

## Original Research Article

# A comparative study between fat myringoplasty and temporalis fascia tympanoplasty in moderate to large central perforation of pars tensa of tympanic membrane

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### ABSTRACT

**Background:** To compare the efficacy between fat graft (FG) and temporalis fascia (TF) graft in tympanic membrane perforations larger than 4mm size or involvement of >25% of tympanic membrane.

**Methods:** This prospective study was carried out during December 2015 to January 2016, for a period of 13 months at our Otolaryngology Department. All study patients, who fit into inclusion and exclusion criteria, were divided into two groups according to the type of graft material taken. In group- 1 temporalis fascia (TF) graft was taken while in group- 2 fat graft (FG) was taken. An evaluation of hearing was done with full Audiometric and Eustachian tube function testing. All laboratory preoperative testing was done. Postoperative follow up was done at 2<sup>nd</sup>, 3<sup>rd</sup> and 5<sup>th</sup> month's period and so, graft status and hearing evaluation with PTA for all four frequencies 500, 1000, 2000 and 4000 Hz with air conduction and bone conduction thresholds were recorded and compared with preoperative PTA records in both groups.

**Results:** In TF group total 24 (80%) patients had graft uptake, 4 (13.3%) patients had residual perforation and 2 (6.6%) patients had graft failure due to postoperative infection. In FG group total 16 (53.3%) patients had graft uptake, 6 (20%) patients had graft medialised and necrosed, 6 (20%) patients had residual perforation and 2 (6.6%) patient had graft rejection due to postoperative infection. Graft uptake rate in group 1 was 80% while in group 2 was 53.3%. Mean preoperative ABG in TF group was 25±17 dB and mean postoperative ABG was 10±02 dB, in fat graft technique mean preoperative ABG was 25±13 dB and mean postoperative ABG was 16±15 dB. Fat graft technique is simple, quick and minimally invasive. It doesn't require middle ear manipulation.

**Conclusions:** There is no ideal material for tympanic membrane repair but for moderate to large perforation temporalis fascia graft is better than fat graft in terms of healing and hearing outcomes but considering morbidity fat gives less morbidity.

**Keywords:** Fat graft, Temporalis fascia graft, Moderate to large perforation of pars tensa of tympanic membrane

### INTRODUCTION

Chronic otitis media is a longstanding infection of the middle ear cleft.<sup>1</sup> It affects both sexes and all age groups<sup>1</sup>. Tympanic membrane (TM) perforations lead to recurrent ear infection and hearing loss.<sup>2</sup> Both these complications can be prevented by the reconstructive procedure of

tympanic membrane. Various graft materials used include autologous temporalis fascia, tragal perichondrium, tragal cartilage and adipose tissue etc. Wullstein and Zollner popularized myringoplasty technique in 1951 and it is still practiced in modern days. Since the introduction by Storrs, temporalis fascia (TF) is still the favored technique of many surgeons worldwide due to its healing

and acoustic properties.<sup>3</sup> There are advantages and disadvantages and ongoing controversies regarding the use of TF.<sup>4</sup>

In 1962, Ringenberg successfully used adipose tissue – fat to repair perforations of TM. Fat tissue has been known to have a high capacity of resistance and is used as an autogenous material for different surgeries.<sup>5</sup> In 1997, Mitchell et al. used fat graft in 342 children to close small tympanic membrane perforation and achieved 92% success rate.<sup>6</sup> There are many studies regarding efficacy of fat myringoplasty in small central perforation of TM. Few studies have been done showing effectiveness of fat graft in moderate to large perforation of TM that is involving >25% of pars tensa. Fat graft can be harvested in a very short time and it avoids extensive surgical manipulation of middle ear.<sup>7</sup> Fat myringoplasty is safe, simple and cost effective technique. In the present study an attempt was made to study and compare results of fat graft myringoplasty (FGM) and TF graft in moderate to large Tympanic membrane perforations.

The aim of the study was

1. To evaluate graft uptake rate in both groups.
2. To evaluate audiological outcome in both groups.
3. To find out intraoperative and postoperative morbidity in both groups.

