A Comparative Study of Ossiculoplasty by Using Various Graft Materials

Dr Sushil Jha*, Dr. Keyur Mehta, Dr Viral Prajapati**,Dr. Deepak Patel***, Dr. Pramod Kharadi******

* Associate Professor**Assistant professor, ,****Fouth year resident, Department of ENT, Govt. Medical College Bhavnagar,*** Consultant ENT Surgeon , CHC Rajpipada

Abstracts: Introduction: The use of ossicular graft material in the ossicular chain reconstruction has significantly improved the results in the hearing after the tympanoplasty and tympanomastoid surgery for the chronic otitis media. The ossicular chain transmits the vibration of tympanic membrane to the inner ear with impedance matching function failure to which results in > 50dB hearing loss of conductive variety. Material and Method: A Prospective study of 76 patients who underwent ossiculoplasty was done in the department of ENT & Head and Neck Surgery , Sir T. Hospital ,Bhavnagar, Gujarat between May 2007 to June 2009.Only patients with conductive hearing loss were included in study and underwent ossiculoplasty with using various graft material and assessment done by post operative closure of air bone gap. Most available graft material used are auto graft, cartilage and bone, and various biosynthetic materials like gold,Teflon,plastipore,titanium etc. Results: Majority of patients are middle age group with moderate conductive hearing loss. The comparison of hearing improvement between various graft materials at 2 month and 5 months post operatively were studied in the relation to the postoperative air bone gap closure shows that auto graft and gold prosthesis are cost effective with comparable results obtained as by expensive titanium and plastipore prosthesis. Discussion & Conclusion: The ossiculoplasty materials produce varying results. The titanium and plastipore are rather expensive for the Indian patients , particularly for the government hospital poor class patients. We have tried to evaluate the results using the economical and readily available graft materials like cartilage, bone and gold prosthesis for ossiculoplasty and compared its results with costly plastipore and titanium prosthesis. prosthesis [Jha S et al NJIRM 2011; 2(4) : 53-55]

Key Words: ossiculoplasty, chronic otitis media, ossicular reconstruction

Author for correspondence: Dr. Sushil Jha , Associate professor, Department of ENT, Government Medical College , Bhavnagar. E-mail: sushilgjha@yahoo.ca

Introduction: Chronic otitis media can cause hearing loss of >50dB in the presence of ossicular chain discountinuity.[1] Reconstruction of ossicular chain can significantly improves the hearing in such cases. Autograft bone and cartilage and synthetic prosthesis like glod,plastipore and titanium have been used for ossiculoplasty with varying success rates.[2] Autograft like ossicles sometimes cannot be used due to underlying diseases process. The selection of a particular prosthesis is based on several factors including cost,compability,technical ease of use and hearing results. In a government hospitals setup ,the autograft bone ,cartilage graft and economical prosthesis like gold due to its cost , availability and ease of use ,can be used as a viable alternative to expensive plastipore and titanium prosthesis. In our study we have compared the results of ossiculoplasty by using bone, cartilage , gold, plastipore and titanium prosthesis.

Material and Methods: A Prospective study of 76 patients who underwent ossiculoplasty was done in the department of ENT & Head and Neck Surgery, Sir T. Hospital ,Bhavnagar, Gujarat between May 2007 to June 2009. All the patients were diagnosed to have chronic otitis media underwent a detailed ENT examination to identify tubotympanic cases (41 cases)and atticoantral cases (35 cases)of chronic otitis media and to rule out any focus of infection, which could adversely influence the results of ossiculoplasty. Pure tone average for 3 frequency (0.5,1,2 kHz) were used to calculate and compare the air bone gap preoperatively and post operatively. The patients were followed up for an average periods of 2 to 5 months. Speech audiometry was not included in the audiological examination,as patients with sensorineural hearing loss were excluded from this study.

In our study the graft materials used for ossiculoplasty were cartilage , bone , gold , plastipore and titanium.

The patients were followed up at 2 month and 5 months post operatively with: Otomicroscopic examination, Audiological test i.e. Pure tone average of post operative air conduction level and

air bone gap closure, Air bone gap closure with respect to preoperative middle ear risk index (MERI) and Incidence of exposure of prosthesis.

The Selection criteria's for the patients in our study were as followings:

- Chronic otitis media -tubotympanic type , atticoantral type.
- Air bone gap more than 30 dB
- No sensorineural hearing loss
- Worse hearing ear selected for the operation in bilateral cases
- Presence of ossicular defect classified as per Austin Kartush classification[3]

Surgical Technique: All patients were operated via a postauricular approach under general and local anesthesia. Patients with tubotympanic disease underwent cortical mastoidectomy with tympanoplasty. Canal wall down mastoidectomy with tympanoplasty done in patient with atticoantral disease. Ossiculoplasty is done by refreshing the autograft cartilage and bone & by using gold,plastipore,titanium prosthesis Total ossicular replacement prosthesis & Partial ossicular replacement prosthesis(TORP & PORP).

