

## **Bone-cement usage for Ossicular Reconstruction.**

**M. Tayyar Kalcioğlu, Tolga Cicek, Lokman Uzun**

Istanbul Medeniyet University, Faculty of Medicine, Department of Otorhinolaryngology, Goztepe Training and Research Hospital, Istanbul, Turkey.

### **Abstract**

**Ossicular chain erosions may cause a hearing loss in many chronic otitis media cases. It may be possible to solve this problem by using incus interposition, autograft bone or cartilage or ossicular replacement prostheses. Bone-cement is recently used material for reconstruction of ossicular chain defects. In this commentary, we discussed to use Bone-cement for some ossicular chain problems.**

**Keywords:** Ossicular chain defect, Bone-cement, Bridging.

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### **Commentary**

Chronic otitis media is a commonly seen Otorhinolaryngology disorder which may affect ossicular chain, especially the long process of the incus. Defective ossicular chain causes conductive hearing loss as a result [1]. To solve these ossicular chain problems, it is possible to use interposed incus, autograft bone or cartilage, ossicular replacement prostheses, or bone-cement. The ideal graft material should be biocompatible, stable and easy to insert.

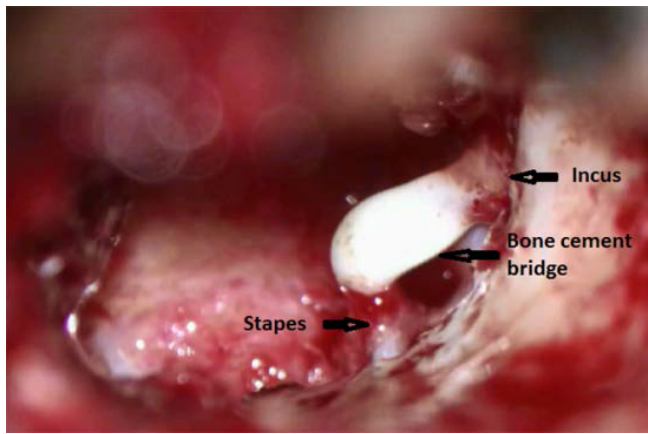
All these options have their own advantages and disadvantages; autograft incus interposition has advantages such as no foreign body reaction due to the use of patient's own tissue and easy to access. On the other hand, it may be affected because of the infection, may dislocate after interposition. These are the main disadvantages of this procedure. Incus interposition can be performed between stapes and malleus if the case has stapes suprastructure. If not, it can be performed between footplate and malleus or footplate and tympanic membrane. In all these procedures, especially if stapes suprastructure is absent, interposed incus may be dislocated and cause hearing loss [1,2]. It is also has been discussed the necessity of being autoclaved of ossicles before the operation to have safe ossicle to use for interposition in the cases who has cholesteatoma [3].

Due to the similar pathologies, to solve ossicular chain problems, various prostheses may be used. These prostheses were specially designed for acoustic transmission [4]. Various prostheses have been produced for various pathologies. Angular clip prosthesis which is applied between stapes and malleus when incus long process is defective [5]. Partial Ossicular Replacement Prosthesis

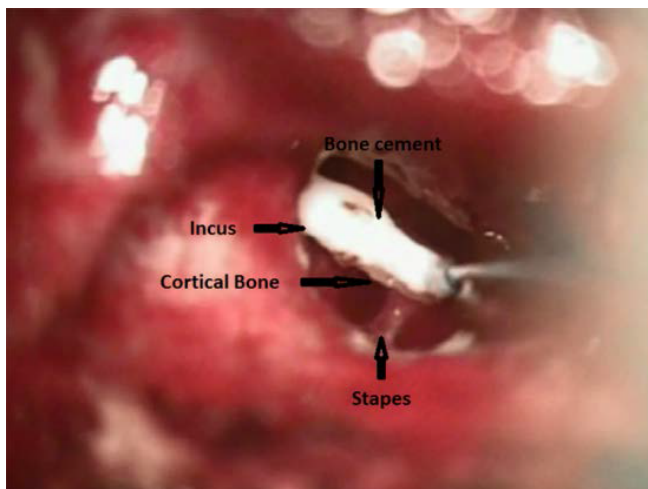
(PORP) that is placed on the stapes suprastructure, Total Ossicular Replacement Prosthesis (TORP) that is placed on the stapes footplate, and Vincent malleus prosthesis which is used when malleus is absent are some of the options that can be used to ensure the integrity of ossicular chain [6,7]. Although these prostheses have good biocompatibility with the tissue, they also have extrusion risk. Because of this, some authors recommend putting some autograft materials on the prosthesis such as cartilage to decrease extrusion risk [8]. Another question about this prosthesis is their high cost. Furthermore, especially TORP can be easily dislocated from used area, cause hearing loss and functional results of surgery may be failure

