



## A Clinical Study of Hearing Outcomes by Using Cartilage Graft V/S Prosthesis in Ear Surgery: An Institutional Experience

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### Abstract

**Context:** Conductive hearing loss results from impaired transmission of sound from the external auditory canal across the middle ear structures to the cochlea of the inner ear. A variety of disorders can affect the sound transmission pathway at the level of the ear canal, tympanic membrane, and ossicles prior to reaching the hearing organ. One of the most intriguing topics in middle ear surgery is the reconstruction of the conductive mechanism. Our study will focus on surgical correction of ossicular continuity and the restoration of hearing mechanism known as Ossiculoplasty [1].

**Aims and Objectives:** To evaluate the hearing outcome following ossicular reconstruction in patient with Chronic Otitis Media. To compare the hearing outcome following ossicular reconstruction using an autograft ossicle, autograft cartilage and PORP/TORP.

**Study Design:** Hospital based Prospective observational study.

**Methods and Material:** 25 patients who underwent ear surgery by post aural route, subjected to ossicular reconstruction between Jun-2019 and Jun-2021 were studied in our institute.

**Statistical Analysis Used:** Paired student t test.

**Results and Conclusion:** (i) Hearing reconstruction by prosthesis gives significantly good result. (ii) Ossicular status is an important predictor for the success of ossicular reconstruction rather than type of material used. (iii) AB gap closer in the prosthesis group showed significantly better results. P value [0.05].

**Keywords:** Ossicular Reconstruction; Ossicular Status; Ossiculoplasty; AB Gap; ENT

### Introduction

Chronic suppurative otitis media (CSOM) is defined as a chronic inflammation of the middle ear and mastoid cavity, which presents

with recurrent ear discharges or otorrhea through a tympanic membrane perforation. Chronic infection of middle ear is a widely prevalent condition in India like it is in the other developing countries.

Chronic otitis media erodes the bone, destroys the ossicles and has the potential to cause life threatening complications. As a result of erosion, Discontinuity of incudo-stapedial joint is the most common ossicular problem encountered in chronic otitis media that leads to moderate to severe hearing loss.

The primary goal of Chronic Otitis Media surgery is to clear the disease and produce a safe and dry ear. Maintenance or improvement of hearing is important but should not be at the cost of the primary goal.

Hence our study purpose is ossicular reconstruction to restore hearing as close as possible to physiological hearing.

Ossiculoplasty is defined as the restoring the hearing mechanism between the tympanic membrane and oval window by re-establishing a functional ossicular chain.

**Materials and Methods**

This is a Prospective observational study involving patients above 12 years, with chronic otitis media. The study was conducted between Jun-2019 and Dec-2021 who came to ENT department, B. J. Medical college, Ahmedabad. 25 patients (16 females, 9 males) who undergone ear surgery by post aural approach, was included and all of them subjected to ossicular reconstruction. Autograft tragal/conchal cartilage, and synthetic prosthesis TORP/PORP will be used to regain ossicular integrity.

Patients having Chronic otitis media, with conductive hearing loss with AB gap of >20 dB hearing loss on PTA who are more than 12 year old, were posted for ear surgery at our institute, willing to undergo PTA in follow up and come for follow up for 6 months and give written consent to be included in study. Patients with sensorineural hearing loss, not willing to participate in the study, not willing for follow up visits and medically unfit for surgery were excluded from the study.

The patients were examined including history, general examination, ENT examination, otoscopy and Tuning fork test followed by microscopic examination of the ear. Pure Tone Audiometry done for all cases and HRCT temporal bone in case of only hearing ear.

Patients were divided into two groups: group 1 (patients with PROSTHESIS GRAFT) and group 2 ( patients with CARTILAGE GRAFT ).

Patients were operated under general anesthesia or local anesthesia.

The instruments were used during the surgery included all micro surgical ear instruments and operating microscope.

Patients will be followed up for a period of six months.

In follow up, they will be subjected to detailed examination of ear, nose and throat. All will be subjected to PTA at 3 months and 6 months post operatively. Their air conduction and bone conduction will be noted down, preoperative air and bone conduction will be compared with postoperative AC and BC at 3 and 6 months and improvement/deterioration in AC and BC will be noted down. The hearing parameters will be compared between different reconstruction material and conclusion will be drawn. Recommendation will be made as per the result.

The patients were assessed for signs and symptoms of complications like headache, vertigo, hearing loss, tinnitus, facial weakness both pre and post-operatively.

**Results**

Majority of the patients in both the groups were females aged between In Group 1 is 11-20 years & 31-40 years of age. In Group 2 is 31-40 years of age.

In our study 25 patients are included and divided in 2 groups comprising 12 patients in group 1 in which PROSTHESIS GRAFT used, and 13 patients in group 2 in which CARTILAGE GRAFT used.

Group 1 divided into 1A (TORP) and 1B (PORP).

Group 2 divided into 2A (Incus Remodeling) and 2B (Tragal Cartilage) used.

