

Comparative Study of Hearing Improvement of Type 1 Tympanoplasty Using Temporalis Fascia and Conchal Cartilage as Graft Material

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Abstract Tympanic Membrane perforation is a common cause of hearing loss. Various surgical techniques with different types of graft materials have been described for the treatment of perforations. The conchal cartilage and temporalis fascia graft are most widely used. We conducted a prospective Randomized control trial at Sri Guru Ram Das Institute of Medical Sciences and Research to compare the post operative hearing outcomes between the patients of safe CSOM (n = 40) using temporalis fascia (n = 20) and conchal cartilage (n = 20). It was found that the AB gap closure at 2 months post-operatively was 11.55 ± 8.173 for conchal perichondrium group as compared to 10.49 ± 9.069 for temporalis fascia group. At 6 months the AB gap closure was 14.98 ± 9.915 for conchal cartilage group as compared 11.41 ± 8.288 db for temporalis fascia group. Thus hearing improvement was better for conchal cartilage group both at 2 and 6 months but the comparison of the AC gain at the end of 6 months and subjective improvement in hearing between the two techniques was not statistically significant owing to the small sample size of the study. Both Temporalis fascia and conchal cartilage with perichondrium were acceptable graft material for successful closure of tympanic membrane

perforation, hearing improvement was better with conchal cartilage group.

Keywords Conchal cartilage · Temporalis fascia · Hearing outcome · Comparison

Introduction

Persistent perforation of tympanic membrane can impair the patients hearing due to effect on sound conducting mechanism of middle ear.

In most cases with persistent perforation, medical treatment is not sufficient and such patients need to undergo surgical correction involving myringoplasty and tympanoplasty depending on type of pathological process.

Different, surgical techniques and grafts are in practice. Since the first description of tympanoplasty in 1952 by Wullstein and Zollner, some grafting materials such as temporalis fascia, fascialata, perichondrium, periosteum, Vein duramater and cartilage have been in used for perforation closure. Temporalis graft is generally considered to be a superior graft with respect to take up rate probably due to its low metabolic rate, also it easily available in sufficient quantity and separate incision is not required [1–8].

On the other hand large perforation, atelactic drums or adhesive otitis media or retraction pockets due to middle ear ventilation problems cartilage grafts are better options [9].

Since Utech in 1959 and then Heermann and Jansen in the early 1960s reported their experience with cartilage graft tympanoplasty, many authors described their use as palisade, perichondrium/cartilage island flap or cartilage shield for cases of high risk failure

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Conchal and tragal cartilage are two most frequently used cartilaginous grafts.

Conchal cartilage is preferred due to its increased stability, pliability, and resistance to negative middle ear pressure, even in cases of eustachian tube dysfunction, also it is easy to harvest, decreased time consumption, minimal scarring, and no significant post op morbidity especially in cases of large perforation, anteriorly placed perforation, adhesive otitis media and recurrent infections.

Various authors have shown that the hearing results are good with cartilage regardless the thickness of the graft [10–13].

Post operative hearing depends on functioning ossicular chain and aerated middle space, assuming that an intact tympanic membrane has been reconstructed.

Taking the above mentioned facts, this study was taken up to compare the hearing improvement of patients undergoing tympanoplasty with temporalis fascia and conchal cartilage with perichondrium.

Materials and Methods

This prospective randomized controlled trial was carried out from January 2015 to November 2017 on consecutive 40 patients of chronic suppurative otitis media, safe type who after thorough clinical, audiological and radiological assessment were selected and admitted in department of otorhinolaryngology, Sri Guru Ram Das Institute of Medical sciences and Research, Sri Amritsar. Necessary permission and approval from ethics committee and authority prior to starting study was taken. Informed written consents were obtained from the patients according to the protocol approved by the Ethics committee of our institution and patient confidentiality was maintained.

These patients undergoing type 1 tympanoplasty were simply randomized into two groups.

Temporalis Fascia group: Included 20 patients in whom temporalis fascia was used as a graft material.

Conchal cartilage group: Included 20 patients in whom conchal cartilage was used as a graft material.

