

## RESEARCH ARTICLE

# To Evaluate and Compare the Results of Over-underlay Graft Technique with Conventional Underlay Myringoplasty

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## ABSTRACT

**Objective:** To evaluate the efficacy of over-underlay graft technique of myringoplasty and compare the results of over-underlay graft technique with conventional underlay myringoplasty.

**Materials and methods:** In this prospective study 40 patients of either sex in age group of 15–50 years with noncholesteatomatous chronic suppurative otitis media (CSOM) were recruited. Patients were initially managed medically to make the ear dry and after that they were operated upon. Twenty patients underwent conventional underlay myringoplasty and 20 patients underwent over-underlay myringoplasty. Follow-up period was at least 3 months.

**Results:** Graft uptake and hearing improvement was comparable in both groups. Although there was 5% lower graft uptake in group underwent conventional underlay myringoplasty (90%) as compared to over-underlay myringoplasty (95%); however, the difference was not statistically significant ( $P = 0.5$ ). But there was statistically significant difference in gain in hearing threshold (gain in A–B gap) in the conventional underlay myringoplasty ( $14.5 \text{ dB} \pm 7.236$ ) as compare to over-underlay myringoplasty ( $18.75 \text{ dB} \pm 5.349$ ) ( $p = 0.04$ ).

**Conclusion:** The over-underlay technique, which is hybrid of both overlay and underlay technique, allows the advantages of both methods. It improves graft uptake rate and hearing improvement in subtotal and large perforations.

**Keywords:** Chronic suppurative otitis media, Myringoplasty, Over-underlay, Underlay

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## INTRODUCTION

Chronic suppurative otitis media (CSOM) is an inflammatory process of the mucoperiosteal lining of the middle ear space and mastoid. Infection of the middle ear has been a problem encountered in the human race, and is as

old as humanity itself.<sup>1</sup> Myringoplasty is the term used to describe the surgical repair of a perforated tympanic membrane is the most frequently performed otologic surgery. An adequate area of contact between graft and tympanic membrane remnant is fundamental to the successful closure of any perforation. Graft failure is considerably higher in anterior perforation, large perforation and more so by dexterity of graft placement.<sup>2</sup>

Underlay and overlay technique of myringoplasty have been used for several years and both have their advantages and disadvantages. When the medial graft technique (underlay) is used to repair subtotal tympanic membrane perforation, the anterior portion of the fascia graft may fall away, resulting in re-perforation and obliteration of the anterior part of middle ear cavity. Although the lateral graft technique (overlay) has a higher success rate for the reconstruction of subtotal tympanic membrane perforation, serious lateralization of graft may occur.<sup>3</sup>

These problems have been managed by a variety of surgical techniques, such as the use of William's microclip, sandwich graft tympanoplasty, loop overlay tympanoplasty and over-underlay tympanoplasty. Yet, a still better method is needed to repair anterior or subtotal tympanic membrane perforations.<sup>4-7</sup>

This study was done to compare the results of over-underlay graft technique with conventional underlay myringoplasty in terms of gain in hearing threshold and graft uptake in cases of inactive mucosal CSOM.

## MATERIALS AND METHODS

A prospective study where 40 patients of either sex in age group of 15–50 years with noncholesteatomatous chronic suppurative otitis media (inactive mucosal otitis media) were recruited during the period of January 2011 to September 2014 from the outpatient clinic of Department of Otorhinolaryngology, Pt BD Sharma University of Health Sciences, Rohtak (India)

Patients were divided into two groups alternately:

- Group 1 (n = 20) patients were operated by conventional underlay myringoplasty
- Group 2 (n = 20) patients were operated by over-underlay myringoplasty.

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Informed consent was obtained from every patient and ethical approval was granted for the study by institutional ethical committee.

### Inclusion Criteria

Patients in the age group of 15–50 years, uncomplicated (central) perforation of pars tensa, dry perforation for at least 4 weeks prior to surgery, absence of cholesteatoma, good cochlear reserve and air bone gap more than 25 db on pure tone audiogram.

### Exclusion Criteria

Patients with history of ear surgery in the past having age <15 years and >50 years with hearing loss >60 dB, actively discharging ear, cholesteatomatous ear, marginal or attic perforation, marked deviated nasal septum and active sinus disease.

