

Perichondrium - An Autologous Substitute for Temporalis Fascia in Type I Tympanoplasty: A Comparative Study

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ABSTRACT

Introduction:

Temporalis fascia is the commonly used graft material for tympanic membrane reconstruction. Tragal perichondrium share with the fascia the quality of being mesenchymal tissue. In our study we compared perichondrium and temporalis fascia in terms of graft uptake and hearing improvement.

Materials and Methods:

All patients presenting with discharge from ear and decreased hearing were subjected to clinical examination and investigation. Patients satisfying inclusion criteria were included in study with total of 40 patients. Twenty underwent type I tympanoplasty with temporalis fascia (TF) and another 20 patients with tragal perichondrium (TP). To evaluate success patients are evaluated at end of 6 months for graft uptake and 3 months for hearing results in audiological gain of 10 dB in two consecutive frequencies.

Results:

Mean Pre-op AC Threshold in TF group was 30.75 dB±5.16 and Post-op AC Threshold was 14.15 dB±8.05. Mean Pre-op AC Threshold in TP group was 32.2 dB±4.81 and Post-op AC Threshold was 20.95 dB±7.14. Mean post-op AC Threshold, Mean Post-Op AB Gap and Mean Audiological Gain was statistically significant among 2 groups $p=0.0075$, $p=0.0013$, $p=0.0294$ respectively. Temporalis fascia was better than Tragal Perichondrium. Graft uptake in 2 groups was not significant ($p=0.6325$).

Conclusion:

From the present study we may conclude that temporalis fascia, tragal perichondrium free grafts provide viable autograft material for tympanoplasty. Both achieve good hearing restoration but the improvement in hearing or audiological gain is better in temporalis fascia graft than in tragal perichondrium graft.

Keywords:

Tympanoplasty; Autografts; Fascia; Perichondrium

The tympanic membrane (TM) plays a significant role in the physiology of hearing as well as in the pathophysiology of chronic inflammatory middle ear diseases. Infection, acute or chronic, is the principal cause of TM perforation. Majority of post acute infection and traumatic TM perforations however heal spontaneously or with conservative treatment. If the perforations fail to heal conservatively they require surgical closure. The repaired perforation restores vibratory area and restores round window protection, thus improving hearing. It also prevents exposure of the middle ear to external infections. There are a number of materials for closure of TM perforations like skin¹ perichondrium,^{2,3} vein,⁴ temporalis fascia,⁵ dura,⁶ cartilage.^{7, 8, 9, 10}

Biological graft material acts as a scaffold of tissue

matrix when applied to seal the perforation. Such abundance of material imply graft selection depends upon surgeon's choice. Temporalis fascia is the commonly used graft material for tympanic membrane reconstruction, because it is an autograft with excellent chance of take up, available close to the site of operation making its harvesting easier, a low basal metabolic rate, increased success rate, and its thickness is more or less similar to that of tympanic membrane. Tragal perichondrium shares with the fascia the quality of

