

A PROSPECTIVE AND COMPARATIVE STUDY OF THE OUTCOME OF PALISADE CARTILAGE WITH TEMPORALIS FASCIA GRAFT TYMPANOPLASTY VERSUS TEMPORALIS FASCIA GRAFT TYMPANOPLASTY

M. Sivakumar¹, N.Raghuram², G. Divya Priya³, R. Suriyaprabha⁴

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Corresponding Author:

Dr. R. Suriyaprabha,
Email: suriyaprabha33@gmail.com

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¹Associate Professor, Department of ENT, Government Medical College, Tirupur, Tamil Nadu, India

²Assistant Professor, Department of ENT, Government Medical College, Tirupur, Tamil Nadu, India

³Assistant Professor, Department of ENT, Government Medical college, Tirupur, Tamil Nadu, India

⁴Special Training Resident, Department of ENT, Government Medical college, Tirupur, Tamil Nadu, India

ABSTRACT

Background: Tympanoplasty is defined as a procedure to eradicate disease in the middle ear and to reconstruct the hearing mechanism, with or without tympanic membrane grafting. Although temporalis fascia and perichondrium still remain most commonly used grafts in tympanoplasty, they have the potential to atrophy and failure in case of high risk ears like Atelectasis and Cholesteatoma, etc. the aim is to compare the anatomical and functional outcomes of palisade cartilage with temporalis fascia graft tympanoplasty and Temporalis fascia graft tympanoplasty. **Materials and Methods:** A prospective comparative study was conducted on 50 patients with inactive mucosal chronic otitis media and tympanic membrane perforation. Patients were divided into two groups of 25 each, among which, in Group A, out of 25, 12 were male patients and 13 were female patients; In Group B, 15 were male patients and 10 were Female patients. Group A underwent palisade cartilage with temporalis fascia graft tympanoplasty, while Group B underwent Temporalis fascia graft tympanoplasty, all patients belonging to age group between 20 to 40 years of age. Patients were followed up at 2, 4, and 6 months. In the Palisade technique, the cartilage is sectioned into several slices, which are pieced together to reconstruct the tympanic membrane. The following two parameters were studied: 1. The Graft uptake was assessed by oto-microscopic examination. 2. Hearing outcomes were assessed using pure tone audiometry and mean air-bone gap (ABG). **Result:** In the present study, both groups demonstrated progressive reduction in mean postoperative ABG over the 6-month follow-up period. The palisade cartilage group showed a slightly better numerical hearing outcome, but the difference was not statistically significant. This finding is consistent with the general literature, which suggests that cartilage may provide better graft stability without producing a clinically important disadvantage in hearing outcomes. Categorical variables were compared using the chi-square test and continuous variables using Student's independent t-test. A p-value <0.05 was considered statistically significant. **Conclusion:** Palisade cartilage with temporalis fascia graft tympanoplasty demonstrated a higher numerical graft uptake rate than Temporalis fascia graft tympanoplasty during 6 months of follow-up, while both techniques produced comparable hearing outcomes. Cartilage reinforcement may offer improved structural stability without compromising postoperative hearing.

INTRODUCTION

Tympanoplasty (TP) is a surgical procedure for removing the middle ear disease in patients with

COM to achieve a dry ear and reconstruct the hearing mechanism.^[1]

The most commonly used graft material is temporalis fascia. However, it is quite possible to have re-perforation or retraction of the eardrum after

reconstruction with temporalis fascia graft, which can change its shape due to uneven shrinkage and thickening, even in the early days of the procedure.^[2] To overcome these issues, many otologists nowadays routinely use cartilage as graft material, while others perform cortical mastoidectomy over and above the tympanoplasty. The cartilage's benefits are that it maintains its firmness and resists resorption and retraction, even in the milieu of continuous eustachian tube dysfunction.^[3]

Cartilage as a graft material resists negative middle ear pressure to a much greater degree than fascia due to its rigidity.^[4]

Hearing outcome and graft take in patients of CSOM with sclerotic mastoids were studied using the novel technique of palisade cartilage tympanoplasty.^[5]

The cartilage tympanoplasty technique consists of a heterogeneous group of techniques, including the cartilage-perichondrium composite graft, butterfly techniques, diced cartilage, and palisade cartilage tympanoplasty.^[6-8]

The present study was designed to prospectively compare the anatomical graft uptake and functional hearing outcomes of palisade cartilage with temporalis fascia graft tympanoplasty versus Temporalis graft tympanoplasty.

