

Results of Ossiculoplasty in Chronic Otitis Media without Cholesteatoma

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Kolesteatomasız Kronik Otitis Mediada Ossiküloplasti Sonuçları

Amaç: Kolesteatomasız kronik otitis medialis kulaklarda işitme sonuçlarının analizi.

Gereç ve Yöntem: Bu retrospektif çalışmada, 1994 ve 1997 yılları arasında Fırat Üniversitesi Tıp Merkezi Kulak Burun Boğaz Kliniği'nde otolog kemikçik ya da kortikal kemik kullanılarak ossiküloplasti uygulanan hastalar değerlendirilmiştir. Ossiküler rekonstrüksiyondan sonra 6 ay ya da daha fazla takip edilebilen 32 kulak incelemeye dahil edilmiştir. Değerlendirmede, preoperatif ve son takip muayenesindeki postoperatif odyometrik veriler ve otoskopik bulgular dikkate alınmıştır. Eğer son postoperatif muayenede intakt bir timpanik membran varsa ve postoperatif hava-kemik aralığı 15 dB ya da daha az ise anatomik ve fonksiyonel başarı sağlanmış olarak kabul edilmiştir.

Bulgular: Ossiküloplasti 29 kulakta otolog kemikçik, 3 kulakta ise kortikal kemik kullanılarak yapıldı. Bütün olguların stapes üstyapıları intakt idi. 26 kulakta (%81) ossiküloplasti komplet basit mastoidektomi ile kombine edildi. Diğer 6 kulakta ossiküloplasti mastoidektomisz yapıldı. Ameliyatla, kulakların %94'ünde intakt graft elde edilirken; %56'sında hava-kemik aralığı 15 dB'den aşağıya, %91'inde ise 25 dB'den aşağıya indi.

Sonuç: Kronik otitis mediada, otolog kemikçik kullanılarak yapılan ossiküloplasti, kemikçik zincirinin rekonstrüksiyonu ve orta kulaktaki ses iletiminin restorasyonu için etkili ve emniyetli bir yöntemdir.

Anahtar Sözcükler: Kemikçik zinciri, rekonstrüksiyon, ossiküloplasti.

Abstract

Objective: To analyze hearing results of ossiculoplasty in ears with chronic otitis media without cholesteatoma.

Materials and Methods: The charts of patients who had ossiculoplasty using autologous ossicles or cortical bone graft performed at the Otolaryngology Department of Fırat University Fırat Medical Center between 1994 and 1997 were evaluated retrospectively. The 32 ears who had follow-up examinations for six months or longer after ossicular reconstruction were included in the analysis. Nine cases with ossicular replacement prostheses were not included in the study. Preoperative and postoperative audiometric data and otoscopic findings at the final follow-up examination were taken into consideration. Results were considered to be satisfactory (anatomic and functional success) if there were intact tympanic membrane and the mean postoperative air-bone gap of 15 dB or less at the last postoperative evaluation.

Results: Ossiculoplasties were performed using autologous ossicles (29 ears) and cortical bone (3 ears). All ears had intact stapes arch. In 26 ears (81%), ossiculoplasty combined with complete mastoidectomy. In the remaining 6 ears, ossiculoplasty was performed without mastoidectomy. The operation resulted in an intact graft in 94% of ears and a postoperative air-bone gap less than 15 dB in 56% of ears and less than 25 dB in 91% of ears.

Conclusion: Ossiculoplasty using autologous ossicles is an effective and safe surgical method for restoration of sound transmission in the middle ear and reconstruction of ossicular chain in chronic otitis media.

Key Words: Ossicular chain, reconstruction, ossiculoplasty.

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Introduction

Functional or anatomic abnormalities of ossicular chain lead the ear surgeon to encounter with a

variety of difficulties. Ossiculoplasty represents the reconstruction of the ossicular chain in such a manner that it will transmit sound vibrations from the tympanic membrane to the oval window.

The aim of ossiculoplasty is to restore the ossicular chain as near to normal as possible or to achieve continuity and transmission in an entirely different way after abandonment of natural system. In the last three decades, various ossiculoplasty methods have evolved and good results were achieved. Nevertheless ossicular reconstruction continues to be a process in evolution.¹⁻³

Ossiculoplasty can be a part of many surgical procedures in the middle ear such as tympanoplasty, surgery for ear trauma, congenital abnormalities of the tympanum, and stapedectomy.

This retrospective study was carried out to analyze hearing results of ossiculoplasty in ears with chronic otitis media without cholesteatoma.

