

# A comparative study between endoscope assisted trans-tympanic pop- in tympanoplasty and permealal underlay tympanoplasty

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## Abstract

**Background:** Otoscopic procedure like tympanoplasty is one of the magic wands that an ear nose throat surgeon possesses to alleviate the suffering of a hearing impaired patient. Endoscopic trans-tympanic pop in technique is an alternative method where tympanic fascial graft is placed medial to tympanic membrane remnant through the perforation without elevation of tympanomeatal flap and angled endoscope is used to assess the ossicular chain.

**Objective:** The study was done to compare the results of endoscope assisted trans-tympanic pop-in tympanoplasty with permealal underlay tympanoplasty.

**Methods:** The study is a prospective, longitudinal and experimental study conducted in Kathmandu Medical College Teaching Hospital from January 2016 to June 2016. A total of sixty-two patients, thirty-one in study and thirty-one in control group were present. The comparison was made in terms of success rate, decrease in taste sensation and time taken for the procedure. Data analysis was done by SPSS version 20. Categorical data were tested by Fisher Exact test and p-value of <0.005 was considered statistically significant.

**Result:** Among 62 patients, 55 had successful graft uptake (88.7% success rate). Hearing improvement was seen in 51 patients (88.25%). Regarding taste sensation 5 out of 62 had decrease in taste sensation after surgery (8%). Time taken was approximately 30 to 45 minutes (mean =44.1min) in endoscopic transtympanic pop-in type and 60 to 90 minutes (mean =73.8 min) in permealal underlay type.

**Conclusion:** We can conclude that endoscopic trans-tympanic pop-in tympanoplasty gives similar hearing and graft uptake result but with less time and greater ease as compared to permealal underlay technique.

**Key words:** Endoscope assisted tympanoplasty, Permealal approach, Tympanoplasty.

## INTRODUCTION

Hearing loss is a hidden disability unlike blindness. Thus the diseased, the society and even the health care system seemed to turn a blind eye to the problem. Since the introduction of tympanoplasty in 1996 by Austin and Shea Jr, the underlay technique of tympanoplasty by elevation of tympanomeatal flap has become the most widely accepted technique so far<sup>1</sup>.

Now the advancement in the field of otolaryngology is so vast that endoscopic nose, throat and ear surgeries are in vogue. Considering the vast use of endoscopes in

the field of otolaryngology namely endoscopic nasal and laryngeal surgeries, its use in otology is also justifiable. Use of angled endoscopes gives the surgeons a wide angled view of normal and not so normal structures before the start of surgery. This makes the surgery a safe, easy and less time consuming procedure.

So it is high time endoscopic ear surgeries are also encouraged. Studies by Singh et al in "Results of transtympanic pop- in surgery" and Kulkarni et al in "Single flap otoendoscopic tympanoplasty for large central perforation- A pilot study" stated that otoendoscopic surgeries give even better results than conventional surgeries<sup>2,3</sup>. Thus both types of surgeries are compared in this study to analyze the outcome.

The study is intended to establish tympanoplasty as a less cumbersome, minimally invasive and safe procedure for ENT surgeons.

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## METHODS

This was a combined study, where quantitative data was collected for hearing improvement, time taken for surgery and qualitative for taste sensation. The entire study was conducted in Kathmandu Medical College (KMC), Sinamangal after obtaining the ethical clearance from the Institutional Review Committee of KMC and informed consent from the patient. Study was of approximately six months duration from January 2016 to June 2016.

A total of sixty two patients were included in the study, thirty one in each group. They were taken from the patients visiting KMC, ENT outpatient clinic with chronic mucosal disease in the study duration, randomly as they visited ENT, Outpatient Department in odd and even serial entry numbers. Simple random sampling was done, single blinded technique was used in audiological investigation and questionnaire was used for decreased taste sensation following the procedure. Patients with chronic mucosal disease were operated by the principal investigator only, with same micro instruments and endoscopes to avoid experimental bias.

The inclusion criteria were; both the sexes of age 15 to 50 years with Air Bone Gap (ABG) of 15 db to 50 db, who had adequately wide external auditory canal (EAC) through which the margin of the perforation was seen clearly by the use of wide ear speculum. Patients with age groups less than 15 and more than 50 years, those with purely sensorineural hearing loss, with small external auditory canal, revision surgery and patients with medical co-morbidities affecting wound healing were excluded from the study.

