Original Research Article

# Evaluation of using temporalis fascia and cartilage graft in type I tympanoplasty among the patient from district Nainital

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**Received: 29-04-2023/ Revised: 27-05-2023 / Accepted: 01-06-2023**

**Abstract**:
The tympanic membrane which is pearly greyish in colour has a function to amplify and transmit sound waves and perforation could be caused due to recurrent middle ear infection or trauma results in symptoms like discharging ear, hearing impairment and otalgia. A total of 120 patients were enrolled for the present study and Pure tone audiometry test along with other tests were performed to evaluate improvement in hearing and closure of the perforation. The mean age of the study population was 29.33±10.77 years, the mean Preop PTA was 39.22±6.39, the mean preop air bone gap was 29.78±4.73 and the post op PTA and air bone gap was 32.91±7.001 and 23.54±6.29 respectively.In preoperative cartilage group, Ab gap was 29.04±4.915, the postoperative AB gap was 23.85±6.65 and 23.07±5.94 for temporal fascia and cartilage respectively. No significant difference was observed among grouped variables among both the groups. It was observed thatpreop PTA (38.53±5.85), preop air bone gap (29.43±4.64), post op PTA (31.45±5.28) and postop air bone gap (22.43±5.51) was significantly less than in patients in whom healing was not present. The mean surface area (%) was greater in patients in whom healing was not present (53.85±17.22 vs 45.56±14.90). Thus, we found that Type I tympanoplasty is an effective and safe procedure with a high anatomical success rate in the treatment of mucosal COM. Tympanoplasty with cartilage graft had a hearing outcome comparable to temporalis fascia graft. We found that factors like age, gender, side of involvement of ear, size and site of perforation and grafting techniques did not affect the success rate of tympanoplasty.



## Introduction

The tympanic membrane is a thin membrane pearly greyish in colour and divides the external ear from the middle ear. Due to its vibratory characteristic, the major function of tympanic membrane is to amplify and transmit sound waves from the external auditory canal through the ossicular chain to the oval window and vestibular ramp. It also helps to prevent middle ear cleft infections.[1,2] Tympanic membrane (TM) perforation which could be caused due to recurrent middle ear infection or trauma results in symptoms like discharging ear, hearing impairment and otalgia.The majority of perforations heal on their own, but 10–20% will become chronic.[3] The incidence of traumatic TM perforation has been estimated to be 6.80 per 1000 people in the literature.[4] Chronic otitis media (COM) is essentially a persistent infection of the mucosa lining the middle ear cleft, which includes the middle ear, attic, aditus, antrum, mastoid air cells, and eustachian tube. It causes numerous pathological changes in tympanic membrane, and middle ear such as perforation, ossicular destruction, myringo sclerosis, tympano sclerosis, granulation tissue, polyp, cholesteatoma, etc.[5]Although the tympanic membrane has demonstrated a remarkable ability for regeneration and spontaneous healing, chronic perforations do commonly occur and may require grafting as a means of repair.COM is classified according to Browning Classification:

Healed COM
Inactive (mucosal)COM
Inactive (squamosal)COM
Active(mucosal) COM
Active(squamosal) COM

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However, an obsolete classification was Tubotympanic disease and Atticoantral disease.

Surgical repair (Tympanoplasty) has been the procedure of choice for COM patients for decades.To reconstruct the tympanic membrane, several graft materials are used, like vein graft, temporal fascia, cartilage, tensor fascia lata, perichondrium, and periosteum. Wullstein and Zollner's promotion of tympanoplasty in 1953 ushered in a new era in otology's tympanic membrane repair. Thus, the present study was conducted to evaluate improvement in hearing and closure of the perforation following type 1 tympanoplasty using temporalis fascia and cartilage graft after 3 months of surgery, to assess graft status after type 1 tympanoplasty using temporalis fascia and cartilage graft and to assess other complications after surgery in both groups.