Materials and Methods

Material consisted of patients who underwent ossicular reconstructions in the department of otolaryngology, Firat University Firat Medical Center, Elazığ, Turkey, between 1994 and 1997. Data on the patients were collected retrospectively. Ears who had follow-up examinations for six months or longer after ossiculoplasty were included in the analysis. Ears with ossicular replacement prostheses were not included in the study, as were not cholesteatoma cases. Twenty-six ears (81%) were subjected to canal wall-up mastoidectomy with ossiculoplasty in the same stage, whereas six patients (19%) with sequela due to otitis media underwent ossiculoplasty without mastoidectomy. Despite preoperative medical treatment, nineteen of the ears (59%) had otorrhea at the time of ossiculoplasty.

Ossiculoplasty was performed using autologous incus (13 vertical incus, 16 horizontal incus; total 29 ears) or cortical bone (3 ears). All ears had an intact stapes superstructure and 29 ears had intact and mobile malleus. In all ears, the ossiculoplasties were carried out by the first three authors and the authors routinely carry out grafting of perforations at the same time as ossicular chain reconstructions. Temporalis fascia was used as a graft material. Until the mid 1995, we have used dried temporalis fascia and afterwards the fascia has been fixed with 4% formaldehyde solution (24 ears).

For hearing measurements, clinical computer audiometer model AC5 (Interacoustics Co., Assens, Denmark), and TDH-39P earphones (mounted in Telephonics cushions) and Oticon 62507 bone vibrator (Oticon International AVS, Copenhagen, Denmark) were employed. All testing were performed in an insulated room (Industrial Acoustics Co., Bronx, New York) and both air and bone conduction thresholds were recorded. The last audiograms of preoperative and postoperative periods were used for comparison. The mean hearing thresholds and mean air-bone gaps were calculated using the frequencies 0.5, 1 and 2 kHz. Preoperative bone conduction thresholds were used in the calculation of air-bone gaps. Because all ears had an intact stapes superstructure, hearing results were considered to be satisfactory if there were mean postoperative air-bone gap of 15 dB or less.⁴

Chi-square and Student's t-test were used in the statistical analyses and $p < 0.05$ was accepted as significant.

Results

Thirty-two ears were included in the study. The patients' ages ranged from 13 to 63 years (mean, 28 ± 14 years); 21 of them were male and 11 were female. The average follow-up period was 9 ± 3 months. The operation resulted in an intact graft in 30 ears (94%) and a postoperative air-bone gap less than 15 dB in 18 ears (56%) (Figure 1). In 9 of these, incudes were vertically repositioned on the stapes. Success rate was 69% in vertical incus cases while 56% in horizontal incus cases. In 91% of the ears (13 vertical incus, 14 horizontal incus, 2 cortical bone, total 29 ears), residual gap was equal or less than 25 dB. In 32 ears, the mean air-bone gap was 45 dB preoperatively and it was reduced to 15 dB postoperatively ($p < 0.05$) (Figure 2). The hearing gain each ear was 30 dB. Preoperative and postoperative mean hearing threshold and mean speech reception threshold were presented in Figure 3.

Discussion

The challenge during ossiculoplasty has been how to achieve a stable, reliable connection between the tympanic membrane and mobile stapes footplate that will provide the best long term hearing results, without complications, in the inimical natu-

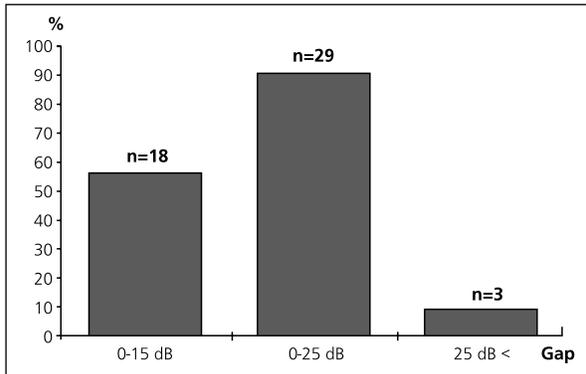


Figure 1. Postoperative air-bone gaps.

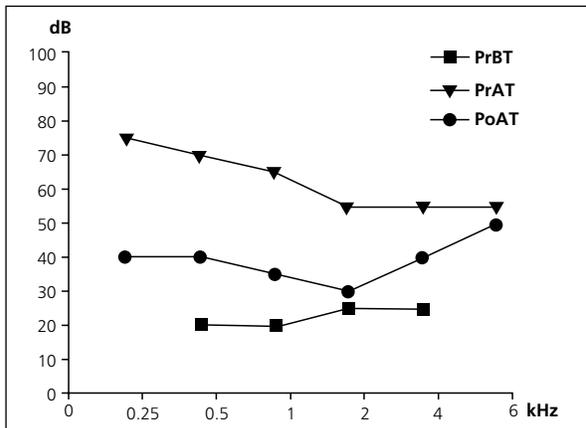


Figure 2. Preoperative and postoperative hearing thresholds. (PrBT: Preoperative bone threshold, PrAT: Preoperative air threshold, PoAT: Postoperative air threshold)

