

Research Article

TO COMPARATIVE STUDY BETWEEN THE CLASSICAL UNDERLAY AND THE RECENT OVER UNDERLAY TECHNIQUE OF MYRINGOPLASTY

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Abstract: **Introduction:** Myringoplasty restores tympanic membrane integrity and improves conductive hearing loss in inactive mucosal chronic otitis media. The over-underlay technique was developed to improve graft support while minimizing limitations associated with classical underlay placement. **Objectives:** To compare over-underlay and classical underlay myringoplasty regarding graft uptake, medialization, postoperative hearing outcomes, and surgical failure. **Materials and Methods:** This single-blind randomized controlled study was conducted over 18 months in the Department of Otolaryngology, Hind Institute of Medical Sciences, Barabanki. Eighty patients undergoing Type I tympanoplasty were randomized into Group A (over-underlay, n=40) and Group B (classical underlay, n=40). Temporalis fascia was used in all procedures. Clinical examination, otomicroscopy, and pure-tone audiometry were performed preoperatively and during follow-up up to six months. Data were analysed using appropriate statistical tests, with $p < 0.05$ considered significant. **Results:** Graft uptake remained sustained at six months in 95% of Group A and 90% of Group B. Failure occurred in 5% and 10%, respectively. Medialization was observed in 2.5% of over-underlay cases and 5% of classical underlay cases. Postoperative air-conduction thresholds were comparable ($p=0.385$), whereas bone-conduction thresholds differed significantly ($p=0.007$). The postoperative air-bone gap was significantly lower in Group A than Group B (10.50 ± 1.55 versus 13.50 ± 1.76 dB; $p < 0.001$). **Conclusion:** Both techniques achieved favourable anatomical and audiological outcomes; however, over-underlay myringoplasty demonstrated higher graft uptake, lower medialization and failure rates, and superior postoperative air-bone-gap reduction.

Keywords: Chronic otitis media; myringoplasty; over-underlay technique; classical underlay technique; graft uptake; air-bone gap.

INTRODUCTION

The tympanic membrane is essential for sound transmission and middle-ear protection. In inactive mucosal chronic otitis media, perforation may cause otorrhoea and conductive hearing loss. Type I tympanoplasty restores membrane continuity when the ossicular chain is intact. Temporalis fascia is commonly used, and anterior tucking can support the anterior graft margin and improve graft uptake.¹ An Indian comparison of overlay and underlay myringoplasty reported satisfactory anatomical and audiological outcomes with both techniques, although underlay repair performed better in operative time, graft uptake, air-bone-gap closure and complications.²

Large and subtotal perforations remain technically challenging. A retrospective study reported higher anatomical success with over-under tympanoplasty than medial tympanoplasty, especially for large perforations.³

A randomized double-blind trial involving large perforations found comparable graft-success rates and significant intergroup differences in postoperative speech-reception threshold and air-bone gap, although these differences were clinically negligible.⁴

In classical underlay myringoplasty, the graft lies medial to the malleus handle and tympanic membrane remnant; in the over-underlay technique, it is positioned lateral to the malleus handle but medial to the annulus. A prospective study reported success rates of 90.0% and 93.3%, respectively, without a significant intergroup difference.⁵ A meta-analysis of eight randomized trials involving 656 patients favoured underlay over classical overlay myringoplasty for pooled surgical and audiological success; however, it did not assess the hybrid over-underlay procedure.⁶ Full-cuff underlay and over-underlay tympanoplasty showed differing rates of residual perforation, lateralization and anterior blunting.⁷

Underlay myringoplasty produced air–bone-gap improvement of at least 10 dB in more patients than overlay repair.⁸

Endoscopic over-under tympanoplasty achieved perforation closure and hearing improvement comparable to underlay repair despite being used for larger and anteriorly extended perforations.⁹ In inactive tubotympanic disease, over-underlay myringoplasty achieved 92.5% graft uptake and mean air–bone-gap closure of 18.9 ± 2.4 dB.¹⁰ Indian comparative evidence demonstrated lower reperforation and medialization rates with over-underlay placement.¹¹ These variations justify comparing postoperative complications, graft position, hearing change and graft acceptance in this North Indian tertiary-care study.

