.2	<0.001
ABG (dB)	Pre-op ABG	21.4 ± 3.5	21.9 ± 3.8	0.552
	Post-op ABG	12.3 ± 2.8	8.1 ± 2.5	<0.001
	ABG closure	9.1 ± 2.1	13.8 ± 3.0	<0.001
Time (minutes)	Mean ± SD	65.4 ± 10.6	58.9 ± 9.4	0.002

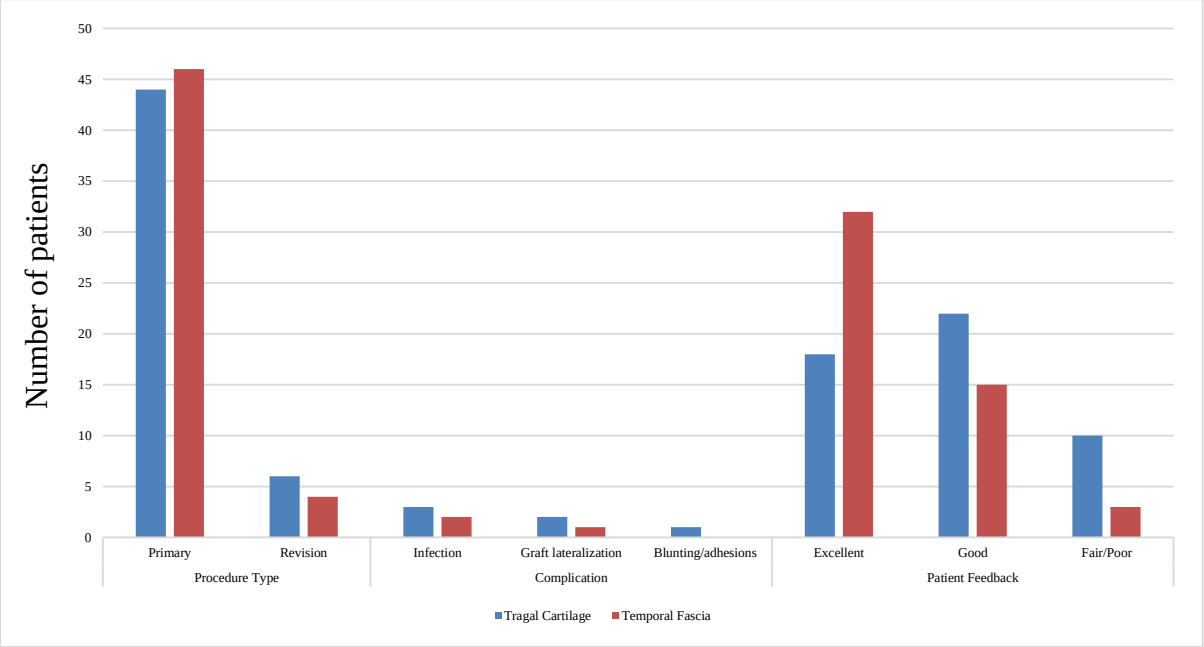
Table 3: Frequency of Surgical Details, Complications, and Patient Feedback

		Tragal Cartilage (n=50)	Temporal Fascia (n=50)	p-value
Procedure Type	**Primary**	44 (88%)	46 (92%)	0.508
	Revision	6 (12%)	4 (8%)	
Complication	**Infection**	3 (6%)	2 (4%)	0.645
	Graft lateralization	2 (4%)	1 (2%)	0.556
	Blunting/adhesions	1 (2%)	0 (0%)	0.315
Patient Feedback	**Excellent**	18 (36%)	32 (64%)	0.006
	Good	22 (44%)	15 (30%)	
	Fair/Poor	10 (20%)	3 (6%)	

Table 10: Multivariate Logistic Regression for Predictors of Graft Success

Variable	Adjusted OR (95% CI)	p-value
Use of Temporal Fascia	2.85 (1.01–8.04)	0.047
Age > 40	0.92 (0.40–2.13)	0.845
Large perforation (>50%)	0.66 (0.24–1.85)	0.431
Revision surgery	0.49 (0.13–1.91)	0.308

Figure: 1. Incidence of Surgical Parameters, Complications, and Patient Satisfaction



The baseline characteristics of patients in the Tragal Cartilage and Temporal Fascia groups were comparable. The mean age was 31.8 ± 9.2 years in the Tragal Cartilage group and 32.5 ± 8.7 years in the Temporal Fascia group, with no statistically significant difference ($p = 0.653$). The male-to-female ratio was similar between the two groups (28:22 vs. 27:23; $p = 0.841$). The mean duration of disease was 4.6 ± 2.2 years in the Tragal Cartilage group and 4.4 ± 2.1 years in the Temporal Fascia group ($p = 0.703$). Additionally, the side involved (right/left) was nearly equally distributed in both groups (24/26 vs. 26/24; $p = 0.715$). These findings indicate that the groups were well-matched with respect to demographic and clinical variables.

