



OSSICULOPLASTY: A COMPARITIVE STUDY USING TRAGAL CARTILAGE AND PARTIAL OSSICULAR RECONSTRUCTION PROSTHESIS (PORP).

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ABSTRACT Ossicular discontinuity is a common complication of chronic otitis media. Reconstruction of the ossicular chain to restore the conductive mechanism of the middle ear is known as ossiculoplasty. The ideal prosthesis for ossicular reconstruction should be biocompatible, stable, safe and easily insertable and capable of yielding beneficial sound conduction. A comparative prospective study of 60 patients of ossiculoplasty between tragal cartilage, and polytetrafluoroethylene (teflon) partial ossicular replacement prosthesis (PORP) to analyse the hearing gain at the end of six months. It was observed that improvement in hearing outcome postoperatively was better when cartilage was used for ossiculoplasty as compared to when PORP was used.

KEYWORDS : Ossiculoplasty, cartilage ossiculoplasty, PORP, TEFLON, Tragal cartilage, Comparative

INTRODUCTION

Ossiculoplasty or ossicular chain reconstruction is the surgical repair of the middle ear ossicles to restore the conductive mechanism in tympanoplasty. Chronic otitis media (COM) is a middle ear pathology that commonly affects the ossicles leading to discontinuity that hampers the conduction of sound¹. The long process of incus, stapes crurae, body of incus are commonly involved in descending frequency. Surgical repair aims to reconstruct the diseased or dislocated or the fixed ossicular chain so as to provide a stable connection between the tympanic membrane and the stapes footplate. The earliest recorded attempt of ossiculoplasty was in 1901, when Matte attempted to re-establish connection between the TM and oval window in case of missing ossicles². In 1971, Austin gave the classification of the ossicular defect based on the presence or absence of the malleus handle and the stapes suprastructure³. A wide variety of materials have been used for ossicular reconstruction, including both biologic and alloplastic materials. Biologic materials include autograft or homograft ossicles, cortical bone, teeth, and cartilage. Alloplastic materials used can be metallic (gold, titanium, platinum) and non-metallic like polymers (polytetrafluoroethylene, plastipore) or ceramics (bioglass, hydroxyapatite)^{4,5}. We present a comparative prospective study of the outcomes of ossiculoplasty between tragal cartilage and polytetrafluoroethylene (teflon) partial ossicular replacement prosthesis (PORP) to analyse the hearing gain at the end of six months.

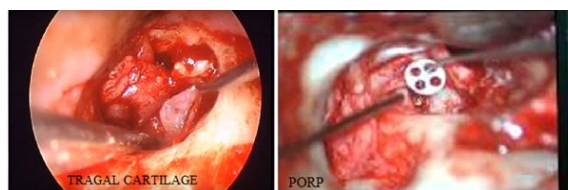
MATERIALS AND METHOD

This is a prospective study of 60 patients who underwent ossiculoplasty at B.J Medical College and Civil hospital, Ahmedabad between 1st November 2015 to 30 April 2016. The patients were examined including history, general physical examination, ENT examination, Otoscopy and Tuning Fork Test followed by microscopic examination of the ear. Pure Tone Audiometry was done for all cases planned for surgery. Patients aged 10-65 years having COM with air bone gap (ABG) >30 dB and having ossicular involvement but with intact stapes were included in the study. Those patients having COM with complications (intracranial or extracranial), sensory-neural or mixed hearing loss, revision ear surgeries or having involvement of the stapes were excluded from the study. The patients were randomly divided intraoperatively into two groups of 30 each. One group (Group 1) underwent ossiculoplasty with tragal cartilage and the other group (Group 2) underwent ossiculoplasty with polytetrafluoroethylene (teflon) partial ossicular reconstruction prosthesis (PORP).

Post Aural (Wilde's) approach was used in all cases.

In Group 1, tragal cartilage was harvested and carved such that the longer end was kept at the tympanic annulus and the shorter end over the stapes head.

In Group 2, the prosthesis was kept over the stapes head and the other end at the annulus. In both the cases, the perforation was repaired with a temporalis fascia graft kept by the underlay technique.



The patients were followed up on Day 7, 15, 30, 3 months and at 6 months. At the end of 6 months, all patients underwent post-operative pure tone audiometry.