Criteria for patient selection:

1. Safe type of csom with central perforation.
2. Pure conductive hearing loss.
3. Adequate cochlear reserve.
4. Patent Eustachian tube.
5. Patient fit for surgery.

Criteria for exclusion from the study:

1. Ossicular discontinuity.
2. External ear pathology.
3. Children below 10 years.

4. Unsafe csom.
5. SNHL/Mixed hearing loss.

Comparative Study was Done on Following Parameters

Preoperative Assessment

For all the patients, detailed history was taken including the history of any past surgical history followed by clinical examination. Thereafter, detailed examination of both ears was done.

Any focus of infection in nose and throat was excluded along with eustachian tube function was evaluated using valsalva maneuver and siegelisation.

Hearing assessment using tuning forks followed by pure tone audiometry was done.

Radiology—bilateral x-ray mastoids in schuller lateral oblique view was done in all cases to know the pneuma-tisation/sclerosis of mastoids, status of sinus plate and the dural plate.

Pre-operatively all the patients with discharging ears were routinely treated by suction clearance, instillation of antibiotic ear drops. It was made sure that ear to be operated was dry for at least 6 weeks pre-operatively for all cases.

Routine blood investigation was done for anesthesia.

Preoperative all patients were explained in their own language about reason for his/her surgery and prospects of success and failure of surgery. Patients were also informed about risk involved and importance of regular follow up.

Anaesthesia

All patients were operated under local anesthesia with 0.5 mg alprazolam night before and 6 am on the morning of surgery. For sedation, injection pentazocine in dose of 0.5 mg/kg/body weight, injection glycopyrrolate in dose of 0.005 mg/kg body weight and injection promethazine 50 mg were given intramuscularly half an hour before surgery Antibiotic prophylaxis was given.

Surgical Technique

Infiltration anesthesia was achieved by using 2% xylocaine with 1:100,000 adrenaline in subcutaneous tissue of post auricular region and external auditory canal, injected at 4 points on the circumference of external auditory canal at 3, 6, 9, 12'o clock positions.

The patient was positioned supine on the operating table with head turned to the opposite side of the ear being operated and stabilized using a head ring.

The external auditory canal and the tympanic membrane were examined under microscope.

Post aural incision approach was used in all cases 5 mm behind post auricular sulcus.

In 20 cases temporalis fascia was used and in 20 cases conchal cartilage with perichondrium was used as a graft material.

After harvesting graft material:

- Meatotomy was done.
- The canal skin was incised at the bony cartilaginous junction posteriorly, superiorly and inferiorly
- Edges of perforation were freshened.
- Tympanomeatal flap was elevated up to the annulus, chorda tympani was identified and preserved.
- The ossicular discontinuity was assessed.
- Handle of malleus was skeletonised and graft was placed under handle of malleus and tympanic membrane remnant, taking care to evert the edges.
- The external auditory canal was packed.
- Suturing followed by mastoid dressing was done.

Post operatively course of an injectable broad spectrum antibiotic was given. After that oral antibiotics were started, with analgesics, antihistaminics and anti-inflammatory drugs were also given along with nasal decongestant drops. First dressing was changed after 48 h.

Post Operative Followup

Patients were followed up in ENT OPD for aural cleaning, otoscopy and hearing assessment.

Tuning fork tests using 256, 512, 1024 tuning forks were used and pure tone audiometry were done at 2 months and 6 months post-operatively.

Ear findings and audiometry reports were recorded.

At the end of the study, decoding of the group was done and results were analysed statistically.

Results

The mean preoperative airborne gap in two groups was tabulated (Table 1, Fig. 1). The mean preoperative airborne gap was compared with postoperative airborne gap closure at 2 months (Table 2) and 6 months (Table 3). Both the

