

Cartilage reinforcement graft versus fascia graft in tympanoplasty*

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Background/aim: The purpose of this study was to compare cartilage reinforcement graft results with temporalis fascia graft alone in terms of hearing and anatomical outcomes in tympanoplasty.

Materials and methods: Patients who underwent tympanoplasty with/without ossiculoplasty and/or mastoidectomy at a university hospital from 2006 through 2013 were reviewed retrospectively. The patients were divided into those grafted with temporalis muscle fascia alone and with fascia reinforced with cartilage. The postoperative air bone gap, gain in hearing thresholds, and graft status were evaluated for each group.

Results: The study subjects included 179 patients. There were 82 patients in the fascia group and 97 patients in the cartilage group. Successful hearing results were elicited in 79.2% of the fascia group and 85.5% of the cartilage group. There was no significant difference in overall graft success. The graft was intact in 82.9% of the fascia group and 86.5% of the cartilage group.

Conclusion: In this comparative study the use of cartilage to reinforce the temporalis muscle fascia was analyzed, showing better hearing and anatomical results than sole use of fascia in tympanoplasty both for primary and revision cases. Thus, in the light of our results, when performing tympanoplasty we recommend the use of cartilage reinforcement grafting whenever needed and indicated.

Key words: Cartilage, fascia, reinforcement, tympanoplasty

1. Introduction

The main aim of successful tympanoplasty is to create a well aerated closed cavity after total removal of the disease. Numerous types of grafting materials have been used for closure of the tympanic membrane including fascia, periosteum, perichondrium, cartilage, vein, skin, and fat tissue (1-4). Autografts are thought to be the most compatible grafting materials with the best surgical results in tympanoplasty. Temporalis muscle fascia (TMF) is the most popular one with the ease of obtainment and the satisfactory functional and anatomical results. TMF has been used in nearly 90% of surgeries (5). Cartilage as a grafting material was popularized by Utech in the 1950s (6). It is a stable and stiff barrier when compared to fascia, particularly in atelectatic ears or eustachian tube dysfunction. Initial studies showed that cartilage is an appropriate material for grafting after cholesteatoma removal or large defects in scutum. On the other hand, the hearing results were not favorable in the preliminary reports.

In this study we aimed to compare TMF and cartilage as grafting materials focusing on the hearing and anatomical outcomes in different pathologies.

2. Materials and methods

2.1. Patient population and study design

A retrospective chart review was conducted for patients who had undergone tympanoplasty with/without ossiculoplasty and/or mastoidectomy at Ankara University Otolaryngology Department from November 2006 through September 2013 with a minimum follow-up period of 6 months.

The patients were divided into two main groups: grafted with TMF alone (fascia group) and TMF reinforced with cartilage (cartilage group). In the cartilage group, conchal, tragal, or cymbal cartilage was used with underlay technique together with the TMF as a part of reinforcement technique as stated by Sarac (7). An elliptic cartilage graft was harvested from the concha, tragus, or cymba with a thickness of 1-3 mm and a diameter of 1 × 1

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cm. The cartilage island technique was used in all patients. The fascia graft was harvested from temporalis muscle in a routine manner.

All the operations were performed by the senior author (CM). The audiological assessment was performed with an AD629 Interacoustics device (Denmark, 2005) in a soundproof room. Audiometry results (air-bone gap [ABG] and gain in decibel hearing level) and anatomical outcomes were evaluated in each group. According to the guidelines of the American Joint Committee on Hearing and Equilibrium, a final ABG of <20 dB was considered a successful hearing outcome (8). This study was approved by the Ethics Committee (EC) of Ankara University (EC 07-272-13).

2.2. Statistical analysis

Pearson's chi-square test and Fisher's exact test were used to compare the groups. SPSS 15.0 for Windows (SPSS, Inc., Chicago, IL, USA) was used for all statistical analyses and a P value of less than 0.05 was considered statistically significant.

3. Results

One hundred seventy-nine patients were included in the study. There were 82 patients in the fascia group and 97 patients in the cartilage group. Mean follow-up period was 31.2 months (range 6–69 months). Mean age of the patients was 31.1 and 33.6 in the fascia and cartilage groups, respectively ($P > 0.05$). The anatomical outcomes did not reveal any significant difference between the groups. However, the cartilage group had slightly better results.

Hearing results were significantly better in the cartilage group. The mean postoperative ABG was 15.27 dBHL in the cartilage group while it was 22.44 dBHL in the fascia group. The gain in the hearing thresholds was also better in the cartilage group ($P < 0.05$). The hearing and anatomical results are summarized in Table 1.