MATERIALS AND METHODS

Study Design and Setting

This single-blind randomized controlled study was conducted over 18 months in the Department of Otolaryngology, Hind Institute of Medical Sciences, Safedabad, Barabanki, after approval from the Institutional Ethics Committee.

Study Population and Sample Size

Eighty patients with inactive mucosal chronic otitis media scheduled for Type I tympanoplasty were enrolled. The sample size was calculated using the Fleiss formula, and 40 patients were included in each group.

Randomization and Group Allocation

Participants were randomized using Sequentially Numbered Opaque Sealed Envelopes. Group A underwent over-underlay myringoplasty, while Group B underwent classical underlay myringoplasty.

Eligibility Criteria

Patients with a dry ear for at least four weeks, small to subtotal tympanic membrane perforation, and mild-to-

moderate conductive hearing loss were included. Patients with active discharge, mixed hearing loss, hearing loss >60 dB, total perforation, tympanosclerosis, ossicular abnormalities, unsafe chronic otitis media, systemic illness, revision surgery, combined procedures, inadequate follow-up, or surgical unfitness were excluded.

Data Collection and Surgical Procedure

Clinical findings were recorded using a structured proforma. Otomicroscopy, otoendoscopy, diagnostic nasal endoscopy, tuning-fork tests, and pure-tone audiometry at 0.5, 1, 2, and 4 kHz were performed. All procedures were conducted under general anaesthesia by a single surgeon through a postauricular approach using temporalis fascia.

Follow-up and Outcome Assessment

Patients were followed weekly during the first postoperative month and monthly up to six months. Graft uptake, medialization, lateralization, residual perforation, complications, and surgical failure were assessed. Pure-tone audiometry was repeated at six months to evaluate postoperative hearing thresholds and air–bone-gap reduction.

Ethical Considerations

Written informed consent was obtained from all participants or their legally authorized guardians. Confidentiality and voluntary participation were maintained.

Statistical Analysis

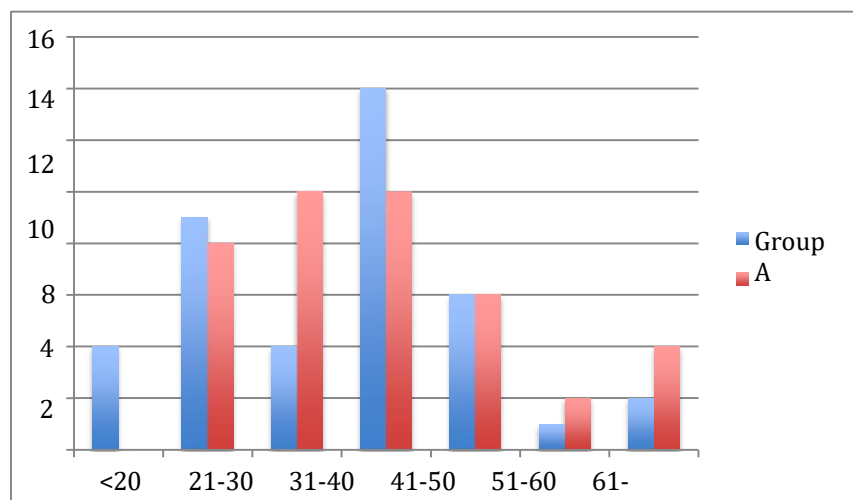
Data were analysed using SPSS version 21.0 or higher. Continuous variables were compared using the independent-samples *t*-test, while categorical variables were analysed using the chi-square or Fisher's exact test. A *p*-value <0.05 was considered statistically significant.

