

Universitätsklinik für Hals-, Nasen- und Ohrenheilkunde  
Medizinische Universität Innsbruck | Tirol Kliniken GmbH



## Implantierbare Hörsysteme

Assoz. Prof. PD. Dr. Joachim Schmutzhard  
Universitätsklinik für Hals-, Nasen- und Ohrenheilkunde  
Medizinische Universität Innsbruck



Universitätsklinik für Hals-, Nasen- und Ohrenheilkunde  
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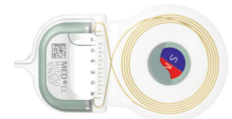
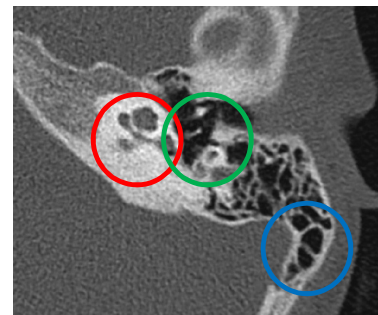
**Cochlea Implantat:**  
elektrische Stimulation des  
Hörnervs



**Aktives Mittelohrimplantat:**  
mechanische Stimulation der  
Gehörknöchelchen



**Aktives Knochenleitungsimplantat:**  
mechanische Stimulation  
des Knochens



## Cochlea Implantate



**MedEl**  
Österreich  
Synchrony II



**Cochlear**  
Australien  
Nucleus Profile



**Advanced Bionics**  
USA  
HiRes Ultra 3D

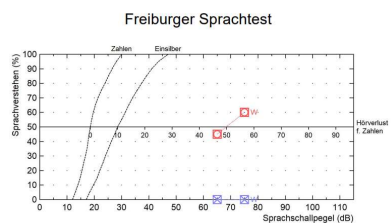
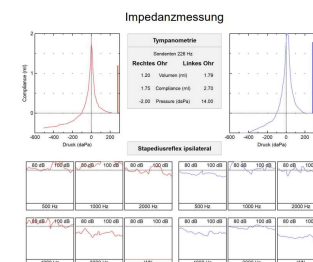
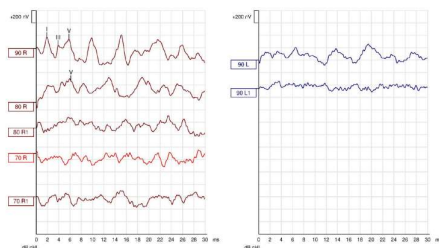
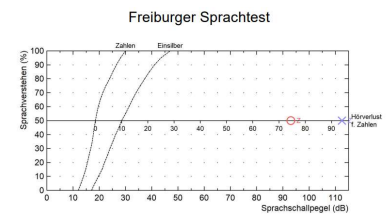
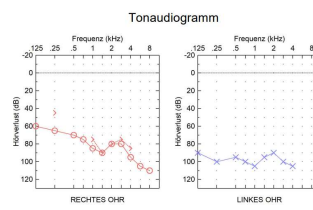


**Nurotron**  
China  
CS-20A

## Audiologische Indikation Erwachsene



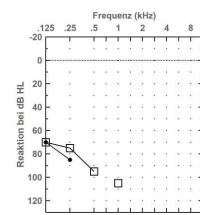
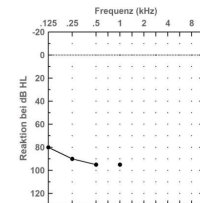
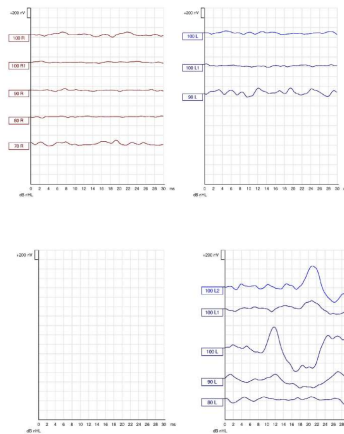
- Postlinguale Hörstörung
- Hochgradige Schwerhörigkeit
- Tonaudio: >70 dB ab 1000Hz
- Freiburger:  
< 50 % bei max. Verstärkung  
< 40% bei 65 dB mit HG
- BERA Bestätigung



