

Electrophysiological assessment of auditory plasticity after relatively long intervals of sequential cochlear implantation

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Intro

- Sharma et al (2002): CI after 7 years abnormal cortical development (unilateral CI)
- Bauer et al (2006) & Sharma et al (2005): interval between first & second CI < 1 year: second ear is able to catch up (electrophysiological data)
- Peters et al (2007) & Wolfe (2007): 2nd CI before age of 4 > CI1=CI2 (behavioral data)



Project goals

- Main project: a multidisciplinary approach to evaluate
 - Psycho-acoustical capacities
 - Language comprehension & development
 - Neurophysiological changes from cochlea to cortex

This presentation: electrophysiological data from brainstem & cortical level with relatively long period between CI1 and CI2



Differences between ABR and EABR?

Differences between ACR and EACR?

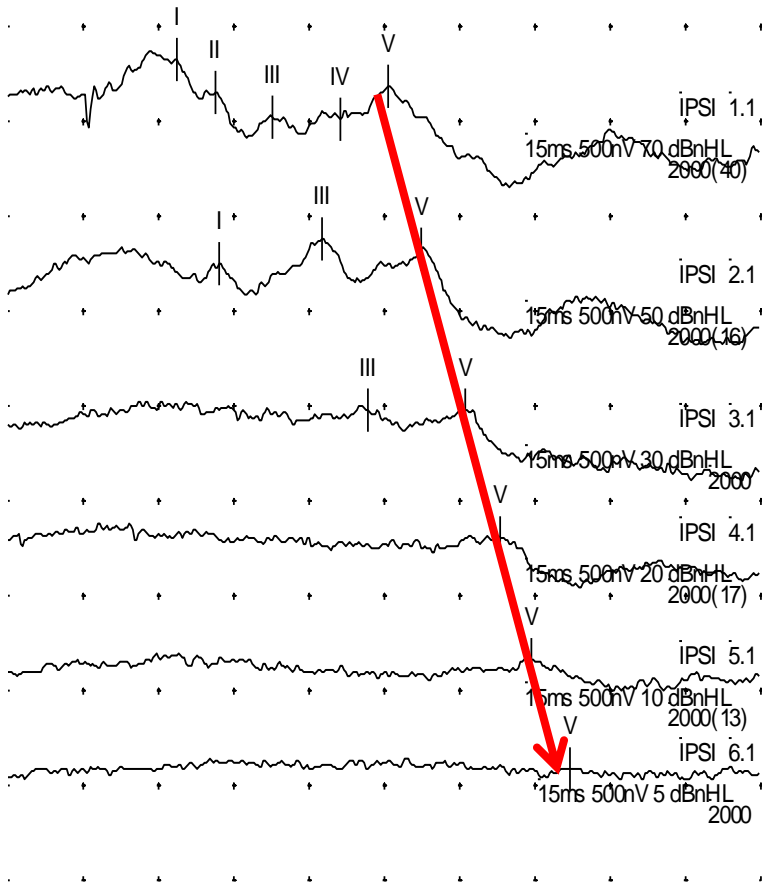


Characteristics E-EAPs

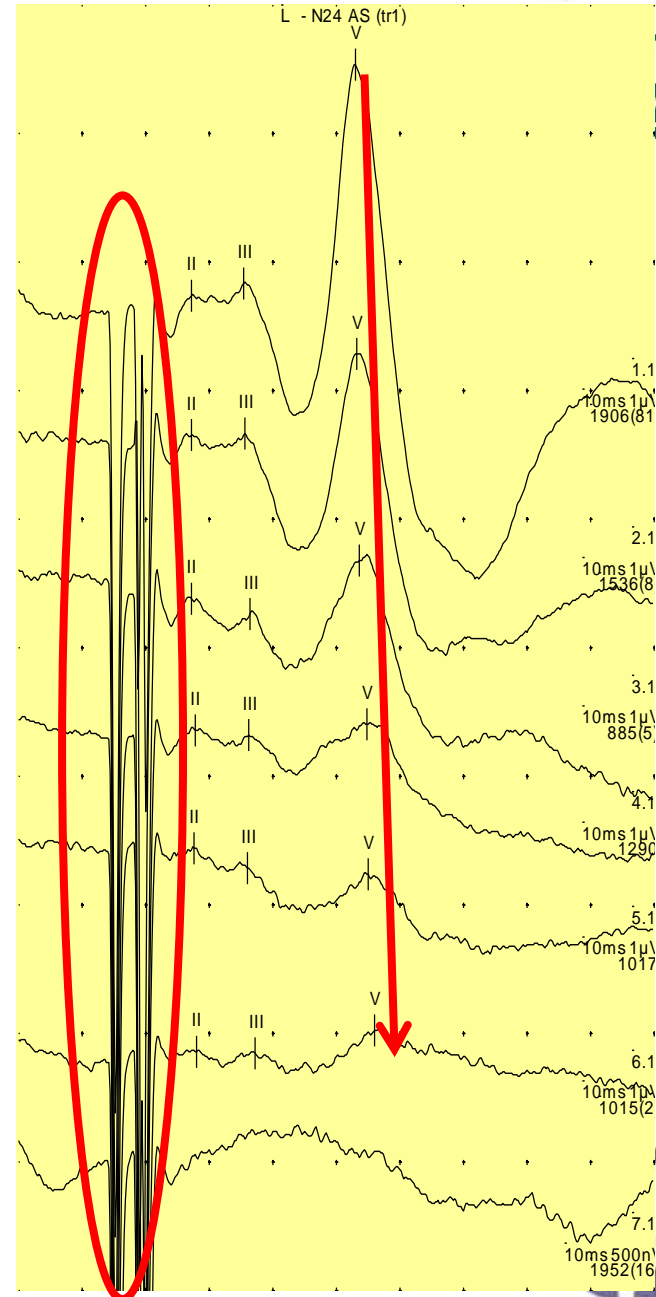
EABR

ABR

R - BERA kotempel 70



> I/0 slope EABR steeper compared to ABR

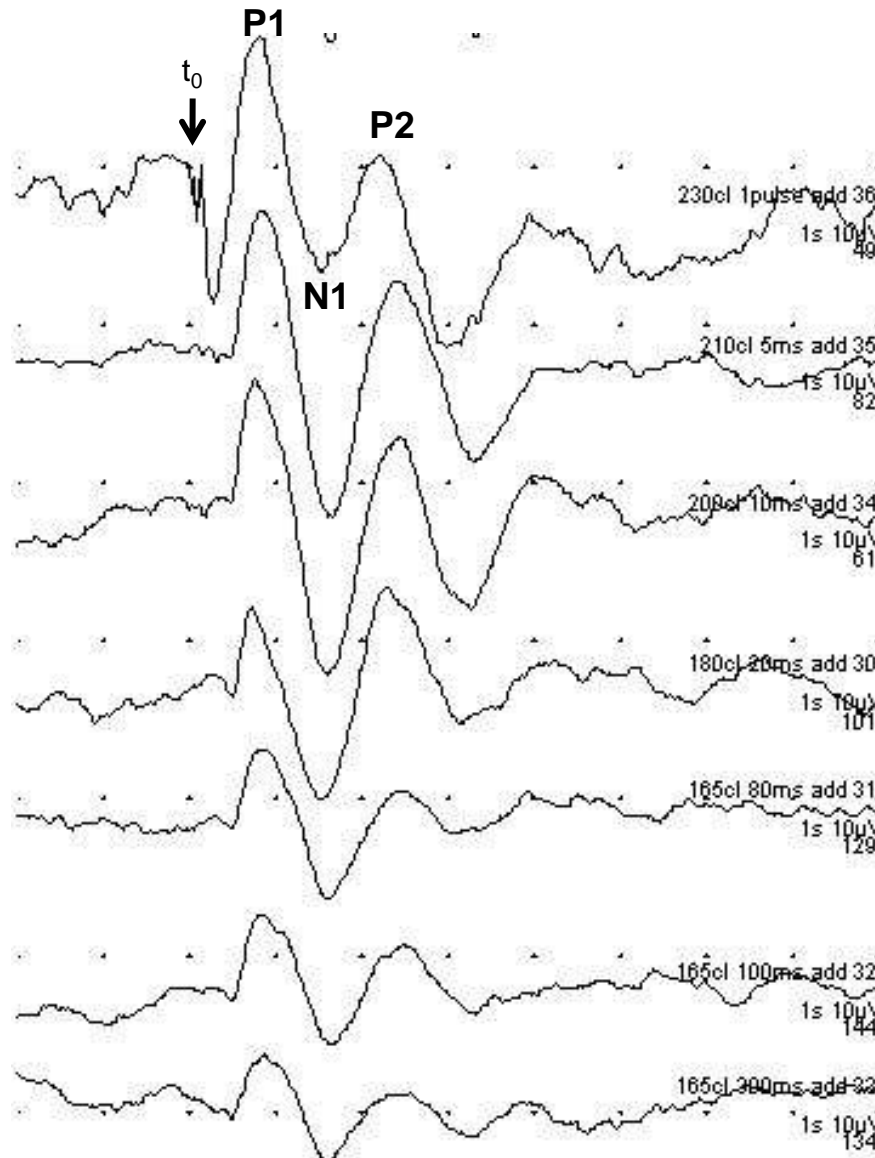


Electrically-evoked auditory cortical response (EACR)

- Characteristics of EACR = ACR



Interpretation of EACRs (effect pulse train duration)



Single pulse

5 ms pulse train

10 ms p.t.

20 ms p.t.

80 ms p.t.

100 ms p.t.

300 ms p.t.

Beynon AJ, internal report 2008



Aims present study

Determine whether:

1. EABR/EACR *latencies* evoked by stimulation with CI2 become comparable with those evoked by CI1?
2. *inter-implant delay* between CI1-CI2 influence auditory maturation after extended unilateral deafness?
3. *maturation* is age-appropriate and whether it is comparable with those of the children with unilateral CI



Subjects

- N = 30 Children
- Bilaterally-implanted Nucleus 24 CI system
- First CI (CI1) received between 11m – 2y;8m
- Second CI (CI2) received between 2y;5m – 8y;6m
- Sequentially-implanted: mean interval 42 months
(i.e. relatively long period between CI1 and CI2)



Methods

- Electrically-evoked Auditory Brainstem (EABR) and Cortical (EACR) Responses:

direct electrical stimulation by the speech processor

- Comparison of the 1st and 2nd implants:

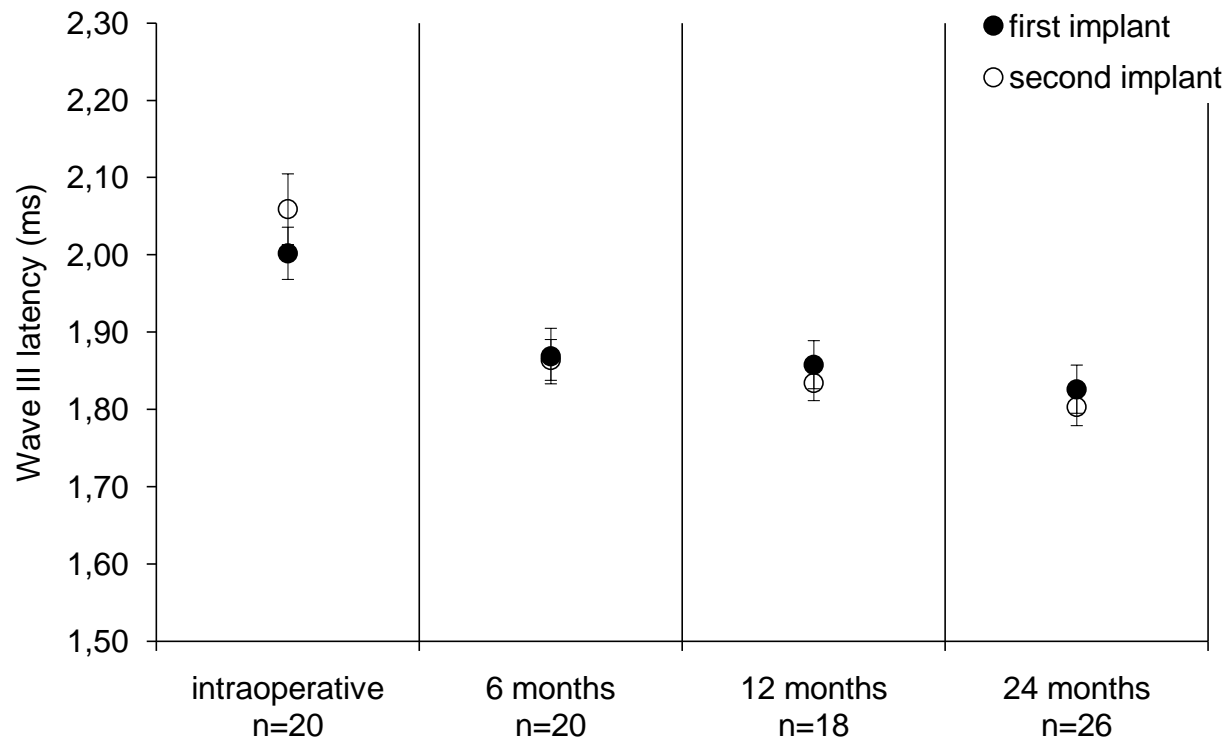
6, 12 and 24 months postactivation

- Analyses:

- EABR: latencies of brainstem components wave III, V & IWI
- EACR: latencies of cortical components P1, N1, P2 (within- and between-ear analyses)



