



Music and Disorders of Consciousness

An introduction to the use of music for diagnosis and treatment of people with traumatic brain injury

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MUSIC IN THE BRAIN and in the MIND



- Auditory Cortex (including the temporal lobe)
- **Prefrontal Cortex**; Anterior Cingulate
- Limbic system: Nucleus Accumbens, Amygdala, Hippocampus, Thalamus, hypothalamus
- Cerebellum
- Occipital lobe



Proposed psychoneurobiological response to music, an application of Damasio's Theory of Emotion, Feeling and Consciousness with Florence Nightingale's Theory of the Nursing and the Environment, adapted from Hannah Damasio, Damasio, 1994.





Early detection of consciousness in patients with acute severe traumatic brain injury

Brian L. Edlow, ^{1,2,3}, Camille Chatelle, ^{1,2,4}, Camille A. Spencer,² Catherine J. Chu,² Yelena G. Bodien, ^{1,2,5} Kathryn L. O'Connor,² Ronald E. Hirschberg, ^{5,6} Leigh R. Hochberg, ^{1,2,7} Joseph T. Giacino, ^{5,6} Eric S. Rosenthal^{2,#} and Ona Wu^{3,#}

Music responders (may) have better outcomes



Castro, M., Tillmann, B., Luaute, J., Corneyllie, A., Dailler, F., Andre-Obadia, N., Perrin, F. Boosting Cognition With Music in Patients with Disorders of Consciousness. Neurorehabilitation and Neural Repair 2015, 29 (8) 734-42

Music (may) boost cognition



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Repeated Exposure to Preferred Music is Associated with higher GCS and lower Quantitative EEG ($\delta + \theta/\alpha + \beta$)

15-30 min 3x/day

Table III. GCS score comparison of music group and control group before and after treatment (n = 40, $\bar{x} \pm s$).

Group	GCS value before treatment	GCS value after 1 month treatment		
Music group	5.55 ± 1.61	$11.30 \pm 2.66^{*,\Delta}$		
Control group	5.65 ± 1.46	$9.45 \pm 2.86^*$		

Table IV. $\delta + \theta/\alpha + \beta$ comparison of music group and control group before and after treatment (n = 40, $\bar{x} \pm s$).

Group	δ +θ/α+β before treatment	δ +θ/α+β after 1 month treatment			
Music group	9.38 ± 2.62	$6.30 \pm 2.12^{*,\Delta}$			
Control group	9.54 ± 3.06	$7.99 \pm 2.81^*$			

Sun, J., Chen, W. Music Therapy for Coma Patients: Preliminary Results. European Review for Medical and Pharmacological Sciences. 2015; 19: 1209-1218

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Group	GCS value before treatment	GCS value after 1 month treatment		
Music group	5.55 ± 1.61 5.65 ± 1.46	$11.30 \pm 2.66^{*,\Lambda}$ p=.041		
Control group	5.05 ± 1.40	9.45 ± 2.80		

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Pleasant Audio Stimulation on the Level of Consciousness of Coma Patients



Rahimi, F., Saleh, K., Seidi, J. The effect of pleasant audio stimulation on the level of consciousness of comatose patient: a randomized clinical trial. Acta Medica Meditterranea 2019: 35: 985-989

GCS by day Music (10 min/day preferred) Versus Control Condition

Meaningful auditory stimulation: familiar voice



Level of consciousness Group	Mean	SD	Mean difference	Р
Intervention	6.25	1.25	0.05	0.89
Control	6.30	1.03		
SD: Standard deviation				
Level of consciousness Group	Mean	SD	Mean difference	Р
Intervention	10.25	1.37	2.50	0.0001
Control	7.75	0.78		
SD: Standard deviation				

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Cognitive-Behavioral Recovery in Comatose Patients Following Auditory Sensory Stimulation

Alice E. Davis, Ana Gimenez

bstract: Nursing therapies promote recovery following A severe traumatic brain injury (TBI). However, the type and dose of treatment needed to stimulate functional plasticity have not been determined. In this guasi-experimental study, the effects of a structured auditory sensory stimulation program (SSP) were examined in 12 male patients, 17-55 years old, with severe TBI. SSP was initiated 3 days after injury and continued for 7 days. Recovery was measured by comparing baseline Glasgow Coma Scale (GCS), Sensory Stimulation Assessment Measure (SSAM), Ranchos Los Amigos Level of Cognitive Functioning Scale (RLA), and Disability Rating Scale (DRS) scores to ending scores between those who received SSP and those who did not. For the intervention group a positive recovery of function trajectory was found for mean GCS, and there was a greater improvement in GCS and RLA scores between baseline and discharge testing periods. DRS and SSAM scores at baseline and at discharge were significantly different. SSP did not affect hemodynamic or cerebral dynamic status. Early and repeated exposure to an SSP may promote arousal from severe TBI without adversely influencing cerebral dynamic status.