## Audiologische Indikation Kinder

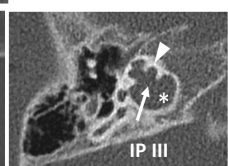
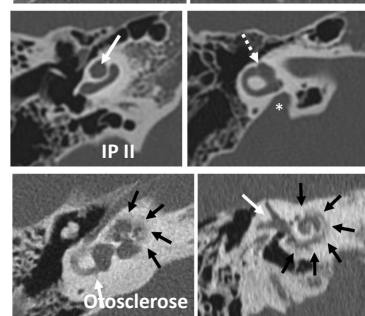
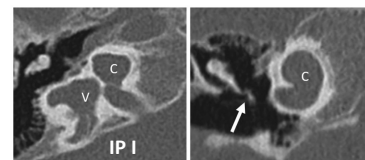
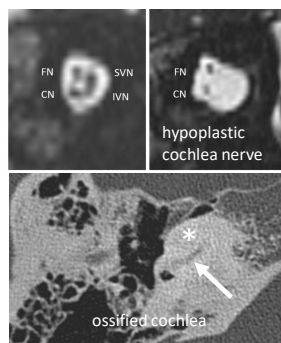
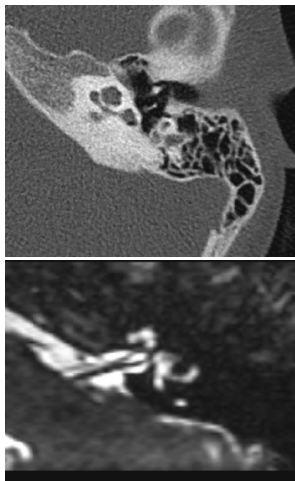


- Prälingual ertaubt bis 6. LJ
- Postlingual ertaubt (s.o.)
- Ausbleibende Sprachentwicklung mit HG- Versorgung
- Negative OAE
- Keine Antworten im Freifeld
- BERA Bestätigung

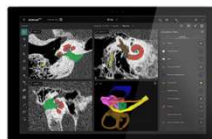


5

## Präoperative Bildgebung



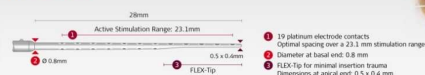
## Elektrodenlänge



OTOPLAN



**FLEX28™** A 28 mm electrode array suitable for 96% of normal cochlear anatomies<sup>6,7</sup> featuring FLEX-Tip technology. Optimised for insertion into the apical region (CCC).



bevorzugte Elektrode:  
Reguläre Anatomie

**FLEX24™** A 24 mm electrode array featuring FLEX-Tip technology and designed for combined Electric Acoustic Stimulation (EAS) with insertion less than 1.5 turns. FLEX24 is formerly known as the FLEXEAS.



Hörerhalt bis 500Hz,  
Mondini Malformation

**FLEX20** A 20 mm electrode array featuring FLEX-Tip technology and designed to be used in cases of partial deafness or for other specific needs or surgical preferences.

