ORIGINAL ARTICLE



Type 1 Tympanoplasty by Cartilage Palisade and Temporalis Fascia Technique: A Comparison

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Abstract (1)To compare graft take up of type-1 tympanoplasty with cartilage palisade technique with those of type-1 tympanoplasty using autotemporalis fascia. (2) To compare hearing results of type 1 tympanoplasty with cartilage palisade technique with those of type-1 tympanoplasty using autotemporalis fascia. A prospective clinical study. It consisted of 60 patients divided into two groups of 30 patients each. After randomization 30 patients underwent type 1 tympanoplasty using cartilage palisade technique and 30 underwent type 1 tympanoplasty using autotemporalis fascia. In follow up, pure tone audiogram were carried out at 2nd, 4th and 6th month. Clinical assessment was done at 2nd 4th and 6th month. The graft uptake rate between the group 1 and group 2 are 93.33 and 90% respectively. As p value was greater than 0.05 so statistically there is no significant difference between the two group. The post operative air bone gap of the two groups were compared using student t test. The pre op mean of group 1 was 32.5 db and pre op mean of group 2 was 30.66 db. The post op mean of group 1 was 21.33, with standard deviation of 3.6984 and standard error of 0.67523. The post op mean of group 2 was 21.09 with standard deviation of 3.29 and standard error of 0.58261. t value was 0.1357. Analysis was done using student t test and p value was found to be greater than 0.05. p value is greater than 0.05 which shows that there is no statistical difference between the two groups. This study establishes the fact that hearing results after performing type 1 tympanoplasty by

autotemporalis fascia when compared with type 1 tympanoplasty performed by cartilage palisade technique showed similar hearing gain and post operatively graft take up rate was also similar in two groups. The disadvantage of reducing the mechanical vibration of the tympanic membrane was overcome by the palisade reconstruction of the tympanic membrane. This study definitely emphasizes upon usage of new grafting materials in reconstruction of tympanic membrane, with similar, if not better functional results, without compromising the acoustic transfer characteristics.

Keywords Tympanoplasty · Cartilage · Chronic otitis media

Introduction

The cartilage palisade technique in which the tympanic membrane is fully reconstructed with palisade shaped cartilage pieces was first described by Heermann in 1962. In cases of larger defects of the tympanic membrane, healing has a much poorer prognosis since with technical difficulty and area which must vascularize and epithelize with larger perforations, surgical failure would be expected [1]. In such cases at high risk for failure, use of cartilage as a grafting material has been advocated [2, 3]. Autologous cartilage obtained from the ear(tragus or cymba) may resist the negative pressure thanks to its rigidity and convexity. Cartilage also seems to offer high resistance both to lack of vascularization and to infections [4]. Considering material properties, large cartilage plates with thickness less than 0.5 mm have been suggested as an acceptable compromise between sufficient mechanical stability and acceptable acoustic transfer characteristics of the cartilage graft [2.] Cartilage has been described for the limited

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management of retraction pockets and more recently for the reconstruction of the tympanic membrane in cases of recurrent perforations with encouraging results. Despite the thickness of the grafts, the hearing result appear to be good [5, 6]. The advantage of cartilage being that it retains its rigid quality and resists resorption and retraction, even in milieu of continous eustachian tube dysfunction [7] Cartilage also provides firm support to retraction and resistance to infection during the healing period, thus the risk of recurrent perforation is reduced. Cartilage mechanically reduces the vibration pattern of the tympanic membrane, contributing to some impairment in functional results, although a comparison with temporalis fascia and perichondrium showed no significant difference in hearing gain [8]. It has been seen that vibration characteristics of the cartilage when thinned out and used in form of palisades are similar to fascia graft [9, 10]. Palisade reconstruction of the tympanic membrane facilitates its mobility and decreases the acoustic impedance in comparison with larger pieces of cartilage [11]. Cartilage has also been shown to reduce recurrent retraction pockets when used for the reconstruction of the posterosuperior quadrant of the tympanic membrane [12]. Cartilage also seems to provide better functional results especially in ears with poor tubal function, which is a common situation after cholesteatoma surgery [13, 14].