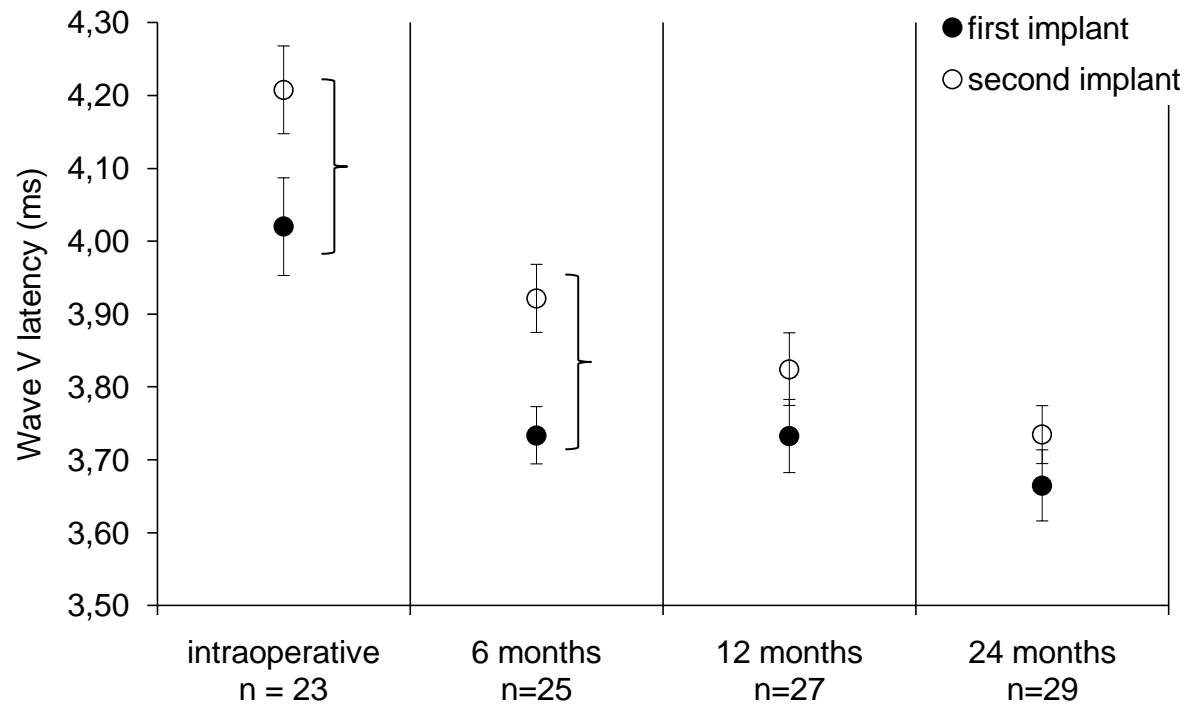
Results EABR wave III



*p < .05
** p < .01



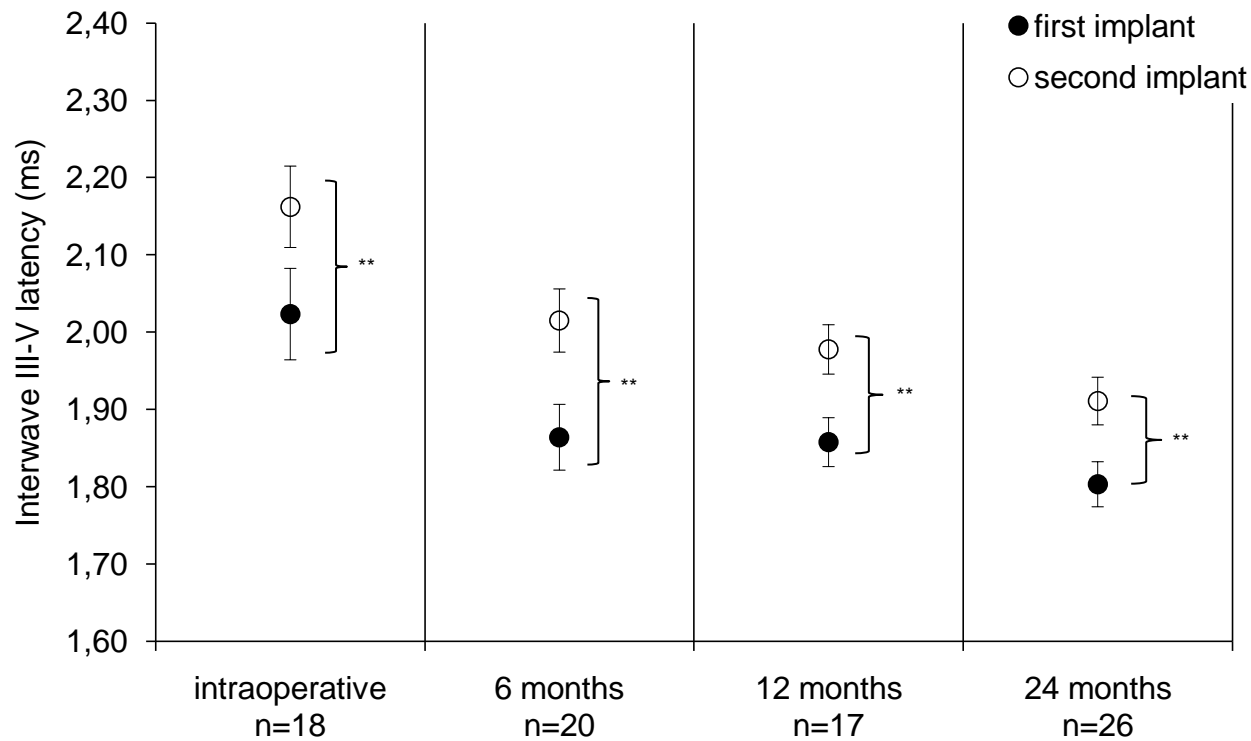