Aims and Objectives

Aim

To compare the outcome of palisade cartilage with temporalis fascia graft tympanoplasty and Temporalis graft tympanoplasty.

Objectives

1. To compare graft uptake rates between the two surgical techniques at 2, 4, and 6 months.
2. To compare postoperative hearing outcomes using pure tone audiometry and mean air-bone gap.
3. To assess whether the difference in graft uptake between the two techniques is statistically significant using the chi-square test.
4. To compare hearing outcomes between the two groups using Student's independent t-test.

MATERIALS AND METHODS

Study Design: Prospective comparative observational/interventional study.

Sample Size: A total of 50 patients were included.

- Group A: 25 patients — Palisade cartilage with temporalis fascia graft tympanoplasty.
- Group B: 25 patients — Temporalis fascia graft tympanoplasty.

Study Population: Patients presenting with inactive mucosal chronic otitis media with tympanic membrane perforation and conductive hearing loss coming to Government Medical College and Hospital – Tirupur were included.

Inclusion Criteria

- Patients with inactive mucosal chronic otitis media.
- Age group belonging from 20 to 40 years of age

- Dry ear for at least 4 weeks.
- Central, large, or subtotal tympanic membrane perforation.
- Intact or functionally adequate ossicular chain.
- Patients willing to undergo surgery and attend follow-up visits.

Exclusion Criteria

- Active ear discharge at the time of surgery.
- Cholesteatoma.
- Ossicular discontinuity requiring reconstruction.
- Previous major middle-ear surgery in the same ear.
- Sensorineural or mixed hearing loss.
- Patients unavailable for 6-month follow-up.

Preoperative Evaluation

All patients underwent:

- Detailed history and Otologic examination.
- Oto - microscopic examination.
- Pure tone audiometry.
- Assessment of air conduction and bone conduction thresholds.
- Calculation of the preoperative air-bone gap.
- Routine preoperative investigations as indicated.

Follow-up

Patients were evaluated at:

- 2 months
- 4 months
- 6 months

At each follow-up, graft status was assessed by Otomicroscopy. Hearing was evaluated using pure tone audiometry.

RESULTS

Primary Outcome: Successful graft uptake, defined as an intact and well-healed tympanic membrane without residual or recurrent perforation.

Secondary Outcome: Hearing improvement assessed by postoperative mean air-bone gap.

Statistical Analysis: Categorical variables, including graft uptake, were analyzed using the chi-square test. Continuous variables, including mean air-bone gap, were analyzed using Student's independent t-test. A p-value of <0.05 was considered statistically significant.

Operative Procedure: Group A: Palisade Cartilage with Temporalis Fascia Graft Tympanoplasty

After adequate anesthesia, the external auditory canal was prepared and the perforation margins were freshened. Tympano meatal flap was elevated according to the selected surgical approach. The middle ear was inspected and any inflammatory tissue was removed.

Temporalis fascia was harvested through a postauricular or temporal incision and prepared for use. Cartilage was harvested from the cyma concha, depending on the surgical requirement. The cartilage was thinned appropriately and fashioned into multiple narrow strips.

The temporalis fascia graft was positioned in the underlay plane. Multiple cartilage strips were placed

in a palisade configuration over the fascia, maintaining appropriate spacing and orientation to reconstruct the tympanic membrane. The tympanomeatal flap was repositioned and the external auditory canal was packed appropriately. Group B: Temporalis Fascia Graft Tympanoplasty The tympanic membrane perforation margins were freshened and the tympanomeatal flap was elevated. Temporalis fascia was harvested, prepared, and placed as an underlay graft beneath the tympanic membrane remnant and malleus handle where appropriate. The flap was repositioned and the external auditory canal was packed. All patients received standardized postoperative care and were followed at the scheduled intervals.