Materials and Methods

The aims of our study were to compare graft take up of type-1 tympanoplasty with cartilage palisade technique with those of type-1 tympanoplasty using autotemporalis fascia and to compare hearing results of type 1 tympanoplasty with cartilage palisade technique with those of type-1 tympanoplasty using autotemporalis fascia. It was a prospective clinical study.

It consisted of 60 patients divided into two groups of 30 patients each. After randomization 30 patients underwent type 1 tympanoplasty using cartilage palisade technique and 30 underwent type 1 tympanoplasty using autotemporalis fascia. Inclusion criteria of patients were, Patients having CSOM (tubotympanic type), patients having medium to large perforation, patients having dry ear for at least 2 weeks, age group 18-50 (either sex) Exclusion criteria were, Patients with unsafe ear, patients with congenital ear anomaly, patients with actively discharging ear, patients with previous ear surgery and patients with acute upper respiratory tract infection. In our study after taking an informed formal written consent from patients, 60 patients divided into two groups of 30 each. They were taken and divided randomly into two groups to undergo two techniques. After taking relevant history and performing local and general physical examination, routine blood investigations, X ray mastoid (bilateral lateral oblique) and pure tone audiogram of the patient was carried out. The preoperative preparation of the patient includes: (1) part preparation of the ear to be operated (2) vital monitoring of the patient (3) pre anaesthetic check up if the surgery is to be carried under GA and (4) written informed consent.

Operative Technique

The surgery was performed by the same surgeon. The surgery was done under local anaesthesia/general anaesthesia by post aural route. A post aural wilde's incision was given. Autotemporalis fascia graft was harvested in one group and conchal cartilage was harvested in other. In cartilage palisade group the tragal cartilage was harvested, it was cut into thickness of less than 0.5 mm with the help of cartilage slicer (Fig. 1), the cartilage slice hence obtained after slicing was cut into small palisades (Fig. 2). Margins of the perforation were freshened. Tympanomeatal flap was raised. Ossicular continuity was checked In palisade technique, small pieces of cartilage were kept parallel to handle of malleus on gelfoam support by underlay technique (Fig. 3). In other technique, autotemporalis fascia was used. In both the groups the cartilage and autotemporalis fascia was placed by underlay technique after creating a gelfoam bed underneath. Tympanomeatal flap was reposited back. Gelfoam placed and wound was closed in two layers. Patients were given post operative



Fig. 1 The sliced cartilage piece of thickness 0.3 mm with the help of cartilage slicer





Fig. 2 Palisades cut out of cartilage piece



Fig. 3 Final appearance of tympanic membrane after cartilage palisade arrangement

intravenous antibiotics, decongestants and analgesics. Stitch removal was done on post-operative day 7. Pack removal was done on post-operative day 10. In follow up, Pure tone audiogram were carried out at 2nd, 4th and 6th month. Clinical assessment was done at 2nd 4th and 6th month.

Results

In this study, 60 patients were taken and divided randomly into two groups, 30 patients underwent Type 1 tympanoplasty by cartilage palisade technique and 30 patients underwent Type 1 tympanoplasty by autotemporalis fascia technique. All patients met the inclusion criteria and accordingly they were included in the study. In this study, total sixty patients were taken and divided randomly into two groups. In group 1, out of 30 patients, 12 (20%) were males and 18 (30%), were females. In group 2, out of thirty patients, 17 (28%) were males and 13 (22%) were females

Table 1 Age distribution in two groups

Serial no	Age group	No of patients in group 1	No of patients in group 2	Total
1	1–15	0	0	0
2	15-30	20 (66.6%)	23 (76.6%)	43 (71.6%)
3	30-45	10 (33.3%)	7 (23.4%)	17 (28.3%)
4	45-60	0	0	0
	Total	30	30	60

Table 2 Sex distribution in two groups

	Males	Females	Total
Group 1	12	18	30
Group 2	17	13	30
Total	19	31	60

Table 3 Post operative appearance of pinna in two groups

Pinna	No of patients in group 1	No of patients in group 2
Normal	30	28
Deformity	0	0
Perichondritis	0	2

Table 4 Size of perforation in two groups

Size of perforation	Group 1	Group 2	Total
Medium	26 (86.66%)	25 (83.33%)	51 (85%)
Large	4 (13.33%)	5 (16.66%)	9 (15%)