RESULTS

Table 1. Age group wise distribution

Years	Group A (Overunderlay)		Group B (Classical underlay)	
	Frequency	Percent	Frequency	Percent
<20	4	10	0	0
21-30	9	22.5	8	20
31-40	4	10	10	25
41-50	14	35	10	25
51-60	6	15	6	15
61-70	1	2.5	2	5
71-80	2	5	4	10
Total	40	100	40	100
Mean±SD	36.90±17.32		45.17±17.01	

Table 1 demonstrates that Group A was predominantly represented by patients aged 41–50 years, whereas Group B showed the highest proportions in the 31–40 and 41–50-year categories. The mean age was lower in Group A (36.90 ± 17.32 years) than in Group B (45.17 ± 17.01 years).

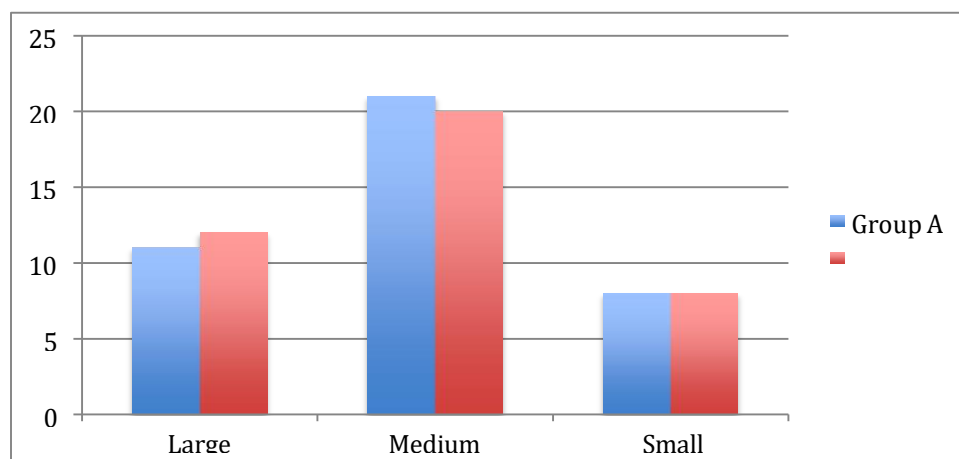


Graph 1. Age group wise distribution

Table 2. Size wise distribution

	Group A (Overunderlay)		Group B (Classical underlay)	
	Frequency	Percent	Frequency	Percent
Large	11	27.5	12	30
Medium	21	52.5	20	50
Small	8	20	8	20

Table 2 shows that medium-sized perforations predominated in both Group A (52.5%) and Group B (50.0%). Large perforations accounted for 27.5% and 30.0%, respectively, while small perforations constituted 20.0% in each group. Overall, the perforation-size distribution was comparable between the two surgical groups.

