PSYCH> Vol.2 No.8, November 2011

OPEN ACCESS

The Effects of Neurofeedback Training on Memory Performance in Elderly Subjects

PDF (Size:183KB) PP. 846-852 DOI: 10.4236/psych.2011.28129

Author(s)

Gaël Lecomte, Jacques Juhel

ABSTRACT

Neurofeedback or electroencephalographic operant conditioning (EEG-OC) is an EEG biofeedback technique used to train individuals to control or modify their cortical activity through learned self-regulation. Initially used for treating a variety of pathologies, neurofeedback has been employed more recently to improve the physical or cognitive performance of human beings. The purpose of this study is to assess the hypothesis of the effect of neurofeedback (the ‘awakened mind’ model) on the memory performance of subjects aged over 65. 30 participants were shared equally between 3 groups: an experimental group that underwent 4 neurofeedback training sessions; a non-neurofeedback group trained at relaxation; and a ‘waiting list’ control group. Results showed that the members of the Neurofeedback group learned to increase the spectral power of the alpha frequency range as well as the alpha/thêta ratio, and that compared with the members of the two other groups, neurofeedback training resulted in a more pronounced decrease, albeit without any relation to changes in EEG activity and the level of stress and anxiety of participants undergoing such training. Yet contrary to expectations, no improvement of memory performance (differed recall of words and learning of lists of words) was observed. These mixed results, which suggest a wide range of applications, underline the need for a more systematic assessment of the potential applications of NFB training in elderly humans in order to be better able to specify the effects of the retained protocol on cognitive performance.

KEYWORDS

aging, neurofeedback training, alpha stimulation, memory

Cite this paper

Lecomte, G. & Juhel, J. (2011). The Effects of Neurofeedback Training on Memory Performance in Elderly Subjects. *Psychology, 2,* 846-852. doi: 10.4236/psych.2011.28129.

References

[1] Albert, A.O., Andrasik, F., Moore, J.L., & Dunn, B.R. (1998). Thêta/ bêta training for attention, concentration and memory improvement in the geriatric population. Applied Psychophysiology and Biofeedback, 23, 109 (abstract).

[2] Andrealotti, C., Veratti, B.W., & Lachman, M.E. (2006). Age differences in the relationship between anxiety and recall. Aging & Mental Health, 10, 265-271. doi.org/10.1080/13607860500409773

[3] Angelakis, E., Lubar, J.F., & Stathopoulou, S. (2004). Electroencephalographic peak alpha frequency correlates of cognitive traits. Neuroscience Letters, 371, 60–63. doi.org/10.1016/j.neulet.2004.08.041

[4] Angelakis, E., Stathopoulou, S., Frymiare, J.L., Green, D.L., Lubar, J.F., & Kounios, J. (2007). EEG neurofeedback : A brief overview and an example of peak alpha frequency training for cognitive enhancement in the elderly. The Clinical Neuropsychologist, 2, 110-129. doi.org/10.1080/13854040600744839

[5] Ayers, C.R., Sorrell, J.T., Thorp, S.R., & Loebach Wetherell, J. (2007). Evidence-Based Psychological Treatments for Late-Life Anxiety. Psychology and Aging, 22, 8-17. doi.org/10.1037/0882-7974.22.1.8

- Open Special Issues
- Published Special Issues
- Special Issues Guideline

PSYCH Subscription

Most popular papers in PSYCH

About PSYCH News

Frequently Asked Questions

Recommend to Peers

Recommend to Library

Contact Us

[6] Basar, E. (2004). Memory and brain dynamics: Oscillations integrating attention, perception, and memory. CRC Press: Florida. doi.org/10.1201/9780203298732

[7] Basar, E., Basar-Eroglu, C., Karakas, S., & Schürmann, M. (2000). Brain oscillations in perception and memory. International Journal of Psychophysiology, 35, 95-124. doi.org/10.1016/S0167-8760(99)00047-1

[8] Basar, E., Basar-Eroglu, C., Karakas, S., & Schürmann, M. (2001). Gamma, alpha, delta and thêta oscillations govern cognitive processes. International Journal of Psychophysiology, 39, 241-248. doi.org/10.1016/S0167-8760(00)00145-8

