A Review of Temporal Bone CT Imaging with Respect to Pediatric Bone-Anchored Hearing Aid Placement

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Introduction

Bone conduction has been used in many ways to augment poor hearing since at least the 16th century. Osseointegrated implants first developed in Sweden by Brånemark in the 1960's led to the adaptation of the technology by Tjellström in 1977 for use in a bone-anchored hearing aid (BAHA). Use of these hearing aids has allowed for hearing amplification in patients with conductive loss not amenable to or easily corrected by conventional surgical techniques, as well as those unable or intolerant of traditional hearing aid technologies. The use of BAHA is particularly of interest in pediatric patients with conductive hearing loss secondary to congenital ear deformities. Current FDA guidelines allow for the placement of BAHA in patients 5 years of age and older, although there are US groups that have implanted patients younger than this and they are approved for use in children younger than 5 in the European Union. One of the main concerns with implanting young children is the development and thickness of the temporal bone at the implant site. We sought to obtain objective data regarding temporal bone thickness in the pediatric population to help determine whether implantation in younger populations might be feasible.

Methods

Fifty patients with chronic ear disease (as delineated in the clinical history and confirmed on imaging) in at least one ear were and 50 patients without chronic ear disease were measured, for a total of 200 ears. Temporal bone thickness was measured at a point 1cm posterior to the sigmoid sinus, and 1cm superior to the superior margin of the external auditory canal (EAC), roughly where BAHA implantation is recommended.

Discussion

The data presented here suggest that concerns regarding temporal bone thickness in consideration of BAHA implantation in pediatric patients less than 5 years of age may be unfounded. We show that there are no significant differences between age groups in temporal bone thickness. There is a wide range of temporal bone thickness seen in this cohort of patients, and the presence of significantly thin temporal bone (down to 1.2mm) is concerning. These thin bones were observed in patients in all age groups. Previous investigators have shown that implantation can be performed in patients with thin bone, down to even 0.5mm. While the standard implant lengths of 3mm and 4mm seem to preclude implantation in patients with thinner bone, failure of osseointegration has not been affected by bone thickness. Indeed, implantation is commonly performed with exposure of the dura in the pediatric population without long-term complications.

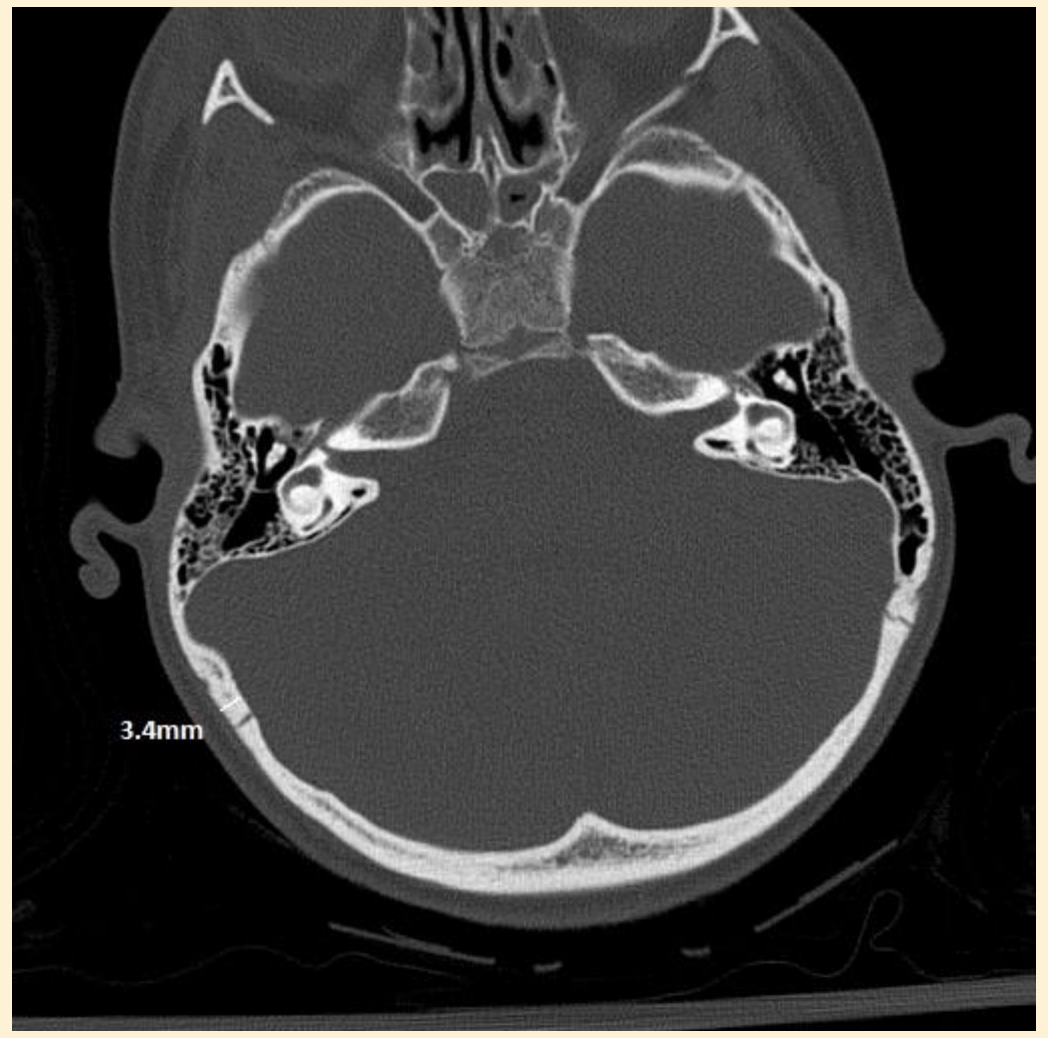

FIG. 1. Temporal bone thickness measurement on axial CT.

