

Effects of Temporalis fascia and Cartilage island graft in type 1 tympanoplasty.

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Abstract:

Our objective of the study was to compare the outcomes of type 1 tympanoplasty using temporalis fascia and cartilage island graft, which was done in a tertiary hospital as a prospective study. **Materials & method:** Out of 80 patients, 40 underwent tympanic membrane repair using temporalis fascia as the graft while in the other group, tragal cartilage was used. Patients having >50 % perforation of tympanic membrane, a dry ear for > 1 month, and intact ossicular chain with pure conductive hearing loss were included in the study. **Result:** At 9 months follow up, the graft uptake was 90 % for temporalis fascia and 97.5 % for cartilage island graft. There was no significant difference in post-operative hearing between the two groups. **Conclusion:** Graft take up rate is higher when cartilage island graft is used. There is a significant improvement in hearing status using both temporalis fascia graft and cartilage island graft but no significant difference when the two are compared..

Keywords: Cartilage, Hearing, Temporalis fascia, Tympanoplasty.

Introduction:

Chronic Otitis Media (COM) is one of the common otological conditions in India for which patients present to the ENT surgeon. The perforation seen in the COM may be the only sequelae remaining when the pathological process in middle ear cleft has healed. It exposes the middle ear mucosa to exogenous source of infection and also produces conductive hearing loss and to address these issues, the surgical technique of tympanoplasty, a term coined by Wullstein in 1953¹, was developed.

Temporal fascia graft, due to the ease of its accessibility at the same site and the high graft take up rate, is the most commonly used grafting material. However, in conditions such as High-risk perforations (anterior perforation, bilateral perforation, perforation involving >50% of the drum), retraction pockets, recurrent cholesteatoma or adhesive otitis media, temporalis fascia may have higher failure rates^{2,3}. This is because the post-operative dimensions of temporal fascia are difficult to predict⁴. In such cases, a more rigid grafting material such as cartilage is preferred⁵. In this prospective study we compared the hearing results and graft take up rate of tympanoplasty using temporalis muscle fascia graft and cartilage island graft.

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Materials and Method:

It is a prospective study of 80 patients carried out in the E.N.T Department of B.J Medical College, Civil Hospital, Ahmedabad during the period of January 2016 to April 2017. The patients included were 18-60 years of age, having >50% perforation of the tympanic membrane due to chronic otitis media, dry for > 1month, with intact ossicular chain and pure conductive hearing loss. Patients with perforation involving <50% of the tympanic membrane, previous ear surgery, only hearing ear or presence of cholesteatoma were excluded from the study.

The patients were examined including history, general examination, ENT examination, Otoscopy and Tuning Fork Test followed by microscopic examination of the ear. Pure Tone Audiometry was done for all cases following which they were randomly divided intra-operatively into two groups of 40 each and underwent Type 1 Tympanoplasty. In Group 1, Temporalis fascia was used as the grafting material and in Group 2 tragal cartilage island graft was used. Same surgeon performed all the surgeries under general anaesthesia. A post aural (Wilde's) approach was used.

In Group 1, the temporalis fascia graft was harvested from the ipsilateral temporal muscle fascia and was placed via underlay technique medial to the long process of the malleus and medial to the tympanic remnant and anterior annulus.

In Group 2, an incision was made over skin on the medial side of the tragus and the Cartilage with the attached perichondrium was dissected medially from the overlying skin and soft tissue. Perichondrium from the side away from the external canal was removed and a flap of perichondrium was left posteriorly to drape over the posterior canal wall. A complete strip of cartilage 2mm in width was removed vertically from the centre to accommodate the handle of malleus. The entire graft is placed in an underlay fashion with the malleus fitting in the groove.

After placement of the graft, it was stabilised with gel foam and medicated aural wick. The wound was closed in 2 layers and a mastoid dressing given.

All Patients were given a course of broad-spectrum antibiotics and analgesic for 1 week and decongestants for 2 weeks. Sutures were removed on seventh postoperative day. The patients were called for regular follow up after 1 month, 6 months and 9 months. The condition of the neotympanum was assessed in terms of uptake, any active disease, signs of retraction. Hearing assessment by pure-tone audiometry was done at 9 months follow up. Pre and Post-operative air conduction thresholds were calculated as the four-tone pure tone average at 0.5, 1, 2, 3 kHz. Air bone gap was calculated as the air conduction minus the same average for bone conduction at the four frequencies. Air bone gap closure was calculated by comparing the pre-operative and post-operative values.