## Materials and Methods

The present study was conducted in the "Department of Otorhinolaryngology & Head and Neck Surgery, Government Medical College, Haldwani, Uttarakhand" over a period of 21 months. Patients with diagnosis of COM (Inactive Mucosal type) requiring Type I Tympanoplasty wererecruited in the study after obtaining informed consent from the patients andafterethicalclearancefrom institutionalethicscommittee. A total of 120 patients were enrolled for the present study and was divided into two groups:

**GROUP A:** 60 Type 1 tympanoplasty using temporalis fascia graft (Figure 1).

**GROUP B**: 60 Type 1 tympanoplasty using cartilage graft (Figure 2).

**Inclusion Criteria**

Patients with age group 10 to 60 years, with diagnosis of chronic otitis media inactive mucosal disease, non-discharging ear for at-least 4 weeks, Conductive hearing loss, Good cochlear reserve and Intact ossicular chain.

**Exclusion Criteria**

Patients not willing for surgery
Age <10 and >60 years of age
Cholesteatoma of ear
Previous history of ear surgery
Pregnancy
Eroded ossicular chain

The study included obtaining detailed history and clinical examinations of ear, nose and throat was performed in the OPD (outpatient department), Otoendoscopy was done. Pure tone audiometry test (PTA) was done in our audiology room within 2 weeks before surgery. Air conduction included at 250 Hz, 500 Hz, 1000 Hz, 2000 Hz, 3000 Hz,4000 Hz and 8000 Hz frequencies and bone conduction included at 250 Hz, 500 Hz,1000 Hz, 2000 Hz, 3000 Hz and 4000 Hz frequencies. Pure toneaverage was calculated from 500 Hz, 1000 Hz, and 2000 Hz. Air Bone gap(ABG) was measured by the difference of average of air conduction, and bone conduction threshold done at the same time. Audiogram was noted. Complete blood count, Bleeding and Clottingtime, ECG and Chest X-ray, X-ray bilateral mastoid Schuller's view, HIV testing, and hepatitis B surface antigen test, hepatitis C were done.

**Figure 1: Temporalis fascia graft harvest**

**Figure 2: Tragal cartilage harvest**

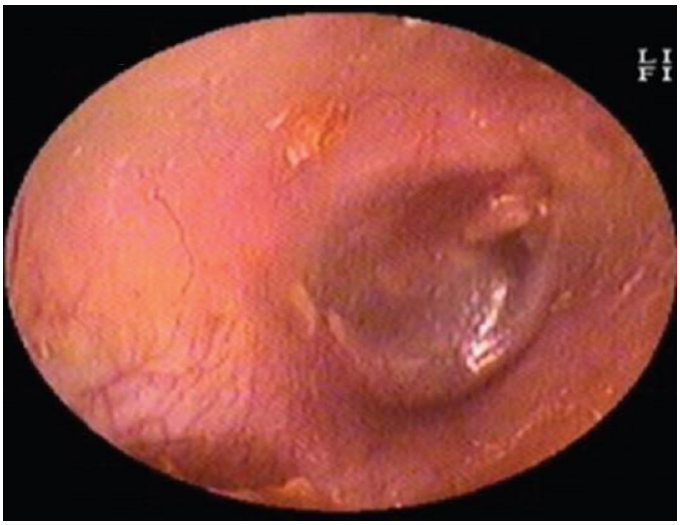

**Figure 3: Post op temporal fascia graft**

**Statistical Analysis**

- All of the data will be recorded on excel sheets and all data will be analysed using IBM SPSS version 26. The data was expressed in frequency and mean value. the mean values of the data were compared using independent T test for comparing two groups while for comparing more than 2 groups ANOVA test was used.
- For comparing categorial variables chi square test was used.

The value of less than equal to 0.05 was considered to be significant while value of <0.001was considered to be highly significant

**RESULTS:**

The present study was conducted on 120 patients with tympanic membrane perforation and inactive mucosal chronic otitis media attending the OPD and admitted in IPD (in-patient department) in Department of ENT, Dr. Sushila Tiwari Government Hospital, Haldwani. The mean age of the study population was 29.33±10.77 years, the mean Preop PTA was 39.22±6.39, the mean preop air bone gap was 29.78±4.73 and the post op PTA and air bone gap was 32.91±7.001 and 23.54±6.29 respectively.The study was divided into 2 groups according to the grafts used for the management. In group A, temporal fascia was used(n=60) while in group B, cartilage was used (n=60).