[9] Bauer, R.H. (1976). Short-term memory: EEG alpha correlates and the effect of increased alpha. Behavioral Biology, 17, 425-433. doi.org/10.1016/S0091-6773(76)90793-8

[10] Bearden, T.S., Cassisi, J.E., & Pineda, M. (2003). Neurofeedback training for a patient with thalamic and cortical infarctions. Applied Psychophysiology and Biofeedback, 28, 241-253. doi.org/10.1023/A:1024689315563

[11] Brefczynski-Lewis, J.A., Lutz, A., Schaefer, H.S., Levinson, D.B., & Davidson, R.J. (2007). Neural correlates of attentional expertise in long-term meditation practitioners. Proceedings of the National Academy of Sciences, 104, 11483-11488. doi.org/10.1073/pnas.0606552104

[12] Budzynski, T.H. (1996). Brain brightening: Can neurofeedback improve cognitive process? Biofeedback, 24, 14-17.

[13] Butnik, S.M. (2005). Neurofeedback in adolescents and adults with attention deficit hyperactivity disorder. Journal of Clinical Psychology, 61, 621-625. doi.org/10.1002/jclp.20124

[14] Cade, M., & Coxhead, N. (1979). The Awakened Mind: Biofeedback and the Development of Higher States of Awareness. New York: Delacorte Press.

[15] DeLuca, A.K., Lenze, E.J., Mulsant, B.H., Butters, M.A., Karp, J.F., et al. (2005). Comorbid anxiety disorder in late life depression: association with memory decline over four years. International Journal of Geriatric Psychiatry, 20, 848 – 854. doi.org/10.1002/gps.1366

[16] Egner, T., & Gruzelier, J.H. (2004). EEG biofeedback of low bêta band components: Frequency-specific effects on variables of attention and event-related brain potentials. Clinical Neurophysiology, 115, 131- 139. doi.org/10.1016/S1388-2457(03)00353-5

[17] Evans, J.R., & Abarbanel, A. (1999). Introduction to Quantitative EEG and Neurofeedback. Orlando : Academic Press.

[18] Fernandez, T., Becerra, J., Roca, M., Espino, M., Bahlke, M.Y., Harmony, T., Fernandez-Bouza, A., Belmont, H., & Diaz-Comas, L., (2008). Neurofeedback in healthy elderly humans with electroencephalographic risk of cognitive impairment. Frontiers in Human Neuroscience. Conference Abstract. doi:10.3389/conf.Neuro.09.2009.01.173

[19] Glazer, H.I., & Laine, C.D. (2006). Pelvic floor muscle biofeedback in the treatment of urinary incontinence : A literature review. Applied Psychophysiology and Biofeedback, 31, 187-201. doi.org/10.1007/s10484-006-9010-x

[20] Gruzelier, J., Egner, T., & Vernon, D. (2006). Validating the efficacy of neurofeedback for optimising performance. Progress in Brain Research, 159, 421-431. doi.org/10.1016/S0079-6123(06)59027-2

[21] Hammond, D.C. (2005). Neurofeedback with anxiety and affective disorders. Child and Adolescent Psychiatric Clinics of North America, 14, 105-123. doi.org/10.1016/j.chc.2004.07.008

[22] Hammond, D.C. (2006). Neurofeedback treatment of depression and anxiety. Journal of Adult Development, 12, 131-138. doi.org/10.1007/s10804-005-7029-5

[23] Hanslmayer, S., Sauseng, P., Doppelmayr, M., Schabus, M., & Klimesch, W. (2005). Increasing individual upper alpha by neurofeedback improves cognitive performance in human subjects. Applied Psychophysiology and Biofeedback, 30, 1-10. doi.org/10.1007/s10484-005-2169-8

[24] Katsamanis Karavidas, M., Tsai, P.S., Yucha, C., McGrady, A., & Lehrer, P.M. (2006). Thermal biofeedback for primary Raynaud's phenomenon : A review of the literature. Applied Psychophysiology and Biofeedback, 31, 203-216.