## **METHODS**

This prospective comparative study was carried out between December 2015 to January 2016, for a period of 13 months at our Otorhinolaryngology Department.

### ***Inclusion criteria***

Inclusion criteria were tubotympanic type of CSOM involving >25% of TM with clear margin of TM perforation with normal appearance of middle ear mucosa; no history of ear discharge for last 6 weeks; age group between 15 to 60 years; patients with pure conductive hearing loss with ABG less than 40 dB.

### ***Exclusion criteria***

Exclusion criteria were Patients with suspected ossicular discontinuity as appeared in otologic examinations or with PTA results showing >40 dB air bone gap; patients with cholesteatoma and marginal perforations; patients with subtotal and total perforations that is involvement of >75% of TM; patients with history of previous ear surgery.

All study patients were divided into two groups, 30 in each of two groups (group -1 and group-2 ) according to the type of graft material taken, in group- 1 TF graft was taken while in group- 2 fat graft (FG) was taken. The study was approved by the ethical committee of our institution. All patients were informed about the

technique before operation and written and informed consent was obtained. Preoperative records of all patients regarding age, gender, address, diseased side and detailed clinical history regarding disease were maintained. Otoscopy as well otoendoscopy examinations were done and perforation size was measured. Otoendoscopy with 30<sup>0</sup>, 4 mm scope was done in all patients to inspect ossicular integrity and mobility and also to inspect hidden areas to rule out adhesion, granulation tissue or retraction. X-ray – mastoid (bilateral Schuller's view) was done in all patients to know mastoid air cells status. Any allergies, tonsil or sino-nasal problems were treated adequately prior to surgery. An evaluation of hearing was done with full Audiometric and Eustachian tube function testing. All laboratory preoperative testing was done. Postoperative graft status checked and pure tone audiometry (PTA) was done at 2<sup>nd</sup>, 3<sup>rd</sup> and 5<sup>th</sup> month's period. All four frequencies 500, 1000, 2000 and 4000 Hz with air conduction and bone conduction thresholds were recorded and compared with preoperative PTA records in both groups.

### ***Group 1 temporalis fascia graft technique***

Full post aural incision few mm away from postaural sulcus was given. TF graft harvested of adequate size. Perforation margin was freshened. After keeping meatotomy incision tympano-meatal flap elevated. Ossicular integrity was checked and graft placed by underlay method under the remnant of drum and handle of malleus with resting on the posterior canal wall. Gelfoam kept under and above the graft to support. Small wick kept in external auditory canal (EAC) and post aural wound closed. Mastoid dressing was given.

### ***Group 2 fat graft technique***

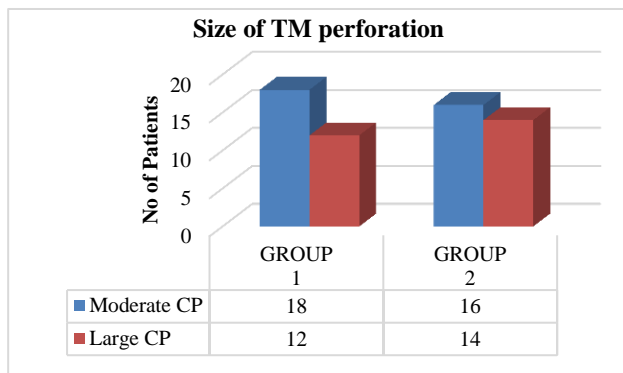
In our patients as perforation size was >25% of TM, fat tissue was obtained from abdominal wall to achieve adequate graft size. A 2 cm transverse paraumbilical incision was given; fat was harvested by sharp dissection with scissors about double or lesser the size of perforation. Abdominal incision was closed in two layers and dressing given. Fat plug harvested was kept in sterile solution until the time of insertion. Through endomeatal technique perforation margins freshened and fat plug was passed through the perforation and pulled out to evert perforation edges. Bulk of the graft fills the depth of middle ear while its outer limb was divided in two halves and rest on remnant of TM for support, which prevent graft medialisation. Fat graft should contact all parts of the margins of the perforation. Gelfoam kept over the graft to support and small wick kept in EAC. No ear dressing required.

