

**CASE REPORT**

## **Incudostapedial rebridging ossiculoplasty with glass ionomer cement: a case report**

İnkus-stapedius iletimi için cam ionomer çimento ile ossiküloplasti: Olgu sunumu

Utku KUBİLAY, M.D., Ozan Seymen SEZEN, M.D., Mahmut ÖZKIRIŞ, M.D.,  
Süheyl HAYTOĞLU, M.D., Şeref ÜNVER, M.D.

A 31-year-old woman presented with a complaint of hearing loss of a two-year history. Otoscopic examination revealed a central ear drum perforation without discharge. The air-bone gap was 35 dB at 0.5, 1, 2, and 3 kHz. Under general anesthesia, the patient underwent tympanoplasty for chronic otitis media. At surgery, the ossicular chain was intact except for discontinuity by a 2-mm gap between the long process of the incus and the head of the stapes. The gap was reconstructed with the use of a fluoroplastic prosthesis. Myringoplasty was successful, but the patient complained of hearing loss at the end of six months. Transcanal posterior tympanotomy was performed under local anesthesia for decreased conductive hearing. The prosthesis was still in place, but was not conducting the movements of the malleus to the stapes. It was removed and glass ionomer cement (Ketac-Cem) was applied for rebridging. The average air-bone gap measured in the postoperative sixth month was less than 10 dB.

**Key Words:** Bone cements; hearing loss, conductive; incus/surgery; prosthesis implantation; stapes/surgery.

Otuz bir yaşında kadın hasta, iki yıldır var olan işitme kaybı nedeniyle başvurdu. Otoskopik muayenede kulak zarında santral perforasyon vardı, ancak akıntı yoktu. Saf ses odyometrisinde 0.5, 1, 2 ve 3 kHz'lerde hava-kemik yolu açıklığı 35 dB idi. Hastaya kronik otitis media tanısıyla genel anestezi altında timpanoplasti ameliyatı yapıldı. Ameliyat sırasında inkusun uzun kolu ile stapes başı arasında 2 mm'lik kemikçik zincir devamsızlığı görüldü. İletim fluroplastik protez ile sağlandı. Altıncı ayda yapılan kontrolde underlay olarak konulan greftin intakt olduğu; fakat, işitme kaybının devam ettiği saptandı. Lokal anestezi altında transkanal olarak yeniden ameliyat edilen hastada fluroplastik protezin yerinde olduğu; fakat, iletimi sağlamadığı görüldü. Protez çıkarılarak bu kez cam ionomer çimento (Ketac-Cem) kullanılarak bağlantı yeniden sağlandı. Hastanın ameliyat sonrası altıncı ayda ölçülen ortalama saf ses hava-kemik yolu açıklığı 10 dB'den azdı.

**Anahtar Sözcükler:** Kemik çimentosu; işitme kaybı, iletim; inkus/cerrahi; protez implantasyonu; stapes/cerrahi.

Ossiculoplasty is an essential part of tympanoplasty whenever it is indicated, and incudostapedial joint discontinuity is the most common ossicular defect

encountered in tympanoplasty.<sup>[1]</sup> Several ossicular prostheses made of a variety of substances have been used for ossiculoplasty. Recently, glass ionomer

- ◆ Department of Otolaryngology, Dr. Lütfi Kırdar Kartal Training and Research Hospital (Dr. Lütfi Kırdar Kartal Eğitim ve Araştırma Hastanesi Kulak Burun Boğaz Hastalıkları Kliniği), İstanbul, Turkey.
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- ◆ Correspondence (İletişim adresi): Dr. Utku Kubilay, Selimiye Eczane Sok., Savtekin Apt., No: 32/10, 34600 Üsküdar, İstanbul, Turkey. Tel: +90 216 - 441 39 00 / 1731 Fax (Faks): +90 216 - 572 47 13 e-mail (e-posta): drutkukubilay@hotmail.com

cement has been available commercially, and its use in otologic surgery is increasing. A substantial improvement in hearing results has been reported with glass ionomer cement ossiculoplasty.<sup>[2]</sup> Various glass ionomer bone cements have been used in ossiculoplasty. We report reconstruction of incudostapedial chain discontinuity with a fluoroplastic prosthesis.

### CASE REPORT

A 31-year-old woman presented to the otolaryngology clinic of our institution with a complaint of hearing loss for two years. Otolaryngologic examination revealed a central perforation in the ear drum with no discharge. The air-bone gap was found to be 35 dB at 0.5, 1, 2, and 3 kHz. The patient underwent tympanoplasty for chronic otitis media under general anesthesia. The middle ear was exposed with the postauricular approach. There was no cholesteatoma and the ossicular chain was intact except for a discontinuity between the long process of the incus and the head of the stapes. The long process of the incus had been eroded, leaving a 2-mm gap with the stapes head.

The loops of two fluoroplastic Causse pistons (Xomed, Jacksonville, Florida, USA) were put onto each other and attached with cyanoacrylate. It was placed between the defective long process of the incus and stapes head. When the malleus was touched it was connected to the stapes. The underlay technique with temporal fascia was used for myringoplasty. No complications were seen during the operation or in the immediate postoperative period.