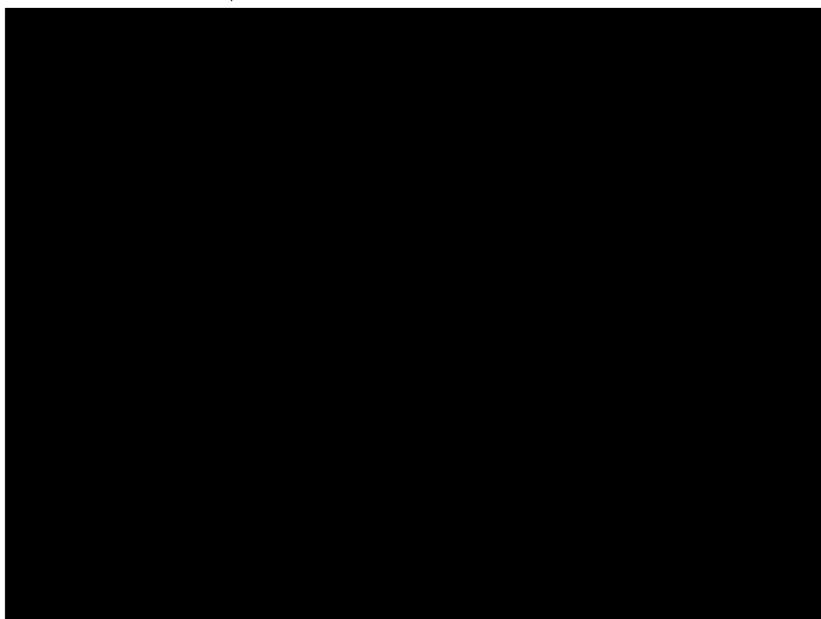


Hörerhalt bis 1000 Hz.  
1000 Hz

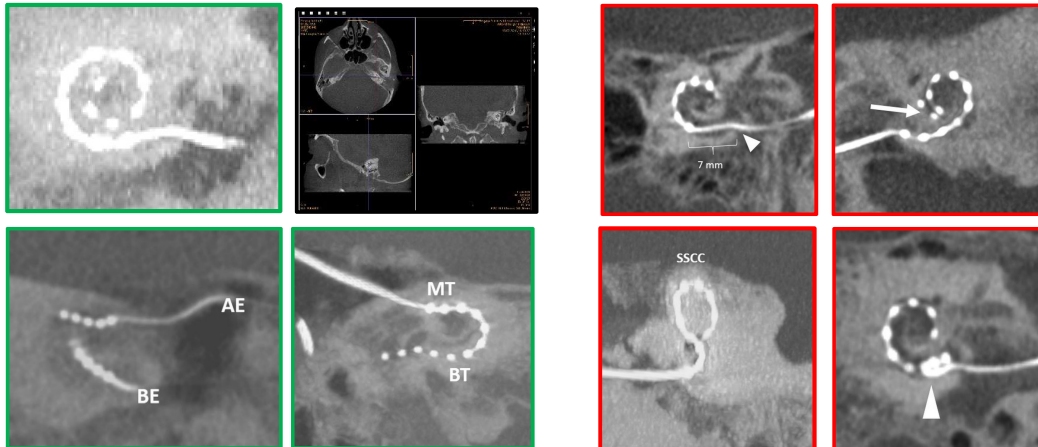
**STANDARD** A 31.5 mm electrode array designed for long cochlear duct lengths.



bereits vorimplantiert,  
Revisionsoperation



## Postoperative Bildgebung



## Verlauf über 10 Jahre

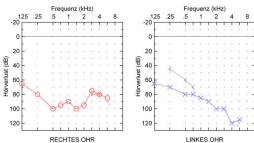
01/2013

12/2013

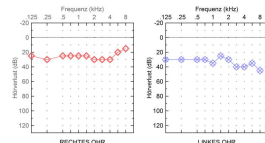
12/2014

12/2022

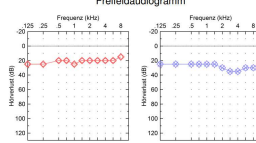
Tonaudiogramm



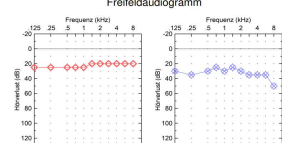
Freifeldaudiogramm



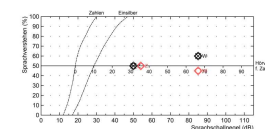
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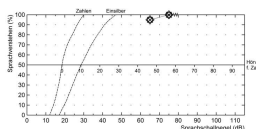
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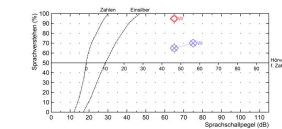
Freiburger Sprachtest