Results:

A total of 80 patients with dry perforation involving >50% of the tympanic membrane were included in the study (Table 1). At 9 months follow up (Table 2), the graft uptake rate was 90% for temporalis fascia graft in Group 1 with 1 patient showing a residual perforation and 3 having retraction of the neotympanum. For group 2, the graft uptake rate was 97.5%

with 1 patient having a residual perforation in the anterior quadrant.

Table 1: Population Study

Group Age	Group 1 (n=40)			Group 2 (n=40)		
	Male	Female	Total	Male	Female	Total
18-30	9	8	17	10	9	19
30-40	4	7	11	6	3	9
40-50	4	2	6	2	6	8
50-60	5	1	6	2	2	4

Table 2: Graft Take Up

GRAFT	Number of Patients	Percentage
Group 1 (Temporalis Fascia) (n=40)		
Graft Take Up	36	90%
Residual perforation	1	2.5%
Retraction	3	7.5%
Group 2 (Cartilage Island Graft) (n=40)		
Graft Take Up	39	97.5%
Residual Perforation	1	2.5%
Retraction	0	0%

In group 1 (Table 3), the mean pre and post-operative air bone gap was found to be 29.52 ± 3.11 dB and 12.8 ± 2.3 dB respectively. The p value was <0.0001 using paired t test and implying a significant improvement in hearing thresholds.

In group 2 (Table 3), the mean pre and post-operative air bone gap was found to be 28.8 ± 2.9 dB and 13.4 ± 2.19 dB respectively. The p value was <0.0001 using paired t test and implying a significant improvement in hearing thresholds.

Table 3: Comparison of Pre and Post-operative Pure Tone Thresholds

Group	Pre-operative	Post-Operative	p value
Group 1			
Air Bone gap (db)	29.52 ± 3.11	12.8 ± 2.3	<0.0001
Group 2			
Air bone gap (db)	28.8 ± 2.9	13.4 ± 2.19	<0.0001

Table 4: Post-operative Air Bone Gap Closure

Closure of Air bone gap (dB)		p Value
Group 1	Group 2	
15.9 ± 3.7	15.4 ± 3.47	>0.05

However, the mean closure of air bone gap in the two groups was found to be 15.9 ± 3.7 dB in group 1 and 15.4 ± 3.47 dB in group 2 (Table 4). Applying the t test, p value was >0.05 . Thus, there was no significant difference in post-operative hearing between the two groups using temporalis fascia graft and cartilage island graft.

Discussion:

Tympanoplasty is the operation performed to eradicate the disease from middle ear and mastoid and reconstruction of the hearing mechanism. Various surgical techniques and different graft materials have been used having variable post-operative outcomes.

Due to the easy availability of the graft from the same incision site, low BMR, high rate of graft uptake, temporalis fascia has been the graft material of choice for reconstruction of the tympanic membrane⁶. However, in high risk cases i.e. a perforation >50%, bilateral perforation, revision surgery, active discharge at the time of surgery, and adhesive otitis media, there is increased risk of failure of the temporalis fascia graft. In such cases, grafting with cartilage is preferred.

The use of cartilage in middle ear surgery is not a new concept⁷. It is naturally thicker and stiffer than fascia, easy to manipulate and place in the middle ear and it has less shrinkage and displacement rate. Moreover, cartilage is well tolerated by the middle ear and since it is nourished largely by diffusion, the cartilage becomes well incorporated in the tympanic membrane^{8,9}. It retains its rigidity and resists resorption and retraction even in chronic eustachian tube dysfunction.

According to an experimental study by Zahnert, cartilage slices <500 um thick are similar to tympanic membrane in terms of their acoustic properties¹⁰.

In our study, the graft uptake up rate for temporalis fascia graft was 90% and for cartilage island graft was 97.5%. This was found to be similar to other studies conducted (Table 5). All the studies show a higher graft take up rate when cartilage is used. This could be due to the ability of the cartilage to resist resorption.