All the patients were subjected to full history taking including onset, course, and duration of the disease, associated symptoms, previous medications, and operations. Patients were subjected to full otological examination to exclude scar of previous operation, condition of the tympanic membrane, condition of the middle ear mucosa, tuning fork tests, and also nasal and oral examination to exclude predisposing factors as allergy, sinusitis, tonsillitis, etc.

All patients were subjected to preoperative pure tone audiometry and it was repeated 3 months postoperatively. Routine preoperative laboratory investigation were done for all patients as required for surgery. If the ear was not already dry, patients were given oral and topical antibiotics to ensure that the ear was not discharging or remained dry for at least 1 month before surgery.

All the patients were operated via postaural approach, temporalis fascia graft was harvested in all cases by giving postaural incision about 3 mm behind the postaural crease.

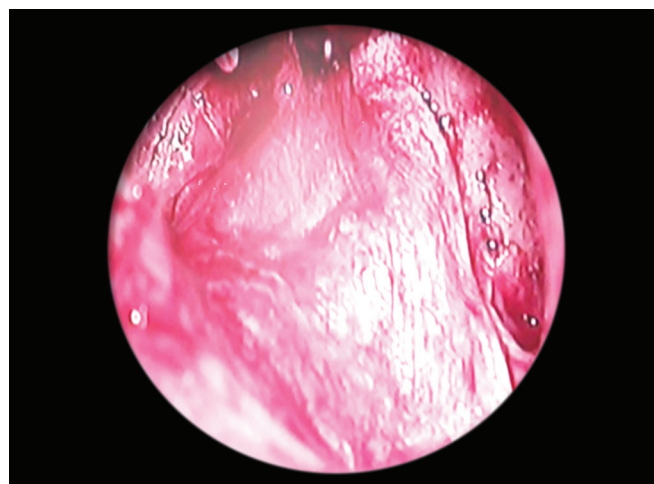
In group 1, graft was placed under the handle of malleus and annulus. An elevator was used to tuck the graft under the drum remnant anteriorly and inferiorly. Tympanomeatal flap repositioned back.

While in group 2, the graft was placed over the handle of malleus and under the tympanic membrane margins and annulus. An elevator was used to tuck the graft under the drum remnant anteriorly and inferiorly. (Fig. 1)

Patients were operated upon by the same surgeon and all patients were followed for at least 3 months after the operation.

Postoperatively, the patients were given, tablet amoxycyclav 1 g BD and tablet levocetirizine 5 mg OD for seven days and tablet ibuprofen 400 mg TDS for 3 days.

Patients were discharged from the hospital after 24 hours of surgery. All the patients at the time of discharge were instructed to take adequate precautions to prevent



**Fig. 1:** Graft placed by over-underlay myringoplasty technique

the entry of water into the ear canal. They were advised to avoid blowing of nose and lifting heavy weights. Further follow-up was done on outpatient basis. All the operated patients were regularly followed up for a minimum period of 3 months in the outpatient department.

On 10th postoperative day, the sutures were removed along with pack from the external auditory canal. Any evidence of infection was looked for. Patients were advised to keep the ear dry.

At 4th week the meatus was examined for any gel foam, and if present it was removed. Condition of the graft was noted regarding take-up, residual perforation or rejection. Thereafter, the patient was followed up for 3 months until the graft uptake could be finally assessed and a pure tone audiogram was taken at the frequency of 500 Hz, 1kHz, 2kHz and 4 kHz and A-B gap was calculated.

### Collection of Data and Statistical Analysis

All collected clinical sheets from the patients were revised for completeness and consistency.

Data were summarized using mean, and standard deviation for quantitative variables and frequency and percentage for qualitative ones. Comparison between groups was performed using independent sample *t*-test for quantitative variables and Chi-square test for qualitative ones.