Results EABR wave V



*p < .05
** p < .01



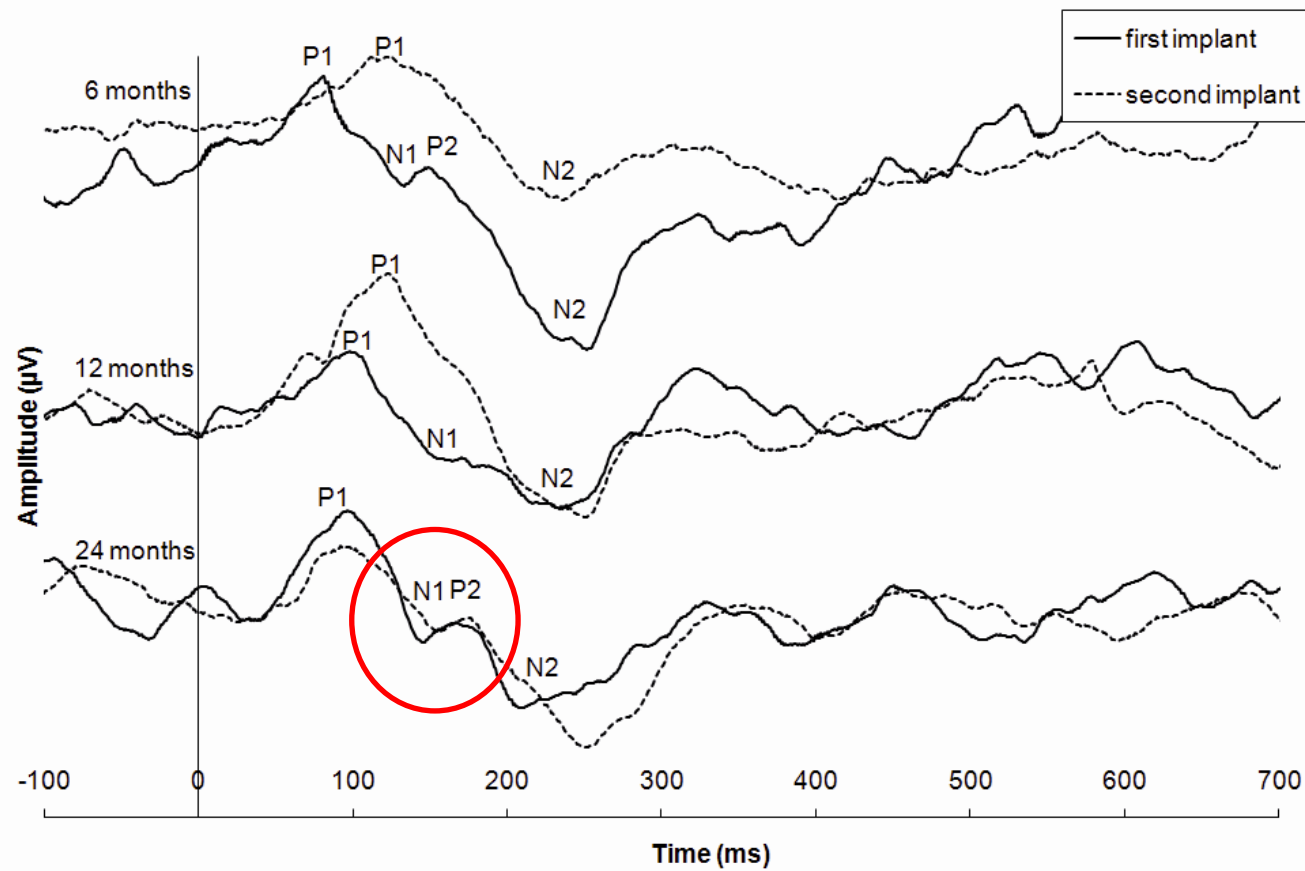
Results EABR IWI III-V