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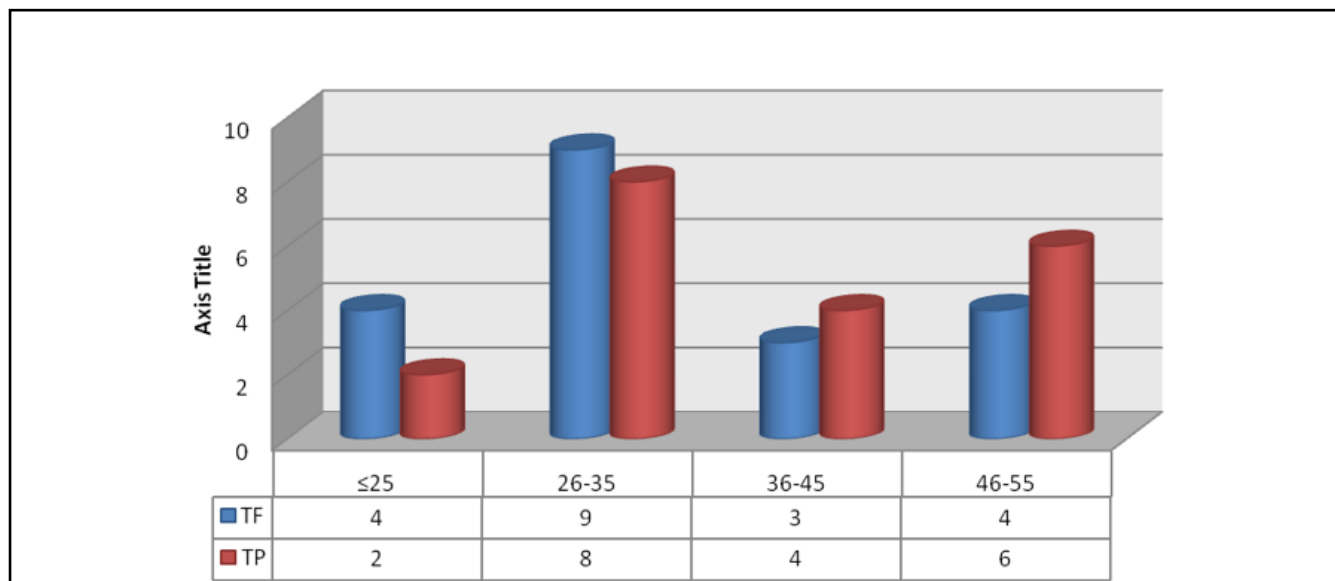


Fig 1. Age wise distribution of two groups. (TF- Temporalis Fascia; TP- Tragal Perichondrium)

being mesenchymal tissue¹¹ but it is thicker and stiffer. It is also easily harvested with small incision on inner surface of tragus with an inconspicuous scar.

This study compared perichondrium and temporalis fascia in terms of graft uptake and hearing improvement.

Materials and Methods

All the patients attending our OPD with history of discharge per ear and decreased hearing were subjected to detailed clinical history taking clinical examination. Patients between 15-55 years of age with central/subtotal perforation of the tympanic membrane and mild to moderate conductive hearing loss were included in the study. Patients with evidence of cholesteatoma, having previous history of surgery, pre-existing/congenital hearing loss, known eustachian tube dysfunction or any associated pathology and active infection in ear, nose, throat and paranasal sinuses were excluded from this study. Patient having ossicular discontinuity/ fixation, abnormality in the external ear canal or patients suffering from diabetes, malignancy and other debilitating diseases were also excluded.

Patients were alternately selected from study population until a sample size of 40 patients was reached. 20 patients of them undergone type 1 tympanoplasty with

temporalis fascia (Group TF) and another 20 patients with tragal perichondrium (Group TP).

To evaluate success patients are evaluated at end of 6 months for graft uptake and 3 months for hearing results in audiological gain of 10 dB in two consecutive frequencies.

Surgical Procedure:

Patients underwent surgery under local anaesthesia. Intravenous antibiotic (Cefotaxime or Ceftriaxone sodium) was given 30 minutes prior to the surgery.

Combination of Inj. Pethidine 75 mg and Promethazine 25 mg (Phenergan) was given 30 minutes prior to the surgery. 2% Lignocaine with 1: 100000 Adrenaline was used for infiltration in tragus, post-auricular and 4 quadrants of external auditory canal.

All patients were operated through postaural approach. The temporalis fascia was harvested through same incision. For the tragal perichondrial graft, an incision was made 2mm medial from the tragal crest line. The tragal cartilage was removed by cutting through the areolar tissue. The perichondrium was dissected in continuity from both surfaces of the excised cartilage. The cartilage was replaced in its skin pocket and the incision closed. The margin of perforation freshened and undersurface of TM scraped. The tympanomeatal flap elevated and middle ear entered. Ossicular intactness

Table I: Sex distribution among the two groups

SEX	GROUP		
	TF	TP	TOTAL
Male	10 (45.5%)	12 (54.5%)	22 (55%)
Female	10 (55.6%)	8 (44.4%)	18 (45%)
Total	20	20	40

Table II: OT laterality of 2 groups.

OT SIDE	GROUP		
	TF	TP	TOTAL
LEFT	12 (60%)	8 (40%)	20 (50%)
RIGHT	8 (40%)	12 (60%)	20 (50%)
TOTAL	20	20	40

Table III: Duration of symptoms among 2 groups.