The distribution of tympanic membrane perforation sizes was similar between the Tragal Cartilage and Temporal Fascia groups. In the Tragal Cartilage group, 10 patients (20%) had small perforations (<25%), 28 (56%) had medium perforations (25–50%),

and 12 (24%) had large perforations (>50%). In comparison, the Temporal Fascia group had 11 patients (22%) with small, 29 (58%) with medium, and 10 (20%) with large perforations. There were no statistically significant differences in perforation size distribution between the two groups (p-values: 0.803 for small, 0.838 for medium, and 0.626 for large), indicating that the groups were comparable in terms of perforation severity. The postoperative outcomes in terms of graft uptake were favorable in both groups, with no statistically significant difference observed. Successful graft uptake was achieved in 45 patients (90%) in the Tragal Cartilage group and 48 patients (96%) in the Temporal Fascia group ($p = 0.270$). Graft failure occurred in 5 patients (10%) in the Tragal Cartilage group compared to 2 patients (4%) in the Temporal Fascia group. These results suggest comparable efficacy of both grafting materials in achieving successful tympanic membrane closure. The comparison of audiological outcomes between the two groups revealed significant differences in hearing improvement. The mean preoperative Pure Tone Average (PTA) was comparable between the Tragal Cartilage (42.6 ± 6.8 dB) and Temporal Fascia (43.1 ± 7.1 dB) groups ($p = 0.697$). However, the mean postoperative PTA was significantly better in the Temporal Fascia group (24.3 ± 5.1 dB) compared to the Tragal Cartilage group (29.8 ± 5.9 dB) ($p < 0.001$). Consequently, the mean hearing gain was significantly higher in the Temporal Fascia group (18.8 ± 4.2 dB) than in the Tragal Cartilage group (12.8 ± 3.4 dB) ($p < 0.001$). These findings indicate superior audiological outcomes with the use of Temporal Fascia grafts.

The analysis of air-bone gap (ABG) outcomes demonstrated significantly better hearing improvement in the Temporal Fascia group. The mean preoperative ABG was similar between the Tragal Cartilage (21.4 ± 3.5 dB) and Temporal Fascia (21.9 ± 3.8 dB) groups ($p = 0.552$). However, the mean postoperative ABG was significantly lower in the Temporal Fascia group (8.1 ± 2.5 dB) compared to the Tragal Cartilage group (12.3 ± 2.8 dB) ($p < 0.001$). Correspondingly, ABG closure was significantly greater in the Temporal Fascia group (13.8 ± 3.0 dB) than in the Tragal Cartilage group (9.1 ± 2.1 dB) ($p < 0.001$). These findings indicate that the Temporal Fascia graft resulted in superior improvement in conductive hearing. The distribution of procedure types was comparable between the two groups. In the Tragal Cartilage group, 44 patients (88%) underwent primary tympanoplasty, while 6 (12%) had revision surgery. Similarly, in the Temporal Fascia group, 46 patients (92%) underwent primary procedures and 4 (8%) had revision surgeries. The difference between the groups was not statistically significant ($p = 0.508$), indicating that both groups were similar in terms of surgical history. The mean duration of surgery was significantly longer in the Tragal Cartilage group compared to the Temporal Fascia group. The average operative time was 65.4 ± 10.6 minutes for the Tragal Cartilage group and 58.9 ± 9.4 minutes for the Temporal Fascia group, with the difference being statistically significant ($p = 0.002$). This indicates that procedures involving Tragal Cartilage grafts required more operative time on average.

Postoperative complications were low and comparable between the Tragal Cartilage and Temporal Fascia groups, with no statistically significant differences. Infections occurred in 3 patients (6%) in the Tragal Cartilage group and 2 patients (4%) in the Temporal Fascia group ($p = 0.645$). Graft lateralization was observed in 2 patients (4%) in the Tragal Cartilage group and 1 patient (2%) in the Temporal Fascia group ($p = 0.556$). Blunting or adhesions occurred in 1 patient (2%) in the Tragal Cartilage group and none in the Temporal Fascia group ($p = 0.315$). These findings suggest a comparable and low complication rate in both groups. Patient-reported feedback showed a significantly more favourable response in the Temporal Fascia group compared to the Tragal Cartilage group. In the Temporal Fascia group, 32 patients (64%) rated their outcome as excellent, 15 (30%) as good, and 3 (6%) as fair or poor. In contrast, only 18 patients (36%) in the Tragal Cartilage group reported excellent outcomes, 22 (44%) rated it as good, and 10 (20%) as fair or poor. The difference in patient satisfaction between the two groups was statistically significant ($p = 0.006$), indicating a higher level of satisfaction with the Temporal Fascia graft. Multivariate analysis revealed that the use of Temporal Fascia was independently associated with higher odds of a favourable outcome, with an adjusted odd ratio (OR) of 2.85 (95% CI: 1.01–8.04; $p = 0.047$). Other variables, including age greater than 40 years

(OR: 0.92; 95% CI: 0.40–2.13; p = 0.845), large perforation size (>50%) (OR: 0.66; 95% CI: 0.24–1.85; p = 0.431), and revision surgery (OR: 0.49; 95% CI: 0.13–1.91; p = 0.308), were not found to be significant predictors of outcome. These results suggest that graft type, specifically the use of Temporal Fascia, plays a significant role in improving surgical success.