Tympanoplasty was done under local anesthesia. In all patients, tympanic membrane perforation margin was freshened with straight needle and its undersurface was scored with a circular knife. Patient in control group underwent elevation of tympanomeatal flap and fibrous annulus by permeal incision. Ossicular chain and middle ear mucosa was assessed after which flap was repositioned. Gel foam was placed medial and lateral to the graft. Then packing was done. In pop in technique, after refreshing the margin 30 degree endoscope was introduced and ossicular chain was assessed by moving the handle of malleus with a straight needle. Then gel foam was packed in the middle ear cavity. After this temporalis fascia graft was popped in through the perforation and evenly spread out with a micro elevator. Then gelfoam was placed laterally too, after this aural packing was done.

The audiological assessment was done after 2 months post surgery. Results in control and study groups were assessed by comparing the mean operative time taken, status of tympanic membrane graft, post operative average air- bone gap and change in taste sensation. An intact tympanic membrane graft and improvement of more than or equal to 10dB average air – bone gap were considered as successful outcome. Decreased in taste sensation was assessed by a questionnaire. All results were analyzed using SPSS version 20 using student's two tailed test. Categorical data were tested by Fisher Exact test and p-value of <0.005 was considered statistically significant.

Biological / individual variability like size of external auditory canal, size and site of perforation and cooperation by the patient in local anesthesia were our study variables.

Time taken for surgery was calculated by using the operation theater's wall clock and same set of operational instruments. Observer bias was modified by making it single blind in audiometry test. Experimental bias was corrected by single handed procedure by principle investigator only.

## RESULTS

Among 62 patients, females were 35 and 27 were male. The mean age group was 29.8 years. The mean operative time taken (Table 1) for permeal underlay technique group was 73.8 min and transtympanic pop-in tympanoplasty was 44.1 minute. Pop in technique was much faster than other technique and this finding was statistically significant (p value<0.001).

The results of closure of tympanic membrane perforation (Table 2) at 2 months post surgery for permeal underlay technique was 88.7% which had successful graft uptake and 87% had successful graft uptake in transtympanic pop-in technique. The success rates were similar and the findings were not statistically significant (p value = 0.75). Out of 7 residual perforations 5 patients were revised with fat grafting and 2 healed with chemical cauterization.

Amidst all patients 67.4% graft uptake was seen in patients with B/L mucosal disease, 98.4% graft success was seen in patients with left mucosal disease and 95.6% had successful graft uptake in right mucosal disease. Though bilateral mucosal disease had more graft failure than unilateral disease, there was no significant difference in success rate (p value=0.148) (Table 3).

Hearing improvement was seen in 85% of total patients (Figure 1). Permeatal, underlay technique had 87% and pop in technique had 83% success rate. Among the patients whose hearing did not improve, 4 had fixed ossicular chain, 3 had absence of lenticular process and 2 had fixed stapes footplate.

Regarding taste sensation 5 out of 62 had decrease in taste sensation after surgery. Among these 3 were seen in transtympanic pop in type and 2 in underlay permeatal type. Taste sensation had no association with the technique used (p value=0.69) for surgery. The ossicular chain was successfully assessed by 30 degree 4mm endoscope in all pop- in tympanoplasties.

**Table 1: Time taken for Endoscopic transtympanic pop in tympanoplasty and Permeatal underlay tympanoplasty**

Name of Surgery	Number	Mean	Std. Deviation	Std. Error Mean
Endoscopic transtympanic pop in	31	44.1935	10.57487	1.89930
Permeatal underlay	31	73.8710	9.89189	1.77664

p value <0.001 (independent t-test)

**Table 2: Tympanic membrane graft uptake at second month**

Type	graft uptake		Total
	failed/revised	taken	
Transtympanic	4	28	32
Permeatal	3	27	30
<b>Total</b>	<b>7</b>	<b>55</b>	<b>62</b>

(p value by Fisher Exact test=.075)