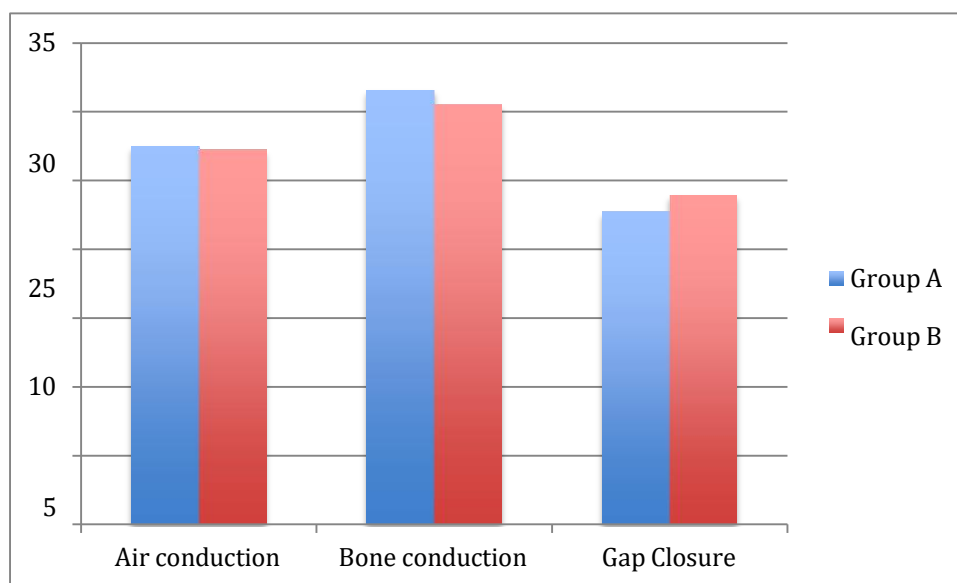


Graph 2. Size wise distribution

Table 3. Pure tone audiometry (before surgery) of the side involved

	Group A (Overunderlay)		Group B (Classical underlay)		t value	p value
	Mean	Std. Deviation	Mean	Std. Deviation		
Air conduction	27.47	2.15	27.20	1.94	-0.590	0.5571
Bone conduction	31.53	2.56	30.50	2.46	-1.835	0.070
Gap Closure	22.67	2.12	23.88	1.95	2.657	0.009

Table 3 shows comparable preoperative air-conduction thresholds between Group A and Group B (27.47 ± 2.15 vs 27.20 ± 1.94 dB; $p=0.557$). Bone-conduction values also did not differ significantly ($p=0.070$), whereas the reported gap was significantly lower in Group A ($p=0.009$).

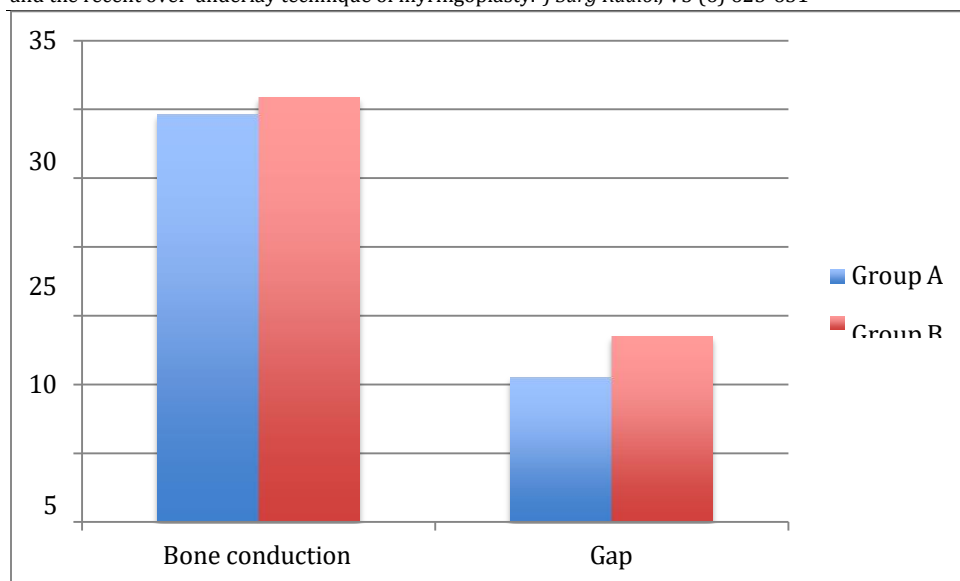


Graph 3. Pure tone audiometry (before surgery) of the side involved

Table 4. Pure tone audiometry (after surgery) of the side involved

	Group A (Overunderlay)		Group B (Classical underlay)		t value	p value
	Mean	Std. Deviation	Mean	Std. Deviation		
Air conduction	35.90	3.69	36.53	2.69	0.87	0.385
Bone conduction	29.63	1.94	30.87	2.08	2.75	0.007
Gap	10.50	1.55	13.50	1.76	8.09	<0.001

Table 4 shows no significant intergroup difference in postoperative air-conduction thresholds ($p=0.385$). Bone-conduction thresholds differed between groups ($p=0.007$), while the air–bone gap was lower in Group A than Group B (10.50 ± 1.55 vs 13.50 ± 1.76 dB; $p<0.001$), indicating better outcome after over-underlay myringoplasty.