GROUP	NUMBER	MEAN	SD	MINIMUM	MAXIMUM	MEDIAN	P-VALUE
TF	20	13.4	6.49	6	24	11	0.8003
TP	20	13.9	5.91	5	24	13	

and mobility confirmed. The graft was placed medial to the handle of malleus in underlay technique. The middle ear cavity is packed with gel foam to support the fascia graft. After repositioning the TM flap antibiotic-soaked gelfoam pieces placed in the external canal to stabilize the graft. Post operatively the patients were put on a course of antibiotic, analgesics, antihistamines and decongestant nasal drops. Mastoid bandage and dressings were removed next day of operation (24-48 hrs). Stitches were removed after 6-7 days later. Patients were discharged after 2 days. Patients were called up for first follow up at the end of 1st week post operatively, then at three weekly interval upto 6 months.

Statistical Analysis was done using appropriate test for various outcomes. Student's independent sample's t-test was applied to compare normally distributed numerical variables between groups, Unpaired proportions were compared by Chi-square test or Fischer's exact test, as appropriate. The p-value <0.05 was considered

significant.

Results

Most of the patients are in the age group of 26-35 yrs. (Fig.1) The mean age in Group TF is 33.95 ± 10.86 years and Group TP is 36.75 ± 11.52 (p-value=0.4340)

In TF group, 10(50.0%) patients were female and 10 (50.0%) patients were male. In TP group, 12(60.0%) patients were female and 8 (40.0%) patients were male. This distribution was not statistically significant (p=0.5250). (Table I)

Laterality distribution of two groups was not statistically significant (p=0.2059). (Table II)

In Group TF, the mean duration of symptoms (mean \pm SD) of patients was 13.40 ± 6.49 months. In Group TP, the mean duration of symptoms (mean \pm SD) of patients was 13.90 ± 5.91 months. Difference of mean duration

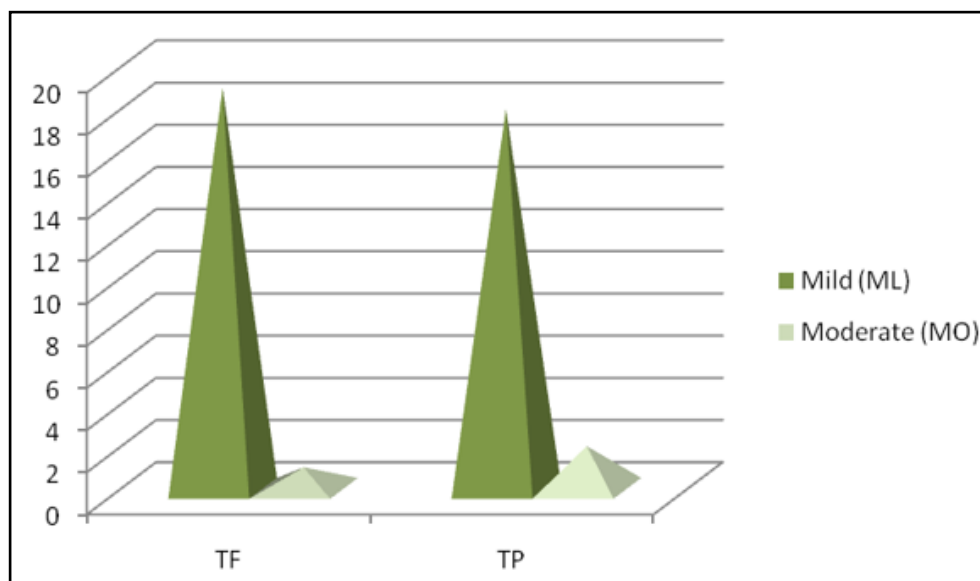


Fig. 2: Distribution of hearing loss among two groups

of symptoms was not statistically significant ($p=0.8003$) between two groups. (Table III)

In TF group, 19 (95%) patients had mild hearing loss and 1(5%) patient had moderate hearing loss. In TP group, 18 (90%) patients had mild hearing loss and 2 (10%) patient had moderate hearing loss. Hearing loss of two groups was almost equally distributed ($p=0.5483$). (Fig.2)

