A STUDY ON THE POST-OPERATIVE AND FUNCTIONAL OUTCOME OF HEARING OF PARTIAL OSSICULAR RECONSTRUCTION PROSTHESIS & TOTAL OSSICULAR RECONSTRUCTION PROSTHESIS

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ABSTRACT

BACKGROUND
Ossicular reconstruction prosthesis has a better success rate in the treatment of chronic otitis media if properly prepared pre-operatively and placed intraoperatively.

The objective of this study was to compare pre-operative and post-operative hearing following reconstruction of the ossicles using TORP/PORP.

MATERIALS AND METHODS
32 patients with chronic otitis media, either tubotympanic or attic-antral, with ossicular erosion were made to undergo ossicular reconstruction using TORP/PORP. The study was conducted both retrospectively and prospectively.

RESULTS
In this technique, patients had an average improvement in hearing up to 14 dB. The mean post-operative period follow up was 2-6 months.

CONCLUSION
Ossiculoplasty gives better results when compared to cases where ossiculoplasty was not done.

KEYWORDS
TORP, PORP, Tubo-Tympanic, Attico-Antral.


BACKGROUND
Ossiculoplasty is the reconstruction of the middle ear ossicular chain which has been disrupted or destroyed, by the use of some interpositioned devices which helps in regaining the original mechanics of the ossicular chain to transfer the sound energy to the inner ear.¹ It is clear, however, that optimal results in ossicular reconstruction depend not only on the qualities of the prosthesis, but also on the environment in which it is placed and the surgical techniques used.² The earliest recorded ossiculoplasty was attempted by Matte in 1901 in a case where he attempted to reduce the gap between the tympanic membrane and the oval window in the case as the ossicles were missing. Then for a long time ossiculoplasty did not gain much importance. Then in 1951, it was further taken up by Wullstein. Wullstein used vinyl acrylic as an ossicular prosthesis. Later in 1957, Hall and Rytzner performed the first ossicular reconstruction. They used autologous incus for the ossiculoplasty. The autologous incus was reshaped and was used to bridge the gap between the malleus and the head of stapes. Further significant work regarding ossiculoplasty was done by Austin in 1971. Austin proposed a classification system based on the ossicles that were affected and those which remained intact. In late 1970s a high density polypropylene sponge was developed. It had biologically inert properties. But a high incidence of extrusion occurred for this material. Later bioactive implants like Bioglass and Ceravital were developed. These materials were biologically inert. But these have limited use in modern era because of the difficulty in trimming these materials and their property of instability in an infected environment.

Different materials can be used for ossiculoplasty which includes autogenic, allogenic and alloplastic materials. It includes plastic, metals and biomaterials. Initially both autographs and allografts were used by otologists. Allografts lost their importance for the fear of prion diseases. It is then that the other materials came into use widely. Alloplastic materials are not commonly used now because they have higher rates of extrusion. The ideal prosthesis for ossiculoplasty should be safe, readily available, compatible,
stable, easily insertable and capable of yielding maximum sound transmission. The aim of this study was to identify the cases requiring ossicular reconstruction intraoperatively, and doing the same using either Teflon TORP or PORP depending upon the ossicle/s eroded. The pure tone average obtained post-operatively was then compared with the pre-operative pure tone average.

MATERIALS AND METHODS

A) Patient Population
From October 2015 to September 2017, ossiculoplasty was performed using Teflon TORP (8) and PORP (24) in 32 patients. (Out of which, 18 were male and 14 were female, age ranging from 12-60 years).

Of the cases selected for the study to do ossiculoplasty, all were primary procedures. Of the procedures done, 5 cases were with adhesive otitis media, 5 cases were Chronic otitis media with active squamous disease. Out of patients with mucosal disease, 15 cases were inactive and 7 were active of the cases studied, 5 had bilateral ear disease and 27 had unilateral ear disease.

