The Journal of International Advanced Otology

J Int Adv Otol 2017; 13(1): 36–9 • DOI: 10.5152/iao.2016.1855

Original Article

A Comparison of Cartilage Palisades and Temporal Fascia in Type 1 Tympanoplasty for Bilateral Tympanic Membrane Perforations in Children

Taylan Gün, Osman Fatih Boztepe, Doğan Atan, Aykut İkincioğulları, Hüseyin Dere

Department of Ear Nose Throat, Bahçeşehir University School of Medicine, Ankara, Turkey (TG)
Department of Ear Nose Throat, Antalya Medical Park Hospital, Antalya, Turkey (OFB)
Department of Ear Nose Throat, Ankara Numune Training and Research Hospital, Ankara, Turkey (DA, Aİ)
Department of Ear Nose Throat, Yıldırım Beyazıt University School of Medicine, Ankara, Turkey (HD)

OBJECTIVE: To compare the graft success rates and audiological outcomes of bilaterally performed type 1 tympanoplasty using cartilage palisades or temporal fascia in children.

MATERIALS and METHODS: We retrospectively analyzed the medical records of patients who underwent type 1 tympanoplasty at Medical Park Hospital between May 2007 and February 2013. 27 patients (54 ears) were enrolled in the study: 15 (30 ears) in the palisade cartilage group and 12 (24 ears) in the fascia group.

RESULTS: The graft success rate for the fascia group was 79.2%, and that for the cartilage group was 96.7%. The difference was statistically insignificant (p=0.078). Audiological improvements were seen in both groups, and the difference was statistically insignificant.

CONCLUSION: The use of temporalis fascia grafting has similar outcomes to palisade cartilage tympanoplasty for both success rate and audiological values in children who have bilateral disease.

KEYWORDS: Cartilage, palisade, pediatric, bilateral, tympanoplasty

INTRODUCTION

Pediatric tympanoplasty is one of the most commonly performed procedures by surgeons; different success rates have been reported, ranging between 35% and 94% [1]. Eustachian tube dysfunction can worsen the condition of the operated ear during the postoperative period. This known but unproven fact has encouraged surgeons to use cartilage material in tympanoplasty procedures, especially for bilateral cases. Cartilage material has strong mechanical endurance and resistance to infection under negative pressure changes inside the middle ear [1-4]. Some surgeons have reported superior results using cartilage grafting in patients with bilateral chronic otitis media, which is an indicator of poor eustachian tube function [3, 4].

Several studies have been conducted to determine the cutoff age for performing tympanoplasty in children; however, this subject is still highly debated [5-7]. Some authors wait until the patient reaches a certain age before performing the procedure, but other authors believe that delaying surgery may cause irreversible complications and adversely affect the restoration of middle ear function [5-7].

The palisade cartilage technique (PCT) was first described by Heermann and later became very popular, especially in Europe, for closing tympanic membrane perforations [8, 9]. However, there are limited studies comparing the PCT and the commonly used temporal fascia (TF) techniques for bilateral perforations in children. The present study aimed to evaluate the graft success rates and hearing results after bilateral type 1 tympanoplasty using cartilage palisades or temporal fascia in children with bilateral tympanic membrane perforations.

MATERIALS and METHODS

We retrospectively analyzed the medical records of patients who underwent type 1 tympanoplasty at our clinic between May 2007 and February 2013. We included the results of bilaterally operated ears in this study. The study was approved by the ethics committee of our institution and conducted in accordance with the ethical principles stated in the Declaration of Helsinki. Written informed

Presented in: This study was presented at the 37th Turkish National Congress of Otorhinolaryngology Head and Neck Surgery, 28 October-1 November 2015 Antalya, Turkey.

Corresponding Address: Taylan Gün E-mail: taylangun@gmail.com

Submitted: 10.10.2015 **Revision received:** 28.12.2015 **Accepted:** 29.08.2016 **Available Online Date:** 23.11.2016

consent was obtained from patients or patients' parents who participated in this study.

We excluded patients who were over the age of 15 and below the age of 6 at the time of the surgery, patients with cholesteatomatous ears, and patients with a previous history of otologic surgery.

27 patients (54 ears) were enrolled in the study: 15 (30 ears) in the palisade cartilage group and 12 (24 ears) in the fascia group. We collected the data of graft success rates, preoperative and postoperative air bone gaps (ABG), and air conduction thresholds (ACT) of the patients from the Medin integrated medical software system (Medin Software, 4T Inc., İstanbul, Turkey).

