Sleeping Implant in the Temporal Bone: Report of a Case with 20-Year Follow-Up

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ABSTRACT

Background: There is limited knowledge of the long-term fate of "sleeping" or nonloaded implants in the temporal bone.

Purpose: This article describes the fate of a fixture installed in the temporal bone that remained unloaded for 20 years.

Patient and Methods: A 25-year-old male with hemifacial microsomia had three osseointegrated implants installed for an auricular episthesis and bone-anchored hearing aid (BAHA) in the left temporal bone in 1988. Two of the implants for the ear episthesis were activated the same year, but the fixture for the hearing aid was not uncovered until 2008. When the patient experienced hearing problems at his office, he wanted to reactivate the sleeping implant. An audiogram showed a maximum conductive hearing loss with good preserved cochlear function. Before reactivation, an Accuitomo three-dimensional, cone beam computed tomography was performed. Resonance frequency analysis (RFA) using the Ostell technique was done when the implant was uncovered.

Results: Preoperative x-ray investigation showed the sleeping implant to be well integrated in the temporal bone, covered with 1 mm bone, and with no signs of resorption. Geometric measurements correlating to the two loaded implants showed the sleeping implant to be positioned too close to these to be able to anchor a BAHA without interference with the episthesis. Surgical exploration was done to analyze the implant. The clinical status correlated well to that diagnosed from the x-ray investigation. RFA revealed the implant to be well integrated. A new fixture and abutment for BAHA was installed in the temporal line and activated 2 months after surgery. The patient is today supplied with a BAHA.

Conclusion: It seems possible to use sleeping implants in the temporal bone even 20 years after installation.

KEY WORDS: Accuitomo 3D, bone-anchored hearing aids, osseointegration, resonance frequency analysis, sleeping implants

INTRODUCTION

Theories have earlier suggested that a nonloaded implant with time may not remain osseointegrated, and hence cannot withstand loads later in life. Arguments against this theory have proposed that nonloaded implants will integrate and remain in the bone until further use. There is limited knowledge of the long-term fate of sleeping or nonloaded fixtures in the temporal bone. From experimental studies of implants in other bones in the body, it seems as nonloaded sleeping implants can be used even after longer times.[1,2]

This article describes the fate of a fixture installed in the temporal bone that remained unloaded for 20 years.

PATIENT AND METHODS

A 25-year-old male with hemifacial microsomia had plastic reconstructive surgery of the left external ear performed in childhood. The result was never successful (Figure 1A), and when a prosthetic alternative was available, he chose to wear a bone-anchored ear prosthesis (bone-anchored episthesis; BAE) according to the osseointegration concept. In 1988, three 4-mm long flange fixtures (CEO 001, Nobelpharma, Göteborg, Sweden) were installed in the left temporal bone, two for the BAE and one for the bone-anchored hearing aid (BAHA) in the left temporal bone. Surgery at that time

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Figure 1 *A,* Status of previous autogenous reconstruction in an attempt to build up a new auricle. *B,* After removal of the reconstructed auricle, three implants were installed in the temporal bone of which two were used for the ear prosthesis. Abutments and bar in place. *C,* Ear prosthesis in place.

was done as a two-stage procedure under local anesthesia. Three months later, the two most anteriorly located fixtures were fitted with abutments for the BAE, while the posterior fixture was left sleeping. Reactivation of the sleeping fixture was planned to take place in 1989 but, for a patient-related reason, it never occurred. The following years, the patient visited the Ear, Nose, and Throat Clinic for regular checkups.

When the patient, in year 2008, experienced a hearing problem at his office, he wanted to receive a BAHA. This would require a reactivation of the sleeping implant. An audiogram showed a maximum conductive hearing loss with good preserved cochlear function. To evaluate the condition of the sleeping implant, an Accuitomo three-dimensional, cone beam computed tomography (J. Morita Co., Kyoto, Japan) examination was performed (Figure 2). Resonance frequency analysis (RFA; implant stability quotient 75, 75, and 78 for three different directions of the probe) using the Ostell technique was done when the implant was uncovered (Figure 3). Upon exploration, it was decided that the sleeping fixture was installed too close to the bar for the BAE and, therefore, was left sleeping. A new 4-mm long fixture equipped with an abutment for BAHA (CEO 00 and CEO 002, Cochlear BAS, Mölnlycke, Sweden) was installed in a one-stage procedure (see Figure 3). After subcutaneous tissue reduction, healing was awaited and the patient was supplied with the BAHA 2 months later.

RESULTS

Preoperative x-ray investigation revealed the "sleeping" implant to be well positioned in the temporal bone, covered with 1 mm bone, and with no signs of resorption (see Figure 2). Measurements correlating to the two active implants showed the sleeping implant to be positioned 11 mm behind and 16 mm above the two anterior implants. Surgical exploration was done to uncover the implant. The clinical situation corresponded exactly to that diagnosed from the x-ray examination. Three RFA measurements revealed the implant to be well integrated with a mean implant stability quotient (ISQ) value of 75 ± 3.