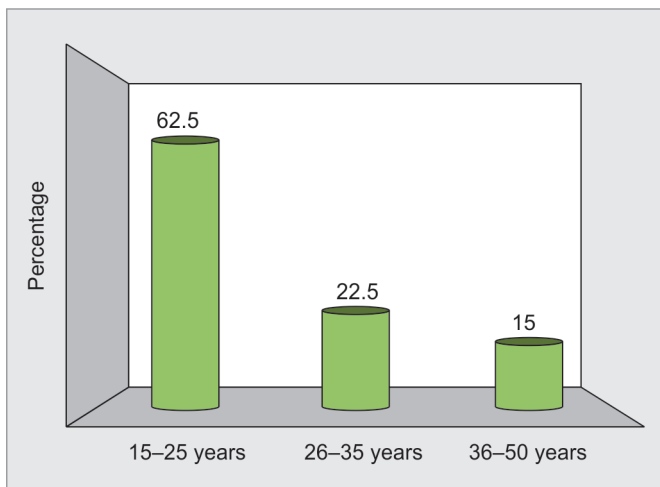
Paired *t*-test was conducted to signify the changes in the related quantitative measurements (air–bone gap). *p* values less than 0.05 were considered statistically significant, and less than 0.01 were considered highly significant.

### RESULTS

The study included 40 patients who were divided randomly into two groups: group 1 (conventional underlay

**Table 1:** Age and sex distribution in the study

		15-25 years	26-35 years	36-50 years	Total	%age
Group 1	Male	08	04	00	12	60
	Female	04	01	03	08	40
Group 2	Male	08	02	01	11	55
	Female	05	02	02	09	45



**Fig. 2:** Distribution of patients according to age in both groups

myringoplasty) included 20 patients where 12 were males and 08 were females. Group 2 (over-underlay myringoplasty) also included 20 patients where 11 were males and 09 were females (Table 1). Maximum no of patients, i.e. 62.5% in both age groups were in the age group of 15-25 years, 22.5% of patients were in age group of 26-35 years and rest 15% were in age group of 36-50 (Fig. 2).

The most common presenting symptoms of these patients were otorrhea and hearing loss.

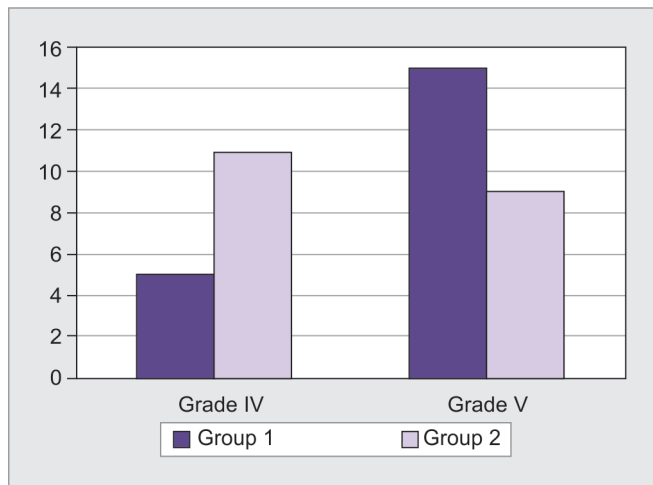
Perforations are divided according to size into small central, large central and subtotal and can also be graded as I-V.<sup>8</sup>

In our study, maximum no of patients 24 (64%) had subtotal perforations while rest 16 (36%) had large central perforations.

**Group 1:** Fifteen (75%) cases had subtotal perforation whereas 05 (25%) cases had large central perforation.

**Group 2:** Nine (45%) cases had subtotal perforation, whereas 11(55%) cases had large central perforation (Fig. 3).

Based upon pure tone audiogram, the hearing loss is classified as mild (25-40 dB), moderate (41-55 dB), moderately sever (56-70 dB), severe (71-90 dB), and profound (>90 dB).<sup>8</sup> In the present study maximum no of patients, in both groups i.e. 77.5% were in the range of 25-40 dB and 9 (22.5%) were in the range of 41-55 dB. In group 1, 80% of the patients were having conductive hearing loss in the range of 25-40 dB while 20% of the patients was having loss of 45 dB. In group 2, 75% of patients were having hearing loss in the range of 25-40 dB while 25% of the patients were having hearing loss of 45 dB (Table 2).