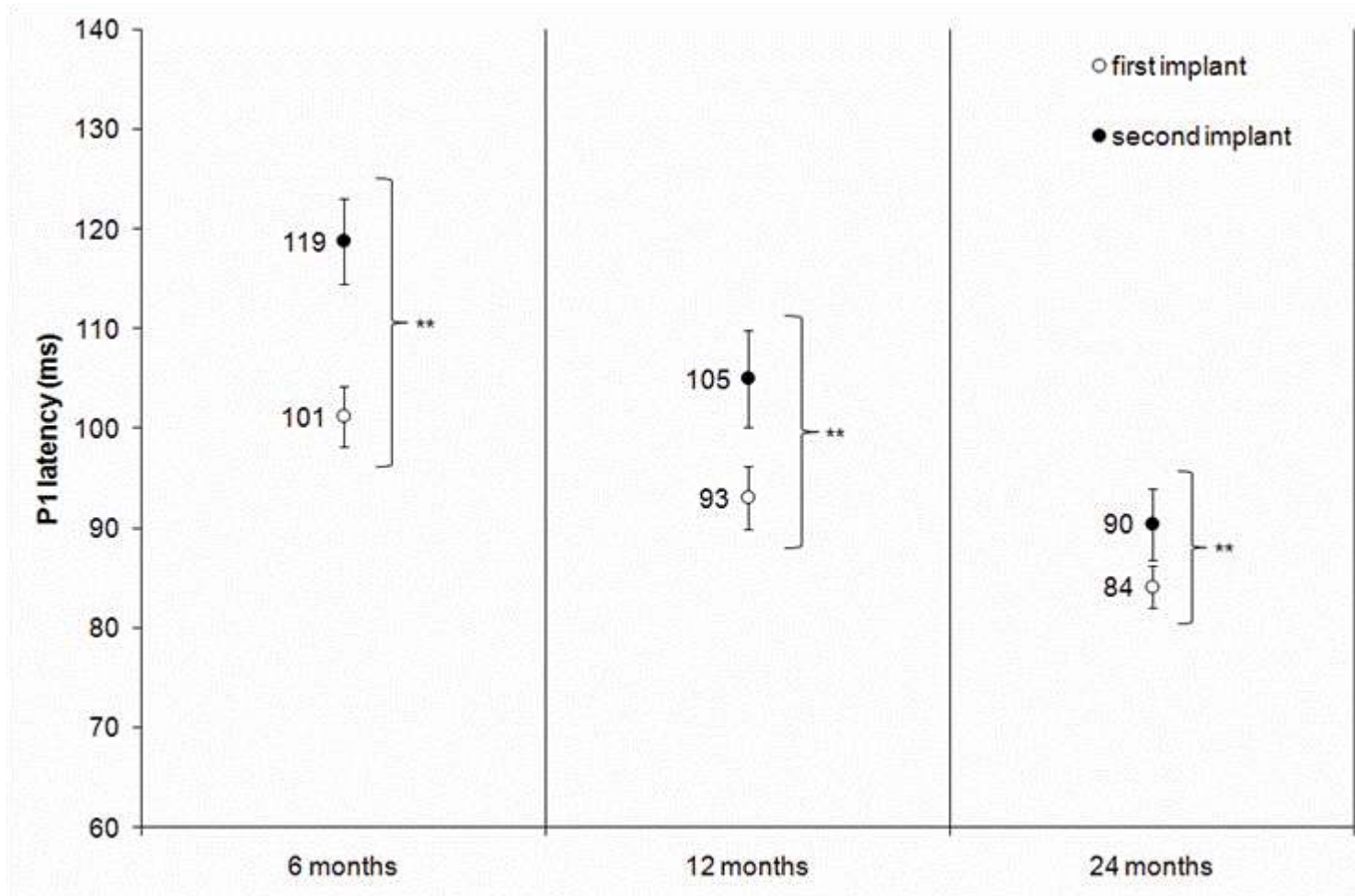
*p < .05
** p < .01



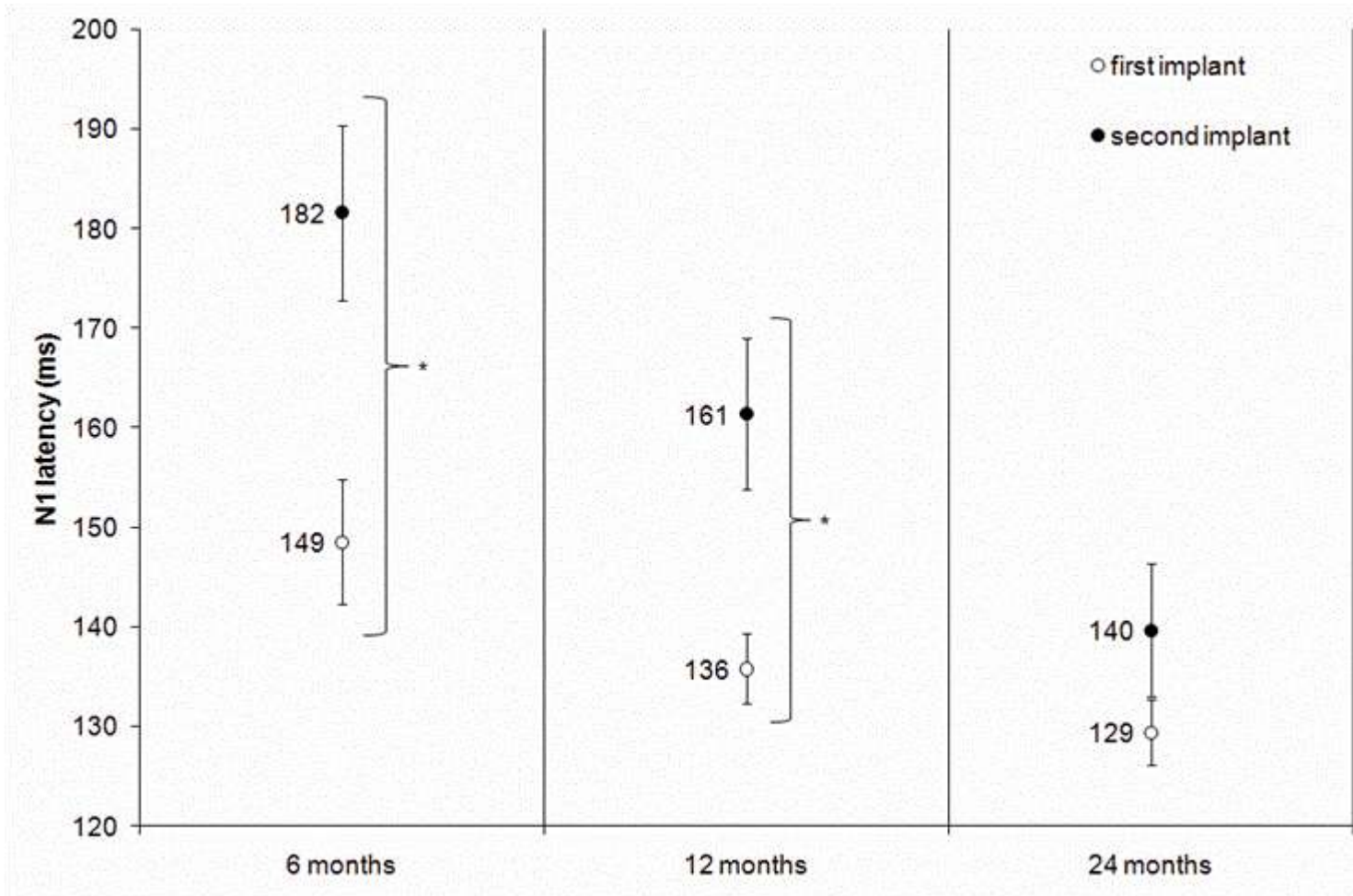
Example EACR (CI1 vs CI2)