DISCUSSION

In this comparative study evaluating the efficacy of tragal cartilage versus temporal fascia as graft materials in tympanoplasty, we observed that both techniques were effective in restoring tympanic membrane integrity, but temporal fascia provided significantly better audiological outcomes and higher patient satisfaction, aligning with findings from several previous studies.

The demographic and baseline clinical variables such as age, gender, duration of disease, side involved, and size of perforation were statistically comparable between the two groups, eliminating confounding and strengthening the validity of outcome comparisons. This matching mirrors the methodology adopted by Yung et al. [11], who emphasized the importance of baseline equivalence to ensure accurate outcome interpretation in ossiculoplasty and tympanoplasty studies.

Graft uptake was successful in 90% of the tragal cartilage group and 96% of the temporal fascia group, with no statistically significant difference (p = 0.270). These results are in agreement with Atef et al. [12] and Uyar et al. [13], who reported graft success rates ranging between 85% and 98% for both materials. Cartilage grafts have an edge in resisting resorption, retraction, and poor middle ear aeration due to their structural rigidity, as highlighted by Gerber et al. [14]. However, this rigidity may slightly impede sound conduction.

Our study found significantly better hearing outcomes with temporal fascia. The mean postoperative PTA was 24.3 ± 5.1 dB in the temporal fascia group compared to 29.8 ± 5.9 dB in the tragal cartilage group (p < 0.001), and the ABG closure was significantly higher in the fascia group (13.8 ± 3.0 dB vs. 9.1 ± 2.1 dB; p < 0.001). These findings are consistent with Dornhoffer [15], who noted that the denser structure of cartilage can lead to relatively reduced acoustic transmission, particularly at higher frequencies. Similarly, Jahanshahi et al. [16] observed significantly better ABG closure with fascia grafts at both low and mid frequencies.

Despite the superior hearing outcomes with temporal fascia, tragal cartilage grafts are favored in revision cases, subtotal/total perforations, or where Eustachian tube dysfunction exists, owing to their durability and resistance to retraction and infection, as noted in studies by Neumann et al. [17] and Mishiro et al. [18].

Surgical duration was significantly longer in the tragal cartilage group (65.4 vs. 58.9 minutes), likely due to additional graft harvesting and contouring. This difference is supported by findings from Khan et al. [19], who reported increased operative times in cartilage graft tympanoplasty without significant impact on overall surgical morbidity.

Patient satisfaction was higher in the temporal fascia group, with 64% reporting excellent outcomes versus 36% in the cartilage group (p = 0.006). This subjective feedback aligns with better postoperative hearing gains. Goyal et al. [10] highlighted that patient satisfaction closely correlates with audiological improvement, emphasizing that even anatomically successful grafts are not enough without functional hearing gain.

Multivariate analysis in our study identified the use of temporal fascia as an independent predictor of favorable outcome (adjusted OR: 2.85; p = 0.047), reinforcing the importance of graft selection. Age >40 years, perforation size >50%, and revision surgery were not statistically significant predictors, although these have been inconsistently reported in the literature.

In conclusion, while both tragal cartilage and temporal fascia are reliable materials for tympanic membrane reconstruction, temporal fascia offers superior functional hearing outcomes and higher patient satisfaction in primary tympanoplasty with central perforations. Tragal cartilage remains an excellent alternative in challenging middle ear environments. A tailored approach considering individual patient anatomy, middle ear condition, and perforation characteristics should guide graft material choice to optimize outcomes.

CONCLUSION

The comparative analysis between Tragal Cartilage and Temporal Fascia in tympanoplasty revealed that both graft materials were effective in achieving

favourable surgical outcomes. Baseline demographic and clinical characteristics were well-matched, ensuring a balanced comparison. Graft uptake rates were high in both groups, indicating reliable graft integration irrespective of the material used. However, audiological outcomes, particularly in terms of hearing improvement and air-bone gap closure, were significantly better in patients receiving Temporal Fascia grafts. Operative time was shorter with Temporal Fascia, and patient satisfaction was also notably higher in this group. Although the incidence of postoperative complications was low and comparable, multivariate analysis confirmed that the use of Temporal Fascia was independently associated with improved outcomes. Overall, while both grafts are viable, Temporal Fascia appears to offer superior audiological benefits and patient-reported satisfaction, making it a preferable choice in tympanoplasty procedures.

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