In the present study, the two groups were stratified according to age and maximum prevalence of TM perforation was seen in age group 21-30 years (40%) followed by 11-20 years (25%), 31-40 years (20%), 41-50 years (13.30%), 6-10 years (1.7%) and no prevalence was observed in age group 51-60 years (0.0%). In group B, highest prevalence was seen in 21-30 years of age group (31.70%) followed by 11-20 years (26.7%), 41-50 years (20%), 31-40 years (16.7%), 51-60 years (5.0%) and no prevalence in 6-10 years. No significant difference was observed with respect to age between both groups which implies that age was equally distributed among both the group (p>0.34). In case of gender distribution, no significant difference was observed between both groups which implies that sex was equally distributed among both the group (p>0.36). about 45% and 53% females had TM perforation and cartilage surgery, respectively, while, 55% and 46% of males had TM perforation and cartilage surgery, respectively.

In present study, graft usedunilaterallyin both groups were observed to be more on right side (44.20%) than left side (41.70%) and bilateral (14.20%). However, no significant difference was observed with respect to laterality between both groups (p>0.92). With respect to Pre-op pure tone audiometry among both the groups, majority of the patients had mild hearing loss (60.8%), 37.50% had moderate hearing loss while 1.70% had severe hearing loss before tympanoplasty. Here also no significant difference was observed with respect to PTA between both groups before tympanoplasty (p>0.36). It was found that although 85.80% of the patients in current study had mild hearing loss and 14.20% had moderate hearing loss after tympanoplasty but no association was seen with respect to PTA between both groups after tympanoplasty (p>0.70). In terms of location of perforation, 73 patients had it in anterosuperior quadrant, in 65 patients it was located in anteroinferior quadrant, in 48 patients it was located posteroinferiorly while in only 37 patients posterosuperior quadrant was involved. Association was not established in terms of perforation location.

It was seen that 60.80% of the patients had 26-50% of the surface area involved while in 26.70% patients <25% of the area was involved and only 12.5% patients covered 75% of the area, with no significant outcomes obtained. In patients with temporal fascia grafts 9(15%) had no healing and 51 patients were healed while in patients with cartilage graft 4(6.7%) had no healing and 56 patients healed with time, however, no significant difference was present (p>0.24) (Figure 3).

**Table 1: Comparison between temporal fascia and cartilage among grouped variables**

| | Temporal Fascia | | Cartilage | | t-value | p-value |
|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | | |
| **Pre op pure tone average ear (dB)** | 39.44 | 6.47 | 39 | 6.365 | 0.38 | 0.704 |
| **Pre op air bone gap ear** | | 4.46 | 29.04 | 4.915 | 1.72 | 0.08 |
| **Post op pure tone after 12 weeks (dB)** | 33.23 | 8.05 | 32.59 | 5.814 | 0.498 | 0.62 |
| **Post op air bone gap ear in 12 weeks** | 23.85 | 6.65 | 23.07 | 5.948 | 0.67 | 0.5 |
| **Mean surface Area** | 46.25 | 15.14 | 46.67 | 15.58 | -0.14 | 0.88 |
| **Improvement PTA** | 6.2 | 4.37 | 6.4 | 3.79 | -0.26 | 0.78 |
| **Improvement Air gap** | 6.61 | 4.39 | 5.83 | 2.63 | 1.18 | 0.23 |

Table 1 showed that the improvement in air gap was slightly more in temporal fascia group however it was not significant. In present study the preoperative while in cartilage group it was 29.04±4.915. the postoperative AB gap was 23.85±6.65 and 23.07±5.94 for temporal fascia and cartilage respectively.No significant difference was observed among grouped variables among both the groups (Figure 4).

**Figure 4: Post op cartilage graft**

In the present study, association of healing, age and gender between both groups was calculated but nosignificant difference was observed between healing and age (p>0.78) and gender (p>0.81). We also observed that in 46.20% of the patients, right side perforations was not healed followed by 30.80% of bilateral perforations and 23.10% of left side perforations with no significant difference (p>0.13). Healed patients were 43.90% for right side, 43.90% for left side and 12.10% for bilateral perforations.
Table 2 showed that patients in whom healing did not occur had significantly (p<0.001) more moderate post op PTA reading (69.20%) as compared to patients in whom healing was present (7.50%).