All of the procedures were performed under general anesthesia. The postauricular approach was favored in all patients. The procedures were performed by the same surgeon (TG). The procedure was randomly selected by the surgeon. Contralateral ears were operated upon using the same technique one month after the first operation. The cartilage graft was harvested from the tragus in cases where PCT was used. Cartilage grafts were prepared to protect the perichondrium on two sides of the cartilage. The cartilage graft was cut in an oblique manner with a no.15 blade, and cartilage palisades were prepared to close all of the perforations parallel to the manubrium mallei from the superior to the inferior direction. The temporalis muscle fascia was placed in an underlay fashion in all of the fascia patients. If the perforation persisted, secondary surgeries were performed with the same technique at least three months after the first operation.

The bilateral graft success rate and hearing improvement results were evaluated in this study. The graft success rate was evaluated as full healing of the grafted material, without any retraction or perforation, for six months postoperatively. All of the patients were followed up for at least one year following surgery.

Audiometric tests were performed on each patient every three months for the first postoperative year. Pre- and postoperative ABG and ACT were evaluated to define the hearing gain after the operation.

For the descriptive statistics, the values of frequency, percentage, average (mean), standard deviation (SD), median (median), minimum (min), and maximum (max) were presented. To analyze the relationship between categorical variables, Fisher's exact test was used. The Shapiro-Wilk test was used to verify the suitability of the normal distribution of data before analyzing the differences between the measurements. The significance of differences between two independent groups was analyzed by Mann-Whitney U test. For the preoperative and postoperative data measurements, the difference was analyzed with the Wilcoxon signed-rank test for abnormal distribution; for normal distribution, if appropriate, the paired samples t-test was used. p-values less than 0.05 were considered statistically significant. Analysis was performed with the Statistical Package for the Social Sciences 22.0 software package (IBM Corp.; Armonk, NY, USA).

RESULTS

The mean ± SD age was 11.63 ± 2.28 years (range, 7–15 years) (Table 1). The mean ± SD follow-up period was 23.2 ± 12.8 months in the fascia group and 21.9 ± 9.2 months in the cartilage group. Postoperative ABG values decreased for the fascia group, and this decrease was statistically significant (p<0.001) (Table 1). Postoperative ABG values decreased for the cartilage group, and this decrease was statistically significant (p<0.001) (Table 2). Postoperative ACT values decreased for the fascia group, and this decrease was statistically significant (p<0.001) (Table 1). Postoperative ACT levels decreased for the cartilage group, and this decrease was statistically significant (p<0.001) (Table 2). The graft success rate for the fascia group was 79.2%, and that for the cartilage group was 96.7%. The difference was statistically insignificant (p=0.078) (Table 3). One failure was observed in the cartilage group, and four failures were observed after contralateral ear surgery.

DISCUSSION

PCT is a technique that is used for conditions such as subtotal perforations, tympanosclerosis, adhesive otitis, and revision surgery; the outcomes for these conditions may be unsatisfactory if the temporal fascia technique is used. Cartilage strips were named palisades by Heermann et al. [9]. Some other authors still prefer to use the term "strips" [9]. Many reconstructive materials have been used for tympanoplasty; however, the use of autogenous materials became popular at the end of the 19th century. Since its introduction by Storrs [10], temporalis muscle fascia is still the first choice for many surgeons all around the world. Many studies have shown better graft acceptance rates using the PCT technique than using the TF technique [9, 11, 12].

There has been some speculation about the hearing results of the PCT technique; however, studies have shown that there is no significant difference in the hearing results [11, 12].

Table 1. Preoperative and postoperative ABG and ACT in the fascia group

Fascia group n=19	ACT (dB) Mean ± SD	ABG (dB) Mean ± SD	p*
Preoperative	24.63 (3.93)	22.26 (2.86)	<0.001*
Postoperative	15.37 (6.28)	12.68 (4.81)	

*p<0.05; Wilcoxon signed-rank test

The results are presented as the mean ± SD and median (minimum-maximum); SD: standard deviation

Table 2. Preoperative and postoperative ABG and ACT in the cartilage group

Cartilage group n=29	ABG (dB) Mean ± SD	ACT (dB) Mean ± SD	p*
Preoperative	25.48 (3.69)	24.48 (2.81)	<0.001*
Postoperative	16 (10–22)	17.55 (3.74)	

*p<0.05; paired samples t-test

The results are presented as the mean ± SD and median (minimum-maximum). SD: standard deviation

Table 3. Graft success rates by graft material

	Graft success rate				
	Fascia		Cartilage		
	n	%	n	%	p*
Success	19	(79.2)	29	(96.7)	
Failure	5	(20.8)	1	(3.3)	0.078*
Total	24	(44.4)	30	(55.6)	

*p value; Fisher's exact test

Many studies have compared the functional and graft success results of the PCT technique and the TF technique [11-13]. Gerber et al. [11] compared the hearing results of the TF and PCT techniques; they found no significant difference between the two techniques. Kazikdas et al. [12] showed that the PCT technique had a significantly greater graft success rate.

