MIDDLE EAR RECONSTRUCTION - OUR EXPERIENCE

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ABSTRACT

A comparative study of ossicular reconstruction using four different graft material was carried out on 40 patients as a second stage procedure from July 1989 to June 1991. The graft materials used were : autologus ossicular bone graft, allogeneic ossicular bone graft, autologus cartilage and bio-compatible materials. All patients were observed for a period ranging from one to two years. Extrusion of ossicular graft was prevented by use of a lace of cartilage between the ossicular graft and neotympanic membrane. Satisfactory results were obtained with cartilage graft in 6%, allogeneic ossicles 70%, autologus ossicular graft 80% and bio-compatible materials 33.3%.

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KEY WORDS : Ossiculoplasty; Autologus and allogeneic ossicular graft; Total ossicular replacement prosthesis; Partial ossicular replacement prosthesis

Introduction

The discontinuity of the ossicular chain is more often caused by chronic ear disease, head trauma and occasionally by deliberate removal of ossicles during surgery. It leads to severe hearing loss. Various methods and materials have been used for the reconstruction of middle ear. Even when the operation is successful, the hearing gain may not be long lasting. Besides skilled operative technique, a successful and lasting outcome of ossicular reconstruction depends upon the type of material used. Since plastic, wire and cortical bone could not give encouraging results, ossicles, cartilage and plastipore are being used today.

Man made incus and incus stapes prostheses of hydroxylapatite provide satisfactory substitute for prostheses sculptured from ossicles [1]. The use of various organic prostheses alone for reconstruction of sound pressure transfer mechanism has been criticised. The prostheses with a shaft of teflon and a homograft bone glange is an alternative method which has been found successful [2]. In the present study, comparative evaluation of different graft materials in ossiculoplasty for

reconstruction of middle ear mechanism has been carried out.

Material and Methods

Forty patients in whom ossiculoplastic procedures were carried out for different ossicular chain defects between 1989-1991, formed the subjects of this study (Table 1). Congenital and traumatic cases were excluded. The materials used were -

1. Autograft - (i) Ossicles - incus (ii) Cartilage from tragus
2. Allograft - Ossicles - Head of malleus and incus
3. Biomaterials - (i) Partial ossicular replacement prosthesis (PORP). (ii) Total

TABLE 1
Ossicular chain defects.

Type	Number	Percentage
M+ S+	10	25
M+ S-	04	10
M- S+	14	35
M- S-	12	30

M - Handle of malleus
S - Stapes Superstructure

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ossicular replacement prosthesis (TORP)

All 40 cases were operated under local anaesthesia. Thirty six (90%) cases had cholesteatoma while other four had central perforation. In 2 cases with minimal spread of cholesteatoma, modified combined approach tympanoplasty (CAT) procedure (CSOM) safe type, transcanal tympanoplasty was carried out. In both procedures, ossiculoplasty was performed in one stage. In 34 cases of cholesteatoma, a standard modified radical mastoidectomy was performed in first stage and after a gap of 3-6 months ossiculoplasty was carried out in second stage. Autograft ossicle, allograft ossicle, autograft cartilage and biomaterial (PORP and TORP) were used in ten cases each with a view to carrying out a comparative study of these materials for ossicular reconstruction. However, use of ossiculoplastic materials was tailored to the individual cases with consideration for providing a stable and lasting ossicular chain.

The results obtained were evaluated according to the following criteria :

- (a) Satisfactory results : Postoperative air-bone gap (a-b gap) of 25 decibels (dB) or less.
- (b) Unsatisfactory results : Postoperative a-b gap of 25 to 35 dB.
- (c) Failure : No improvement or deterioration in hearing or perforation of neotympanic membrane and graft extrusion.

As the cases were done under local anaesthesia, a rough peroperative hearing improvement was assessed on the table after the ossicular reconstruction was done.

Results

Significant per-operative hearing improvement could be achieved which lasted during early postoperative period (Table 2). Thereafter, in a high percentage of cases the hearing level deteriorated. This deterioration is due to instability of the graft material in the middle ear.

The details of the methodology used and results obtained with different materials are

TABLE 2
Results obtained

Result	No of cases	Percentage
Satisfactory	22	55
Unsatisfactory	04	10
Failure	14	35

as under :

1. Preserved autograft ossicles (10 cases)

In M+ S+ defect (6 cases) and M+ S- defect (4 cases) sculptured incus was used with cartilage interposition between tympanic membrane (TM) and ossicular graft. Satisfactory results were obtained in 8 cases with a-b gap of 15-20 dB. There were 2 failures due to possible instability of the ossicular graft between the stapes superstructures (SSS) and malleus handle.

2. Preserved allograft ossicles (10 cases).

In 2 cases with M + S+ defect, sculptured incus transposition was done giving satisfactory results with a-b gap of 15 dB in both. Out of 4 cases with M+ S- defect, 2 cases were reconstructed with sculptured incus transposition and both were failures possibly due to extrusion since TM showed perforation. In other 2 cases cartilage was interposed between sculptured incus graft and the TM giving satisfactory results with a-b gap 20 to 25 dB.