**Table 2: Association of healing and post -op PTA between both groups**

| Post op PTA | Healing | | | | | | p-value |
|---|---|---|---|---|---|---|---|
| | Healed | | Non healed | | Total | | |
| | N | % | N | % | N | % | |
| **Mild (25-40dB)** | 99 | 92.50% | 4 | 30.80% | 103 | 85.80% | <0.001 |
| **Moderate(41-55dB)** | 8 | 7.50% | 9 | 69.20% | 17 | 14.20% | |
| **Total** | 107 | 100.00% | 13 | 100.00% | 120 | 100.00% | |

On the other hand, patients in whom healing did not occur had significantly more moderate hearing loss (76.90%) as compared to patients in whom healing was present (32.70%). (p>0.008) (Table 3).

**Table 3: Association of healing and pre -op PTA between both groups**

| Preop PTA | Healing | | | | | | p-value |
|---|---|---|---|---|---|---|---|
| | Healed | | Non healed | | Total | | |
| | N | % | N | % | N | % | |
| **Mild (25-40dB)** | 70 | 65.40% | 3 | 23.10% | 73 | 60.80% | 0.008 |
| **Moderate(41-55dB)** | 35 | 32.70% | 10 | 76.90% | 45 | 37.50% | |
| **Severe(56-70dB)** | 2 | 1.90% | 0 | 0.00% | 2 | 1.70% | |
| **Total** | 107 | 100.00% | 13 | 100.00% | 120 | 100.00% | |

Apart from this, we observed that patients who had posteroinferior and anterosuperior lesion have comparatively more non healed lesions though not significant. Further, patients who had involvement of 75% surface area have comparatively more non healed lesions but the difference was not significant (p>0.9).

**Table 4: Comparison between healing among grouped variables**

| | HEALED | | NON-HEALED | | t-value | p-value |
|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | | |
| **Pre op pure tone average ear (dB)** | 38.53 | 5.85 | 44.94 | 7.98 | -3.579 | 0.001 |
| **Pre op air bone gap ear** | 29.43 | 4.64 | 32.64 | 4.72 | -2.348 | 0.021 |
| **Post op pure tone after 12 weeks (dB)** | 31.45 | 5.28 | 44.94 | 7.98 | -8.176 | <0.001 |
| **Post op air bone gap ear in 12 weeks** | 22.34 | 5.51 | 32.64 | 4.72 | -6.445 | <0.001 |
| **Mean surface Area** | 45.56 | 14.90 | 53.85 | 17.22 | -1.862 | 0.065 |
| **Improvement PTA** | 7.07 | 3.63 | 0.00 | 0.00 | 6.987 | <0.001 |
| **Improvement Air gap** | 6.98 | 3.07 | 0.00 | 0.00 | 8.157 | <0.001 |

Table 4 showed that preop PTA (38.53±5.85), preop air bone gap (29.43±4.64), post op PTA (31.45±5.28) and postop air bone gap (22.43±5.51) was significantly less than in patients in whom healing was not present. The mean surface area (%) was greater in patients in whom healing was not present (53.85±17.22 vs45.56±14.90). However, the difference was not significant. Improvement in PTA and air gap was significantly more in patients in whom healing occurred.

**Discussion**

The present study was conducted on 120 patients with tympanic membrane perforation and inactive mucosal chronic otitis media attending the OPD and admitted in IPD of Department of ENT, Dr. Sushila Tiwari Government Hospital, Haldwani. The study was divided into 2 groups according to the grafts used for the management. The mean age of the study population was 29.33±10.77 years. No significant difference was observed in respect to age between both groups which implies that age was equally distributed among both the group. In both the group, prevalence of TM perforation was maximum in age group 11-30 years. The result of the present study was in accordance with the report conducted by Singh et al[6] in 2021 who observed that maximum cases (40%) were in the age group of 21-30 years. The mean age of all the cases was 28.20 years. Nahata et al[7] in a cross-sectional prospective study included 100 perforated ears from patients of CSOM safe. Unilateral/bilateral CSOM of safe type with no history of ear discharge for at least 6 weeks were selected randomly irrespective of age and gender. In their study the mean age of the patients was 23.2 years ± 11.8 years. Adegbiji et al[8] also reported the 11-20 years to be the predominant age group for tympanic membrane perforation. This can be attributed to the fact that this is the age for jobs and also of marriage which compel the patients for reconstructive surgery. Also, CSOM occurs in children because of the presence of a straighter and shorter Eustachian tube predisposing easy passage of infection from nose to ear, lower immunity and recurrent upper respiratory tract infection (URI's) in this age group[6].