[25] Klimesch, W. (1999). EEG alpha and thêta oscillations reflect cognitive and memory performance: A review and analysis. Brain Research, 29, 169-195. doi.org/10.1016/S0165-0173(98)00056-3

[26] Klimesch, W., Vogt, F., & Doppelmayer, M. (2000). Interindividual differences in alpha and thêta power reflect memory performance. Intelligence, 27, 347-362. doi.org/10.1016/S0160-2896(99)00027-6

[27] Klimesch, W., Schack, B., & Sauseng, P. (2005). The functional significance of thêta and upper alpha oscillations for working memory: A review. Experimental Psychology, 52, 99-108. doi.org/10.1027/1618-3169.52.2.99

[28] Lutz, A., Greischar, L.L., Rawlings, N.B., Ricard, M., & Davidson, R.J. (2004). Long-term meditators self-induce high-amplitude gamma synchrony during mental practice. Proceedings of the National Academy of Sciences, 101, 16369-16373. doi.org/10.1073/pnas.0407401101

[29] Markand, O.N. (1990). Alpha rythms. Journal of Clinical Neurophysiology, 7, 163-189. doi.org/10.1097/00004691-199004000-00003

[30] Maassen, G.H. (2004). The standard error in the Jacobson and Truax Reliable Change Index: The classical approach to the assessment of reliable change. Journal of the International Neuropsychological Society, 10, 888-893. doi.org/10.1017/S1355617704106097

[31] Masterpasqua, F., & Healey, K.N. (2003). Neurofeedback in psychological practice. Professional Psychology: Research and Practice, 34, 652-656. doi.org/10.1037/0735-7028.34.6.652

[32] Middaugh, S.J., & Pawlick, K. (2002). Biofeedback and behavioral treatment of persistent pain in the older adult: A review and a study. Applied Psychophysiology and Biofeedback, 27, 185-202.

[33] doi.org/10.1023/A:1016208128254

[34] Moore, N.C. (2000). A review of EEG biofeedback treatment of anxiety disorders. Clinical Electroencephalography, 31, 1-6.

[35] Nestoriuc, Y., & Martin, A. (2007). Efficacy of biofeedback for migraine : A meta-analysis. Pain, 128, 111 – 127. doi.org/10.1016/j.pain.2006.09.007

[36] Obrist, W.D. (1954). The electroencephalogram of normal aged adults. EEG Clinical Neurophysiology, 6, 235-244. doi.org/10.1016/0013-4694(54)90025-5

[37] Sauseng, P., & Klimesch, W. (2008). What does phase information of oscillatory brain activity tell us about cognitive processes. Neuroscience Biobehavioral Research, 32, 1001-1013. doi.org/10.1016/j.neubiorev.2008.03.014

[38] Scott, W.C., Kaiser, D., Othmer, S., & Sideroff, S.I. (2005). Effects of an EEG biofeedback protocol on a mixed substance abusing population. The American Journal of Drug and Alcohol Abuse, 31, 455-469. doi.org/10.1081/ADA-200056807

[39] Signoret, J.-L. (1996). B.E.C. 96 : Evaluation des troubles de mémoire et des désordres cognitifs associés. Paris : Ipsen.

[40] Sterman, M.B., & Egner, T. (2006). Foundation and practice of neurofeedback for the treatment of epilepsy. Applied Psychophysiology and Biofeedback, 31, 21-35. doi.org/10.1007/s10484-006-9002-x

[41] Vernon, D.J. (2005). Can neurofeedback training enhance performance? An evaluation of the evidence with implications for future research. Applied Psychophysiology and Biofeedback, 30, 347-364. doi.org/10.1007/s10484-005-8421-4

[42] Vernon, D., Egner, T., Cooper, N., Compton, T., Neilands, C., Sheri, A., & Gruzelier, J. (2003). The effect of training distinct neurofeedback protocols on aspects of cognitive performance. International Journal of Psychophysiology, 47, 75-85. doi.org/10.1016/S0167-8760(02)00091-0

[43] von Stein, A., Chiang, C., & Konig, P. (2000). Top-down processing mediated by interarea-synchronization. Proceedings of the National Academy of Sciences, 26, 14748-14753. doi.org/10.1073/pnas.97.26.14748