Title

Auditory Brainstem responses (ABR) in sight recovery individuals suggest the presence of auditory crossmodal sensitive periods in humans

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Abstract

The auditory system does not develop and function in isolation: vision exerts a modulatory role on its functional and structural organization. Studies in non-human animal models have revealed that, through a functional crossmodal mechanism, the onset of visual input (eyes-opening) elicits the closure of certain auditory critical-periods. The study of individuals whose sight was restored after a period of congenital blindness provides the unique opportunity to assess whether this tight interplay between visual input onset and auditory functional development exists in humans. To this aim we collected click-evoked Auditory Brainstem Responses (ABRs) from two single case studies, young children (below 5 years of age) who experienced a transient visual deprivation since birth due to congenital bilateral dense cataracts (BC), and who regained sight after surgery within the first two months of age. As controls we also tested 40 children (sighted controls, SC) with typical development, as well as two children who were treated (within the first two months of age) for congenital monocular cataracts (MC).

ABRs are widely used in the clinical practice to assess the functionality and the development of the subcortical auditory pathway and, most importantly, provide reliable data at the individual level. ABR latencies are known to provide sensitive information regarding the sequential development of subcortical structures. Four primary waves, occurring within the first 12ms after sound onset and characterizing the click-evoked ABRs (waves I, III, V and SN10), were extracted. Bootstrap-based statistics were separately performed at the single participant level as well as at the group level on latencies of ABR waves. The modified *t*-test of Crawford-t was implemented to compare single cases (BC and MC) to the normative control group (SC).

Results revealed delayed response latencies for both BC individuals compared with SC for waves III, V and SN10. Conversely results revealed that for all waves MC individuals did not differ to SC. These findings suggest that a delayed onset of patterned visual input delays the subcortical auditory system development. Results are in support of the presence of a visually dependent sensitive period in the human auditory system.