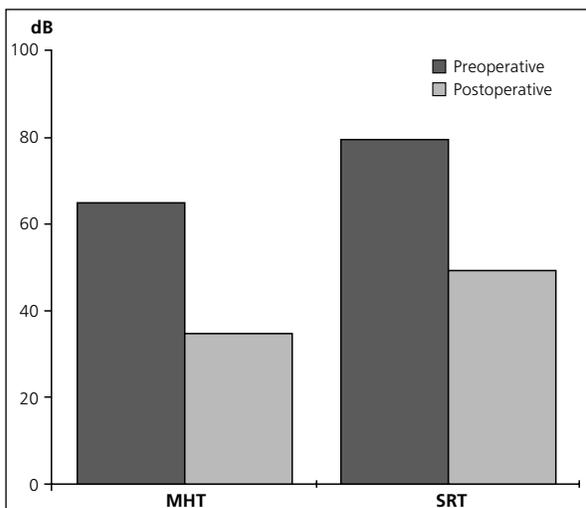


Figure 3. Preoperative and postoperative mean hearing thresholds (MHT) and speech reception thresholds (SRT).

re of the chronically infected ear. The controversy remains unresolved, and ossicular reconstruction continues to be a process in evolution.

Many different materials such as autografts (ossicles, sculptured mastoid or squamous cortex of the temporal bone, teeth, auricular or septal cartilage), homografts (ossicles, composite ossicular chain), prostheses (polyethylene, ceramic or hydroxyapatite) and steel wire have been used for ossicular reconstruction. In all ears in the present study, autologous incus or cortical bone were used for ossicular reconstruction. Many advantages of this material have been reported.^{5,6} The only disadvantage is that the shaping the new columella which is time consuming. Unsuccessful results with synthetic materials have been reported.^{5,7} Lysis or biodegradation of some alloplastic materials may occur. Foreign body reaction to the prostheses and extrusion of the prostheses have been observed. Extrusion of the prosthesis through the tympanic membrane is the major cause of failure. Other causes of failure include migration and displacement of the prosthesis in the postoperative period. We have also similar disappointing results about prosthetic materials after limited experience.

The presence of stapes superstructure is a very important factor to improve hearing in ossiculoplasty.^{8,9} Brackmann reported long term results as 86% of success rate in adults and 92% in children with a postoperative air-bone gap of 15 dB or less, when the stapes was intact.⁴ On the other hand, Vartiainen and Nuutinen⁶ reported Kuopio experience as 59% of success rate with a postoperative air-bone gap of 0-20 dB when the stapes was intact after a long term follow-up period. In these two studies, not only non-cholesteatomatous ears, but also cholesteatomatous ears were reported. Several authors reported that cholesteatomatous ears have poorer hearing results than non-cholesteatomatous ears.^{6,10} Hearing results after canal wall-up mastoidectomy have been reported to be better than those after canal wall-down procedures.¹¹ Length of follow-up period is another important factor in analyzing hearing results after ossiculoplasty. Hearing gains after ossiculoplasty may worsen in the course of time, but usually remain stable one year after ossiculoplasty.¹²

In the present study, only the ears with chronic otitis media without cholesteatoma were evaluated.

All ears had an intact stapes superstructure. Almost in all ears, ossiculoplasty was carried out for reconstruction of incus defect. In 81% of the ears, ossiculoplasty were combined with canal wall-up mastoidectomy. When all these factors are taken into consideration, 56% of success rate is slightly lower than expected.^{12,13} Success rate was 69% in vertical incus cases versus 56% in horizontal incus cases. Consequently, probable cause of this lower success rate is the horizontal replacement of incus in half of all ears. As it is known, although horizontal incus replacement has great advantage of easier to carry out, but it has some disadvantages: it is often unstable, there is a high risk of fixation by fibrosis to the promontory or bony annulus and it may be lifted up by the graft. Vertical incus is more difficult to fashion and to place, but it gives better tension and more stability.¹⁴ Comparison of vertical and horizontal cases showed no statistical significance ($p>0.05$) although success rate of vertical cases were superior to horizontal cases. In our patients, the mean air-bone gap was 45 dB preoperatively which was reduced to 15 dB postoperatively; so, 30 dB hearing gain per ear is an acceptable result.

In this study, graft success rate was 94%. This rate is in agreement with the relevant literature.¹⁵⁻¹⁸

We concluded that ossiculoplasty using autologous ossicles is effective and safe surgical method for restoration of sound transmission in the middle ear and reconstruction of ossicular chain in chronic otitis media if the stapes is intact and mobile.

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