Distribution of Size of perforation of two groups was not statistically significant ($p=0.7411$). (Table IV)

Mean pre-op AC threshold difference of two groups was not statistically significant ($p=0.3646$). Mean pre-op AB gap difference of two groups was not statistically significant ($p=0.5641$). (Table V)

Mean post-op AB gap difference of two groups was statistically significant ($p=0.0013$), that is mean post op

AB gap was less in TF group than in TP group. Mean post-op AC threshold difference of two groups was statistically significant ($p=0.0075$.) Mean post op AC threshold with temporalis fascia was better than tragal perichondrium. (Table VI)

Mean audiological gain difference of two groups was statistically significant ($p=0.0294$), that is mean audiological gain is better in TF group than in TP group . (Fig. 3)

In both TF and TP group, difference between pre-op and post op AC threshold was statistically significant ($p<0.001$).

In both TF and TP group, difference between pre-op and post op AB gap was statistically significant ($p<0.001$).

Graft uptake rate in TF group and TP group are not

Table IV: Table showing distribution of size of perforation among two groups.

SIZE OF PERFORATION	GROUP		
	TF	TP	TOTAL
Central	14 (70%)	12 (60%)	26 (65%)
Subtotal	6 (30%)	8 (40%)	14 (35%)
TOTAL	20	20	40

Table V: Pre-operative Distribution of hearing threshold and AB gap in two groups

GROUP	PRE-OP AB GAP			PRE-OP AC THRESHOLD		
	MEAN	SD	P VALUE	MEAN	SD	P VALUE
TF	31.9	5.1	0.5641	30.75	5.16	0.3646
TP	32.8	4.66		32.2	4.81	

Table VI : Post-operative Distribution of hearing threshold and AB gap in two groups

GROUP	POST OP AB GAP			POST OP AC THRESHOLD		
	MEAN	SD	P VALUE	MEAN	SD	P VALUE
TF	13	6.34	0.0013	14.15	8.05	0.0075
TP	19	6.22		20.95	7.14	

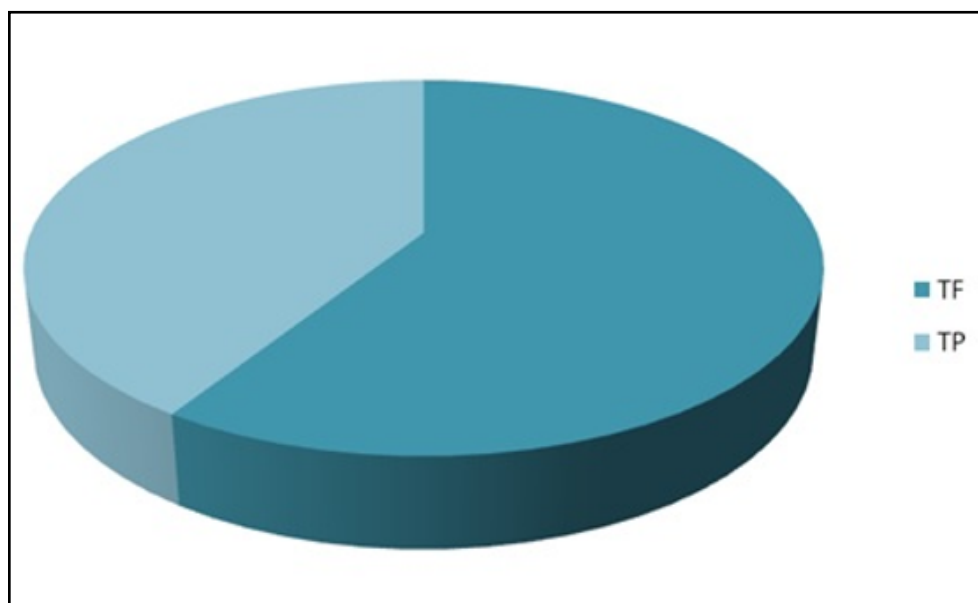
statistically significant, $p = 0.6325$ (Fig. 4).