In this study, we assessed patients older than 6 years and younger than 15 years with bilateral chronic otitis media. Bilateral disorder is a poor prognostic factor for tympanoplasty results. Chandrasekhar et al. [6], Koch et al. [5], and Gianoli et al. [7] reported that the condition of the contralateral ear has no effect on healing rates after tympanoplasty. However, other studies showed that a diseased contralateral ear may be a negative prognostic factor for tympanoplasty patients [14, 15]. Kessler et al. [14], in their study, observed a greater rate of tympanoplasty failure in patients with an abnormal contralateral ear. There are no studies in the literature comparing bilaterally performed pediatric tympanoplasties using the PCT and TF techniques. Our study shows that the bilaterally performed PCT technique has approximately similar postoperative results to the TF technique in terms of graft success rate, and the audiological outcomes are statistically insignificant.

New surgical methods should be carefully considered for children because they are an especially vulnerable population. It is believed that tympanoplasty failure in children is more common than in adults. Factors that may contribute to this failure include young age, status of the contralateral ear, perforation size, and potency of the Eustachian tube [5-7]. In the literature, there is a consensus that a functioning Eustachian tube in pediatric patients is important for graft success [15]. It has also been shown that bilateral perforations in children are associated with a higher risk of failure [16]. However, some surgeons perform early surgery on children [17], while others recommend delaying surgery [18]. Surgeons who defend early surgery speculate that delaying surgery can cause complications, leading to hearing loss [19]. Delaying surgery may also increase the potential risk of cholesteatoma formation and ossicular chain erosion in the future. Vrabec et al. [19], in their meta-analysis, showed superior success rates with advancing age in pediatric type I tympanoplasty. However, age was not a prognostic factor in studies conducted by Yung [20] and Merenda et al. [21] we prefer early surgery for pediatric patients; in our opinion, delaying surgery may cause further complications.

Uzun et al. [2] reported complete success of surgery in children with tensa cholesteatoma using the PCT technique, whereas the closure rate was 84.2% for the fascia group. Our study also correlates with the study of Uzun I by demonstrating that the overall hearing gain after cartilage tympanoplasty with the PT technique is comparable to the hearing gain after fascia grafting. Our study includes only cholesteatoma-free ears and ears with an intact ossicular chain. Hearing results may be altered not only by cartilage grafting but also by cholesteatoma and ossicular chain reconstruction. In both groups in this study, the patients had similar perforation sizes and represent homogenous groups; therefore, we could clearly define the results of the surgeries.

There are also some disadvantages of using cartilage palisades for tympanoplasty. Cosmetic problems can be observed postoperatively. A cartilage strip of at least 2 mm should be left to prevent tragal deformity [13, 14]. Investigation of the middle ear status by tympanometry is not useful after cartilage tympanoplasty due to the effects of stiffness on tympanic membrane compliance [13, 14]. Observation of the middle ear is difficult after PCT due to the opaque appearance of cartilage palisades [13, 14]. Ventilation tube insertion may also be difficult after cartilage tympanoplasty [13].

Zahnert et al. [22] reported that to achieve better hearing results, the ideal thickness of palisades should be about 0.5 mm instead of the full thickness of 0.7–1 mm. However, in 2009 and 2010, Aarnisalo et al. [23] used laser and stroboscopic holography to study the thickness of the cartilage and the connection of the cartilage with the bone annulus; they discovered that palisades have no effect on the transmission of sound vibration. We also recommend using full-thickness palisades of tragal cartilage in PCT to obtain a higher graft success rate.

Based on the findings of the present study, we believe that the status of the opposite ear may indicate the presence of ongoing bilateral Eustachian tube dysfunction, which may lower the success rate of tympanoplasty surgery. We found that surgical failures mostly occurred after contralateral ear surgery; therefore, we postulate that it may not be necessary to perform tympanoplasty on one ear first and wait to see the outcome before considering contralateral tympanoplasty. We found that the use of TF grafting has similar outcomes to PCT grafting in terms of both success rate and audiological values for children with bilateral disease.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Ankara Numune Training and Research Hospital 19.8.2015/15574.

Informed Consent: Written informed consent was obtained from patients or patients' parents who participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept - T.G., O.F.B., D.A.; Design - T.G., O.F.B.; Supervision - T.G., A.İ., H.D.; Resources - T.G.; Materials - T.G.; Data Collection and/or Processing - T.G., O.F.B., D.A., A.İ.; Analysis and/or Interpretation - T.G., O.F.B., A.İ., H.D.; Literature Search - T.G., O.F.B.; Writing Manuscript - T.G., O.F.B.; Critical Review - H.D., T.G.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study has received no financial support.