Table 5: Graft Take Up Rate in Different Studies

Study	Graft Take Up	
	Temporalis fascia Graft	Cartilage Island Graft
Kalcioglu et al. ¹¹	86.1%	95%
Gamra et al. ¹²	96.9%	97.7%
Seta et al. ¹³	92.6%	96.3%
Durán-Padilla et al. ¹⁴	83.3%	93.9%
Jain A, et al. ¹⁵	82.9%	97.1%
Our Study	90%	97.5%

Table 6: Post-operative Hearing Outcome in Various Studies

Study	Closure of Air Bone Gap (dB)		p Value
	Temporalis fascia graft	Cartilage island graft	
Gamra et al. ¹²	18	14	>0.05
Demirpehlivan et al. ¹⁶	10.54	10.09	>0.05
Onal et al. ¹⁷	11.63±12.62	14.49±10.05	>0.05
Jain A, et al. ¹⁵	17.2±8	19±10.9	>0.05
Our Study	15.9 ± 3.7	15.4 ± 3.47	>0.05

The average air bone gap closure in our study was 15.9 ± 3.7dB using temporalis

fascia graft and 15.4 ± 3.47 dB using cartilage island graft (p Value >0.05). As compared with other studies, the post op hearing outcome is not statistically significant when temporalis fascia graft and cartilage island graft are used (Table 6).

Conclusion:

Graft take up rate is higher when cartilage island graft is used and also, there is no incidence of retraction of the graft. There is a significant improvement in hearing status using both temporalis fascia graft and cartilage island graft but no significant difference when the two are compared. Cartilage island graft is suitable for high risk cases.

References:

1. Shambaugh GE: Surgery of the ear. 6th edition. Chapter 3: 49-72
2. Buckingham RA. Fascia and perichondrium atrophy in tym-panoplasty and recurrent middle ear atelectasis. *Ann OtolRhinolLaryngol.* 1992;101:755---8.11.
3. Milewski C. Composite graft tympanoplasty in the treatment of ears with advanced middle ear pathology. *Laryngoscope.*1993;103:1352---6.
4. Indorewala S. Dimensional stability of free fascia grafts: an animal experiment. *Laryngoscope.* 2002;112:727---30
5. Dornhoffer J. Cartilage tympanoplasty: indications, techniques, and outcomes in a 1000-patient series. *Laryngoscope.*2003;113:1844---56.
6. Herman H. Tympanic membrane plastic repair with temporalis fascia. *Hals NasOhrenh.* 1960;9:136---9
7. Jansen C. Cartilage-tympanoplasty. *Laryngoscope.*1963;73:1288---302
8. Kerr AG, Byrne JE, Smyth GD. Cartilage homografts in the middle ear: a long term histological study. *J Laryngol Otol.*1973;87:1193---9
9. Levinson RM. Cartilage-perichondrial composite graft tym-panoplasty in the treatment of posterior marginal and attic retraction pockets. *Laryngoscope.* 1987;97:1069---74.
10. Zahnert T, Huttenbrink KB, Murbe D, Bornitz M. Experimental investigations of the use of cartilage in tympanic membrane reconstruction. *Am J Otol.* 2000;21:322---8
11. Kalcioglu MT, Firat Y, Selimoglu E. Cartilage tympanoplasty with island technique: a comparison with the temporalis muscle fascia technique. *Int Adv Otol.* 2009;5:45---50.
12. Gamra OB, Mbarek C, Khammassi K, Methlouthi N, OuniH, Hariga I, et al. Cartilage graft in type I tympanoplasty: audiological and otological outcome. *Eur Arch Otorhinolaryngol.*2008;265:739---42.
13. De Seta E, De Seta D, Covelli E, Viccaro M, Filippo R. Type I tym-panoplasty with island chondro-perichondrial tragal graft: the preferred technique? *J Laryngol Otol.* 2013;127:354---8

14. Durán-Padilla CL, Martínez-Chávez J, Amador-LiconA, Pereyra-Nobara TA. Cartilage island versus temporalis fascia in high-risk tympanic perforation. *Rev Med Inst Mex Seguro Soc.*2017;55 Suppl. 1:S58---63
15. Jain A, Samdani S, Sharma MP, Meena V. Island cartilage vs temporalis fascia in type 1 tympanoplasty: A prospective study. *Acta Otorrinolaringol Esp.* 2018 Nov - Dec;69(6) 311-317.
16. Demirpehlivan IA, Onal K, Arslanoglu S, Songu M, Ciger E, CanN. Comparison of different tympanic membrane reconstruction techniques in type I tympanoplasty. *Eur Arch Otorhinolaryngol.*2011;268:471---4.
17. Onal K, Arslanoglu S, Songu M, Demiray U, DemirpehlivanIA. Functional results of temporalis fascia versus cartilage tym-panoplasty in patients with bilateral chronic otitis media. *JLaryngol Otol.* 2012;126:22---5