



Research Article

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The first step toward improving cochlear implant insertion using a New Technique called Slide Method (Motasaddi Method)

Masood Motasaddi Zarandy¹, Sara Saki² and Nader Saki^{3*}

¹Professor of Otolaryngology, Head and Neck Surgery, Tehran University of Medical Sciences, Tehran, Iran

²Students Scientific Research Center, Tehran University of Medical Sciences, Tehran, Iran

³Associate Professor of Otolaryngology, Head and Neck Surgery, Hearing & Speech Research Center, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran

*Email: Ahvaz.ent@gmail.com

ABSTRACT

With recent increased interest in minimizing intracochlear trauma during cochlear implantation, increased attention must be paid to the cochleostomy site. The present study was conducted in an attempt to introduce a new method to improve the first step of cochleostomy in cochlear implant insertion by Using Slide Method. 306 cochlear implant recipients were included in this study. 235 of the patients received a Nucleus 24 contoured-array cochlear implant (Cochlear Nucleus Series, Cochlear Ltd, Sydney, Australia) and 71 of patients received Advanced Bionics implants, USA. The anteroinferior margin of the RWM or adjacent otic capsule was identified as the site for a cochleostomy. The electrode array ordinarily advances easily without any force. while surgery is ongoing, so that the surgeon can understand the causative maneuver and decide whether to modify the surgical procedure to minimize trauma to the cochlea accordingly. Today this can be pursued by utilizing the Slide Method that used by Motasaddi (the first author). Of all subjects, 57.3% were boys and 42.7% were girls with the average age of 42.15 (± 11.00) months. From 306 implants 221 cases we used a cochleostomy approach. In these subjects, the electrodes were fully inserted without surgical complications. In a new method to improve the first step of cochleostomy in cochlear implant insertion, we used the Slide Method. In this method removing the inferior and posterior part of cochleostomy site facilitate the sliding of the device into scala tympani without any trauma (Fig. 1). Inferior drilling relative to the round window membrane should be more likely to ensure and an atraumatic scala tympani insertion. For atraumatic opening of the scala tympani using a cochleostomy approach, initiation of drilling should proceed from anterior inferior to the round window annulus, with gradual progression toward the labyrinthine membrane. Once the labyrinthine membrane of scala tympani (ST) can be clearly visualized by the surgeon, drilling continue to remove the inferior part of the cochleostomy site, then the membrane opened by fine pick. The electrode arrays are guided through the cochleostomy site. The electrode array ordinarily advances easily without any force. Removing the inferior part of cochleostomy site facilitates to slide the device into scala tympani. This is the first step of cochleostomy in cochlear implant that facilitates insertion of implant (CI) that we named it the Slide Method. We have used this approach in 221 patients that underwent CI and 191 cases have shown no clinical problems. CI has become an increasingly accepted and effective treatment for deaf patients. Cochleostomy through the promontory, especially using slide method is safe and atraumatic.

Keywords: Cochlear Implant, Cochleostomy Site, Slide Method, Surgical Outcome

INTRODUCTION

Cochlear implant (CI) has become an increasingly accepted and effective treatment for profoundly pre- and postlingually deaf patients (1). CI can provide hearing ability to an individual by stimulating the auditory nerve with electrical impulses delivered via an electrode array inserted into the scala-tympani (ST) after a cochleostomy.

Cochleostomy is the most important moment in intracochlear implant surgery (2-5). A microanatomical study was performed to evaluate which kind of cochleostomy would be most effective and safe for the main structures of the temporal bone. Cochleostomy through the promontory, especially using the "soft" technique of endosteum opening is safe for all the structures. A cochleostomy is a 2mm to 3 mm wide hole-drilled through the wall of the cochlea, inferior, rather than anterior, to the round window. The cochleostomy must be made to ensure scala tympani insertion and to decrease the likelihood of insertion-induced intracochlear damage during electrode insertion (6). During insertion into the scala tympani, delicate intracochlear structures are often damaged, which can result in loss of residual hearing and decreased implant effectiveness, especially when the implant deviates into another cochlear chamber. Several studies showed causes of intracochlear trauma that can occur during implantation, including tip scraping (6), (7), tip fold-over (6), (8), and electrode array buckling (6), (9), (10). Each of these trauma modes could be decreased or eliminated by steering the implant electrode array during insertion. Decreasing insertion trauma is among the three goals stated by Rebscher et al. (6), (11), which are widely accepted for the development of future cochlear implant (CI) electrode arrays. These goals are (2), (12). deeper insertion into the ST to access lower-frequency cochlear neurons; (6), (13) greater operating efficiency, defined as a reduction in the stimulus charge required to produce a comfortable loudness level; and (6) reduced intracochlear damage associated with surgical insertion. The aim of this study was to introduce a new method to improve the first step of cochleostomy in cochlear implant insertion using Slide Method.