TM perforation were almost equally distributed among male (50.80%) and female (49.20%). No significant difference was observed in respect to gender between both groups which implies that sex was equally distributed among both the group(p>0.05). In a study by Adegbiji et al[8]65.5% patients were male while 34.5% were females. Singh et al[6] also reported 65% patients to be male and male: female ratio in their series was approximately 2:1. Dornhoffer at al[9] in which tragal perichondrium tympanoplasties were performed on 55% male and 45% on female patients. In a study by Nahata et al[7] female predominance was observed with 36 out of sixty-three patients being females while 27/ 63 were males. The difference observed in this study could be due to difference in literacy levels in different geographical locations where women visit hospitals less frequently.

In present study, 85.90% patients had unilateral involvement [right side (44.20%) left side (41.70%)] while 14.20% had bilateral

involvement. No significant difference was observed in respect to site of involvement between both groups (p>0.05). Ibekwe et al[10] showed that out of 77 perforated ear drums (62 patients) were studied and 15(24.2%) had bilateral while 75.8% had unilateral involvement (21 (33.9%) right, 26(41.9%) left). Our results were in discordance with a study by Nahata et al[7] bilateral involvement was more than right or left. The right ear hadmore of theperforated TM; as compared to the left ear. The difference washowever marginal. Although the reason for this could not be clearly defined. In present study, it was observed that in maximum patients had only 50% of the area involved. Also, maximum patient had perforation in anterosuperior quadrant and anteroinferior quadrant, while less had perforations located posteroinferiorly and in posterosuperior quadrant. In a study by Singh et al[6] in 22 (55%) cases there was a medium sized central perforation, occupying two-fourth or any two quadrants of tympanic membrane. 11 cases (27.5%) had large, occupying two-fourth or any two quadrants of tympanic membrane and only 7 cases (17.5%) had small central perforation, occupying one-fourth area of tympanic membrane or limited to one quadrant of tympanic membrane. Similar selection criteria regarding the size of perforation were used in the study of Indorewala et al[11] In a study by Bhadesia et al[12] the most common size of perforation was moderate (55%), followed by large (41%) and small (4%). In a study by Lakpathi et al[13], 46.66% patients had a small perforation, 45% had moderate and 8.33% patients had a large perforation. In Kumar et al[14] study, small, moderate and large perforation was present in 33% patients each. In a study by Bhadesia et al[12], most common site of perforation was central (51%), followed by posterior (37%) and anterior (12%). Central perforation was also commonly seen with Arindam et al (39%)[14] and Singh et al[6] (41.81%). Dinesh et al[15] reported perforation in inferior quadrant most commonly (37.78%).

Majority (60.8%) patients had mild PTA, 37.50% had moderate PTA while 1.70% had severe PTA before tympanoplasty. No significant difference was observed in respect to PTA between both groups before tympanoplasty (p>0.05). The mean Preop PTA was 39.22±6.39 dB. The mean PTA in Temporal fascia group was 39.44±6.47dB and cartilage group it was 39±6.36dB. The pre op PTA was almost similar for both the group. In a study by Nahata et al[7] based on WHO grades of hearing impairment, the ears were classified and maximum ears were seen to have a mild hearing loss (81 ears), followed by moderate loss (16 ears) and normal hearing. In a study by Singh et al[6]maximum number of cases (20, 50%) had hearing loss from 30-40 dB followed by 10 cases (25%) had hearing loss of more than 40 dB and 10 cases (25%) had hearing loss of less than 30 dB. The post op PTA in temporal fascia group was 33.23±8.05dB while in cartilage group it was 32.59±5.81dB. No significant difference was observed in post op PTA also but the improvement observed in temporal fascia group was 6.2±4.37dB while in cartilage group it was 6.4±3.79 dB. No significant difference was observed between two groups regarding grafts used. In a study done by Kumar et al[14] in Temporal fascia group pre op PTA was 44.44±8.66 dB and post op it was 24.48±6.13 while in cartilage group it was 43.24±12.15 and post op PTA was 27.16±10.5dB. In 2004, Gierek et al[16], performed 112 cases with cartilage and 30 cases with temporalis fascia. They observed that there was no significant hearing difference between the two groups. Couloinger et al[17], observed 59 cartilage graft tympanoplasties and 20 temporalis fascia graft tympanoplasties in 2005, and they reported no postoperative hearing difference between the two groups.