Figure 1: Conchal Cartilage cut into thin palisade strips



Figure 2: Post operative appearance of Tympanic membrane after 4 months following Palisade cartilage with temporalis fascia graft tympanoplasty

Graphical Representation

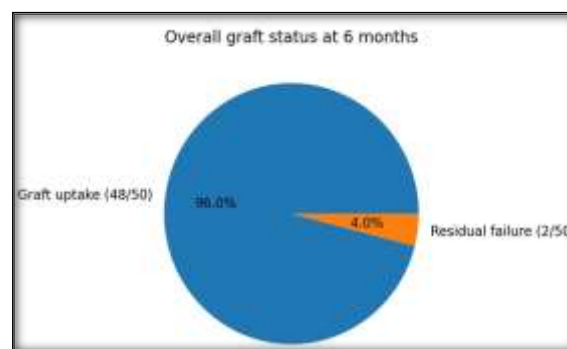
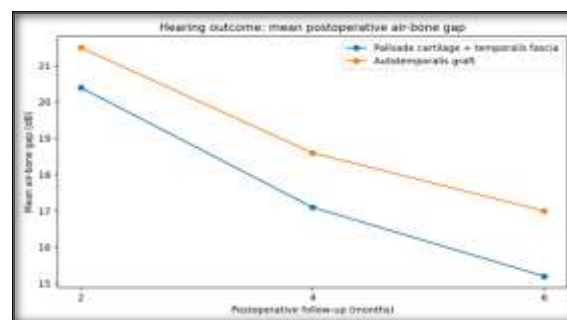
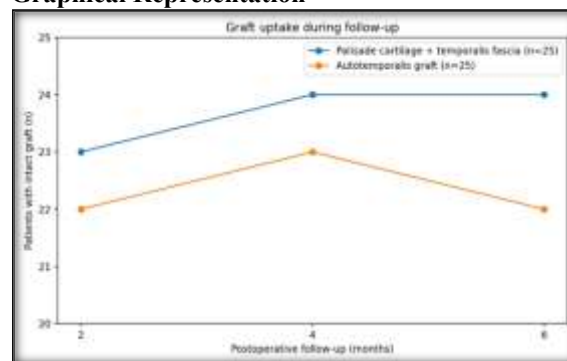


Table 1: Graft Uptake at 2, 4, and 6 Months

Follow-up	Group A: Palisade cartilage + temporalis fascia	Group B: Temporalis graft	χ^2	p-value
2 months	23/25 (92%)	22/25 (88%)	0.22	0.637
4 months	24/25 (96%)	23/25 (92%)	0.35	0.552
6 months	24/25 (96%)	22/25 (88%)	1.09	0.297

There was a numerically higher graft uptake rate in the palisade cartilage group at all follow-up intervals.

However, the difference between the groups was not statistically significant.

Table 2: Hearing Outcome: Mean Postoperative Air-Bone Gap

Follow-up	Group A Mean ABG ± SD (dB)	Group B Mean ABG ± SD (dB)	t-value	p-value
2 months	20.4 ± 5.8	21.5 ± 6.1	-0.65	0.517
4 months	17.1 ± 5.1	18.6 ± 5.7	-0.98	0.332
6 months	15.2 ± 4.8	17.0 ± 5.2	-1.27	0.210

Both groups showed progressive improvement in hearing during follow-up. The palisade cartilage group showed a slightly lower mean postoperative

ABG at each follow-up, but the difference was not statistically significant.

Table 3: Gender Distribution of Study Participants (n = 50)

Gender	Group A (Palisade Cartilage + Temporalis Fascia) n=25	Group B (Temporalis Graft) n=25	Total (n=50)
Male	12 (48.0%)	15 (60.0%)	27 (54.0%)

Female	13 (52.0%)	10 (40.0%)	23 (46.0%)
Total	25 (100%)	25 (100%)	50 (100%)

In the present illustrative dataset, graft uptake was higher in the palisade cartilage with temporalis fascia group than in the Temporalis fascia graft group at all follow-up points. At 6 months, the graft uptake rate was 96% in the palisade cartilage with Temporalis fascia group compared with 88% in the Temporalis fascia group. Although this difference was clinically favorable toward the cartilage group, it did not reach statistical significance.