**Fig. 3:** Distribution of patients according to size of the perforations in both groups

**Table 2:** Audiological assesment preoperatively

Degree of hearing loss	Hearing loss in dB	Total number of patients	
		Group 1	Group 2
Mild	25-40 db	16 (80%)	15 (75%)
Moderate	41-55 db	04 (20%)	05 (25%)
Mod severe	56-70 db	0	0
Severe	71-90 db	00	00
Profound	>90 db	00	00

**Table 3:** Air-bone gap in dB pre- and postoperatively

	Group 1 (n = 20)	Group 2 (n = 20)	p value
Preoperative A-B gap	34 dB ± 7.007	38.5 dB ± 6.840	0.046
Postoperative A-B gap	19.5 dB ± 4.1432	19.75 dB ± 5.876	0.8
A-B gap difference	-14.5 dB ± 7.236	-18.75 dB ± 5.439	0.04

Average A-B gap preoperative was 34 dB ± 7.007 in Group 1, whereas it was 38.5 dB ± 6.840 in Group 2. Average A-B gap 3 months postoperative in group 1 was 19.5 dB ± 4.1432, whereas it was 19.75 dB ± 5.876 in group 2. Average gain in A-B gap 3 months postoperative in group 1 was 14.5 dB ± 7.236, whereas it was 18.75 dB ± 5.349 in group 2. There was statistically significant difference i.e. 0.04 between group 1 and group 2 regarding gain in A-B gap postoperative (Table 3).

**Graft Uptake**

Graft success rates were comparable i.e. 90% in group 1, 95% in group 2 with *p value* 0.5. There was no statistically significant difference between group 1 and group 2 (Table 4).

**Relation between Graft Take-up and Size of Perforation**

In group 1 graft take up was 100% in both grade IV perforations and 86.6% in grade V perforation. While in



**Table 4:** Graft uptake in both groups

Status of Graft	Total number of patients	
	Group 1	Group 2
Graft taken up	18(90%)	19 (95%)
Graft Failure	02(10%)	01 (05%)

**Table 5:** Relation between graft take-up and size of perforation

Size of Perforation	Total number of cases	
	Group 1	Group 2
Grade I	0	0
Grade II	0	0
Grade III	0	0
Grade IV	5/5 (100%)	10/11 (90.9%)
Grade V	13/15 (86.66%)	09/09 (100%)
Overall	18/20 (90%)	19/20 (95%)

group 2 graft uptake was 90.9% for grade IV perforations and 100% for grade V (Table 5).

## DISCUSSION

Myringoplasty is an operative procedure, in which the reconstructive procedure is limited to repair of tympanic membrane perforation. Implicit in the definition is that the ossicular chain is intact and mobile, and the middle ear is disease free.<sup>1</sup> Tympanic membrane repair has undergone significant refinements over the years. The anterior or subtotal tympanic membrane perforation is difficult to repair because of less vascularity; moreover, the anterior bony overhang blocks visualization. The graft may fall in the middle ear, resulting in reperforation and obliteration of the anterior part of middle ear cavity.<sup>2</sup>

To manage these problems variety of surgical techniques, such as the use of William's microclip, sandwich graft tympanoplasty, loop overlay myringoplasty and over-underlay technique myringoplasty has been used.<sup>4-7</sup>

The prognostic factors influencing the success rate of myringoplasty are technical, including the surgical approach, the operative field and the skills of the surgeons; for example, the worse results obtained after the transmeatal approach are consequent to the more difficult positioning of the graft through this narrower operative field. Graft failure is considerably higher in anterior perforation, large perforation and possibly influenced by difference in grafts placement. Schuknecht emphasized that the surgical technique is important in success of myringoplasty.<sup>9</sup>

Lateralization of the tympanic membrane is a condition in which the visible surface of the tympanic membrane is lateral to the bony annular ring and loses contact with the conducting mechanism of the middle ear and is associated with considerable hearing loss. Surgical repair is often necessary, however reestablishment of normal hearing can be challenging.<sup>3</sup>

Over-underlay myringoplasty technique is aimed at eliminating the disadvantages of the two classical techniques of overlay and underlay myringoplasty. Over-underlay myringoplasty is performed by placing the graft over the handle of malleus and under the annulus.<sup>7</sup>