REFERENCES

1. Lin AC, Messner AH. Pediatric tympanoplasty: factors affecting success. Curr Opin Otolaryngol Head Neck Surg 2008; 16: 64-8. [CrossRef]
2. Uzun C, Thomasen P, Andersen J. Eustachian tube patency and function in tympanoplasty with cartilage palisades or fascia after cholesteatoma surgery. Otol Neurotol 2004; 25: 864-72. [CrossRef]
3. Mohamad SH, Khan I, Hussain SS. Is cartilage tympanoplasty more effective than fascia tympanoplasty? A systematic review. Otol Neurotol 2012; 33: 699-705. [CrossRef]
4. Onal K, Arslanoglu S, Songu M, Demiray F. Functional results of temporalis fascia versus cartilage tympanoplasty in patients with bilateral chronic otitis media. J Laryngol Otol 2012; 126: 22-5. [CrossRef]
5. Koch WM, Friedman EM, McGill TJI, Healy GB. Tympanoplasty in children. The Boston Children's Hospital experience. Arch Otolaryngol Head Neck Surg 1990; 116: 35-40. [CrossRef]

6. Chandrasekhar SS, House JW, Devgan U. Pediatric tympanoplasty: a 10-year experience. Arch Otolaryngol Head Neck Surg 1995; 121: 873-6. [CrossRef]
7. Gianoli GJ, Worley NK, Guarisco JL. Pediatric tympanoplasty: the role of adenoidectomy. Otolaryngol Head Neck Surg 1995; 113: 380-6. [CrossRef]
8. Neumann A, Kevenhoerster K, Gostian AO. Long term results of palisade cartilage tympanoplasty. Otol Neurotol 2010; 31: 936-9. [CrossRef]
9. Heermann JJ, Heermann H, Kopstein E. Fascia and cartilage palisade tympanoplasty: Nine years' experience. Arch Otolaryngol 1970; 91: 228-41. [CrossRef]
10. Storrs L. Myringoplasty with the use of fascia grafts. Arch Otolaryngol Head Neck Surg 1961; 74: 45-9. [CrossRef]
11. Gerber MJ, Mason JC, Lambert PR. Hearing results after primary cartilage tympanoplasty. Laryngoscope 2000; 110: 1994-9. [CrossRef]
12. Kazikdas KC, Onal K, Boyraz I, Karabulut E. Palisade cartilage tympanoplasty for management of subtotal perforations: A comparison with the temporalis fascia technique. Eur Arch Otorhinolaryngol 2007; 264: 985-9. [CrossRef]
13. Ozbek C, Onur C, Tuna EU. A comparison of cartilage palisades and fascia in Type1 tympanoplasty in children: Anatomic and functional results. Otol Neurotol 2008; 29: 679-83. [CrossRef]
14. Kessler A, Potsic WP, Marsh RR. Type 1 tympanoplasty in children. Arch Otolaryngol Head Neck Surg 1994; 120: 487-90. [CrossRef]
15. Collins WO, Telischi FF, Balkany TJ, Buchman CA. Pediatric tympanoplasty: effect of contralateral ear status on outcomes. Arch Otolaryngol Head Neck Surg 2003; 129: 646-51. [CrossRef]
16. Friedman AB, Gluth MB, Moore PC, Dornhoffer JL. Outcomes of cartilage tympanoplasty in the pediatric population. Otolaryngol Head Neck Surg 2013; 148: 297-301. [CrossRef]
17. Ophir D, Porat M, Marshak G. Myringoplasty in the pediatric population. Arch Otolaryngol Head Neck Surg 1987; 113: 1288-90. [CrossRef]
18. Glasscock ME. Symposium: contraindications to tympanoplasty. An exercise in clinical judgment. Laryngoscope 1976; 86: 70-6. [CrossRef]
19. Vrabec JT, Deskin RW, Grady JJ. Metaanalysis of pediatric tympanoplasty. Arch Otolaryngol Head Neck Surg 1999; 125: 530-4. [CrossRef]
20. Yung M. Cartilage tympanoplasty: literature review. J Laryngol Otol 2008; 122: 663-72. [CrossRef]
21. Merenda D, Koike K, Shafiei M, Ramadan H. Tympanometric volume: a predictor of success of tympanoplasty in children. Otolaryngol Head Neck Surg 2007; 136: 189-92. [CrossRef]
22. Zahnert T, Huttenbrink KB, Murbe D, Bornitz M. Experimental investigations of the use of cartilage in tympanic membrane reconstruction. Am J Otol 2000; 21: 322-8. [CrossRef]
23. Aarnisalo AA, Cheng JT, Ravicz ME, Furlong C, Merchant SN, Rosowski JJ. Motion of the tympanic membrane after cartilage tympanoplasty determined by stroboscopic holography. Hear Res 2010; 263: 78-84. [CrossRef]