In 4 cases with M- S- defect head of malleus was placed on stapes foot plate with cartilage interposition between TM and ossicular graft. Satisfactory result was achieved in 2 cases with a-b gap 25 dB. Two cases were failures due to postoperative infection with perforation of TM and possible extrusion.

3. Fresh autograft cartilage (10 cases)

Two cases with M+ S+ defect were reconstructed with cartilage interposition between incus and SSS giving satisfactory result with a-b gap 10 dB each.

In 4 cases with M- S- defect 'L' shaped cartilage was placed between stapes footplate and TM. All these 4 cases have become failures with a-b gap more than 45 dB probably due to displacement of graft from stapes footplate.

In rest 4 cases with M- S+ defect cartilage was laid over SSS with latter fitting into the depression in the undersurface of the cartilage and its lateral side tautly connected to the undersurface of the TM. We achieved satisfactory result in all 4 cases with a-b gap 25 dB.

4. Biomaterial PORP and TORP (10 cases)

PORP was placed on SSS with cartilage interposition between prostheses and TM in 6 cases with M- S+ defect. Two cases were satisfactory with a-b gap 20 dB. Unsatisfactory result were in 2 cases with a-b gap 30 dB. In rest 2 cases the improved hearing deteriorated within 24 hours probably due to displacement of prostheses off SSS.

In 4 cases with M- S- defect, TORP was placed on stapes footplate with cartilage interposition between TORP and TM. 2 cases were unsatisfactory with a-b gap 30 dB. In 2 cases hearing deteriorated on second postoperative day probably due to displacement of prostheses at stapes footplate.

Discussion

A comparative evaluation of different graft materials in the reconstruction of the middle ear mechanism was done. With autograft ossicles we obtained result in M+ S+ defect in 66.6% and M+ S- defect in 100%. Smyth [3] obtained satisfactory result in 57% in M+ S+ defect and 50% in M- S+ defect. With allograft incus transposition in M- S+ defect, we got satisfactory result in 50% (2 cases). Bahadur *et al* [4] had a-b gap closure to 15 dB or less in 60% (6 cases) and Lesinski [5] had in 80% (47 cases). Intragroup comparison between autograft and allograft ossicles shows satisfactory results in 80% and 60% respectively. Out of 10 allograft ossicles, 2 extruded possibly due to non-interposition of cartilage and two ossicular grafts extruded due to postoperative infection. As a result we got 60% satisfactory result. Taking into consideration these avoidable reasons of extrusion in 4 cases, it is justifiable to say that there is no appreciable difference between autograft and allograft ossicles for ossiculoplasty.

The failure with 'L' shaped cartilage in our

hands in all 4 cases might be due to inadequate tautness of the flexible cartilage between the footplate and the TM causing its displacement. However, the technique of 'L' shaped cartilage prosthesis for M- S- defect is potential one. The horizontal arm serves two functions. Firstly, it gives efficient coupling to the TM for transfer of sound energy; secondly, by virtue of support to the TM, it prevents collapse of the tympanum. Moreover, if the cartilage touches oval window edge or posterior canal wall, bony fixation does not occur, as seen with ossicular grafts. As a result, hearing is not likely to be affected in the postoperative period.

Altenau and Sheehy [6] got air-bone gap of 20 dB or less in 67% of 339 cases and 10 dB or less in 37% cases with 'L' shaped cartilage prosthesis. We used cartilage in 4 cases with M- S+ defect and got satisfactory result in all cases (100%). Shea and Glasscock [7] obtained air-bone gap of 20 dB or less in 65% of 172 cases and Bahadur *et al* [4] obtained air-bone gap of 15 dB or less in 60% (6 cases). With PORP in M- S+ defect in 6 cases we obtained satisfactory, unsatisfactory and failure in 2 cases (33.3%) each. Brackmann and Sheehy [8] achieved result with air-bone gap closure to within 10 dB in 40% and within 20 dB in 85%. Bojrab *et al* [9] got 49% air-bone gap closure to 20 dB or less.

We used TORP in M- S- in 4 cases and got satisfactory and failure results in 2 cases (50%) each. Brackmann and Sheehy [8] achieved air-bone gap closure to within 10dB in 55% (31 cases) and within 20dB in 85% (52 cases). Bojrab *et al* [9] got 43% air-bone gap closure to 20 dB or less. Our result with cartilage graft (60% satisfactory) are comparable with our ossicular graft (70% satisfactory) both allograft (60%) and autograft (80%). Extrusion or resorption of cartilage was not encountered.

In view of these facts autograft tragal cartilage was found as good prosthesis as ossicular autograft or allograft. However, long term hearing gain with cartilage prosthesis required further observation for a longer period.

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