**Table 3: Tympanic membrane graft uptake related to laterality.**

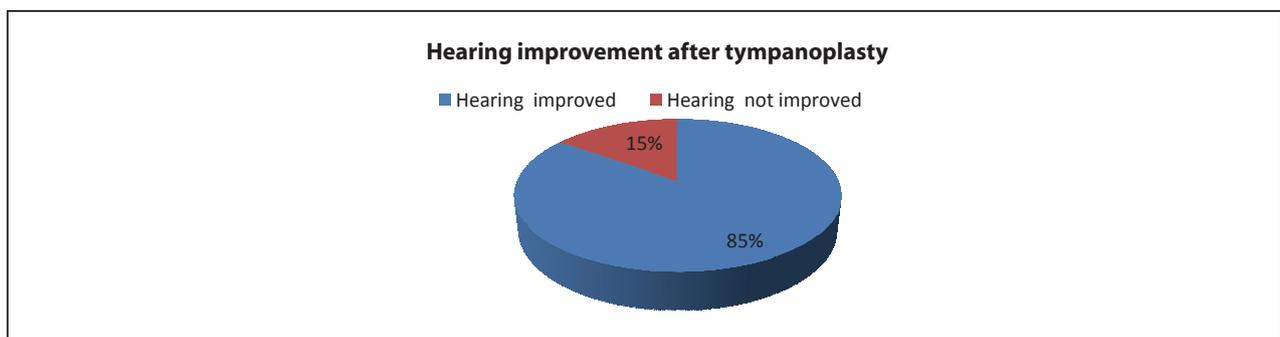
Laterality	graft uptake		Total
	failed/revised	taken	
B/L	4	13	17
Lt	2	19	21
Rt	1	23	24
<b>Total</b>	<b>7</b>	<b>55</b>	<b>62</b>

(p value by Fisher Exact test= 0.148)

**Table 4: Post operative change in taste sensation**

Type	Taste		Total
	decreased	Normal	
Transtympanic	3	29	32
Permeatal	2	28	30
<b>Total</b>	<b>5</b>	<b>57</b>	<b>62</b>

(p value by Fisher Exact test = 0.69)



**Figure 1:** Hearing improvement after tympanoplasty.

## DISCUSSION

This study compares the results of endoscopic trans-tympanic pop- in tympanoplasty with permeatal underlay tympanoplasty. The success rate of graft uptake is seen to be 88.7% in permeatal underlay tympanoplasty and 87% in endoscopic trans-tympanic pop- in tympanoplasty. In a similar study but without the use of endoscope by Vishal Sharma et al shows 81.1% graft uptake success rate in trans-tympanic pop in myringoplasty and 80% success rate in permeatal underlay myringoplasty. It shows no statistically significant difference<sup>4</sup>. In an original article, "Endoscopic transcanal middle ear surgery" by Tarabichi M, 92 % success in endoscopic transcanal success rate in graft closure was seen compared to microscopic surgery which was 80%. The advantage of endoscope was, it could be easily negotiated behind the narrow segment of external auditory canal and provides a panoramic, wide angled, magnified view that allows the surgeon to "look around corners" unlike microscope<sup>5</sup>. One handed technique and loss of depth perception are the disadvantages of endoscopic technique<sup>6</sup>.

In this study there was no statistically significant difference between graft uptake rate of bilateral and

unilateral mucosal disease. This shows similar result with study done by Kamath M P et al in his study "Success of Myringoplasty: Our experience"<sup>7</sup>.

Taste sensation had no statistical difference between the tympanoplastic methods used. Sharma V et al showed trans-tympanic pop in technique had better outcome in taste sensation compared to other techniques<sup>4</sup>.

Time taken for trans-tympanic pop in tympanoplasty was significantly less than that of permeatal underlay tympanoplasty. This finding is supported by studies done by Sharma V et al<sup>4</sup> and Patel J et al in their studies<sup>6</sup>.

## CONCLUSION

Endoscopic trans-tympanic pop in tympanoplasty gives similar outcome in hearing, graft uptake and preservation of taste compared with underlay, permeatal tympanoplasty. However, endoscopic assistance provides all round vision to the surgeon with minimal trauma and less operating time. Thus Endoscope assisted trans-tympanic pop in tympanoplasty is a minimally invasive technique added as a very useful, new tool in ENT surgeon's basket.

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