Freiburger Sprachtest



Freiburger Sprachtest



16-jähriger Bursche  
Mondini bds.

progressive Hörstörung

Verschlechterung in die funktionelle Taubheit bds. 01/2012

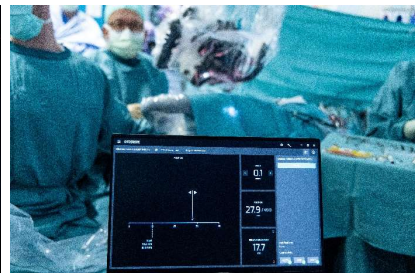
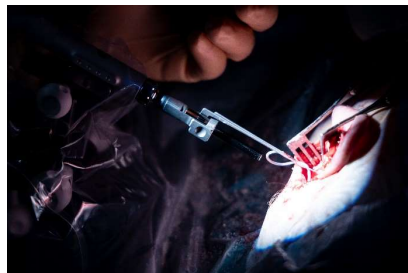
Cochlea Implantation 04/13 und 09/13 mit 24mm flex



## OTOARM/OTODRIVE System

motorisierte Insertionspinzette

- keine Mikrobewegungen
- konstante langsame Insertion



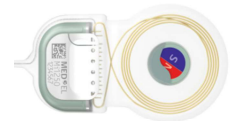
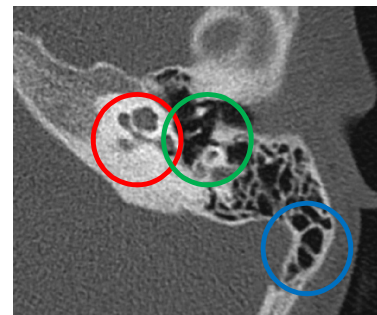
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**Aktives Mittelohrimplantat:**  
mechanische Stimulation der  
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**Aktives Knochenleitungsimplantat:**  
mechanische Stimulation  
des Knochens



## Aktive Mittelohrimplantate



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**Cochlear  
CODACS**



**Cochlear  
Carina**



**ENVOY medical  
Esteem**



**MedEl  
Vibrant Soundbridge**

Mini-Review

SCIENCE PROGRESS

### Bone conduction implants and active middle ear implants for adults

Eleonor Koro<sup>1</sup> , Jeremy Wales<sup>2</sup>   
and Mimmi Werner<sup>1</sup>

<sup>1</sup>Department of Clinical Sciences, Otorhinolaryngology, University of  
Umeå, Umeå, Sweden  
<sup>2</sup>Department of Clinical Science, Intervention and Technology,  
Karolinska Institute, Stockholm, Sweden

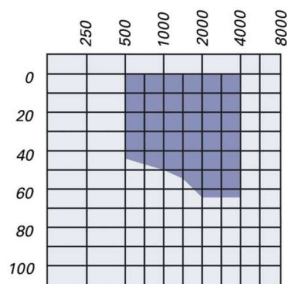
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## Audiologische Indikationen Vibrant Soundbridge

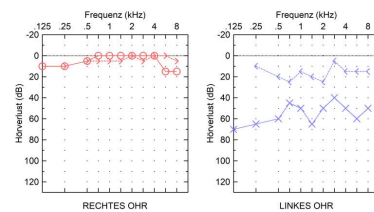


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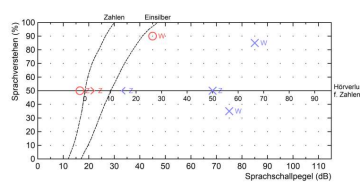