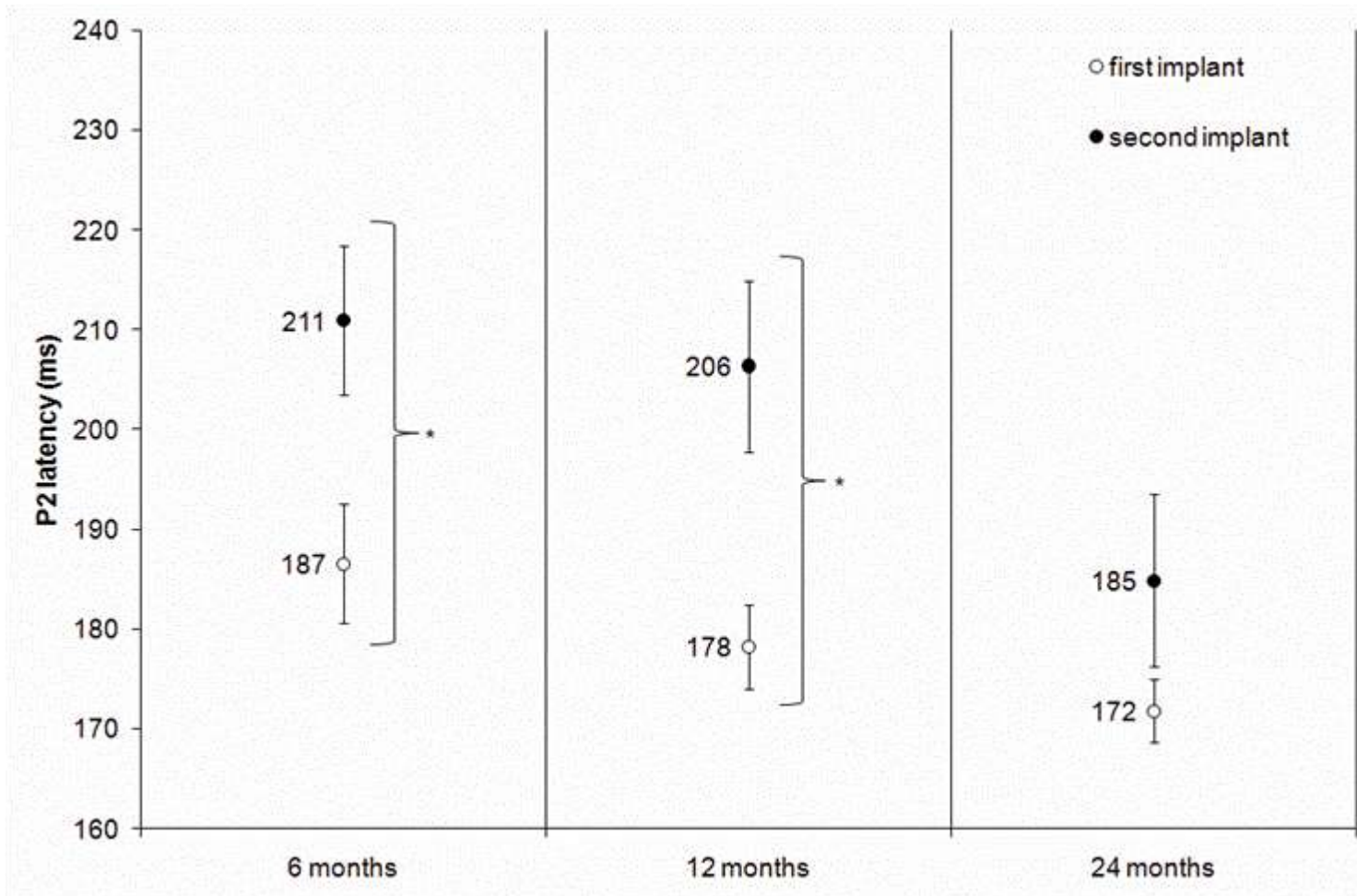
Results P1 latency



Results N1 latency



Results P2 latency

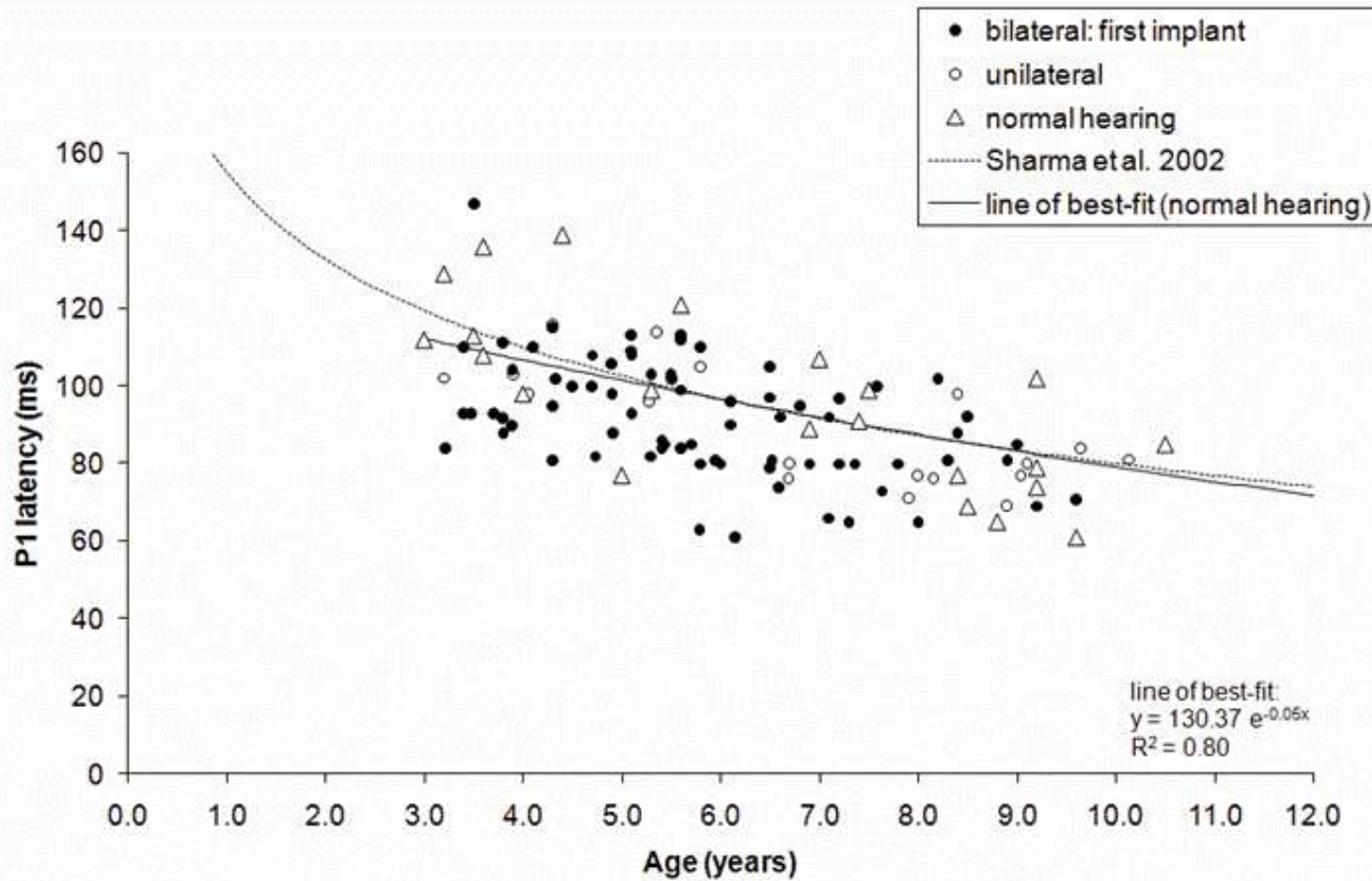


Conclusions

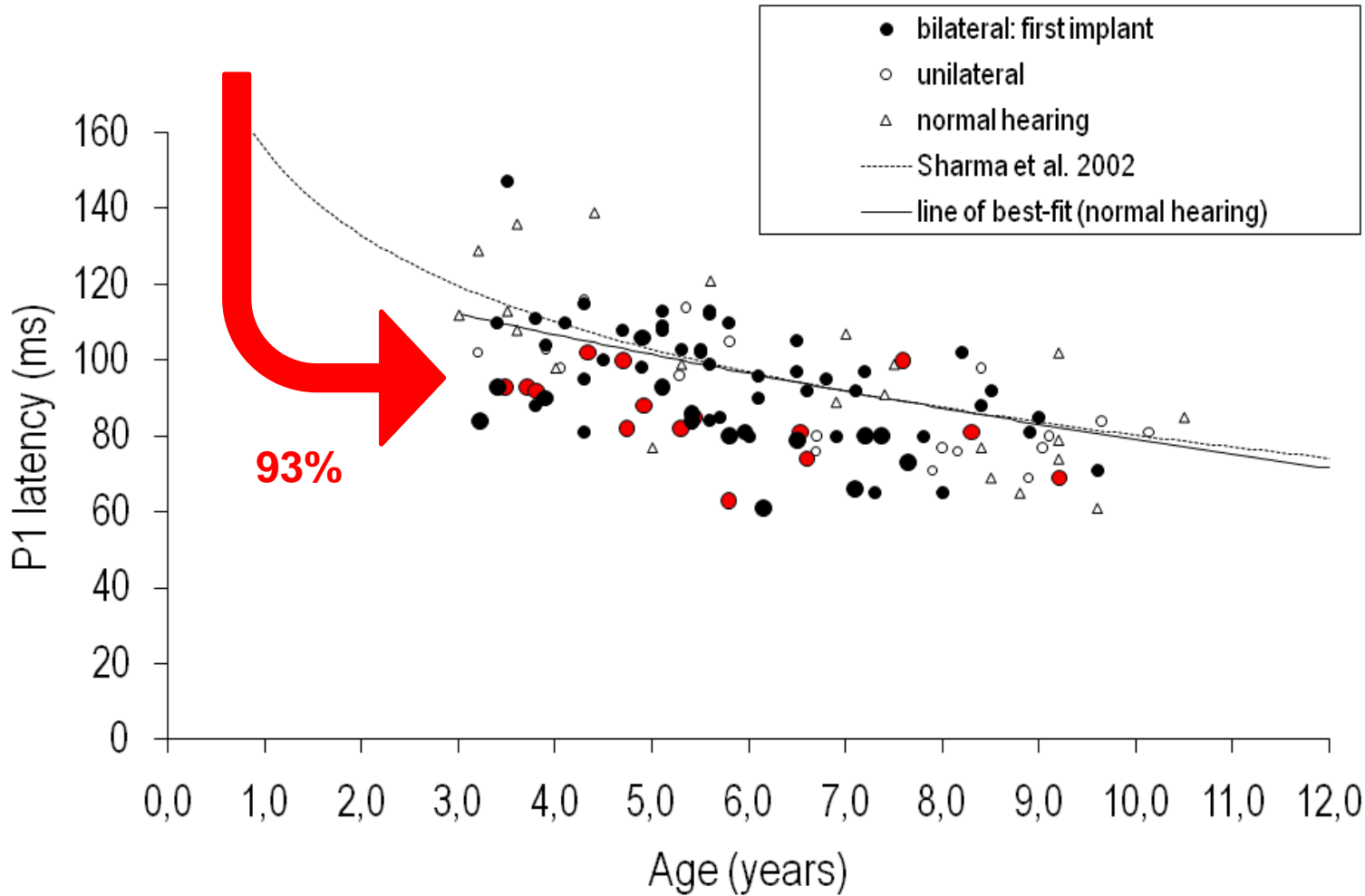
- Maturational effects in all EAP-components
- EABR: age at 2nd implantation had no effect on the interaural latency differences of the EABR.
- EACR: prolonged latencies of CI2 compared to CI1
- Improvement of neural conduction of CI1 follows normal development
- Neural conduction is still in favour of CI1