Incus was always involved in the disease process. Suprastructure of stapes was eroded in 8 cases and malleus in 3 cases. Canal wall down mastoidectomy was done in 4 patients. Intact canal wall mastoidectomy done in 8 patients and tympanoplasty in 20 patients. All the cases were done in single centre, Upgraded Institute of Otorhinolaryngology, Chennai. The procedure was not done by a single surgeon. The following parameters were studied: effectiveness of Teflon TORP and PORP, change between pre and post op pure tone audiogram showing improvement in air bone gap.

The PTA-ABG for each audiogram was made out by calculating the mean air bone gap at 500, 1000 & 2000Hz. Pre and post-operative audiograms were compared using ‘t’ test.

Institutional ethical committee clearance and patient consent was obtained for the study.

B) Pre-Operative Evaluation
An audiogram is performed preoperatively at the following frequencies: 500, 1000, 2000 and 4000Hz.

C) Surgical Procedure
An informed consent was obtained from all patients following which all our patients were operated under general anaesthesia.

Mastoidectomy
A William Wilde post-aural incision is made and extended up and temporalis fascia graft was harvested.

The incision was deepened and then a T shaped incision was made and periosteum was elevated. Spine of Henle was identified.

A meatotomy was done and pinna retracted forwards. Tympanomeatal flap was elevated.

Bone work was started in the MacEwan’s triangle and the mastoid antrum reached which is usually located at a distance of 1-1.5cm from the mastoid cortex.

The following were analysed-
1) Extent of the disease determining whether to do an intact canal wall or canal wall down procedure.
2) 2) The ossicular status according to Austin’s classification.

In an intact canal wall procedure, the canal wall is preserved.

In canal wall down procedures, the bridge is removed and the ridge is reduced while reducing the anterior and posterior buttresses, thereby making the mastoid and middle ear into a single cavity.

After disease clearance, an ossiculoplasty is done using TORP or PORP depending on the ossicular status.

If the incus alone is eroded, PORP is used. If incus and superstructure is eroded, a TORP is used.

The TORP and PORP have to be altered for length before being used. A cartilage cap is then kept between the prosthesis and tympanic membrane.

In canal wall down mastoidectomy, conchal cartilage was used and in intact canal wall mastoidectomy, tragal cartilage was harvested.

Tymanoplasty
Temporalis fascia graft was harvested using a supraaural incision. Using 0° Hopkin’s rod-lens endoscope, infiltration was given in all 4 quadrants of external auditory canal. Edges of the perforation were freshened. 6 o’clock and 12 o’clock position incisions made and joined using a curvilinear incision. Tymanomeatal flap elevated. Middle ear inspected and ossicular integrity checked.

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The tympanomeatal flap is then repositioned and gel foam is kept in the EAC. Medicated wick is then kept in the EAC and mastoid dressing done.
Figure 2, 3, 4 shows TORP in situ.

D) Post-Operative Evaluation

An audiogram was repeated at least 3 months post operatively.

RESULTS

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<th>t-Test</th>
<th>GROUPS = PORP</th>
<th>Paired Samples Statisticsa</th>
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<td>POST- OP PTA</td>
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In the study it was observed that, of the 32 cases that were included in the study, 24 cases underwent placement of partial ossicular replacement prosthesis and in 8 of the patients total ossicular replacement prosthesis was placed. Among the cases in whom PORP was placed, there was an improvement in the preop PTA average of 44.17db, which reduced to 32.54 after the placement of PORP.

Among the 8 cases that underwent TORP placement, the mean pre op hearing loss was estimated at 64.0 db. Following surgery, at the end of three months, the mean post op hearing threshold was found to be at 42.27. Both the values were found to be statically significant.

Success in ossiculoplasty is determined by the technical skill and on the case selection. The ossicles which are not affected by the disease is an important prognostic factor in determining the functional outcome after surgery. When only the stapes suprastructure is present the post-operative hearing gain will be less compared to a case with an intact stapes and then an ossiculoplasty being performed.

DISCUSSION

1. Shrinivas Sripatrao et al\textsuperscript{2} conducted a study on 80 patients and concluded by saying that TORP fared better when the handle of malleus was found to be eroded and the suprastructure of stapes was absent whereas PORP fared better when the handle of malleus was intact.