Stage and Bak-Pederson (1992) in a study of 39 ears reported that it was advantageous to place the graft lateral to the handle of malleus and under the annulus. In this study 49% patients had total or subtotal defects, 18% had anterior defects and 33% had posterior or inferior defects. The median postoperative observation time was 20 months (range 1.5–58 months). They reported that 38 ears had an intact drum, while one ear had a small dry perforation anteriorly. This gives a closure rate of 97%. They further reported that the tendency of lateralization from the handle of malleus was very limited in nature and authors did not consider it to be significant. In their follow-up, no case of cholesteatoma or epithelial pearl formation was reported. The authors highlighted the advantages of this technique as better access to the anterior part of the middle ear, thus allowing a much safer alignment between graft and drum remnant in critical areas.<sup>10</sup>

Kartush et al. (2002) coined the term over-underlay technique to emphasize that the graft was placed over the handle of malleus but under the residual drum and annulus. They reported on 120 patients who underwent over-underlay tympanoplasty between 1993 and 1999. The average follow-up period was 1.8 years (range 6 months 6.5 years). Their group of patients included 81(67.5%) patients with cholesteatoma. Fifty-four patients (45%) underwent intact canal mastoidectomy, 19 (15.8%) had a canal wall down mastoidectomy and 25 (20.8%) had endaural atticotomies and only 22 (18.3%) had no mastoidectomy. All 120 patients had a full take-up of the graft at 6 months follow-up. However, the authors reported delayed tympanic problems like atelectasis in 17 cases and perforation in 12 cases. There was no recurrence of cholesteatoma apart from small epithelial pearls on tympanic membrane in three children which were removed easily.<sup>7</sup>

Ahmed et al. (2005) reported on 65 patients who underwent over-underlay myringoplasty. The patients were followed up for 6 months. The authors reported take-up rate of 97%. No graft lateralization was seen and reported that it is a good technique due to high success rate.<sup>11</sup>

Yigit et al. (2005) reported on 104 patients of myringoplasty. Underlay myringoplasty was done in 46 patients and 58 patients underwent over-underlay myringoplasty. The mean follow-up period was 11 months. In the underlay group the success rate was 91.5%. The success in over-underlay group was 94.9%. Lateralization of the graft was not seen in either group.<sup>12</sup>

Aslam and Aslam (2009) undertook a comparative study of over-underlay and underlay techniques of myringoplasty. A total of 34 patients underwent over-underlay myringoplasty and 28 patients underwent underlay myringoplasty. Patients were followed up for 6 months. In over-underlay group the graft take-up rate was 94.1% as compared to 92.8% in underlay group. Medialization of the graft was seen in 17.8% of patients of underlay group, while it was seen in 2.9% cases of over-underlay group. Lateralization of graft was not seen in any groups. The authors concluded that the over-underlay technique is effective and is associated with less chances of graft medialization.<sup>13</sup>

In this study, we carried out myringoplasty using over-underlay technique. Our study revealed that graft success rate was 90% in group 1 and 95% in group 2 with no statistically significance in the uptake rate. There was statistically significant difference ( $p = 0.03$ ) between group 1 and group 2 regarding gain in A–B gap post-operatively. These results are comparable with previous study in view of graft uptake and hearing improvement.

The advantages of over-underlay technique include the following:

- Ideal for perforations of all sizes in all quadrants. Excellent exposure of the anterior middle ear. No blunting with high success rate. No reduction of middle ear space thus prevents adhesions between drum and middle ear.<sup>7,11,12</sup>
- Further total elevation of the drum remnant off the malleus provides following advantages:
  - Increased overlap of the graft and drum remnant. Better preparation of the graft bed. Precise graft placement un-obscured by the malleus. Excellent medial support by the malleus handle.<sup>7,12</sup>
- In the view of above advantages, we plan to take up a prospective and comparative evaluation of over-underlay versus conventional underlay techniques of myringoplasty.

## CONCLUSION

Myringoplasty is a safe and effective technique to improve the quality of life of patients, avoiding

continuous infections and allowing them contact with environment. Myringoplasty is a beneficial procedure to protect the middle ear and inner ear from future deterioration. The present study emphasizes the fact that overall satisfactory hearing outcome with adequate air–bone closure and improved graft uptake rate can be achieved in the surgical treatment of tubotympanic disease (large anterior or subtotal perforation) by using over-underlay myringoplasty.

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