The patient was examined at 1, 2, and 4 weeks after surgery. Myringoplasty was successful, but the patient complained of hearing loss at the end of six months. Transcanal posterior tympanotomy was performed under local anesthesia for unsatisfactory conductive hearing. The prosthesis was still in place but was loosened (Fig. 1). Control examination revealed that the prosthesis was not conducting the movements of the malleus to the stapes. After taking out the fluoroplastic prosthesis, the mucosal membrane and all other soft tissues from the surface of the long process and stapes head were removed. The long process and the stapes head were dried. This time glass ionomer cement (Ketac-Cem Radiopaque, ESPE, Seefeld, Germany) was used for rebridging. Before application, the fascial nerve and middle ear mucosa were covered with Spongostan. The two components, the powder and liquid of glass ionomer were mixed for 10 seconds on a

glass plate, causing an exothermic reaction and the mixture was allowed to become muddy. By use of a needle, the cement was taken piece by piece, and the ossicular gap between the incus and stapes head was reconstructed. The new bridge hardened and allowed for stable continuity between the ossicles. The cement adhered immediately to the dry surface of the ossicles, forming a tight link. After five minutes, it was observed that movements of the malleus were conducted to the stapes. Instant evaluation of hearing improvement was determined by a tuning fork (Fig. 2). No complications were seen during the operation or in the immediate postoperative period. The patient was examined at 1, 2, and 4 weeks after surgery. The average air-bone gap measured in the postoperative sixth month was less than 10 dB at 0.5, 1, 2, and 3 kHz.



*Fig. 1 - Loosening of the prosthesis six months after the first reconstruction.*



*Fig. 2 - Ossicular gap between the incus and stapes head was reconstructed by tight adherence of glass ionomer cement to the stapes and incus.*

## DISCUSSION

Patients with isolated erosion of the long incus process suffer from moderate hearing loss caused by the lack of continuity of the ossicular chain. Surgical techniques have evolved to reconstruct the ossicular chain and several ossicular replacement prostheses, made of a variety of substances, have been used for ossiculoplasty.<sup>[3]</sup> Small gaps, as in our case, may be bridged by chips of bone or cartilage, but this method is both time-consuming and prone to dislocation.<sup>[4,5]</sup> Tange<sup>[6]</sup> described successful repair with the use of glass ionomer cements in incudostapedial joint discontinuity and inadequate incus after prior stapes surgery.<sup>[6]</sup>

Glass ionomer bone cement is an ionomer-based cement that forms a stable, waterproof junction with adjacent bone during the process of setting and hardening. After hardening, the bone cement can be shaped by drilling.<sup>[7]</sup> These properties enable ionomer bone cement to be used for bony defects in the middle ear, mastoid, and tegmen; however, it was emphasized in an animal study<sup>[8]</sup> and in a retrospective clinical study<sup>[9]</sup> that glass ionomer cement should not be the first-choice material for obliteration of the mastoid cavity or closure of the bony tegmen defects.

Concerning postoperative air-bone gap, the results obtained by glass ionomer cement are very satisfactory when compared with other techniques for ossiculoplasty.<sup>[10-12]</sup> Brask<sup>[7]</sup> reported significantly better results with glass ionomer cement in closing the air-bone gap in comparison with the results of conventional prosthesis materials (autograft, homograft, or hydroxylapatite). Özer et al.<sup>[13]</sup> reported successful hearing results (air-bone gap within 20 dB) in nine of 15 patients after a year of incudostapedial rebridging ossiculoplasty. Kjeldsen and Grontved<sup>[14]</sup> rebuilt the eroded long process using ionomeric bone cement. Hearing performance was evaluated before and after surgery, and there were no significant differences with the results of a former group of controls who underwent surgery using incus autograft interposition. In our patient, compared to the preoperative audiometric results, air-bone gap decreased to 10 dB at the end of six months.

Ionomer cement has been reported to have high biostability and biocompatibility.<sup>[15,16]</sup> The cement is incorporated into the bone both structurally and functionally.<sup>[17]</sup> During a six-month follow-up, we did not observe any extrusion in our case.

To obtain good results with glass ionomer cement, it is important to remove the mucosal membrane and all other soft tissues from the surface of the bony area since it does not adhere to soft tissues.

Due to inherent neurotoxicity, it is important that the glass ionomer should not come into contact with nerves, and contact with middle ear mucosa causes formation of granulation tissue.<sup>[18]</sup> Because of these adverse effects, the facial nerve and middle ear mucosa were covered with Spongostan before application. Similarly, ionomeric cement should not be used directly under an epithelial surface, as it may cause epithelial deficits.<sup>[19]</sup>

Glass ionomer cement should be prepared in minutes before the mixture becomes hard. In the presence of a large gap between the stapes and the long process of the incus, some additional cement may be needed. The mixture becomes cool after the exothermic reaction and can be applied without thermal injury to the ossicles. In our case, glass ionomer cement was applied by a thin needle and optimal application time in the middle ear was only a few seconds and the amount of cement used for reconstruction was very small. No chemical or thermal injury, or any postoperative infection associated with its use was observed.

Restoration of the incudostapedial joint with glass ionomer cement may be considered a new technique. Most of the reports demonstrate that this new technique results in better audiologic outcome. No rigid fixation can be obtained if any wet surface is left on the head of the stapes. With this in mind, the tight adherence of the cement to the stapes and incus promises a mechanically more stable connection, decreasing residual air-bone gaps.<sup>[20]</sup>

Preferably, reconstruction of the ossicular chain with ionomeric cement is performed under local anesthesia due to the chance of instant evaluation of improvement in hearing.

In conclusion, the use of glass ionomer cement in repair of defects in the ossicular chain is an easy, efficient, quick, and inexpensive method, that should be considered for middle ear surgery.

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