When the results were compared in terms of mastoidectomy procedure, no significant difference was found between the groups. Patients with/without mastoidectomy and grafted either with fascia or cartilage had similar anatomical results (Table 2).

On the other hand, middle ear risk index (MERI) was calculated for each patient and the study subjects were divided into three groups as mild, moderate, and severe according to MERI score regardless of the type of grafting material. The mild group had a MERI score less than 3, the moderate group one between 4 and 6, and the severe group one higher than 7. There were 83, 69, and 27 patients in the mild, moderate, and severe groups, respectively. The reason for such scoring was to prevent any possible bias while forming the two groups and no significant difference was found between choosing fascia or cartilage graft for different MERI scores in the two groups ($P > 0.05$) (Table 3).

When revision cases were taken into consideration 70 patients in the fascia group had primary and 12 had revision surgery, while in the cartilage group 79 had primary and 18 had revision surgery. Graft success rate in the cartilage group was significantly better in revision cases when compared to the fascia group.

Table 1. Hearing and anatomical results.

P		Fascia (n: 82)	Cartilage (n: 97)
<0.05	ABG	22.44 dB	15.27 dB
<0.05	Gain*	9.98 dB	18.73 dB
NS	Anatomical success	82.9%	86.5%

ABG: Air-bone gap, Gain: Gain in hearing thresholds, NS: Nonsignificant.

Table 2. Anatomical success of the groups in relationship with mastoidectomy.

	Mastoidectomy (+) (n: 91)	Mastoidectomy (-) (n: 88)	P
Fascia	25 (69.4%)	34 (73.9%)	NS
Cartilage	47 (85.5%)	39 (95.1%)	NS
Overall success	72 (79.1%)	73 (83.9%)	

NS: Nonsignificant.

Table 3. Middle ear risk index score of each group.

	Fascia	Cartilage	Total
Low	47 (56.6%)	36 (43.4%)	83
Moderate	24 (34.7%)	45 (65.3%)	69
Severe	11 (40.7%)	16 (59.3%)	27

4. Discussion

For a long time TMF has been the most popular grafting material for tympanoplasty, with approximately 90% usage (6). The ease of obtaining, removing the need for another incision, and satisfactory hearing and anatomical results make TMF an ideal material for tympanoplasty. Nonetheless, cartilage has attracted attention in the last two decades. Early reports indicate that the hearing results with cartilage were not as good as those with TMF because of its stiffness and rigidity. In addition, thickness might be a disadvantage in the follow-up period, especially after cholesteatoma removal. Thus for a long time cartilage was used particularly in ossiculoplasty as a shield between the prosthesis and tympanic membrane remnant (9).

Although having impressive results among healthy ears with well aerated mucosa, TMF remains insufficient in patients with eustachian tube dysfunction, retraction pockets, atelectasis, and tympanosclerosis and in revision cases (6). In such cavities more resistant, stable, and stiff grafting materials like cartilage can increase the success rates. In most cases cartilage graft is harvested from the concha, tragus, or cymba. Cartilage can be used alone or together with other materials like TMF. Numerous techniques have been described such as palisade, island, or butterfly grafts. In this study we used the reinforcement technique popularized by Sarac.

There are several reports comparing cartilage with other grafting materials. Yang et al. reported a success rate of more than 90% and 80% for anatomical and hearing outcomes in their review comparing cartilage and fascia. They state that there were no significant differences between

the two groups in anatomical or hearing outcomes (10). In another study, Jiang et al. reported significantly better anatomical results with cartilage graft (11). Similar results were published about anatomical outcomes by numerous researchers (12–15).

In our study, unlike the reports mentioned before, the anatomical outcomes were similar between the two groups. However, in revision cases cartilage had better results than TMF. Overall both grafting materials had a success rate over 80%. Performing mastoidectomy and/or ossiculoplasty had no effect on closure rates. Moreover, the hearing results in our subjects were better in the cartilage group, which is not consistent with the great majority of the literature. Both postoperative ABG and the gain in hearing thresholds were significantly better in the cartilage group.

Apart from these, patients were categorized with their MERI score regardless of the type of grafting material to eliminate any possible bias. As seen in Table 3, numbers of patients grafted with cartilage or TMF in each category were similar.

TMF alone is the most commonly used grafting material for tympanic membrane reconstruction. In our comparative study the use of cartilage to reinforce the TMF was analyzed, showing better hearing results and anatomical outcomes than sole use of fascia in tympanoplasty. Thus, in the light of our results, when performing tympanoplasty we recommend the use of cartilage reinforcement grafting whenever needed and indicated.

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