At 2 months, graft uptake was observed in 23 (92%) patients in Group A and 22 (88%) patients in Group B. At 4 months, uptake was observed in 24 (96%) and 23 (92%) patients, respectively. At 6 months, graft uptake was achieved in 24 (96%) patients in Group A and 22 (88%) patients in Group B. The difference in

graft uptake was not statistically significant at 2 months ($\chi^2=0.22$, $p=0.637$), 4 months ($\chi^2=0.35$, $p=0.552$), or 6 months ($\chi^2=1.09$, $p=0.297$). Mean postoperative ABG at 6 months was 15.2 ± 4.8 dB in Group A and 17.0 ± 5.2 dB in Group B. The difference was not statistically significant ($t=-1.27$, $p=0.210$).

Among the 50 study participants, 27 (54%) were males and 23 (46%) were females. In Group A, 12 (48%) were males and 13 (52%) were females, whereas in Group B, 15 (60%) were males and 10 (40%) were females. The difference in gender distribution between the two groups was not statistically significant (Chi-square = 0.72, $df = 1$, $p = 0.396$), indicating that both groups were comparable with respect to gender at baseline.

Statistical Analysis

Variable	Test Used	χ^2 Value	Degrees of Freedom (df)	p-value	Interpretation
Gender Distribution	Chi-square test	0.72	1	0.396	Not statistically significant

DISCUSSION

Cartilage palisades were first used by Heermann to reconstruct the tympanic membrane to prevent the torsion associated with larger slices of cartilage.^[9]

Berna l- sprekelsen et al. modified the technique of Heermann and used fewer, broad palisades and supported them in the middle ear using cartilage slices.^[10]

The use of cartilage for tympanic membrane repair is well described and has reported advantages of long-term graft survival (2,11), low recurrence, lower infection rates, and decreased formation of tympanic membrane retraction pockets over time.^[11-13]

Furthermore, cartilage offers good resistance to infections and impaired vascularization.^[14] In addition, the palisade cartilage technique can resist the extreme barometric changes that occur during ascent or descent.^[15]

The improved anatomical stability associated with cartilage may be explained by its resistance to resorption, retraction, and negative middle-ear pressure. The palisade technique also allows cartilage to be distributed in multiple strips, thereby providing structural support while avoiding the excessive rigidity that can theoretically impair sound transmission.

Previous prospective comparative work has demonstrated high graft acceptance with palisade cartilage and comparable auditory outcomes with temporalis fascia. A study comparing palisade cartilage and temporalis fascia in 54 patients reported 100% graft acceptance in the cartilage group and 92.5% in the temporalis fascia group, although the difference was not statistically significant.

Evidence from larger systematic reviews and meta-analyses suggests that cartilage grafts may have a higher morphological success rate than temporalis fascia, while hearing outcomes are generally

comparable. The reported benefit of cartilage appears to be predominantly anatomical, whereas both graft materials can provide satisfactory functional hearing improvement.

The limitations of the present model include the relatively small sample size, short follow-up period, and use of illustrative numerical data. A larger study with longer follow-up would be useful to assess late graft retraction, recurrent perforation, and long-term hearing outcomes.

CONCLUSION

Palisade cartilage with temporalis fascia graft tympanoplasty and Temporalis Fascia graft tympanoplasty both provide satisfactory anatomical and functional outcomes.

In this 50-patient comparative model:

- Graft uptake was numerically higher with palisade cartilage with temporalis fascia.
- At 6 months, graft uptake was 96% versus 88%.
- Both techniques resulted in progressive improvement in hearing.
- The difference in graft uptake was not statistically significant by chi-square testing.
- The difference in mean postoperative ABG was not statistically significant by Student's t-test.

Therefore, palisade cartilage with temporalis fascia graft tympanoplasty may offer better structural stability while maintaining hearing outcomes comparable to Temporalis graft tympanoplasty.

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