RESULTS

In our study of 60 patients, 38 were males and 22 were females. Intraoperatively, necrosis of the long process of incus was seen in 42 cases and necrosis of long process along with lenticular process was seen in 18 cases.

TABLE 1

Age Group (years)	Number of patients
10-19	02 (04%)
20-29	08 (16%)
30-39	16 (32%)
40-49	10 (20%)
50-59	09 (18%)
>60	05 (10%)

TABLE 2: Pre-operative Hearing Status

Air Bone Gap (dB)	Number of Patients (%)
30-40	18 (30)
40-50	24 (40)
50-60	11 (18.3)
>60	07 (11.6)

TABLE 3: Post-operative Hearing Status

Air Bone Gap (dB)	Cartilage (%)	PORP (%)
0-10	01 (3.3)	0
11-20	09 (30)	06 (20)
21-30	09 (30)	10 (33)
>30	11 (36.6)	14 (46.6)

In Table 2, most of the patients have a pre-operative ABG in 40-50 dB range (40%).

From Table 3, when post-op hearing status is assessed at the end of 6 months, it is seen that when cartilage is used as prosthetic material, only 36.6% patients have an ABG > 30 dB whereas it is 46.6% when PORP is used.

TABLE 4: Success Rate

Material	Success (%)	Failure (%)
Cartilage (30)	19 (63.3)	11 (36.6)
PORP (30)	16 (53.3)	14 (46.6)

In Table 4, defining Success as post-op hearing status with ABG <30 dB, cartilage was found to be successful in 63.3% cases as compared to PORP in 53.3% cases.

DISCUSSION

Loss of ossicular continuity is common cause of conductive hearing loss in patients with COM. This can be managed surgically by ossiculoplasty. In our study, we evaluated autologous cartilage and Teflon prosthesis for the reconstruction of the ossicular chain. All the patients gave a history of ear discharge and decreased hearing. This is consistent with the studies by Gulati and Sheahan which showed that otorrhoea and hearing loss were the most common complaints at presentation.

Long process of incus was found to be eroded in 70% cases while long process and lenticular process was eroded in 30% cases. Long process of incus is the most common ossicle to undergo necrosis and this can be attributed to its tenacious blood supply. According to the literature, Incus necrosis is very common and was found in about 60-80% cases⁶.

In our study of 60 cases, 30 patients underwent a cartilage ossiculoplasty and 30 underwent polyethylene PORP ossiculoplasty. Amongst these, the success rate for cartilage was 63.3% and for polyethylene PORP was 53.3% after 6 months of post-operative hearing assessment by pure tone audiometry. Success was defined as < 30 dB ABG. Jha *et al.* in their comparative study on ossiculoplasty described that the failure and extrusion in case of cartilage were 11.5% and in plastic PORP it was 20%. In study by Naragund A of 24 patients, 12 underwent ossiculoplasty with autograft incus and 12 with titanium prosthesis. Postoperative hearing evaluation by pure tone audiogram was done after 3 months and showed successful hearing improvement in 58% of cases with autologous incus as compared to 33% cases with titanium prosthesis⁷. In a similar study by Mahanty S, when success was defined as <20dB ABG on postoperative pure tone audiometry done after 6 months of surgery, the success rate was 60% for cartilage ossiculoplasty and 56.25% for PORP⁸.

Surgical outcome depends on preoperative status of ossicles, intraoperative skill of surgeons, total eradication of disease, proper aeration of middle ear and the connection between the tympanic membrane and stapes which depends upon the prosthesis being used. The mass and stiffness of prostheses can influence the conduction of sound. Studies by Meister *et al.*⁹ and Kelly *et al.*¹⁰ have suggested mass the most important variable, and prostheses weight should be as light as possible to optimize transmission of frequencies above 1000 Hz. Zenner *et al.*¹¹ have determined that a mass of 5 mg or less provides maximum transfer of energy.

CONCLUSION

The ideal prosthesis for ossicular reconstruction should be biocompatible, stable, safe and easily insertable and capable of yielding beneficial sound conduction. In our study, we found cartilage ossiculoplasty to have a better outcome as compared to PORP ossiculoplasty in terms of postoperative hearing benefit.

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