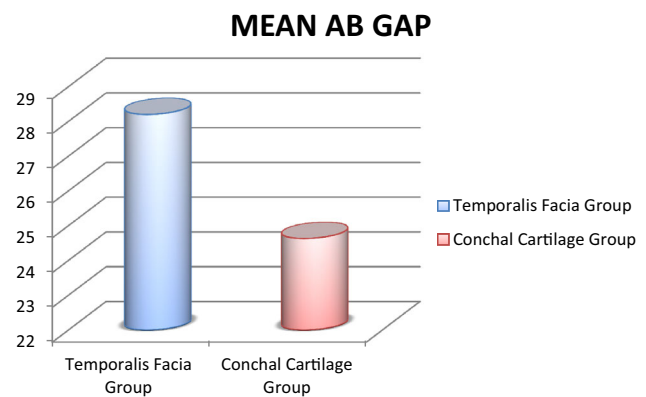


Fig. 1 Comparison of preoperative mean AB Gap b/w two groups

comparisons are shown in Fig. 2. Mean preoperative hearing levels were compared with postoperative hearing levels at 2 months (Table 4) and 6 months (Table 5). The mean AC gain at 6 months is shown in Fig. 3. Subjective improvement in hearing was tabulated at the end of 6 months and results are shown in Table 6.

Discussion

The present study was designated to evaluate hearing improvement while using temporalis fascia and conchal cartilage with perichondrium as graft material in type 1 tympanoplasty. The patients were divided into two groups 20 each on basis of graft material used. All patients were regularly followed initially at 2 months and then 6 months post-operatively. Post operative hearing was assessed by tuning fork using 256, 512, 1024, and pure tone audiometry. Both AB closure and mean hearing levels at 2 months and 6 months were seen in comparison to preoperative levels.

The hearing improvement in our study was assessed by air bone gap i.e. AB gap pre and post operatively. This was calculated for each patient individually at 2 and 6 months post operatively. Both the conchal cartilage perichondrium group and temporalis fascia group was studied in this manner. The AB gap closure at 2 months post operatively was 11.55 ± 8.173 for conchal perichondrium group as compared to 10.49 ± 9.069 for temporalis fascia group. At 6 months the AB gap closure was 14.98 ± 9.915 for conchal cartilage group as compared 11.41 ± 8.288 db for

Table 1 Preoperative air bone gap

	Temporalis fascia group	Conchal cartilage group	Intergroup significance
Mean AB gap	28.20 ± 9.161	24.63 ± 9.903	$p > 0.05$ NS

Data: Mean + SD, NS Non significant ($p > 0.05$)

Table 2 Air bone closure at 2 months

	Temporalis fascia group	Conchal cartilage group	Intergroup significance
AB gap closure	11.55 ± 8.173	10.49 ± 9.069	$p > 0.05$ NS

Data: Mean + SD, NS Non significant ($p > 0.05$)

Table 3 Air bone closure at 6 months

	Temporalis fascia group	Conchal cartilage group	Intergroup significance
AB gap closure	14.98 ± 9.915	11.41 ± 8.288 S	$p > 0.05$ NS

Data: Mean + SD, NS Non significant ($p > 0.05$)

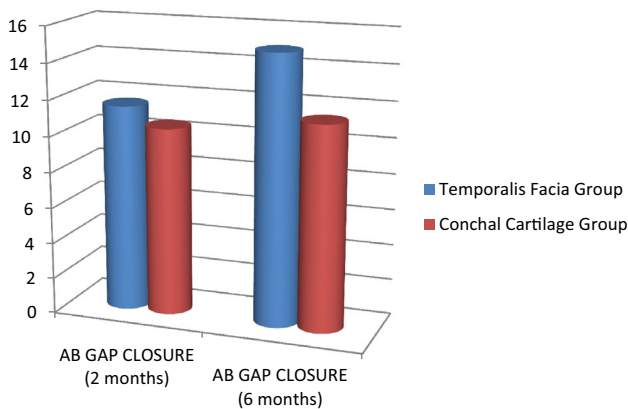


Fig. 2 The comparison b/w AB gap closure at 2 and 6 months of two groups

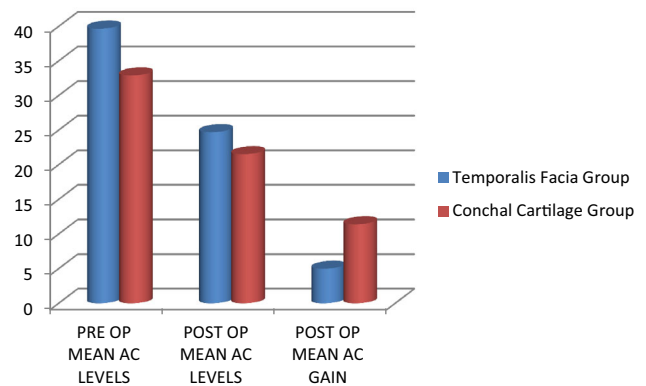


Fig. 3 Comparison of hearing improvement thresholds at 6 months followup b/w two groups