Graph 4. Pure tone audiometry (after surgery) of the side involved

Table 5. Graft uptake at different time points

Follow-up	Outcome	Group A (Overunderlay)		Group B (Classical underlay)	
		Frequency	Percent	Frequency	Percent
Week 1	Failure	2	5.0	4	10.0
	Success	38	95.0	36	90.0
Week 2	Failure	2	5.0	4	10.0
	Success	38	95.0	36	90.0
Week 3	Failure	2	5.0	4	10.0
	Success	38	95.0	36	90.0
Week 4	Failure	2	5.0	4	10.0
	Success	38	95.0	36	90.0
2 Months	Failure	2	5.0	4	10.0
	Success	38	95.0	36	90.0
3 Months	Failure	2	5.0	4	10.0
	Success	38	95.0	36	90.0
4 Months	Failure	2	5.0	4	10.0
	Sustained response	38	95.0	36	90.0
5 Months	Failure	2	5.0	4	10.0
	Sustained response	38	95.0	36	90.0
6 Months	Failure	2	5.0	4	10.0
	Sustained response	38	95.0	36	90.0

Table 5 demonstrates that graft uptake remained consistently high throughout the six-month follow-up in both groups. Group A achieved successful or sustained graft uptake in 38 patients (95%), compared with 36 patients (90%) in Group B. Corresponding failure rates were 5% and 10%, respectively, and no additional failures were observed after the first postoperative week.

Table 6. Medialization

Follow-up	MEDI Status	Group A (Overunderlay)		Group B (Classical underlay)	
		Frequency	Percent	Frequency	Percent
Week 1	Absent	39	97.5	38	95.0
	Present	1	2.5	2	5.0
Week 2	Absent	39	97.5	38	95.0
	Present	1	2.5	2	5.0
Week 3	Absent	39	97.5	38	95.0
	Present	1	2.5	2	5.0
Week 4	Absent	39	97.5	38	95.0
	Present	1	2.5	2	5.0
2 Months	Absent	39	97.5	38	95.0
	Present	1	2.5	2	5.0
3 Months	Absent	39	97.5	38	95.0
	Present	1	2.5	2	5.0
4 Months	Absent	39	97.5	38	95.0
	Present	1	2.5	2	5.0
5 Months	Absent	39	97.5	38	95.0
	Present	1	2.5	2	5.0
6 Months	Absent	39	97.5	38	95.0
	Present	1	2.5	2	5.0

Table 6 shows that graft medialization was uncommon and remained unchanged throughout the six-month follow-up. In Group A, medialization was absent in 39 patients (97.5%) and present in 1 patient (2.5%). In Group B, it was absent in 38 patients (95.0%) and present in 2 patients (5.0%), indicating a numerically lower incidence with over-underlay myringoplasty.

DISCUSSION

The age profile was mainly middle adult with 35% of Group A and 25% of Group B in the 41-50 year old age groupings. This is in accordance to adult patients enrolled by Kumar Gupta et al., (2022)¹ and Basavaraj et al., (2020)¹¹ where the age group of patients were 15-60 years and 16-60 years respectively. Hameed (2021)¹⁰ included subjects from 15 to 45 years of age and Shishegar et al (2023)⁴ included subjects up to 75 years of age. The mean age in Group B was greater compared to Group A (45.17±17.01 years vs 36.90±17.32 years).

This age distribution is unique in which participants aged 61–80 years accounted for 7.5% and 15% respectively. Majority of the group is medium sized perforations (52.5% in group A and 50% in group B). Large sized perforations are (27.5% in group A and 30% in group B). The over-under tympanoplasty has a higher success rate of 89.80% when compared with the medial tympanoplasty of 71.43% in large perforation (Zhang et al. (2025)³) and is better suited for bigger defects, perforations small to subtotal. Basavaraj et al. (2020)¹¹ Shishegar et al. (2023)⁴ considered perforations of specifically more than 50% of the membrane. Conversely, the two groups in the present study were well matched. Bao et al. (2022)⁹ reported a larger mean perforation size with over-under tympanoplasty than underlay tympanoplasty, 54% vs 31%.