(Table 2). Most of the cases belonged to 15-30 year age group with 71.6% of patients falling under this age group (Table 1). In post operative evaluation of the external appearance of the pinna in both the groups, group 1 had normal appearing pinna of all the thirty patients and in group 2, 28 patients had normal pinna with 2 patients developing post operative perichondritis (Table 3). Pre operatively patients were classified according to the tympanic membrane perforations. In group 1, 26 (86.6%) patients had medium sized perforations and 4 patients (13.33%) had large perforations while in group 2, 25 (83.33%) patients had medium sized perforations and 5 patients (16.66%) patients had large perforations (Table 4). Tympanic membrane was found to be normal in 39 of total 60 cases, 16 patients had retracted tympanic membrane. In group 1, two patients had residual perforation while in group 2, three patients had residual perforation (Table 5). Statistical analysis of the graft take up rate between the two



Table 5 Post operative appearance of tympanic membrane in two groups

Post op appearance of tympanic membrane	Group 1	Group 2	Total
Normal	20	19	39
Retracted	8	8	16
Perforation	2	3	5

Table 6 Graft uptake between two groups

Graft uptake	Group 1	Group 2
Successful	28	27
Failure	2	3
Total	30	30

groups was done using Chi square test with vate's correction Value of Chi square was 0.218 with 1 degree of freedom. p value was greater than 0.05. The graft uptake rate between the group 1 and group 2 are 93.33 and 90% respectively (Table 6). As p value was greater than 0.05 so statistically there is no significant difference between the two group. Post operative hearing result in db in group 1 and group 2 at 2nd, 4th and 6 months. The post operative air bone gap of the two groups were compared using student t test. The pre op mean of group 1 was 32.5 db and pre op mean of group 2 was 30.66 db. The post op mean of group 1 was 21.33, with standard deviation of 3.6984 and standard error of 0.67523. The post op mean of group 2 was 21.09 with standard deviation of 3.29 and standard error of 0.58261. T value was 0.1357. Analysis was done using student t test and p value was found to be greater than 0.05. p value is greater than 0.05 which shows that there is no statistical difference between the two groups.

Summary

- 66.6% of patients in group 1 and 76.6% in group 2 belonged to age group 15–30 years.
- None of the patient showed deformity of pinna post operatively in both groups while in group 2, two patients showed post operative perichondritis of the pinna.
- The graft take up rate was 93.33 and 90% in respective groups.
- The pure tone audiogram was carried out 6 months post operatively in both groups and air bone gap compared of both groups, after statistical analysis, no statistical difference was found in both groups.

Conclusion

This study establishes the fact that hearing results after performing type 1 tympanoplasty by autotemporalis fascia when compared with type 1 tympanoplasty performed by cartilage palisade technique showed similar hearing gain and post operatively graft take up rate was also similar in two groups. Tympanoplasty is a standard procedure to repair the perforated tympanic membrane and reconstruct the ossicular chain, thereby leading to hearing gain in the patient. Various materials have been used as a grafting material to create a new tympanic membrane ranging from temporalis fascia, cartilage, perichondrium to skin grafts. Autotemporalis fascia has been the most popular of the grafting materials as it is easily harvested from the same incision, the thickness of the fascia being similar to the original tympanic membrane and the low basal metabolic rate of the fascia leading to higher chances of graft take up. The cartilage as a grafting material was usually discouraged because it is considered that the increasing mass and stiffness of the reconstructed tympanic membrane leads to raised acoustic impedance which alters the acoustic transfer characteristics. Murbe, Zahnert, Bornitz, Huttenbrink et al. in their study comparing cartilage and autotemporalis fascia as a grafting material proposed that large cartilage plates with thickness less than 0.5 mm have been suggested as an acceptable compromise between sufficient mechanical stability that is offered by cartilage as a grafting material and acoustic transfer characteristic of the cartilage graft. Dornhoffer stated that in cases of tubal dysfunction, adhesive processes, tympanic fibrosis and defects of the entire tympanic membrane, healing has a much poorer prognosis where cartilage has proven advantage. In our study, both the materials as a grafting material were compared and it showed that when cartilage pieces are used in palisades and cut into thickness less than 0.5 mm, had comparable hearing gain and graft take up postoperatively as shown by temporalis fascia. The basis of using cartilage as a grafting material was the rigid quality it provides as a grafting material and resistance to infection and retraction provided by it certainly provides an advantage with post operative results. The disadvantage of reducing the mechanical vibration of the tympanic membrane was overcome by the palisade reconstruction of the tympanic membrane. Palisade reconstruction facilitates mobility and decreases the acoustic impedance in comparison with large pieces of cartilage. After thorough follow up of the patients postoperatively till 6 months (Fig. 4), our observations confirm the fact that using cartilage by palisade technique retains the advantage provided by cartilage as a grafting material without hampering the hearing gain expected post operatively. In our study, only three patients had a residual