Bone-cement was developed in the 1970s and started to use in dental practice [1]. It has good biocompatibility and presences new bone formation on applied ossicle. It has been started to use for otologic and neurotologic surgeries since 1992 [1,9-12]. In addition to being well tissue biocompatibility, the usage of bone cement is very easy and much more economical than the prostheses. Those are some of the reasons why the bone cement becomes popular recently. Bone cement is prepared and shaped easily and after getting hard and it doesn't get affected by any fluids like blood [1].

The majority of used area of bone-cement is the defect of incus long process [1]. Most preferred pathology to use bone-cement is incus long process defect and it is used between incus and stapes for incudostapedial re-bridging. This usage gives a natural sound transmission way (Figure 1). In this way, the energy of the sound transmits to use malleus, incus, stapes, and oval window way as the natural pathway. Thanks to that, the natural pathway of the sound



**Figure 1.** Incurdostapedial re-bridge with bone cement



**Figure 2.** Incurdostapedial re-bridge by using cortical bone and bone-cement together

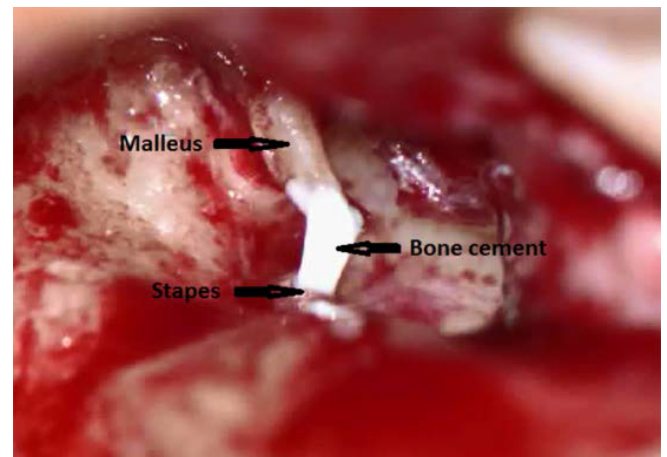
transmission is continued. According to us, the natural pathway is very important for the middle ear mechanics.

When incus long process is defective, according to the size of the defect, bone-cement may be applied directly (Figure 1), after putting a cortical bone (Figure 2) or a wire between incus and stapes [1,13].

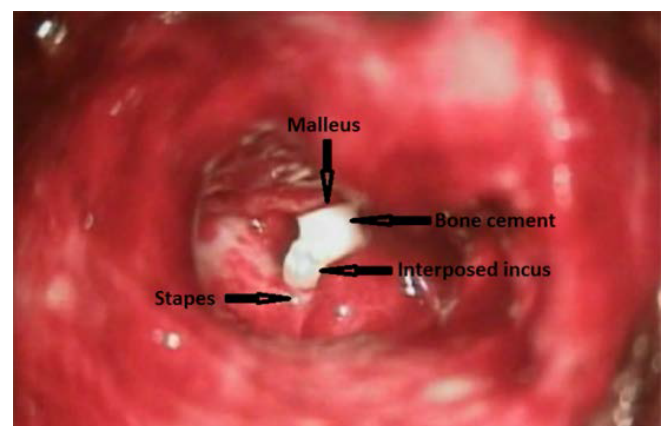
There are many studies in the literature about incurdostapedial re-bridging with bone-cement. In our previous study, results of the 29 patients which bone-cement was used for incus long process defect was reported [1]. In these patients, the preoperative mean Air-Bone Gap (ABG) was 32.8 dB. After postoperative 35 months follow-up period, mean ABG was found 15.3 dB [1]. In the study performed by Dere et al. 23 patients who had incurdostapedial re-bridging with bone-cement, had 27 dB ABG preoperatively and 20.7 dB ABG postoperatively after at least one-year follow-up [9]. All these and similar studies have shown that, when incurdostapedial re-bridging perform for incus long process defects, the functional results are quite successfully. When incus is absent or not useful for incurdostapedial re-bridging, to make a bridge between malleus and stapes is another way for sound transmission to the inner ear (Figure 3). Both our personal experiences and results of the literature show