In present study the preoperative AB gap was 33.23±8.05 while in cartilage group it was 29.04±4.915, the post-operative AB gap was 23.85±6.65 and 23.07±5.94 for temporal fascia and cartilage respectively. On comparing the air bone gap, we observed that the improvement in air bone gap was greater in temporal fascia (6.61±4.39) group than cartilage group (5.83±2.63). It was observed that the improvement in air gap was slightly more in temporal fascia group however, it was not significant. A study by Chen et al[18] conducted on 102 patients using perichondrium/cartilage composite graft in 79 patients undergoing palisade tympanoplasty showed the AB gap to be 41.66 ± 10.22 and post operatively AB gap to be 26.86 ± 8.92 db.

Onal et al[19]. compared in this regard the functional outcomes of patients with bilateral COM and subtotal perforation treated with TPL I with temporalis fascia (n = 41) or cartilage graft (n = 39). TPL I with cartilage in these subjects demonstrated better auditory outcomes (23 _ 8.4 dB vs. 28.5 _ 14.2 dB; p < 0.001) and graft success rates than fascia (92.3% vs. 65.9%; p < 0.001). However, the authors treated only subtotal perforations, and a comparison of early and long-term outcomes was not performed. In contrast, Demirpehlivan et al[20]. reported similar postoperative results in terms of air conduction gain between the two graft types (24.54 dB cartilage vs. 24.51 dB fascia; p > 0.05), emphasizing the superior take rate of the cartilage graft (97.06% vs. 80.6%; p < 0.001). In a study by Ferlito et al[21], the highest recurrence rate was found in the fascia graft group, although not significant (15/98, 15.3% vs. 4/44, 2.27%; p = 0.37). In terms of auditory outcomes, on the other hand, both groups demonstrated significant improvement in postoperative air conduction, although a greater gain was found in the fascia group (p < 0.001). Jalali et al[22]. in this regard included 11 prospective and 26 retrospective studies with a total of 3,606 patients. Indeed, the authors showed cartilage graft demonstrated better outcomes than fascia graft in a pooled analysis of overall TPL I graft integration rates (92% vs. 82%; p < 0.001). In addition, although there were no significant differences in ABG between the two groups, the subanalysis demonstrated better outcomes for patients in the temporalis fascia group. (p = 0.02)

It was observed that however no significant difference was observed among both the group with respect to healing, the patients in cartilage had better healing. In patients with temporal fascia grafts 9(15%) had no healing while in patients with cartilage graft 4(6.7%) had no healing. (p>0.05). Fernandes et al in their study showed that in their study the successful closure of perforation was seen in 93.33% when cartilage was used along with temporalis fascia as compared to 81.66% with temporalis fascia alone, at 8 weeks post operatively. There was a significant improvement in hearing as suggested by the statistical tests.

In a study by Onal et al[19]65.9% of patients who had been given temporal fascia graft and 93.2% who had been given cartilaginous grafts were successful. In a study by Yu et al[23] 80% with temporal fascia and 92.4% with cartilaginous flaps were successful.It was observed that total 89.20% of the tympanoplasties healed successfully while 10.80% did not heal. Age, sex, size of perforation, site of perforation, were not found to have a significant relation with the successful outcome of endoscopic type 1 tympanoplasty.