2. F. Pathan et al\textsuperscript{3} conducted a study on 80 patients and concluded that the postoperative hearing improvement was better when cartilage was used for ossiculoplasty when compared with Teflon PORP.

3. Pasha et al\textsuperscript{4} conducted a study on 33 patients and concluded that the use of the Kartush incus strut is
superior when both the handle of the malleus and the stapes superstructure are preserved.

4. House et al. conducted a study on 1210 patients and supports the importance of placing a cartilage cap between the prosthesis head and the tympanic membrane.

5. Lurato et al. conducted a study it was shown that there was a success of 84% in the incus interposition groups with a success of 82% for those with a PORP.

6. A study by Ho et al. reviewed patients who had undergone ossiculoplasty using titanium middle ear implants. He concluded that 64% and 45% of patients achieved air-bone gap less than 20 dB with PORP and TORP respectively.

7. Neff et al. studied 18 patients who underwent tympano-ossiculoplasty with a titanium TORP in the year 2003. Hearing results were analysed and showed 89% surgical success.

8. Rondini-Gilli et al. studied 100 patients who received either a Hydroxyl Apatite PORP/TORP. Extrusion or displacement of the implants occurred in 10% of cases. These displacements were mostly seen when no cartilage cap was placed. The results showed that the majority did not have a successful closure less than 20 dB ABG. Poor auditory results were due to an absent stapedial arch with type 3 tympanoplasty, a radical mastoidectomy and previous tympanoplasty.

9. Hillman et al. reviewed 84 patients who underwent tympanoplasty using Plastipore prosthesis and 53 who used titanium. There was 1 extrusion in the titanium group. There was one incidence of prosthesis failure in the titanium group. 60% of patients had postoperative air-bone gap of 20 dB or less in the Plastipore group. In the titanium group, 45.3% achieved a 20 dB or less air-bone gap.

10. Emir reviewed 304 patients who underwent ossiculoplasty with an intact canal wall. A 58% success rate was seen in the group with autologous incus interposition, while those with Plastipore PORPs resulted in 56% success rate. 9.3% of implants were extruded in this study.

11. Jha et al. concluded that compared to titanium and Plastipore the better alternatives were cartilage, gold and bone. A similar report was also obtained in the study conducted by Yung et al. They also reported that there was no difference in the functional outcome based on the type of prostheses used. In contrary to these studies, was a study conducted by Jackson et al on 141 cases of ossiculoplasty. They reported better results with Teflon TORP than PORP.

12. According to a study conducted by Mahanty et al. on 50 patients who underwent different types of ossiculoplasty. In the study 5 patients underwent cartilage ossiculoplasty, 19 patients underwent autologous incus ossiculoplasty, 6 patients underwent ossiculoplasty with polyethylene PORP prosthesis. It was noted that when the post-operative pure tone audiogram was taken at the end of 6 months, the success rate was 60% in case of cartilage, 73.68% in case of autologous incus and 56.25% in case of PORP prosthesis. In the study was success was taken as an improvement in the air bone gap of more than 20 db.

Dornhoff et al. stated that the type of surgical procedure done and the complexity of the procedure done also had a role to play in the post op functional outcomes. According to his study he observed that, partial mastoid obliteration and reconstruction of the tympanic ring with cartilage while performing canal wall down procedure had a role in improving the post op hearing outcomes.

CONCLUSION

1. Ossiculoplasty gives better results when compared to cases where ossiculoplasty isn't done.

2. Ossiculoplasty should always be done in patients with conductive hearing loss which is secondary to ossicular pathology. This can be done at a primary or second sitting.

3. Teflon prosthesis gives an acceptable hearing gain.

4. Teflon is cost effective when compared to other commercially available prostheses.

5. Teflon is taken up well in the three month follow up period.

6. The only complication recorded was extrusion of the prosthesis which was seen in 1 case.

7. Long term results are awaited.

REFERENCES


