

Music-Based Sound Stimulation In Pediatric Acquired Brain Injury Rehabilitation: Preliminary Case Studies

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Abstract

Background:

Sensory input is used in rehabilitation to stimulate subcortical and cortical activity in patients with acquired brain injury (ABI). Recent studies have shown that patients in minimally conscious and persistent vegetative states show neural activity in auditory and prefrontal cortices, and auditory association areas in response to auditory stimulation (Baker 2001, Boly 2005, Bradt 2010). Research supports the connection between music and sensory, emotional, motor and cognitive functions in higher level patients with ABI (Boly 2004). While sound and music have been found to stimulate neural activity and function, protocols for programming with music-based sound stimulation in association with levels of coma recovery are not yet established for patients with acquired brain injury. Considering ongoing healthcare changes and challenges, and reduced lengths of inpatient stays for recovering ABI patients, there is a need for effective programs which lend themselves to an easily implemented continuum of care through inpatient hospitalization and the transition from inpatient to outpatient services, or as part of outpatient services. Increased research into the delivery of systematic, complex and meaningful sound stimulation is needed (Boly 2004).

Aims:

At Children's Specialized Hospital (CSH), progressive music-based sound stimulation protocols in association with Rancho Los Amigos/Levels of Coma Recovery have been developed for limited trial use in support of the healing processes of patients with ABI. These clinical trials are aimed at establishing the need for a full pilot study, an essential initial step toward a long term goal of incorporating sound/music-based protocols into the systematic stimulation programs designed for those recovering from ABI.

Method:

Limited clinical trials were conducted with select in and out-patients with ABI who listened to music from The Listening Program™ (TLP), and the Sound Health Series™ (SHS), following the newly developed CSH protocols. Subjects for these trials were initially recommended by their therapists, and were chosen based on medical stability, parental and rehab team involvement, review of recently administered quantitative and qualitative assessment measures, level of coma recovery, and anticipated duration of services. Upon selection, subjects underwent pre-listening testing as needed, based on assessment measures already administered, and were

assigned one of three protocols of stimulation. Team members and parents were trained in equipment use, the implementation of the specified protocol, and underlying theoretical rationale, and implemented programs according to protocols. Subjects listened to the TLP and SHS music as per designated programs (with music delivered through speakers, air conduction headphones, and/or air conduction/bone conduction headphones); in or out-patient therapies continued. Therapist/parent observations were recorded and compiled. Post-listening testing was conducted.

Results:

JP, a 9 year old girl diagnosed two weeks post Bickerstaff Brainstem Encephalitis (Rancho Level IV), began her 31-day listening protocol 12 days post admission. Two days into her program, parents and therapists began to observe changes including decreased nystagmus, dizziness, and vomiting and an increased tolerance to movement, improved visual fixation, improved sleep/wake cycle, and decreased agitation which resulted in a decrease in medication. Parents and therapists relate the changes in the rate of her recovery to her music-based sound stimulation program. KC is a 22 year old diagnosed with left hemiplegia post traumatic brain injury sustained in 2008 when hit by a car. She began her initial listening protocol in fall of 2010 and continues to listen, with ongoing specification of her protocol. Clinically observed areas of change include improved postural extension, spatial awareness and comfort with movement, midline orientation, and active left shoulder movement. Post-listening testing will be conducted, with findings to be discussed.

Conclusion:

Clinical findings suggest that listening with enhanced bone conduction may assist the recovery of patients with ABI and support neural activity associated with the vestibular system during various stages of the rehabilitation process. Further research, with a feasibility pilot study and randomized clinical trials for both inpatients and outpatients, is warranted. The authors can be reached at sheila.allen@PediatricTherapeutics.org and at dkelly@childrens-specialized.org