MATERIALS AND METHODS

We evaluated 306 cochlear implant recipients in this study, of them 235 received the nucleus 24 contour cochlear implant system (Australia) and the remaining 71 patients received HiRes 90K implant with HiFocus 1J electrode (Advanced Bionics, USA). All subjects underwent CI surgery during March 2008 and January 2012 at the Cochlear Center of Tehran University in Amir Alam Hospital by the first author. In all subjects, the electrodes were fully inserted without surgical complications. First, a standard trans-mastoid facial recess approach was used for all specimens under direct microscopic guidance. The RW is identified through the facial recess. For atraumatic opening of the scala tympani using a cochleostomy approach, initiation of drilling should proceed from anterior inferior to the round window annulus, with gradual progression toward the labyrinthine membrane. Once the labyrinthine membrane of scala tympani (ST) can be clearly visualized by the surgeon, drilling continues to remove the inferior part of the cochleostomy site, then the membrane is opened by fine pick. The electrode array and the surgical stylet, which holds the array in a straight position, are guided through the cochleostomy site. The tip of the electrode array is carefully and slowly inserted through this opening in an effort to implant the scala tympani. The electrode array ordinarily advances easily without any force. Removing the inferior part of the cochleostomy site facilitates the sliding of the device into scala tympani. ST is bounded by both the basilar membrane and osseous spiral lamina, offering a natural protective mechanism during insertion.

RESULTS

Of all subjects, 57.3% were boys and 42.7% were girls with the average age of 42.15 (± 11.00) months. A total of 306 cochlear implant recipients were included in this study. 235 of the patients received a Nucleus 24 contour array cochlear implant (Australia) and 71 of patients received Advanced Bionics, USA made implants. From 306 implants 221 cases we used a cochleostomy approach. From 221 implanted cases we used this approach in 191 cases without any problem. In these subjects, the electrodes were fully inserted without surgical complications. For a traumatic opening of the scala tympani using a cochleostomy approach, initiation of drilling should proceed from anterior inferior to the round window annulus, with gradual progression toward the labyrinthine membrane. Once the labyrinthine membrane of scala tympani (ST) can be clearly visualized by the surgeon, drilling continues to remove the inferior part of the cochleostomy site, then the membrane is opened by fine pick. The electrode array, which holds the array, are guided through the cochleostomy site. The electrode array ordinarily advances easily without any force. Removing the inferior part of the cochleostomy site facilitates the sliding of the device into scala

tympani(Fig. 1). This is the first step of cochleostomy in cochlear implant that facilitates insertion of implant that we named it Slide Method.

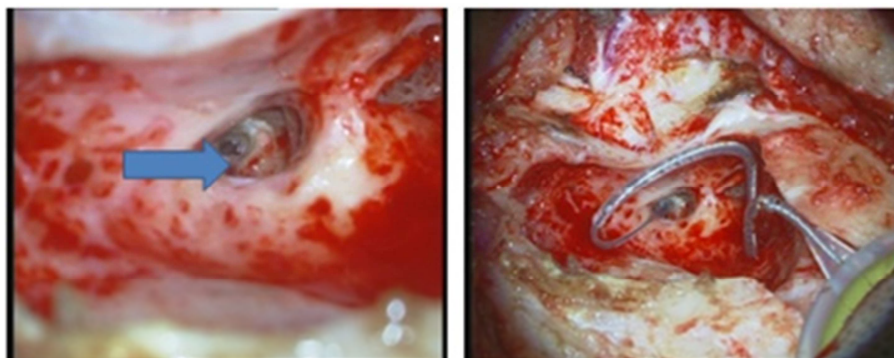


Fig. 1. View from the facial recess arrow show the side drilling for sliding the electrodes

DISCUSSION

It was once accepted that after cochlear implant surgery, the only transmission route of sound to the auditory nerve would be through electrical stimulation via the implant, as insertion trauma during the surgical process would destroy all residual hearing (10).

However, recent studies and clinical trials have demonstrated the feasibility of hearing preservation following cochlear implantation in conjunction with refined surgical approach. “Soft surgery” is a term used to describe surgical implantation of the electrode array that results in the least amount of disruption and damage to cochlear structures such as the basilar membrane, osseous spiral lamina, and the modiolar wall. A traumatic insertions decrease sequel secondary to fibrosis and ossification after placement of the array (11), (12).

Components of the technique include: anterior-inferior cochleostomy placement with respect to the round window (14), cochleostomy size less than 1.2 mm, placement of the array in the ST, avoidance of suction of perilymphatic fluid, containment of bone dust (15), (16), a slow rate of insertion (10),(17), as well as an insertion depth of less than 400 degrees (18).

Our results showed that we can use slide method in all cochleostomy to facilitate the insertion of the electrode array into the site. From 221 implanted cases we used this approach in 191 cases without any problem The electrode array, which holds the array are guided through the cochleostomy site. The electrode array ordinarily advances easily without any force. This is the first step of cochleostomy in cochlear implant that facilitates insertion of implant that we named it Slide Method.

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