The Graft uptake success rate was 88.46% in central perforation and 85.71% in subtotal perforation. Association between graft uptake with respect to size of perforation (Fig. 5) was not statistically significant (p value = 0.802)

The post-op complications are illustrated in Fig. 6.

Discussion

The mean age was 32.28 years (± 10.27 years). Similar findings were noted in the study of Singh et al¹¹ in which the mean age was 28.9 years and in the study of Dornhoffer¹² in which the mean age was 28 years. Varshney and Nangia observed similar finding that the number of cases in the 16-25 years age group was (51.3%), and this formed the largest group in their

**Fig. 3 : Mean audiological gain in 2 groups.**

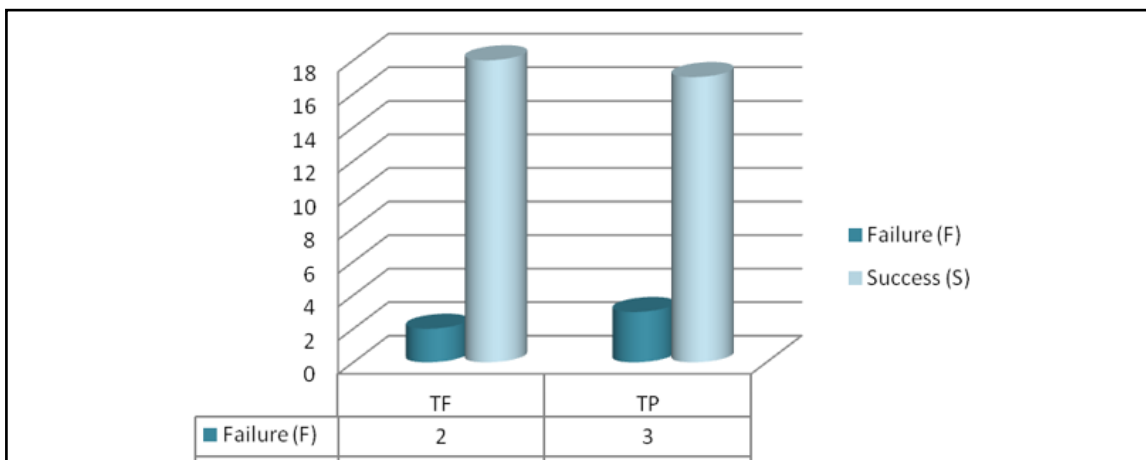


Fig. 4: Graft uptake distribution in 2 groups.

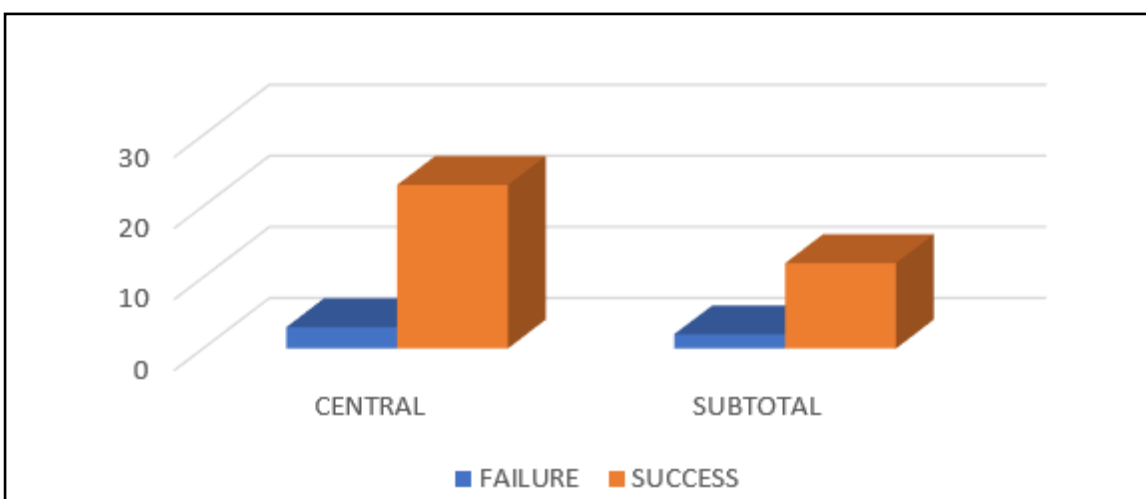


Fig. 5: Graft uptake in respect to size of perforation.