Age group (years)	Squamous Temporal Bone Thickness (mm)	Maximum Thickness (mm)	Minimum Thickness (mm)
1.00 - 1.99	3.23 ± 0.79	4.9	1.5
2.00 - 2.99	3.36 ± 0.93	6.3	1.9
3.00 - 3.99	3.04 ± 0.82	4.5	1.7
4.00 - 4.99	3.74 ± 1.56	7.7	1.2
5.00 - 5.99	3.42 ± 1.16	7.3	1.3

Table 1: Temporal bone thickness (mm) by age group (years)

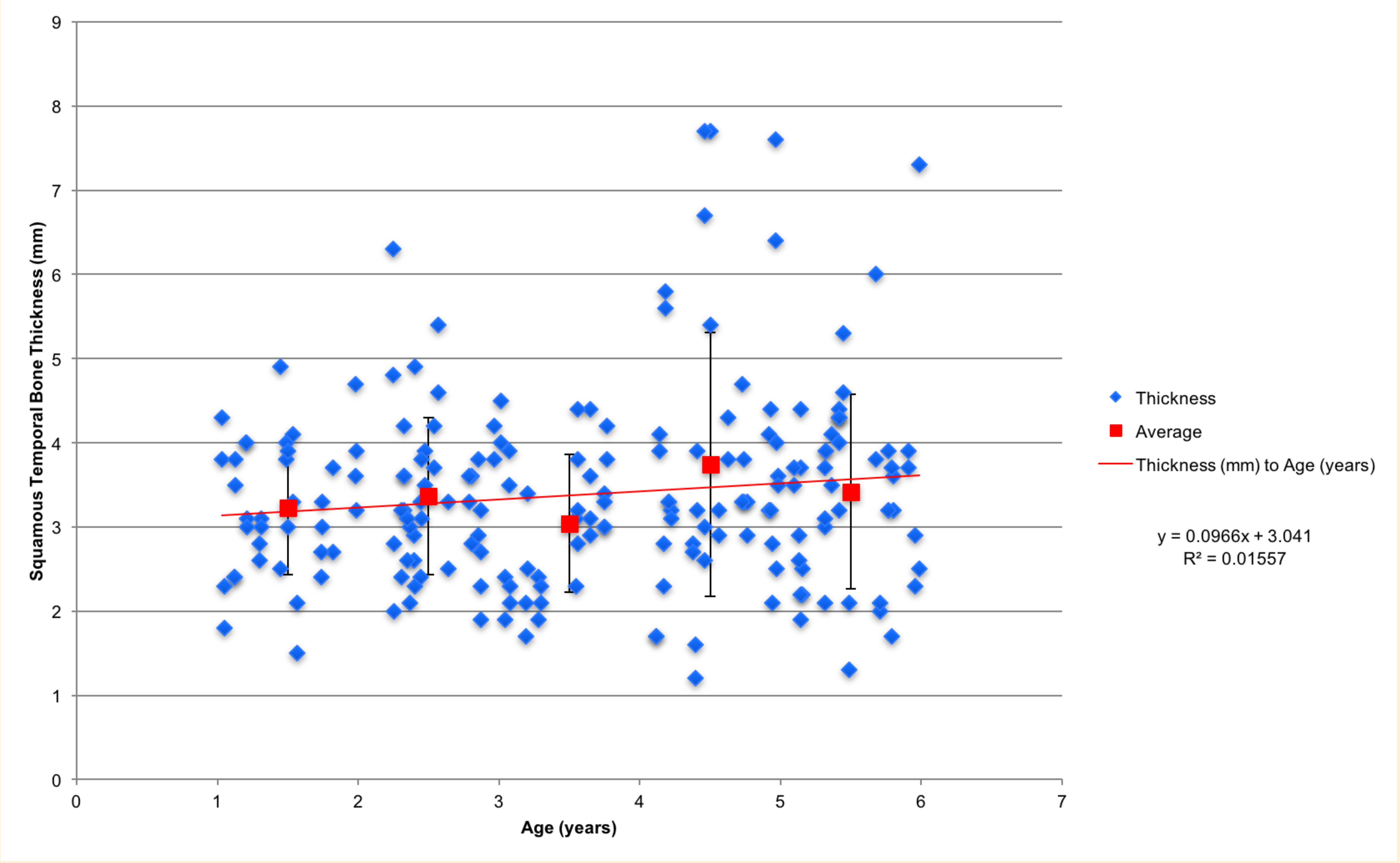

Fig. 2. Squamous temporal bone thickness (mm) versus age (years) with trendline.

References

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