Pathologischer Gehörgang  
Radikalhöhle  
Rückkopplung

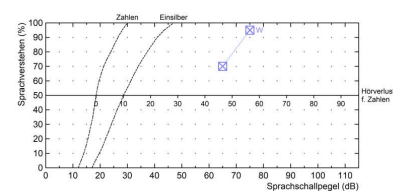
Tonaudiogramm



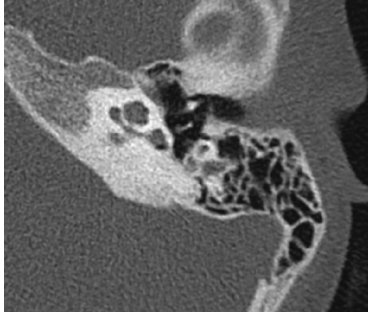
Freiburger Sprachtest



Freiburger Sprachtest



## Präoperative Diagnostik



### Audiologie:

Reintonaudiometrie, Freiburger Sprachtest  
Tympanometrie, Stapediusreflexe  
BERA

### Bildgebung:

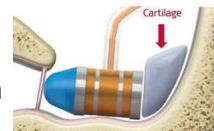
HR CT Felsenbein  
MR Imaging (CISS 3 D Sequences)

## Vibrant Soundbridge Coupler



### Round Window Coupler:

Nach destruktiven Mittelohreingriffen



### Short Process of the incus coupler:

Chronische Otitis externa, Power-Stapes



### Clip coupler – Stapes Suprastruktur

Nach destruktiven Mittelohreingriffen



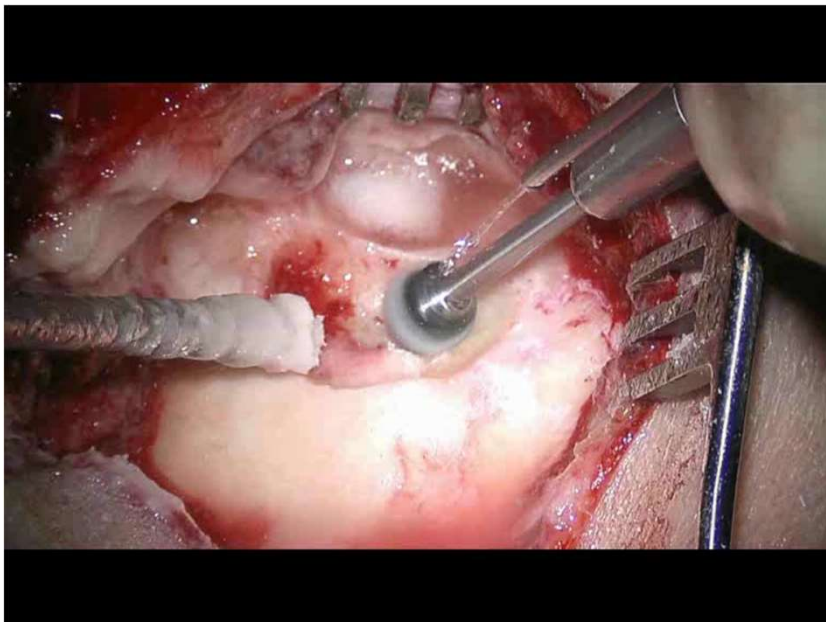
### Long Process of the Incus Coupler:

classic approach





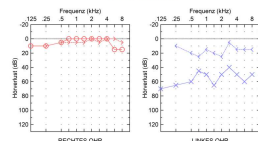
## round window coupler



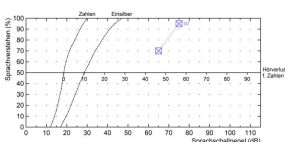
## Verlauf

01/2020

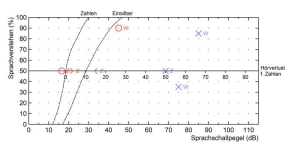
Tonaudiogramm



Freiburger Sprachtest

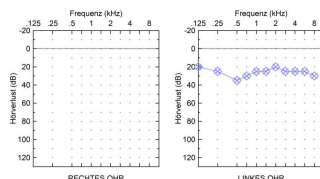


Freiburger Sprachtest

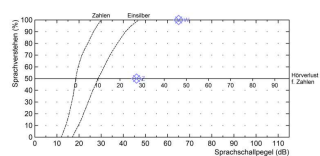


06/2020

Freifeldaudiogramm



Freiburger Sprachtest



11/2024

Letzte klinische Kontrolle:  
hoch zufrieden  
als Musiker (Solist) aktiv

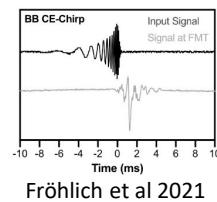
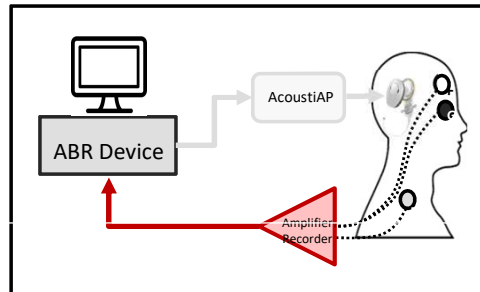


## Intraoperative BERA



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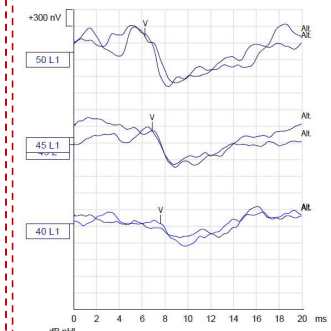
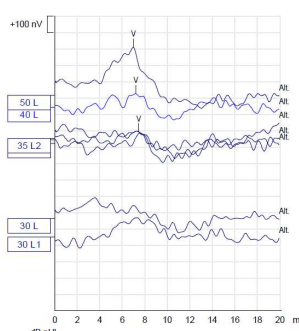
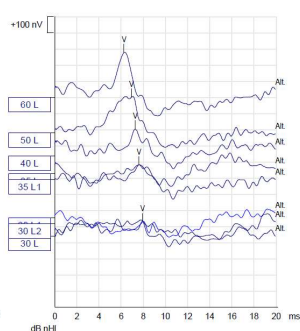
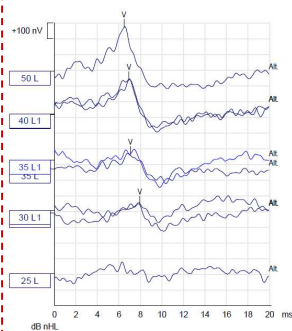
Stimulus	CE-Chirp®
Stimulation rate	49,1Hz
Averaging	2000 Samples
Stop Criteria	None
Output impedance setting	Air conduction / Insert-earphone
Filtering: Low pass	1500 Hz
Filtering: High pass	33 Hz
Polarity	Alternative
Rejection Level	40µV
Skin Impedance	<5kΩ



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### Intra OP

### Post OP



Cartilage housing

Fluid phase fixation

## Effekt auf die Kopplungsqualität

	With intraoperative ABR	Without intraoperative ABR	P value
<b>Mean postoperative BC PTA3</b>	41.43 (± 14.96; 16.67-60.00)**	41.79 (± 18.37; 8.33-61.67)**	0.765*
<b>Mean Delta preoperative vs. postoperative BC PTA3</b>	-1.43# (± 11.47; -18.33 – 30.00)	+1.19# (5.89; -11.67 – 8.33)	0.111*
<b>Mean postoperative Vibrogramm PTA3</b>	43.21 (±18.26; 23.75-63.33)**	54.05 (±15.74; 26.67-78.33)**	0.161*
<b>Mean postoperative coupling quality PTA3</b>	1.79 (+6.8; -16.67 – 13.33)**	12.26 (+12.60; -5.00 – 43.33)**	0.006*