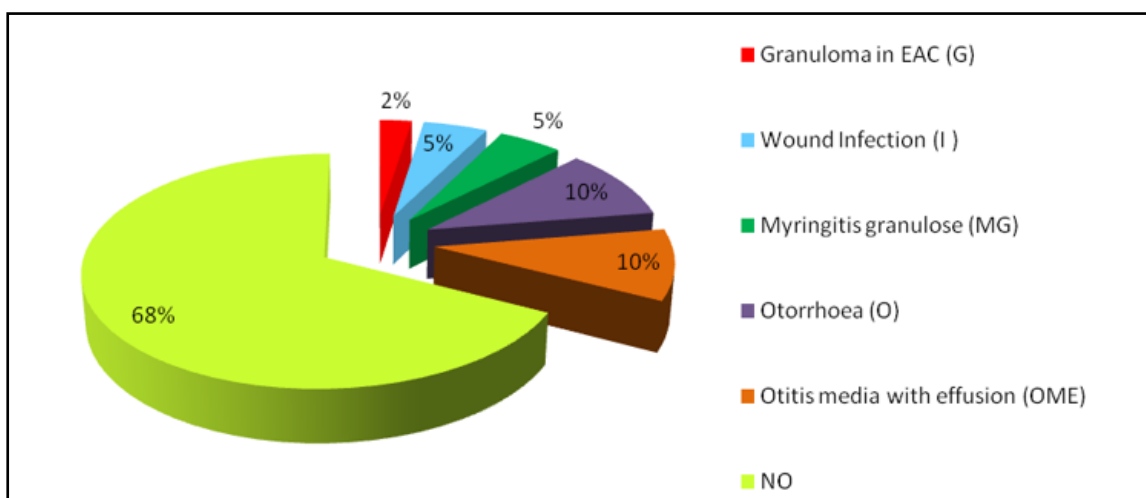


Fig. 6 : Post-op Complications

study.¹³ Raine and Singh in a retrospective analysis of 114 tympanoplasties in children in the age group of 7 to 16 demonstrated a significant higher rate of failure between 8 and 12 years. The probable explanation of high incidence of failure in younger children is due to increased incidence of upper respiratory tract infection and immature Eustachian tube function. They advocate deferring surgery till 12 years for achieving better results.¹⁴

Male to female ratio in this study was 1.2:1. Sex ratio did not have any statistically significant difference between the two groups.

Palva et al achieved success rate of 96% in their study of 165 cases of myringoplasties, which was carried out only when the ear was dry for at least 3 months.¹⁶ Gibb and Chang, in their study of 206 cases of underlay myringoplasty, found the uptake rate of 91.4% for dry ear and 80.9% for wet ear.¹⁷ The state of middle ear at the time of operation influences surgical outcome and long term result of myringoplasty in adult and children with wet ears having higher rate of reperforation.¹⁸ In our study of 40 cases of tympanoplasty all cases had dry ear preoperatively at least for 6 weeks. The overall graft uptake rate was 87.5%.

Shrestha and Sinha, found preoperative A-B gap of around 30 dB in 76% of the patients.¹⁹ In another study by Shaikh et al, showed mean pre-operative air conduction of 40 dB and A-B gap of around 25 dB.¹⁵ In our study, the mean pre-op AC threshold was 30.75 dB in TF group and 32.2 dB in TP group.

In our study 65% had central and 35% subtotal perforation. Distribution of size of perforation was not significant among the two groups in our study. In the comparative study by Awan et al 76.7% cases had medium sized perforation.²⁰ Hussain et al had patients with small or medium size perforation in 75% cases and large perforation in 25% cases.²¹ Similar selection criteria regarding the size of perforation, as were used in the studies of Indorewala²² and Roychaudhuri²³ to have a consistency in the outcome and to avoid bias in the analysis of the results of surgery.