It was observed that in present study preop PTA (38.53±5.85), preop air bone gap (29.43±4.64), post op PTA (31.45±5.28) and postop air bone gap (22.43±5.51) was significantly less than in patients in whom healing wasn't present. The mean surface area (%) was greater in patients in whom healing wasn't present (53.85±17.22 vs45.56±14.90). However, the difference wasn't significant. Improvement in PTA and air gap was significantly more in patients in whom healing occurred. Salvador et al[24] in 2020 in their study observed that he overall surgical anatomical success rate was 75%. In their study perforations above 50% of the tympanic membrane area had a borderline effect on graft uptake (p=.05). There was a significative improvement in the average air conduction thresholds of 7.44dB and an ABG closure rate at 10dB and 20dB was achieved in 47% and 84.5%, respectively. Patients who received temporalis fascia graft had similar hearing gain compared to patients who underwent cartilage tympanoplasty these findings were in accordance with the present study.

Dangol et al[25] in their study found the graft uptake rate to be 83.1% at one year in 219 patients. they found no statistically significant difference in graft uptake results with other factors. The average Air Conduction Threshold improvement was 11.44dB (p < 0.001) and the average Air-Bone Gap closure was 8.89dB, highly statistically significant (p < 0.001). The results were in accordance to the present study. Singh MN et al[26] in their study showed the graft uptake rate in to be 90% and hearing improvement in terms of air bone (AB) gap within 0-15 dB was achieved in 83.3%. Age, sex, size of perforation, site of perforation, wet/dry ear, and status of the mastoid air cell system were not found to have a significant relation with the successful outcome of endoscopic type 1 tympanoplasty in their study.

Thus, we found that Type I tympanoplasty is an effective and safe procedure with a high anatomical success rate in the treatment of mucosal COM. Tympanoplasty with cartilage graft had a hearing outcome comparable to temporalis fascia graft. We found that factors like age, gender, side of involvement of ear, size and site of perforation and grafting techniques did not affect the success rate of tympanoplasty.

**Conclusion**

Thus, we found that Type I tympanoplasty is an effective and safe procedure with a high anatomical success rate in the treatment of mucosal COM. Tympanoplasty with cartilage graft had a hearing outcome comparable to temporalis fascia graft. We found that factors like age, gender, side of involvement of ear, size and site of perforation and grafting techniques did not affect the success rate of tympanoplasty.