Disability Rating Scale Sensory Stimulation Assessment Measure Glasgow Coma Score & Ranchos Los Amigos +/-Eye/Motor after **music and family** No change in HR, BP, RR, and **DID NOT AFFECT ICP, MAP, CPP**

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Journal of Neurotrauma

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Mary Ann Lielest, Inc. Fullislers www.liebenpub.com/neu

Music Therapy Enhances Executive Functions and Prefrontal Structural Neuroplasticity after Traumatic Brain Injury: Evidence from a Randomized Controlled Trial

Ms. Sini-Tuuli Siponkoski 🖂, Dr. Noelia Martinez-Molina, Ms. Linda Kuusela, Ms. Sari Laitinen, Ms. Milla Holma, Ms. Mirja Ahlfors, Ms. Päivi Jordan-Kilkki, Ms. Katja Ala-Kauhaluoma, Dr. Susanna Melkas, Dr. Johanna Pekkola, Dr. Antoni Rodriguez-Fornells, Prof. Matti Laine, Prof. Aarne Ylinen, Dr. Pekka Rantanen, Dr. Sanna Koskinen, Dr. Jari Lipsanen, and Dr. Teppo Särkämö

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Mary Ann Lielest, Inc. Follislen www.licberspub.com/neu Baseline, 3 month and 6 month baseline: neuro-psych executive function (Frontal Assessment Battery) Motor Testing MRI (voxel based morphometry)

Randomized Cross over design (AB/BA) 3 months music therapy vs standard

↑ Grey matter volume (GMV) in the right inferior frontal gyrus **after music therapy intervention**

Correlates with \uparrow cognitive improvement (set shifting)

Music Interventions for Acquired Brain Injury: Cochrane Database Systematic Review







Overall Communicatio n 0.75 sd Naming 9.79 units Aachen Aphasia Test







Quality of Life 0.89 sd

Magee, WL, Clark, I, Tamplin, J., Bradt, J. Music interventions for acquired brain injury. Cochrane Database Syst Rev. 2017 Jan 20;1:CD006787.



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(Classical)Music as a therapeutic intervention on an inpatient Neuroscience Unit

BASELINE SCORES			MEAN CHANGE SCORE				
POMS	Usual Care (n=29)	Treatment Group (n=24)	р	POMS	Usual Care (n=29)	Treatment Group (n=24)	Ρ
Anxiety	3.5 (3.2)	7.5 (4.6)	.001	Anxiety	0.5 (2.5)	↓4 (3.0)	0.000
Depressio n	2.9 (2.9)	5.6 (3.8)	.005	Depressio n	0.52 (1.5)	↓2.8 (2.1)	0.000
Anger	2.5 (3.5)	3.0 (3.7)	.612	Anger	0.36 (2.0)	1.1 (2.3)	0.23
Fatigue	6.5 (4.8)	9.3 (4.6)	.036	Fatigue	0.81 (2.7)	↓2.8 (3.6)	0.03
Confusion	0.6 (2.8)	2.6 (3.3)	.023	Confusion	0.13 (2.2)	0.55 (1.7)	0.49
Vigor	4.6 (5.3)	2.8 (3.6)	.141	Vigor	0.52(2.7)	0.64 (2.8)	0.16
Total	11.4+/- 15	26.4 +/- (16)	.001	Total	1.26 (7.9)	↓12.4 (10)	0.000

Phipps, M., Carroll, D., Tsiantoulas, A. Music as a therapeutic intervention on an in patient neuroscience unit. Complement Ther Clin Pract. 2010 Aug;16(3):138-142. doi: 10.1016/j.ctcp.2009.12.001. Epub 2010 May 15.

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The effect of music therapy on mood and anxiety-depression: An observational study of institutionalized patients with traumatic brain injury.





Fig. 3. Change over time in anxiety and depression for S1, S5, S10, S15 and S20.

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Take home

- Perception/cognition of music may signal consciousness
- The environment matters: sensory deprivation versus meaningful cognitive stimulus
- Music as a therapeutic cognitive life line
- Personalized music as an equity-based treatment
- Neuro-rehab can start day 1

What's next

- Examining differences in patient preferred music
- Measuring effects of music listening on autonomic nervous system correlates
- Developing protocols to offer preferred music to patients and families in acute hospitalization
- Interested? Get in touch!
 <u>Rebecca.Menza@ucsf.edu</u>

References

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