In our study 87.5% patients show improvement in hearing, 12.5% shows no improvement. In TF group 90% patients show improvement in hearing and in TP

group 85% patients show improvement in hearing. Dabholkar et al²⁴ reported hearing result in total 50 patients, temporalis fascia group improved hearing in 76% while tragal perichondrium group achieved 75% hearing gain. Umar et al showed post-operative improvement in hearing in 87.06% of patients.²⁵ In his study 12.94% patients failed to show any improvement of A-B gap.

In our study Group TF, the mean audiological gain (mean \pm SD) of patients was 17.7500 \pm 8.0516 dB. In Group TP, the mean audio logical gain (mean \pm SD) of patients was 12.3000 \pm 7.1532 dB. Patil et al reported that, mean gain in ABG was not significantly different between the different graft materials used in tympanoplasty.²⁶ The mean gain for temporalis fascia was 9.36 dB, tragal perichondrium was 10.92 dB. Similar findings were noted by Dornhoffer, where in it was 10.2 dB for tragal perichondrium.¹² Indorewala noted a higher gain of 17 dB for temporalis fascia.²³ Singh et al achieved mean gain of 9.3 dB for temporalis fascia, and 8.5 dB for tragal perichondrium, which is lesser than our study.¹¹

In our study 87.5% (n=35) patients had overall successful result in graft uptake. The overall success rate of type 1 tympanoplasty using temporalis fascia were 90% (n=18) and using tragal perichondrium were 85% (n=17) respectively. 12.5% (n=5) patients were marked as failure cases during post-operative follow up period. The overall failure rate of type 1 tympanoplasty using temporalis fascia were 10 % (n=2) and with tragal perichondrium were 15% (n=3) respectively. Palva and Virtaen in their study of 172 cases, found a number of successfully repaired tympanic membrane of 153 (89%).²⁷

Gibb and Chang in their study of 206 cases of myringoplasty employing the underlay technique with temporalis fascia reported a graft take rate of 89.3%.¹⁷ Our results are comparable with study of Strahan et al, in which take-up rate of 87.5% was achieved using temporalis fascia and 86% by tragal perichondrium by underlay technique.²⁸ Eviatar noted that graft take rate with tragal perichondrium by underlay technique was 88% at the end of 1 year follow-up.²⁹ Dornhoffer achieved graft uptake success rate of 85% using tragal perichondrium by underlay technique.¹² Rizer achieved a

success rate of 88.8% using temporalis fascia by underlay technique.³⁰ Dabholkar et al compared temporalis fascia with Tragal Perichondrium in underlay tympanoplasty and achieved a graft success rate of 84% for Temporalis fascia and 80% for tragal perichondrium.²⁴

Conclusion

From the present study we may conclude that temporalis fascia, tragal perichondrium free grafts provide viable autograft material for tympanoplasty. They achieve comparable and excellent graft up take of 90% in temporalis fascia group and 85% in tragal perichondrium group. They achieve good hearing restoration but the improvement in hearing or audiological gain is better in temporalis fascia graft than in tragal perichondrium graft. Size of the perforation doesn't significantly influence the success rate of tympanoplasty. Normal translucent appearance of neotympanic membrane in the postoperative period was seen with temporalis fascia while with tragal perichondrium, the neotympanic membrane was whitish, thicker, and translucent to opaque. Thus with all the things we come to the conclusion that the graft uptake rate of type 1 tympanoplasty is not influenced by graft material (temporalis fascia and tragal perichondrium) but the hearing improvement depends upon the graft material and it is better with temporalis fascia than tragal perichondrium.