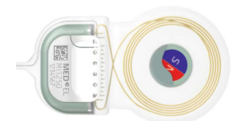
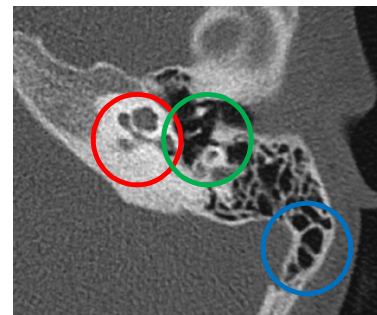
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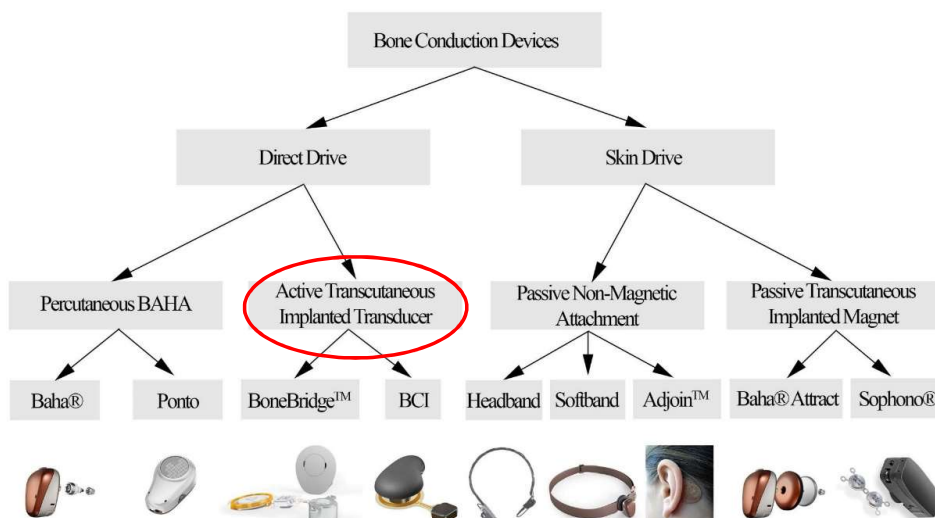
**Aktives Mittelohrimplantat:**  
mechanische Stimulation der Gehörknöchelchen



**Aktives Knochenleitungsimplantat:**  
mechanische Stimulation des Knochens



## Knochenleitungshörgeräte



## Aktive transkutane Knochenleitungsimplantate



**Oticon**  
Sentio Ti



**Cochlear**  
Osia



**MedEl**  
Vibrant BoneBridge

Mini-Review

SCIENCE PROGRESS

### Bone conduction implants and active middle ear implants for adults

Eleonor Koro<sup>1</sup>, Jeremy Wales<sup>2</sup> and Mimmi Werner<sup>1</sup>

<sup>1</sup>Department of Clinical Sciences, Otorhinolaryngology, University of Umeå, Umeå, Sweden

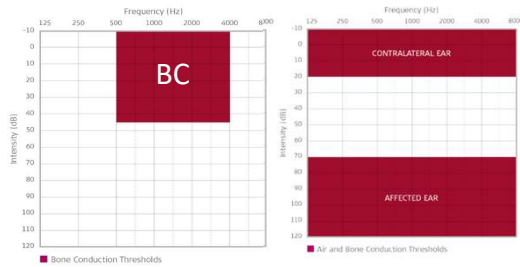
<sup>2</sup>Department of Clinical Science, Intervention and Technology, Karolinska Institute, Stockholm, Sweden

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## Audiologische Indikationen

### BoneBridge

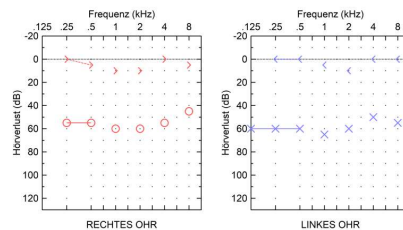


CHL/MHL

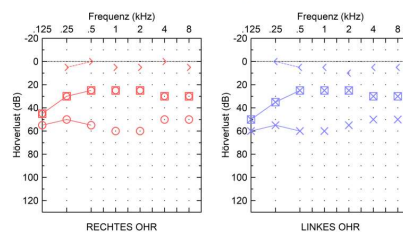
SSD

- Stabile Hörkurve
- Schallleitungsschwerhörigkeit
- SSD Patienten mit leicht eingeschränktem Gegenohr
- Ab dem 5. Lebensjahr