All patients in both groups were given oral antibiotics, analgesics and decongestants for 7 postoperative days. Patients were discharged on next day morning. On 7<sup>th</sup> postoperative day suture removal was done, EAC wick removed and antibiotic ear drops instilled for 2 weeks.

On 21<sup>st</sup> day, otoscopy examination was done to see graft status. Then patients were followed up on 2<sup>nd</sup>, 3<sup>rd</sup>, 5<sup>th</sup> months and SOS postoperatively. On every follow up graft status, wound examination and hearing assessment with PTA was done and recorded.

**RESULTS**

The present study was conducted in total 60 patients. Out of which, TF graft was taken in 30 patients and labeled as group -1, while in group- 2 fat graft was used in 30 patients. In group 1, 16 (53.3%) were females and 14 (46.6%) were males while in group 2, 19 (63.3%) were males and 11 (36.6%) were females. Median age group was 33.0 in both groups ranging from (15-60). Size of the tympanic membrane perforation was measured. Perforations involving >25% and <50% of TM were classified as moderate perforation and involving >50% and <75% were classified as large perforation with remnant of drum surrounding. In TF technique 18 (60%) patients had moderate perforation and 12 (40%) had large perforation, while in FG technique 16 (53.3%) patients had moderate perforation and 14 (46.7%) had large perforation.



**Figure 1: Showing size of perforation and their distribution in group-1 and group-2.**



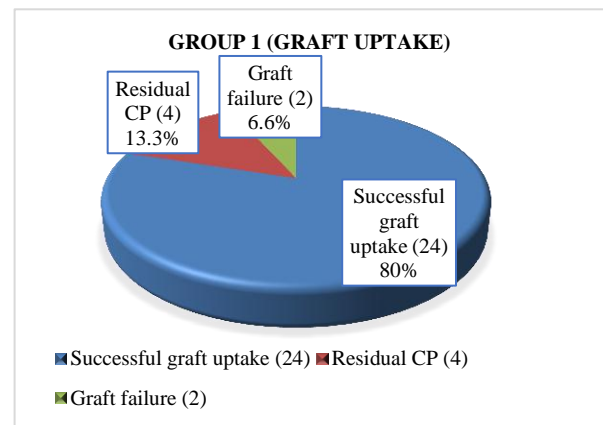
**Figure 2: Temporalis fascia graft at 5<sup>th</sup> month postoperative period.**

All patients were followed every 2<sup>n</sup>, 3<sup>rd</sup> and 5<sup>th</sup> month postoperatively. On every follow-up otoendoscopy done,

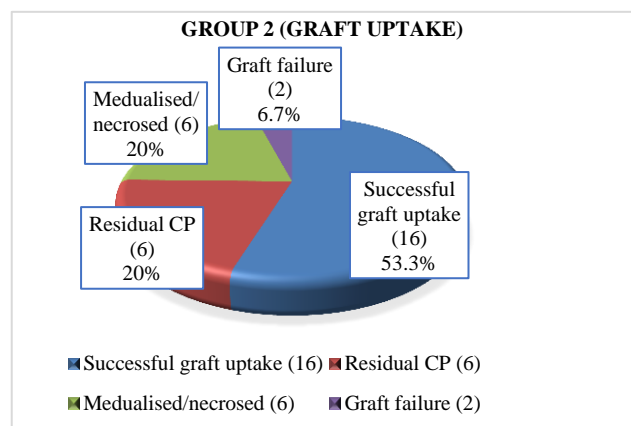
graft status was checked and hearing assessment with PTA done and recorded.