DISCUSSION

Brånemark showed, in his initial studies, that the bone surrounding the implants remained without significant structural alterations as revealed by x-ray investigation or morphological techniques.[1,2] The fixtures we used in

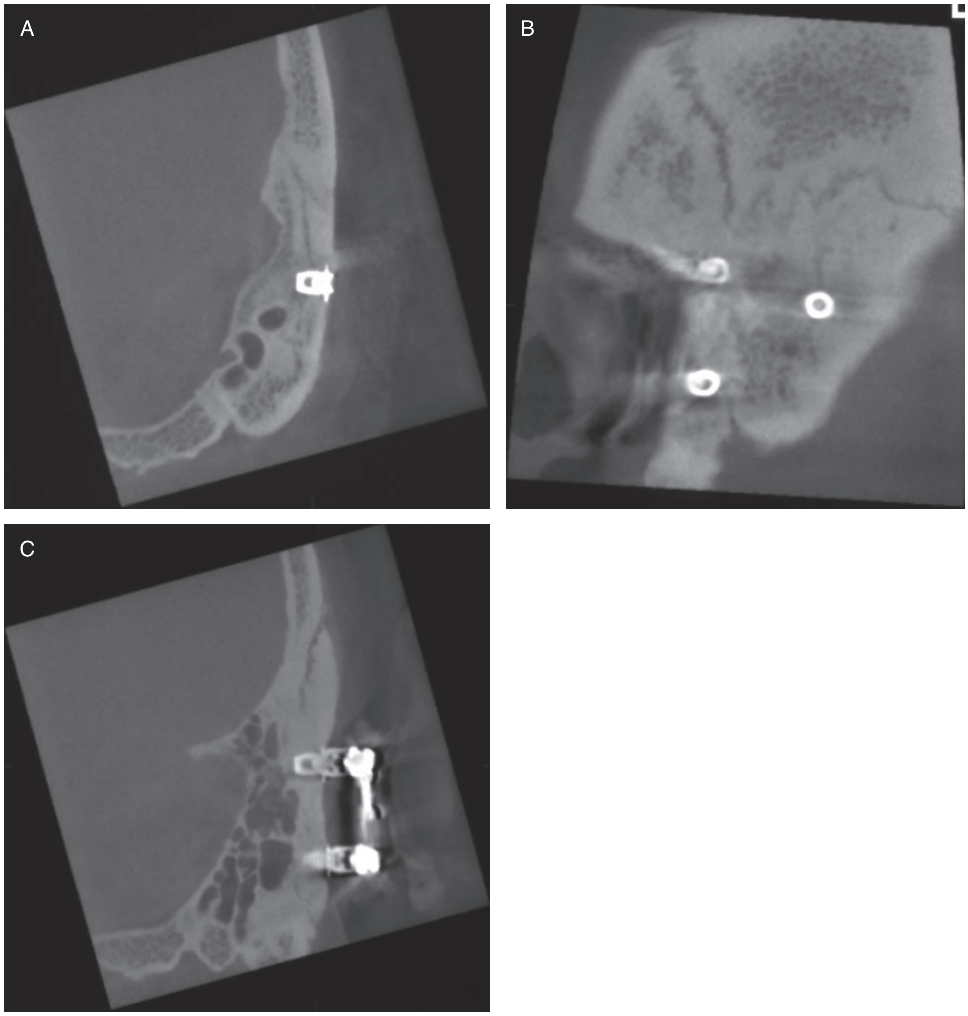

Figure 2 Cone beam computed tomography of the temporal bone showing *A,* the sleeping implant well integrated 20 years later, and with bone growing over the flange. *B,* The individual position of the three implants. *C,* Good anchorage of the loaded implants with minimal bone resorption under the flange.

1988 belonged to the original model developed by Brånemark with machined surface, and are hence comparable to those inserted in the above-mentioned experimental studies. The implant used in 2008 has the same machined surface, but has a different angulation and is self-tapping.

There is limited information regarding the fate of sleeping implants over a long-term period. A small number of articles have described that implants have been installed but left sleeping, and generally, the fate of these implants is not reported.[3–6] In irradiated patients, we have recommended that more fixtures than needed should be installed due to the high frequency of lost implants in these patients, especially as regards implants placed around the orbita.[7] After fixture failures, the sleeping orbita implants have been reactivated and used to anchor the orbita prosthesis. These implants have, however, never been left sleeping for as long as 20 years, but have usually been reactivated within a time span 2 to 5 years after installation. At that time, they have been well integrated.[8]

Implant failures in the temporal bone for BAHA has been in the range of 8 to 10% during a 10-year period.[9] It seems as older patients lose implants to a higher degree, which could be related to osteoporosis.[10] Continuous bone resorption could be one factor of importance in this context. In another case at our department, a woman had two 4-mm long fixtures installed in 1989. One of these was loaded immediately, and the other was left as a sleeper. An Accuitomo three-dimensional, cone beam computed tomography performed in 2009 revealed the sleeping implant covered with bone and the