Table 4 Mean level of hearing at 2 months postoperatively as compared to preoperative levels

	Pre OP mean AC levels	Post OP mean AC levels	Post OP mean AC gain	Intergroup significance
Temporalis fascia group	39.68 ± 11.290	28.13 ± 9.259	11.55 ± 8.173	$p > 0.05$
Conchal cartilage group	32.91 ± 11.848	22.43 ± 14.153	10.49 ± 9.069	> 0.05

Data: Mean + SD, NS Non significant ($p > 0.05$)

Table 5 Mean level of hearing at 6 months postoperatively as compared to preoperative levels

	Pre OP mean AC levels	Post OP mean AC levels	Post OP mean AC gain	Intergroup significance
Temporalis fascia group	39.68 ± 1.290	24.70 ± 8.383	4.98 ± 9.915	$p > 0.05$
Conchal cartilage group	32.91 ± 11.848	21.51 ± 13.807	11.41 ± 8.288	> 0.05

Data: Mean + SD, NS Non significant ($p > 0.05$)

temporalis fascia group. Thus hearing improvement was better for conchal cartilage group both at 2 and 6 months but the comparison of the AC gain at the end of 6 months and subjective improvement in hearing between the two techniques was not statistically significant. This is probably due to the small sample size of the study. In present study

hearing improvement increased gradually with time which explained gradual process of healing and post operative stabilisation of graft of the neotympanic membrane.

Each patient was taken his control and mean was taken for differences in AB gap. In our study 47.5% showed a post operative AB gap of less than or equal to 10 db. In this

Table 6 Subjective improvement in hearing at 6 months

	Temporalis fascia group		Conchal cartilage group		Intergroup significance
	N	%	N	%	
Absent	2	10	3	15	NS
Present	18	90	17	85	
Total	20	100	20	100	

NS Non significant ($p > 0.05$)

study though only single method of doing tympanopalsty was undertaken i.e. post aural underlay and study was limited to only central perforations with mild to moderate conductive hearing loss, however the strength of this trial was randomisation, data collection and analysis which was performed centrally. This was in contrast to most studies which arbitrarily define the improvement in hearing loss as cut off or mean of audiometric parameters with very different values and time.

According to some authors, cartilage may be good for graft stabilization but not for hearing results [14]. Zahnert and colleagues has postulated that the thickness of cartilage graft in cartilage tympanoplasty should be less than 0.5 mm for it to achieve acoustic properties similar to normal tympanic membrane. However thinning of the cartilage graft, normally in the range of 0.7 mm to 1 mm, results in inevitable twisting of the cartilage making reconstruction more difficult.

In recent studies no significant differences were found for hearing improvement after full thickness cartilage and fascia tympanopalsty, similar to our results [10, 15, 16].

A study by Chen et al. [17] conducted on 102 patients using perichondrium/cartilage composite graft in 79 patients undergoing palisade tympanopalsty showed the AB gap to be 41.66 ± 10.22 and post operatively AB gap to be 26.86 ± 8.92 db.

In a study of Zhang et al. [18], early improvement in temporalis fascia were seen than in cartilage composite graft, but there was no significant difference after 1 year. An overall hearing improvement, with an AB gap difference of less than 20 db, was seen approximately in 56% cases after 2 years of follow up in a study by Labatut Pesce et al. [19]. Their results were better than the ones in our study probably because threshold of AB gap was higher than our study.

Conclusion

Although both temporalis fascia and conchal cartilage with perichondrium are acceptable graft material for successful closure of tympanic membrane perforation however hearing improvement was better with conchal cartilage group.

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