Maturation over time CI1 vs UNI & NH



11-24 months CI1



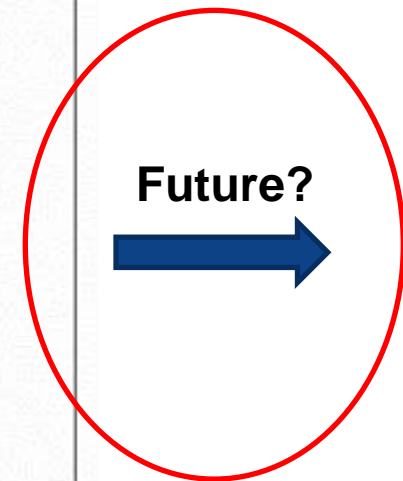
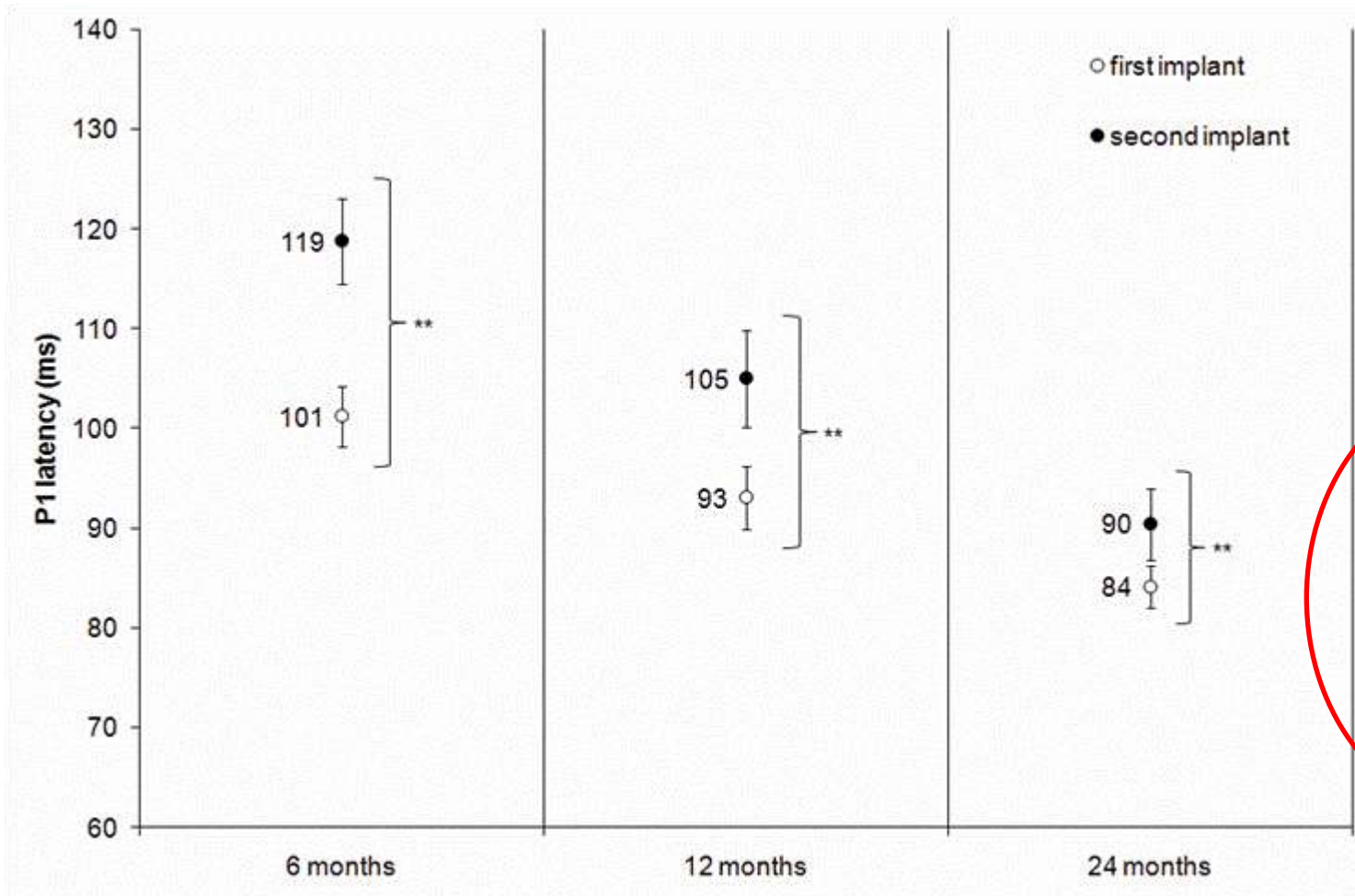
(Conclusions)

- children with *relatively long intervals* between CI1 and CI2 are *still able* to catch up with respect to the first implant

- *critical age* for CI1 surgery for children undergoing sequential implantation is likely to be *before* the age of 3.5 years



Results P1 latency



Thanks for your attention

and





Venue: Mövenpick Conference Centre Amsterdam

Welcome to Amsterdam!



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