The tympanic membrane was reconstructed by underlay technique by using temporalis fascia graft. A thin slice of cartilage was placed between the prosthesis and temporalis fascia graft to prevent the extrusion of the prosthesis.

Result: Majority of the patients were between the age group of 14 to 35 years. There were 39 male and 37 female patients. 41 patients had tubotympanic & 35 patients had atticoantral disease. Most patients had preoperative hearing loss of between 40 to 60 dB (Table 1).

Table 1 : Preoperative Air bone gap

Air Bone Gap (db)	Cartilage	Bone	Gold	Plastipore	Titanium
30- 40	03	01	01	--	--
40 – 50	16	14	15	08	03
> 50	07	02	03	02	01
Total	26	17	19	10	04

26 patients underwent tympanoplasty with cartilage,17 patients with bone,19 patients with gold prosthesis, 10 patients with plastipore and 4 patients with titanium prosthesis. The following table shows ossiculoplasty by using various graft materials in the relation to the intraoperative ossicular status (MERI GROUP Table 2).

Table 2 : Intra Operative Middle Ear Risk Index (MERI) With Ossiculoplasty Using Various Graft Materials

Ossicle Status (Meri Group)	Cartilage	Bone	Prosthesis (Torp / Porp)		
			Gold	Plastipore	Titanium
a	09	07	07	05	02
b	07	05	06	03	01
c	04	02	02	--	--
d	06	03	04	02	01
Total	26	17	19	10	04

The comparison of hearing improvement between various graft materials at 2 month and 5 months post operatively were studied in the relation to the postoperative air bone gap closure (Table 3)

In some cases graft extrusion had occurred. All extrusions were associated with graft failure. The following table shows the extrusions of the grafts between various graft materials (Table 4).

Table 3 : Postoperative Results Of Ossicular Reconstruction In Reference To Air Bone Gap Closure.

Air bone gap closure	Cartilage		Bone		Gold		Plastipore		Titanium	
	2M	5M	2M	5M	2M	5M	2M	5M	2M	5M
0-10 db (excellent)	--	--	01	01	--	--	--	--	--	--
10-20 db (very good)	05	05	03	03	02	02	01	01	01	01
20-30 db (good)	09	10	06	06	03	04	03	03	01	02
> 30db	12	11	07	07	06	05	06	06	02	01

Table 4 : Graft failure & Extrusion of Prosthesis

Cartilage (N= 26)		Bone (N=17)		Gold (N=19)		Plastipore (N = 10)		Titanium (N = 10)	
3	11.5%	1	05.9%	2	10.5%	2	20%	01	25%

Discussion: The most commonly involved ossicle in the case of chronic otitis media was incus [4]. The second most common ossicles to be involved is the stapes suprastructure. Our study reflected the same.

Over years , ontological surgeons have used a variety of materials for ossiculoplasty , including both biologic and alloplastic materials. Biologic materials include autograft or homograft materials like ossicles, cortical bone,teeth & cartilage. With a number of prosthesis being available, comparisons become inevitable. The ideal prosthesis for ossiculoplasty should be compatible, stable, safe, readily available,easily insertable and capable of yielding optimal sound transmission. Common middle ear prosthesis used presently includes autografts like reshaped ossicles & cartilages and alloplasts like gold , plastipore and titanium (TORP / PORP). Autograft have several disadvantages including lack of availability in chronically diseased ears, prolonged operation time to obtain and reshape the material and / or loss of rigidity.

Titanium prosthesis for ossiculoplasty have been extensively used over the past several years. Gardner et al [5] Reported that the air bone gap could be reduced to 20db or less in 70% of patients with titanium partial ossicular prosthesis and to 30 db or less in 44 % with titanium total ossicular prosthesis. Dalchow et al [6] reported postoperative air bone gaps of 20db or less in 76 % with titanium prosthesis. Zenner et al[7] reported better hearing results in the high frequency than with gold or ceramic prosthesis. Our study also reveals very good results with the titanium prosthesis with about 75 % of success rate.

Gold prosthesis has been used as a viable alternative to the most conventional prosthesis. Gold has a high compatibility to human body tissues. It is nontoxic,nonmagnetic,chemically stable and non erosive. Gold is also biocompatible, well tolerated , easily malleable, cheap and readily available. It has been used recently as a prosthesis in ossiculoplasty and clinical studies reported favorable results. In pure tone average , 52.6% of patients with gold prosthesis had a hearing improvement between 10-30db at 5 months of followup.

Ossiculoplasty with biocompatible alloplastic materials like Teflon,poroplast have sometimes resulted in migration,extrusion,penetration into the inner ear or significant middle ear reactivity . Extrusion of prosthesis is reduced considerably when cartilage is placed between the prosthesis and the tympanic membrane.

Conclusion: Autograft ,cartilage and bone are effective ossicular reconstruction materials. Among the various prosthesis gold is an effective and low cost alternative to the plastipore and titanium as an ossiculoplasty materials. The success rate of gold is comparable to that with the other ossiculoplasty materials. Finally our study reveals that the cartilage,bone and gold prosthesis are better and cost effective alternatives to the plastipore and titanium as an ossicular reconstruction materials.

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