Tonaudiogramm



Freifeldaudiogramm



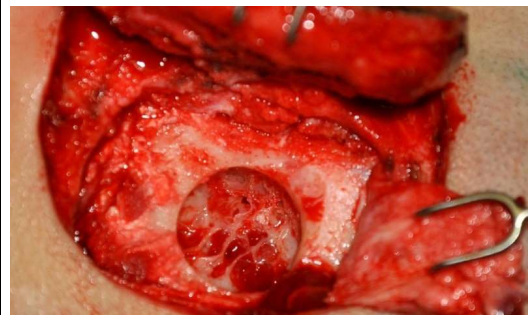
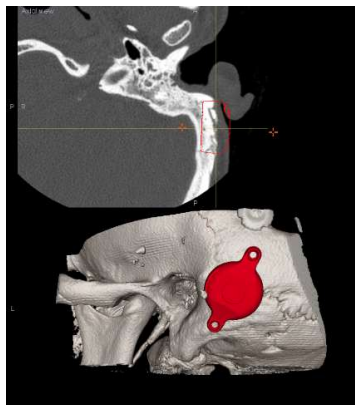
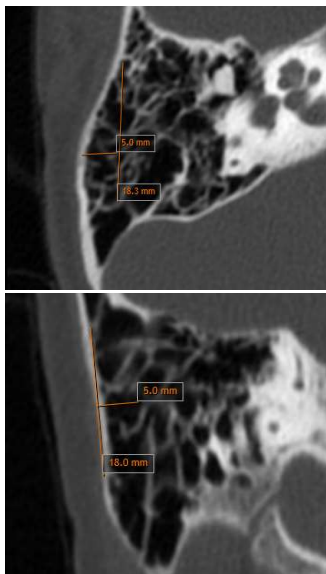
Contact Mini



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## OP Planung BoneBridge



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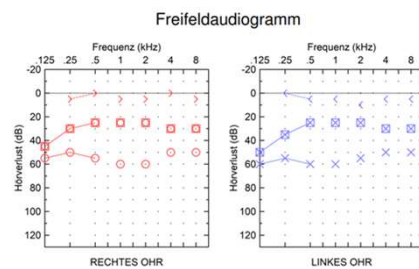
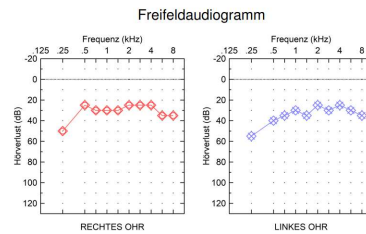
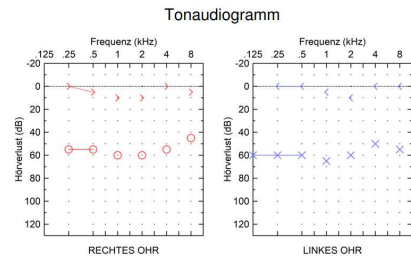
## Verlauf



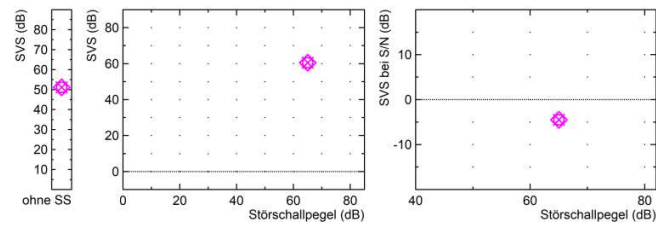
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01/2019

06/2020



## Oldenburger Kindersatztest



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# Danke für die Aufmerksamkeit