Fig. 4 Post operative 6 months graft take up in tympanoplasty group

defect postoperatively when cartilage was used as a grafting material whereas fascia group had two patients with residual defect. In post operative period, two patients in the cartilage group developed perichondritis emphasizing on the difficult technique involved in harvesting the cartilage with minimal disturbance of the surrounding normal tissues during the procedure. Post operative perichondritis can be a very debilitating condition which usually occurs when infection sets in the perichondrium surrounding the cartilage leading to necrosis of the cartilage and subsequent ear deformity. Once perichondritis has set in, it is of utmost importance to remove the necrotic cartilage for preventing further spread of infection and giving intravenous antibiotics with regular dressing. We acknowledge limitations associated with this study. First the limited number of patients included in the study and consequently the limited number of the encountered complications. Secondly, the difficulty of the procedure and time consumed when compared with the fascia group also emphasises the amount of surgical experience needed before using the cartilage palisade technique for tympanoplasty. This study definitely emphasizes upon usage of new grafting materials in reconstruction of tympanic membrane, with similar, if not better functional results, without compromising the acoustic transfer characteristics.

References

- Adkins WY, White B (1984) Type 1 tympanoplasty: influencing factors. Laryngoscope 94(7):916–918
- Murbe D, Zahnert T, Bornitz M, Huttenbrink KB (2002) Acoustic properties of different cartilage reconstruction techniques of the tympanic membrane. Laryngoscope 112(10):1769–1776
- Neumann A (1999) The Heermann "cartilage palisade tympanoplasty". HNO 47(12):1074–1088
- Kazikdas KC, Onal K, Boyraz I, Karabulut E et al (2007) Palisade cartilage tympanoplasty for management of subtotal perforations. Eur Arch Otorhinolaryngol 264:985–989
- Amedee RG, Mann WJ, Riechelmann H (1989) Cartilage palisade tympanoplasty. Am J Otol 10:447–450
- Duckert LG, Mueller J, Makielski KH, Helms J (1995) Composite autograft "shield" reconstruction of remnant tympanic membranes. Am J Otol 16:21–26
- 7. Dornhoffer JL (2006) Cartilage tympanoplasty. Otolaryngol Clin N Am 39:1161–1176
- 8 Gerber MJ, Mason JC, Lambert PR (2000) Hearing results after primary cartilage tympanoplasty. Laryngoscope 110:1994–1999
- 9 Neumann A, Kevenhouster K, Gostian AO (2010) Long term results of palisade cartilage tympanoplasty. Otoneurotol 31:936–939
- 10 Gerber MJ, Mason JC, Lambert PR (2000) Hearing results after primary cartilage tympanoplasty. Laryngoscope 110:1994–1999
- 11 Beutner D, Huttenbrink KB, Stumpf R et al (2009) Cartilage plate tympanoplasty. Otoneurotol 31:105–110
- 12 Poe DS, Gadre AK (1993) Cartilage tympanoplasty for the management of retraction pockets and cholesteatoma. Laryngoscope 103:614–618
- 13 Uzun C, Caye-Thomasen P, Andersen J, Tos M (2003) A tympanometric comparison of Tympanoplasty with cartilage palisades or fascia after surgery for tensa cholesteatoma in children. Laryngoscope 113:1751–1757
- 14 Yetiser S, Hidir Y (2009) Temporalis fascia and cartilage-perichondrium composite shield grafts for reconstruction of the tympanic membrane. Ann Otol Rhinol Laryngol 118(8):570–574