**Figure 3: Fat graft at 5<sup>th</sup> month postoperative period.**



**Figure 4: Showing graft status at 5<sup>th</sup> month postoperative period in TF group.**



**Figure 5: Showing graft status at 5<sup>th</sup> month postoperative period in FG group.**

In TF group total 24 (80%) patients had graft uptake, 4 (13.3%) patients had residual perforation and 2(6.6%) patients had graft failure due to postoperative infection. In FG group total 16 (53.3%) patients had graft uptake, 6(20%) patients had graft medialised and necrosed, 6

(20%) patients had residual perforation and 2(6.7%) patient had graft rejection due to postoperative infection. Graft uptake rate in group 1 is 80% while in group 2 is 53.3%. A paired sample test used for comparison of graft uptake in both groups, resulted p value <0.05, which is statically significant. Graft uptake rate was found better in TF group than with fat graft.

Preoperative and postoperative air bone gap (ABG) calculated from difference of air conduction thresholds and bone conduction thresholds for all four frequencies 500, 1000, 2000 and 4000 Hz and taking average of it and then compared among both groups. In TF technique 22 (73.3%) patients had ABG reduced and fall in <10 dB, 6(20%)patients had no change seen in postoperative ABG and remain same as in preoperative period and 4 (13.3%) patients had increased postoperative ABG then preoperative period. We noticed that out of 4 (13.3%) patients who had worsened ABG, 3 (10%) patients graft was taken up well, and 1 (3.3%) patient graft was

rejected. We have also noticed that out of 22 (73.3%) patients who had ABG<10dB after surgery, 4 (13.3%) patients had residual perforation. This data shows that 4 (13.3%) patients with residual perforation had hearing gain while 4 (13.3%) patients in whom graft uptake was satisfactory but hearing gain was not achieved which may be due to lateralization of graft with no contact with ossicles. Mean preoperative ABG in TF group was 25±17 dB and mean postoperative ABG was 10±02 dB, in fat graft technique mean preoperative ABG was 25±13 dB and mean postoperative ABG was 16±15 dB. In fat graft technique 12 (40%) patients had ABG reduced to <10 dB, 10 (33.3%) patients had no change seen in postoperative ABG and 8 (26.6%) patients had increase in postoperative ABG seen. Fat had inherent property of thickness which is responsible for 5 -10 dB loss even graft has taken completely. While in temporalis fascia grafting after healing, normal translucent appearance of the neotympanum was seen, which facilitates vibration of TM and gives better audiological results.

**Table 1: Comparison of preoperative hearing with postoperative hearing results at 5<sup>th</sup> month.**

ABG Air bone gap calculated from average air conduction (AC) and bone conduction(BC) thresholds at frequencies 500, 1000, 2000 and 4000 Hz	Group 1 (temporalis fascia)		Group 2 (fat myringoplasty)	
	Preoperative no. of patients	Postoperative no. of patients	Preoperative no. of patients	Postoperative no. of patients
<10 dB	4	22	5	12
10-20 dB	14	2	16	10
20-30 dB	7	2	6	4
30-40 dB	4	4	2	4
40-50 dB	1	-	1	-

We observed that fat graft technique is simple, quick and minimally invasive. It doesn't require middle ear manipulation. Average operative time in TF technique was 80-110 minutes while is FG technique it was 30-60 minutes. In 18 (60%) patients had hypoesthesia of helix and in 6 (20%) patients perverted taste sensation noted in TF group which was not seen in FG technique. Cosmetic scar was excellent in FG technique. Blunting of angle of annulus and lateralization of graft seen in TF group.

**DISCUSSION**

Ringenberg was the first to describe fat myringoplasty and the characteristics of fat tissue for otologic procedures in 1967. He compared three donor sites for FG- ear lobule, abdomen and buttock, and concluded that the ear lobe showed better epithelial and mucosal tympanic growth due to high density.<sup>8</sup> But in our study, we preferred to use abdomen fat, as ear lobe fat volume is not enough to cover large size perforation. Gun et al, landsberg et al and kim et al used FGM technique in the repair of small versus large perforations and reported no significant difference.<sup>9</sup> While Dedden et al believed that the perforation size is the important factor for success in