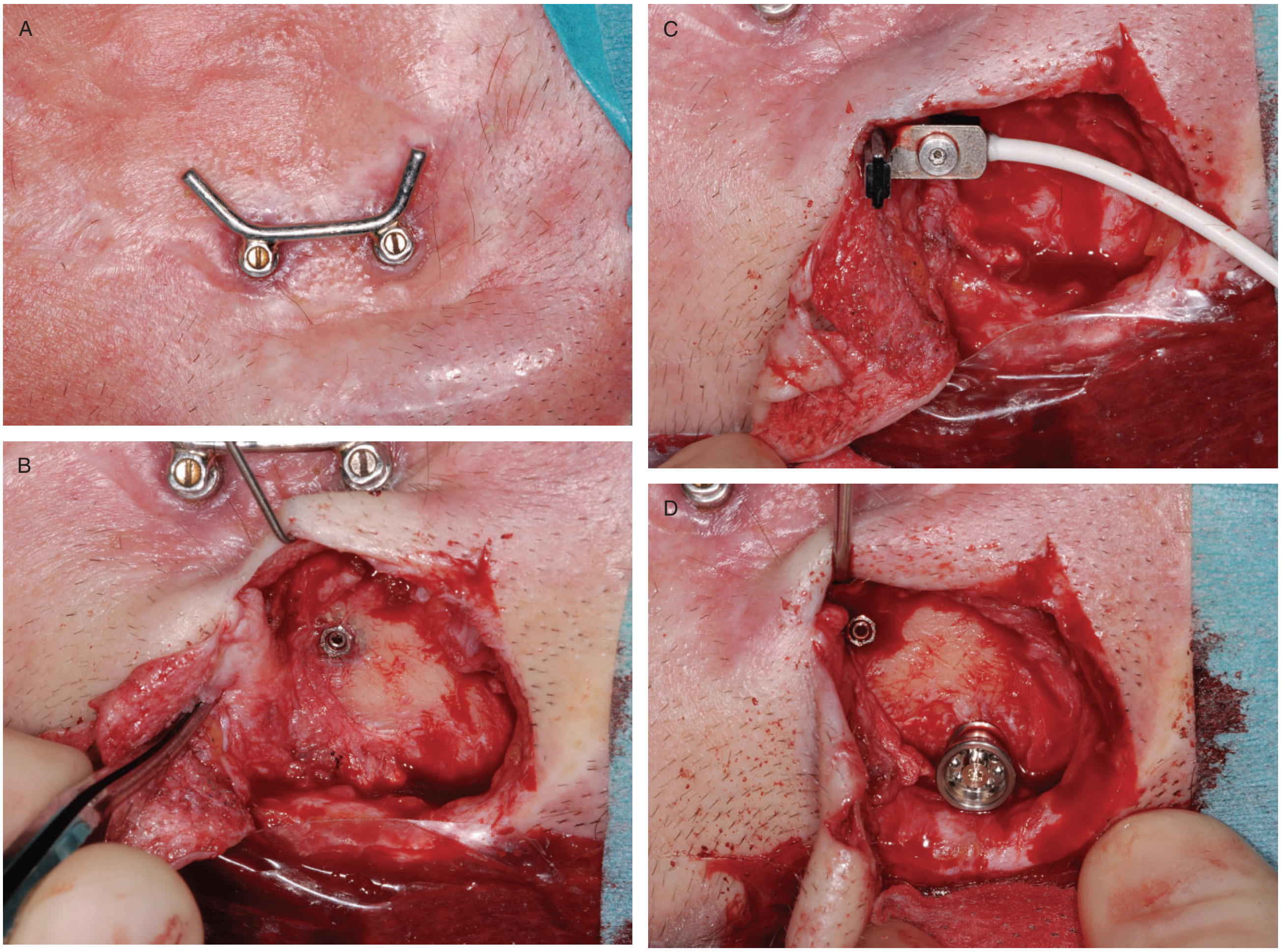

Figure 3 *A,* At surgery, an incision was made posterior to the uncovered implants. *B,* The sleeping implant was localized at the spot that the previous cone beam computed tomography had determined. It was found to have a rim of compact bone growing over the flange. *C,* Resonance frequency analyses showed good stability of the implant. *D,* A new fixture and abutment was installed posterior to the sleeping implant for future use of a bone-anchored hearing aid.

loaded implant with bone resorption to the first thread (data not shown). Thus, it seems as bone resorption only occurs when the implant is loaded.

The reason the patient in this case presentation received a third fixture was related to his ear malformation, which gave him a maximum conductive hearing loss on the affected side. He was planned to have second-stage surgery for a BAHA the same year, but due to a patient-related reason, this surgery was postponed. During this time (1980s), we had a further conservative attitude to single-sided hearing loss, as it was then generally presumed that any patient could handle the daily life with only one hearing ear. Today, a shift to bilateral hearing is generally present, and many patients are given a BAHA despite normal hearing on the contralateral side.

CONCLUSIONS

It seems possible to reactivate sleeping implants in the temporal bone for use even 20 years after their installation.

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