that patients who had a malleostapedial bridge by using bone-cement have successful hearing results [10,14,15]. Sennaroglu et al. reported 30.2 dB hearing improvement in 5 patients whom they used bone cement between manubrium mallei and stapes [14]. Edizer et al. reported their results of bone cement usage between malleus and stapes in 32 patients when incus is absent [15]. According to their results, postoperative ABG was 28 dB after at least one-year follow-up while preoperative ABG was 42.4 dB. Bayazit et al. reported their results of 42 patients who have malleostapedial bone-cement bridge with preoperatively 22.7 dB ABG and postoperatively 6.2 dB hearing level [10]. All these results and our personal experience point that when there is no useful incus, performing bone cement between manubrium mallei and stapes may show quite successfully results.

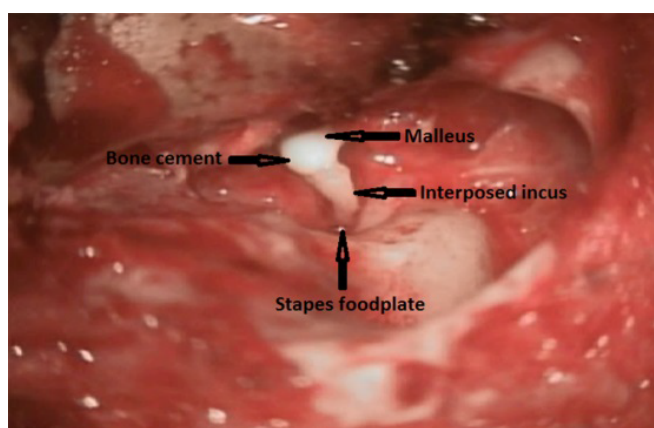
Bone-cement may be also used to avoid dislocation of interposed incus [1]. If there is a useful malleus, interposed incus can be fixed by bone-cement to the malleus, if it uses between stapes suprastructure and malleus (Figure 4) or stapes footplate and malleus (Figure 5). Hearing loss due to dislocation can be prevented with these methods. Hearing results as ABG in our previous study were preoperatively 34,3 dB and postoperatively 18,5 dB in the group which incus interposition performed between stapes suprastructure and malleus while preoperatively



**Figure 3.** Malleo-stapedial bridge with bone-cement



**Figure 4.** Incus interposition between stapes suprastructure and malleus and fixation by bone-cement



**Figure 5.** Incus interposition between stapes footplate and malleus and fixation by bone-cement

43dB and postoperatively 20,8 dB in the group which incus interposition performed between stapes footplate and malleus and fixed with bone-cement, after 36 and 39 months follow-up period, respectively [1]. There were 25 and 13 patients and the net gain was 15,8 dB and 22,2 dB in both group, respectively.

Since bone-cement becomes popular to use in otologic and neurotologic surgeries, some discussions started on it. One of them is medium and long term results of bone-cement used cases and its shear bond strength on ossicles. Also, its separability from the ossicles was begun to be questioned. Experiences developed over time showed that when it is needed to separate bone-cement from the ossicles, it can be done easily with an instrument such as a peak. It was reported as a result of a recent study to evaluate the shear bond strength of different hydroxyl apatite and glass ionomer cements that water-based cements such as Aqua Meron (Voco, Germany) and Aqua Cem (Dentsply, USA) are held on to the ossicles strongly than the others [16]. There is a need for new studies on this topic.

## Conclusion

According to results of our personal practice and some literature, bone-cement usage for some type of ossicular chain problems as an economic application, may have successfully functional results. Longer term follow-up results may help to understand long-term efficiency of bone-cement.

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## Correspondence to:

M. Tayyar Kalcioğlu,  
Istanbul Medeniyet University,  
Faculty of Medicine,  
Department of Otorhinolaryngology,  
Goztepe Training and Research Hospital, Istanbul,  
Turkey.  
E-mail: mtkalcioğlu@hotmail.com