References

- Berthold E. Uber Myringoplastic. Med-chir centralb. 1879; 14: 195-207
- Goodhill V. Articulated polyethylene prosthesis with perichondrial graft in stapedectomy. Rev Laryngol. (Bordeaux) 1951; 82:305-20
- Linde RE. The cartilage-perichondrium graft in the treatment of posterior tympanic membrane retraction pockets. Laryngoscope 1973; 83:747-53
- Tabb HG. Closure of perforations of the tympanic membrane by vein grafts: a preliminary report of 20cases. Laryngoscope 1960; 70:271-86
- Storrs L. Myringoplasty with the use of Fascia Grafts. Arch Otolaryngol. 1961; 74:45-9
- Yetiser S, Tosun F, Satar B. Revision myringoplasty with solvent-dehydrated human dura mater. Otolaryngol Head Neck Surg. 2001;124(5):518-21
- Heermann J, Heermann H, Kopstein E. Fascia and cartilage palisade tympanoplasty. Arch Otolaryngol. 1970; 91:228-41
- Couloigner V, Baculard F, El Bakkouri W, Viala P, Francois M, Narcy P et al. Inlay butterfly cartilage tympanoplasty in children. Otol Neurotol. 2005; 26:247-51
- Gerber MJ, Mason JC, Lambert PR. Hearing results after primary cartilage tympanoplasty. Laryngoscope 2000;110:1994-9
- Adkins WY. Composite autograft for tympanoplasty and tympanomastoid surgery. Laryngoscope 1990; 100:244-7
- Singh BJ, Sengupta A, Das SK, Ghosh D, Basak B. A comparative study of different graft materials used in myringoplasty. Indian J Otolaryngol Head Neck Surg. 2009; 61:131-4
- Dornhoffer JL. Hearing results with cartilage tympanoplasty. Laryngoscope 1997; 107:1094-9
- 13.Varshney S, Nangia A. Ossicular status in chronic suppurative otitis media in adults. Indian J Otolaryngol Head Neck Surg. 2010; 62(4):421-6
- Raine CH and Singh SD. Tympanoplasty in Children: A Review of 114 Cases. Journal of Laryngol Otol. 1983; 97:217-21
- Shaikh AA ,Onali.MAS, Shaikh MS, Rafi T. Outcome of Tympanoplasty type I by Underlay Technique. JLUMHS 2009; 8(1): 80-4
- Palva T. Surgical treatment of chronic ear disease 1. Myringoplasty and tympanoplasty. Acta Otolaryngol. (Stockh) 1987; 104(3-4): 279-84
- Gibb AG, Chang SK. Myringoplasty (A review of 365 operations). J Laryngol Otol. 1982; 96:915-30
- Gersdoff M, Grain P, Decat M, Jugantegui M. Myringoplasty: Long term result in adult and children. Am J Otol. 1995; 16(4):532-5
- Shrestha S, Sinha BK. Hearing results after Myringoplasty. Kathmandu Medical College University Journal 2006; 4(16): 455-9
- Awan Z, Bashir H, Hussain A. Myringoplasty: A comparative study of different graft materials and various surgical techniques. Ann. Pak. Inst. Med. Sci. 2008;4(4): 209-11
- Hussain A, Yousaf N, Khan AR. Outcome of myringoplasty. J Pak Med Assoc 2004; 18:695-8
- Indorewala S. Dimensional stability of free fascia grafts: Clinical application. Laryngoscope 2005;115:278-82
- Roychaudhuri BK. 3-flap tympanoplasty-A simple and sure success technique. Indian J Otolaryngol Head Neck Surg. 2004; 56:196-200
- Dabholkar JP, Vora K, Sikdar A. Comparative study of underlay Tympanoplasty with temporalis fascia and tragal perichondrium. Indian J Otolaryngol Head Neck Surg. 2007; 59(2):116-9
- Umar AS, Ahmed J. Anatomical and functional outcome

- following type 1 tympanoplasty in chronic tubotympanic SOM. Military Hospital Rawalpindi, March, 2008; Issue-1
26. Patil K, Baisakhiya N, Deshmukh PT. Evaluation of different graft materials in type1 tympanoplasty. *Indian J Otology* 2014; 20(3):106-14
 27. Palva T, Virtanen H. Pitfalls in myringoplasty. *Acta Otolaryngology* 1982; 93:441-6
 28. Strahan RW, Acquarelli M, Ward PH, Jafek B. Tympanic membrane grafting. Analysis of materials and techniques. *Ann Otol Rhinol Laryngol.* 1971; 80:854-60
 29. Eviatar A. Tragal perichondrium and cartilage in reconstructive ear surgery. *Laryngoscope* 1978; 88(Suppl) 11:1-23
 30. Rizer FM. Overlay versus underlay tympanoplasty. Part II: The study. *Laryngoscope* 1997; 107:26-36.