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The Influence of the Footplate-Perilymph Interface on Postoperative Bone Conduction

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Abstract

In a prospective study, 165 total stapedectomies and 152 small fenestra stapedotomies were performed by three experienced surgeons between 2001 and 2003. In total stapedectomy, a self-made Schuknecht steel wire connective tissue prosthesis, and in stapedotomy, a 0.6-mm platinum wire Teflon piston was used. The pre- and postoperative bone conduction thresholds were compared at the frequencies 250 Hz, 500 Hz, 1 kHz, 1.5 kHz, 2 kHz, 3 kHz and 4 kHz. The postoperative bone conduction between 250 Hz and 3 kHz was significantly better in the total stapedectomy group than in the stapedotomy group. At 4 kHz, both groups showed a slight decrease in bone conduction but the difference was not statistically significant. Therefore, especially in cases with preoperative moderate sensorineural hearing loss, we recommend total stapedectomy using a Schuknecht steel wire connective tissue prosthesis, which offers a stapes-perilymph interface similar to the normal stapes.

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Smyth and Hassard [1] reviewed 800 stapedectomies and reported that in terms of hearing the small fenestra technique and the total footplate removal were virtually the same concerning results for air conduction. Persson et al. [2] compared the findings in 437 ears from patients with otosclerosis who had undergone partial stapedectomy, total stapedectomy and stapedotomy. Partial stapedectomy was performed on 70 ears (16%) and total stapedectomy was performed on 205 ears (47%). In both groups, the House steel wire prosthesis on fascia was used. On the remaining 262 ears (37%), stapedotomy was performed using the Fisch 0.4-mm Teflon platinum piston. Persson et al. [2] reported that none of these patients in these series presented with sensorineural hearing loss

(>15 dB). The comparison between the three groups postoperatively showed that the air-bone gap was smaller for partial and total stapedectomy than for stapedotomy for all frequencies except at 4 kHz. Partial and total stapedectomy also showed a larger improvement in bone conduction thresholds compared with stapedotomy for all frequencies except 4 kHz. At the 3-year follow-up, the hearing gain for all frequencies (250 Hz to 8 kHz) was larger for partial and total stapedectomy than for stapedotomy. In 2002, House et al. [3] stated that the success in stapes surgery depends more on the experience and skill of the surgeon than on the type of prosthesis used.

Since the age of the patients which undergo stapes surgery is increasing worldwide, we have more and more patients who additionally to the loss of air conduction have a moderate to severe sensorineural hearing loss. According to the investigation of Böhnke and Arnold (pp 150–154), there is a rational proof that the size of contact between the prosthesis and the perilymph has an important influence on bone conduction.

Methods

In a prospective study, the first author performed 165 total stapedectomies using a Schuknecht steel wire connective tissue prosthesis. The other authors performed 152 stapedotomies using a 0.6-mm Teflon platinum piston. Six weeks and 3 months after surgery, the postoperative values of bone conduction were measured at the frequencies 250 Hz, 500 Hz, 1 kHz, 1.5 kHz, 2 kHz, 3 kHz and 4 kHz. The pre- and postoperative bone conduction data were collected from both groups and a statistical analysis was performed by the Institute of Medical Statistics of the Technical University of Munich.

Results

The statistical analysis of pre- and postoperative bone conduction thresholds from 165 patients with total stapedectomy and 152 patients with stapedotomy reveals a significantly better outcome of the total stapedectomy group. The difference of postoperative gain of bone conduction is demonstrated in figure 1.

Discussion

Our study shows that the size of the footplate-perilymph interface has an influence on the gain of bone conduction. Since the size of the footplate has a direct influence on sound pressure in the inner ear and on the extension of the basilar membrane movement, it is obvious that the larger the footplate-perilymph

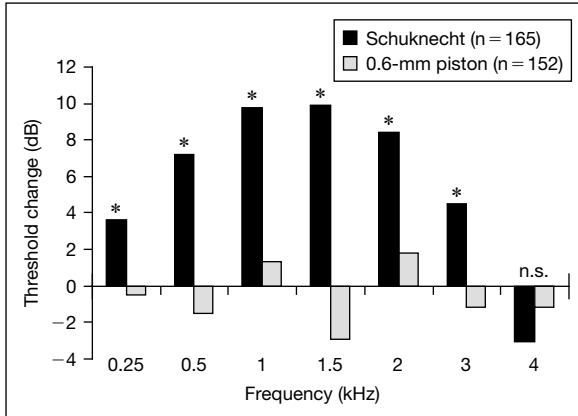


Fig. 1. Difference of postoperative gain of bone conduction. *Statistically significant.

interface the larger the gain in bone conduction. This effect has also been shown by à Wengen [4] and Persson et al. [2].

We therefore recommend a total stapedectomy using a prosthesis with an interface to the perilymph similar to the normal stapes. At the moment, this is given with the ‘old’ Schuknecht wire connective tissue prosthesis.

References

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