**References**

1. Lim DJ. Structure and function of the tympanic membrane: a review. Acta Otorhinolaryngol Belg. 1995;49(2):101-15.
2. Dawood MR. Spontaneous Healing of Traumatic Tympanic Membrane Perforation. Mustansiriya Med J. 2015;14(1):24–29.
3. Saimanohar S, Gadag RP, Subramaniam V. Management of Traumatic Perforations of the Tympanic Membrane:A Clinical Study. Int J Otorhinolaryngol Clin. 2015;7(3):114–116.
4. Wani A, Rehman A, Lateef S, Malik R, Ahmed A, Ahmad W, et al. Traumatic tympanic membrane perforation:An overview. Indian J Otol. 2016;22(2):100–104.
5. Gova SK, Chaitanya VK. A Prospective Observational Study of Temporalis Fascia with Tragal Perichondrium as Graft Material in Type I Tympanoplasty.IJSR. 2019;8(12):509:31.
6. Singh B, Verna JK. Clinico-demographic Profile of Tympanic Membrane Perforation Cases in Tertiary Care Hospital in Bundelkhand Region of India. Int J Contemp Med Res. January 2021;8(1):A1-4
7. Nahata V, Patil CY, Patil RK, Gattani G, Disawal A, Roy A. Tympanic membrane perforation: Its correlation with hearing loss and frequency affected - An analytical study. Indian J Otol 2014;20(1):10-5
8. Adegbiji WA, Olajide GT, Olajuyin OA, Olatoke F, Alabi SA, Nwawolo CC. Traumatic Tympanic Membrane Perforation in Tertiary Health Institution. The Journal of Middle East and North Africa Sciences. 2018;4(1):1-7.
9. Dornhoffer John L: Hearing results with Cartilage Tympanoplaty; Laryngoscope; 1997;107: 1094-9.
10. Ibekwe TS, Nwaorgu OG, Ijaduola TG. Correlating the site of tympanic membrane perforation with Hearing loss. BMC Ear Nose Throat Disord. 2009 Jan 4;9:1. doi: 10.1186/1472-6815-9-1. PMID: 19121227; PMCID: PMC2631525.
11. Indorewala ST: Dimensional stability of free fascia graft: Clinical application; Laryngoplasty with the use of different Graft Materials; Journal of the Medical research Institute, 2005;26: 369-374.
12. Bhadesia B, Joshi H, Desai N, Hirani N, Khilnani AK, Sorathiya R. A study of factors affecting the success rate of type-1 tympanoplasty. Int J Otorhinolaryngol Head Neck Surg 2020;6(12):2237-42.
13. Lakpathi G, Sudarshan Reddy L, Anand. Comparative Study of Endoscope Assisted Myringoplasty and Microscopic Myringoplasty. Indian J Otolaryngol Head Neck Surg. 2016 Jun;68(2):185-90.
14. Kumar A, Narayan P, Narain P, Singh J, Porwal PK, Sharma S, et al. Comparative study between result of temporalis muscle fascia and tragal cartilage perichondrium as a graft material in type 1 tympanoplasty. Int J Otorhinolaryngol Head Neck Surg 2018;4:565-8.
15. Sharma DK, Singh S, Sohal BS, Singh B. Prospective study of myringoplasty using different approaches. Indian J Otolaryngol Head Neck Surg. 2009;61(4):297-300.
16. Gierek T, Slaska-Kaspera A, Majzel K, KlimczakGotqb L. Results of Myringoplasty and Type I Tympanoplasty with the Use of Fascia, Cartilage and Perichondrium Grafts. Otolaryngologia Polska. 2004;3:529-33.
17. Couloigner V, Baculard F, El Bakkouri W, Viala P, Francois M, Narcy P, et al. Inlay Butterfly Cartilage Tympanoplasty in Children. OntolNeurotol. 2005;26:247-51.
18. Chen XW, Yang H, Gao RZ, Yu R, Gao ZQ. Perichondrium/cartilage composite graft for repairing large tympanic membrane perforations and hearing improvement. Chin Med J. 2010;123(3):301–304.
19. Onal K, Arslanoglu S, Songu M, Demiray U, Demirpehlivan IA. Functional results of temporalis fascia versus cartilage tympanoplasty in patients with bilateral chronic otitis media. J Laryngol Otol. 2012 Jan;126(1):22-5.
20. Demirpehlivan IA, Onal K, Arslanoglu S, Songu M, Ciger E, Can N. Comparison of different tympanic membrane reconstruction techniques in type I tympanoplasty. Eur Arch Otorhinolaryngol. 2011 Mar;268(3):471-4.
21. Ferlito S, Fadda G, Lechien JR, Cammaroto G, Bartel R, Borello A, et al. Type 1 Tympanoplasty Outcomes between Cartilage and Temporal Fascia Grafts: A Long-Term Retrospective Study. J Clin Med. 2022 Nov 26;11(23):7000.
22. Jalali MM, Motasaddi M, Kouhi A, Dabiri S, Soleimani R. Comparison of cartilage with temporalis fascia tympanoplasty: A meta-analysis of comparative studies. Laryngoscope. 2017 Sep;127(9):2139-2148.
23. Yu L, Han C, Yu H, Yu D. [Auricular cartilage palisade technique for repairing tympanic membrane perforation]. Zhonghua Er Bi Yan Hou Ke Za Zhi. 2001 Jun;36(3):166-8. Chinese.
24. Salvador P, Gomes P, Silva F, Fonseca R. Type I Tympanoplasty: surgical success and prognostic factors. Acta OtorrinolaringolEsp (Engl Ed). 2021 May-Jun;72(3):182-189. English, Spanish. doi: 10.1016/j.otorri.2020.04.009. Epub 2020 Aug 27. PMID: 32862972.
25. Dangol K, Shrivastav RP. Study of Various Prognostic Factors Affecting Successful Myringoplasty in a Tertiary Care Centre. Int Arch Otorhinolaryngol. 2017 Jul;21(3):250-254. doi: 10.1055/s-0036-1593818. Epub 2016 Nov 28. PMID: 28680493; PMCID: PMC5495587.
26. Singh MN, Hamam PD, Lyngdoh NC, Priyokumar OS. Evaluation of hearing status in pre and post-operative endoscopic type 1 tympanoplasty and its influencing factors. J Med Soc 2014;28(3):166-70

**Conflict of Interest: Nil**
**Source of support: Nil**