FGM; perforations larger than one quadrant are unfavorable for FG.<sup>10</sup> According to Kaddour, the size of the perforation should not exceed 30% of the size of the eardrum.<sup>11</sup> Terry et al, who performed FGM to correct perforations of various sizes, cited a closure rate of 79.4% if the perforation accounted for <50% of TM and 57.1% if the perforation was larger than that size, that is comparable with our study which shows graft uptake rate in FG group 53.3%.<sup>12</sup> According to Barbieri and Fiorino various causes of failures such as anterior perforations, inadequate graft support and poor vascular supply are responsible.<sup>13</sup> Failure rate in FG group could be avoided and therefore increase in the success rate of the technique could achieve if proper and strict postoperative instructions and precautions are followed. In our study TF group had 80% success rate, which is comparable with study of Strahan et al, had take up rate was 87.5%.<sup>14</sup> A paired sample test used for comparison of graft uptake in both groups, resulted p value <0.05, which is statically significant. Graft uptake rate was found better in TF group than with fat graft.

In this study both groups were followed for 5 months and hearing assessment was done at the end of 5<sup>th</sup> month. Mean preoperative ABG in TF group was 25±17 dB and

mean postoperative ABG was  $10 \pm 02$  dB, in fat graft technique mean preoperative ABG was  $25 \pm 13$  dB and mean postoperative ABG was  $16 \pm 15$  dB. Hearing gain between two groups shows statistical significance, p value is  $< 0.05$ . According to literature, there is significant bulging on the tympanic membrane till the end of the third month postoperatively, and otosclerotic area appears on the tympanic membrane at the fifth month in FG. This phenomenon also seen in all our successful patients in the postoperative period of 5 months. In FG technique fat volume regressed to 70% of its bulging at 2<sup>nd</sup> postoperative month. At the end of 5<sup>th</sup> month tympanosclerotic area develops on the TM. There is inherent property of thickness in fat which impairs vibration of TM in postoperative period, which is responsible for less ABG closure than TF graft. From this study we confirmed the findings of a bulky appearance of graft and its relation to bad audiological outcome in FG procedure, for large TM perforations. TF displays acoustic properties similar to those of TM. This might be reason for good hearing results after TF graft. TF has structure which is similar to missing tunica propria of TM.<sup>15</sup> Its availability at the site of surgery, is thin, strong and it's having a low basal metabolic rate. In TF group we found normal translucent appearance of neotympanum after healing, which gives better audiological outcome in comparison to fat graft.

TF is most widely used autogenous graft material in tympanoplasty. However TF tympanoplasty requires large incision, preparation of TM flap, lifting of annulus thereby discontinuation of TM and manipulation of middle ear structures, that all leads to hypoesthesia of helix, blunting of angle of TM, impairment of taste sensation, lateralization of graft and it affects acoustics. In FG small incision, simplicity of procedure, no disturbance of middle ear structures, makes it easy to perform and has less morbidity.

Efficacy of FG myringoplasty in small perforations of pars tensa of TM is established, but for moderate or large perforations further studies are recommended to compare the efficacy.

## CONCLUSION

Safe, relative ease of the procedure, minimally invasive and better cosmesis makes fat plug myringoplasty an office based procedure. However temporalis fascia is the gold standard, versatile, easily attainable and durable with an outstanding graft uptake rate gives better hearing outcomes when compared to fat myringoplasty. Temporalis fascia has its unique features like lower metabolic rate, high ischemic tolerability and low oxygen requirement, resistant to infection, larger graft obtained through same incision, is preferred when the perforation is large to subtotal in nature. Post-operative gain in air conduction and closure in A-B gap is comparatively less than that of fascial graft, may be because the temporalis fascia offers more resistance in the vibration of the tympanic membrane and that fat graft mostly heals with a

tympanosclerotic patch which hampers the vibrations of the neotympanum.

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*Ethical approval: The study was approved by the Institutional Ethics Committee of GMERS Medical College, Gandhinagar on dated 18/12/2015*

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