Preoperative air-conduction thresholds were similar in group A and group B (27.47±2.15 dB vs 27.20±1.94 dB, p=0.5571). Audiological baseline with bone-conduction values (31.53±2.56 vs. 30.50±2.46 dB, p=0.070) was not found to be statistically different as well. Hameed (2021)¹ found higher pre-operative air-bone gap in over-underlay cases (28.5 ± 4.2 dB). However, we also considered ≥10 dB improvement as efficacy (Arif et al., 2022⁸). Zakzouk et al., (2025)⁵ achieved mean gap closure of 8.02 ± 2.92 and 9.57 ± 3.99 db. Also measured PTA and air-bone gap Bao et al ⁹. However, exact baseline means were not reported. The reported preoperative gap differed significantly between groups (p=0.009).

Postoperative air-conduction thresholds were comparable between Group A and Group B (35.90±3.69 versus 36.53±2.69 dB; p=0.385), whereas bone-conduction thresholds differed significantly (29.63±1.94 versus 30.87±2.08 dB; p=0.007). The postoperative air-bone gap was significantly lower with over-underlay myringoplasty (10.50±1.55 versus 13.50±1.76 dB; p<0.001). Similar results were reported by Hameed (2021)¹⁰ with over-underlay surgery with post-op gap of 9.6 + 3.9 dB. The postoperative air-bone gap was less in the over-underlay technique but this difference was not statistically significant in the clinical significance (Shishegar et al. 2023 ⁴). There was no difference between groups for closures of 9.57±3.99 and 8.02±2.92 dB (Zakzouk et al. 2025)⁵. But, better hearing gain with

underlay myringoplasty than overlay myringoplasty was reported by Arif et al. (2022)⁸.

Graft uptake remained stable from the first postoperative week through six months, with success in 38 patients (95%) in Group A and 36 patients (90%) in Group B; corresponding failure rates were 5% and 10%. Similar results were reported by Zakzouk et al. (2025)⁵ who achieved 93.3% success rate for over-underlay and 90% for underlay and Hameed (2021)¹⁰ reported 92.5% uptake after over-underlay myringoplasty. Zhang et al (2025)³ 90.76 % vs 81.31 % Kumar Gupta et al (2022)¹ 93.4 % vs 84 % Similar closure rates of 95 % and 96 % were also shown in the study by Bao et al (2022)⁹. However, the performance of over-underlay is relatively poor in Shishegar et al. (2023)⁴ and Pandey et al. (2023)⁷. Medialization was rare during follow-up period unchanged from 1 week to 6 months. 1 patient (2.5%) in Group A and 2 patients (5%) in Group B had medialization. This is in agreement with Basavaraj et al. (2020)¹¹ who did not find any medialization after over-underlay tympanoplasty compared to 13.3% after classical underlay surgery. In a study by Zhang et al (2025)³ no significant difference was observed in overall postoperative complication rates between medial and over-under tympanoplasty. There was no post-operative atelectasis in both groups (Shishegar et al., 2023)⁴. Similar closure findings were reported by Bao et al (2022)⁹, but they did not report medialization rates separately. Conversely, Pandey et al. (2023)⁷ reported 4.4% of graft lateralization in over-underlay cases and none in fullcuff underlay surgery.

CONCLUSION

This randomized comparison indicates that both over-underlay and classical underlay myringoplasty provide satisfactory anatomical and functional outcomes in inactive mucosal chronic otitis media. Graft uptake remained stable through six months, reaching 95% with the over-underlay technique and 90% with the classical underlay technique, while corresponding failure rates were 5% and 10%. Medialization was uncommon in both groups but occurred less frequently after over-underlay repair (2.5% versus 5%). Postoperative air-conduction thresholds were comparable, whereas bone-conduction values differed significantly between groups. Most importantly, the postoperative air-bone gap was significantly lower with over-underlay myringoplasty (10.50±1.55 dB) than with classical underlay myringoplasty (13.50±1.76 dB; $p < 0.001$), demonstrating superior audiological performance. These findings support over-underlay myringoplasty as a reliable alternative, particularly when improved graft stability and greater air-bone-gap reduction are desired, while confirming that classical underlay repair remains an effective and acceptable technique for appropriately selected patients with an intact ossicular chain.

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