Number of patients	Group 1 (12 patients)		Group 2 (13 patients)	
	1A	1B	2A	2B
	3	9	3	10

**Table 1:** Types of graft material used.

Ossicle	Group 1A	Group 1B	Total
M+ S+	0	3	3 (25%)
M+ S-	0	2	2(17%)
M- S+	0	3	3(25%)
M- S-	3	1	4(33%)
TOTAL	3	9	12

**Table 2:** Ossicular status in Group 1.

Ossicles	Group 1A	Group 1B	Total
M+ S+	3	7	10(76%)
M+ S-	0	1	1(8%)
M- S+	0	1	1(8%)
M- S-	0	1	1(8%)
TOTAL	3	10	13

**Table 3:** Ossicular status in Group 2.

As per Wehr’s classification, 100% of patients in Group 1A and 1B have got improvement in A-B gap.100% of patients in Group

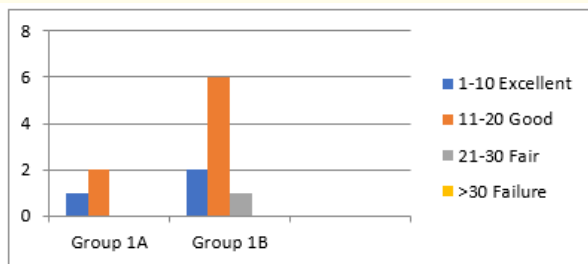
2A have got improvement in A-B gap, in Group 2B 90% of patients have got improvement and 10% have failed to get improved in A-B gap.

	AB gap	Mean	S.D.	Mean difference	S.D. difference	Z value	P value	Remark
Group 1A	Pre op	0.5	0.83	0.25	0.12	7.53	0.00001 (i.e. <0.05)	Highly Significant
	Post op	0.75	0.95					
Group 1B	Pre op	1.5	2.73	0.75	0.11			
	Post op	2.25	2.62					

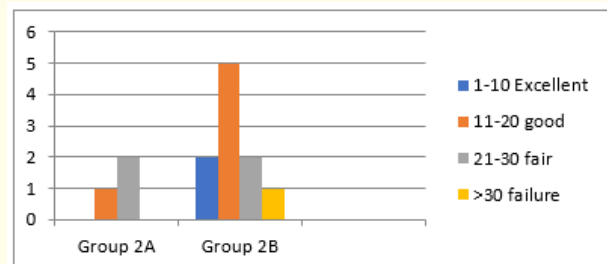
**Table 4:** Comparison of mean A-B gap within the group 1.

	AB gap	Mean	S.D.	Mean difference	S.D. difference	Z value	P value	REMARK
Group 2A	Pre op	0.5	0.83	0.25	0.12	2.29	0.02 (i.e.<0.05)	Highly Significant
	Post op	0.75	0.95					
Group 2B	Pre op	1.66	2.42	0.9	0.69			
	Post op	2.5	1.73					

**Table 5:** Comparison of mean A-B gap within the group 2.



**Graph 1:** Post operative A-B gap in group 1.



**Graph 2:** Post operative A-B gap in group 2.

## Discussion

The primary goal of my study is to compare hearing outcome using prosthesis and cartilage in ear diseases. Secondary aim is to improve the hearing to the extent possible with proper ossiculoplasty. While treating chronic otitis media is complete exenteration of disease.

The incus is the most vulnerable ossicle both to trauma and infectious processes because of its anatomic position and the course of its blood supply. Mawson and Glasscock [1,2], both report a damaged incus as the surgical finding in three fourths of ossicular reconstructions. Therefore, replacement of the incus poses a significant challenge to the otologist. Similar results found in both Group of patients in my study.

The status of the ossicular chain as a determinant of hearing results has been somewhat controversial in the literature. In the study by Dornhoffer, *et al.* [3], only the malleus manubrium was found to be significant in acoustic gain of the middle ear mechanism, whereas the stapes superstructure contributed little, similar results were found in my study whereas Albu, *et al.* showed statistical significant contribution of both malleus and stapes in successful ossiculoplasty [4]. My study result is differed with this study.

O'Reilly showed that with the use of autograft incus he achieved a mean A-B gap of 18.6 dB. Siddiq, *et al.* with the same material achieved a mean post operative A-B gap of 21dB. Our study had achieved a mean post operative A-B gap 25.3 dB in Group 2A (autograft incus) [5,6].

Kadambri, *et al.* used commercially available PORP/TORP ossicular implant and achieved the overall postoperative A-B Gap of 26 dB. Rahul Kawatra, *et al.* used PORP/TORP ossicular implant and achieved the overall postoperative A-B Gap of 20 dB [7]. The hearing results in our study using TORP/PORP of Group 1 revealed a mean post operative A-B gap of 15.08 dB which is comparable to the above cited studies.

The ideal prosthesis for ossiculoplasty should be compatible, stable, safe, readily available, easily insertable, and capable of yielding optimal sound transmission. As our study showed there was no statistical difference in the use of different types of ossicular

implants for ossiculoplasty, i.e. refashioned incus, autologus cartilage, PORP or TORP but the result of PORP or TORP prosthesis are little bit better than cartilage and autologus incus.

## Conclusion

The present study titled "Clinical Study of hearing outcomes by using cartilage graft v/s prosthesis in ear surgery" was carried out on 25 patients of chronic otitis media of safe and unsafe type. All the patients are divided in to two groups according to the type of materials used.

In our analysis we have found that ossicular status is an important predictor for the success of ossicular reconstruction rather than type of material used in ossicular reconstruction.

In our analysis we found that out of 12 patients in which TORP/PORP was kept all the patients had post operative hearing gain (100% success). Out of 3 patients in which autologous incus was kept all patient had post operative hearing gain (100 %success). Out of 10 patients in which autologous tragal or conchal cartilage was kept 9 patients had post operative AB gap < 30 dB (90% success).

All modalities gave statistically significant improvement ( $p < 0.05$ ) in A-B gap leading to improvement in hearing.

The only difference between the treatment of groups was cost effectiveness and availability as autologous material requires no extra cost in comparison to bio synthetic material. Autologous material can be considered as a preferred choice as majority of patients in our region were from the low socio-economic background.

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## Conflict of Interest

No conflict of interest is between any authors or among any author and other people or organisations.

## Ethical Approval

Ethical committee approval and written consent from patients has been taken to participate in this study.

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