

Research Note

PHOTIC STIMULATION ENHANCEMENT OF PEAK ALPHA FREQUENCY AND HIGH/LOW ALPHA RATIO

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Fox and Raichle (1985) showed that photic stimulation at alpha and low beta frequencies increased cerebral blood flow 20 - 30% over baseline in the striate cortex. Numerous studies have documented the decrease in cerebral blood flow in elderly people (Alexander et al. 1994; Celsis, et al. 1997; Gur, et al. 1987; Heiss et al. 1992; Melamed, et al. 1980; Meyer et al. 1993; Mints, et al. 1987-88; Nagahama et al. 1997; Waldemar, 1995; Wszolek, et al. 1992; Wyper, 1993). Therefore a technique that increases blood flow may at least partially remediate certain cognitive deficits if applied regularly over a period of time. Moreover, certain parameters of the EEG tend to correlate with the cerebral perfusion at least in the neocortex (Fried, 1993). Thus, an area of hypoperfusion will tend to be mirrored by the increase of theta band (4 - 8 Hz) power in the EEG on the scalp surface in that location.

Can photic stimulation do more than just entrain at the stimulation frequency - and, if so, will the effect last? We decided to answer these questions by presenting subjects with constant 14 Hz photic stimulation from a device called the Biolight. Amber light emitting diodes (LEDs) in a goggle frame provided the flashing stimulus at the 14 Hz frequency. We chose 14 Hz as the stimulation frequency because of research and clinical results relating to the activity in the narrow bands of 14 Hz or 12 -15 Hz frequency. Based on Giannitrapani's findings on the positive correlations between 13 and 14 Hz single band power and I.Q. (1988), Serman's work with epileptics (1996), Lubar's research with ADHD (1979, 1995), Tansey's clinical results with 14 Hz (1982, 1990) and numerous anecdotal reports, e.g., Tachiki on depression and mild head injury (1998), and Weiler on a variety of disorders seen at his clinic in Germany (1997), and we concluded that the activity level in this frequency band is important for proper functioning of the brain.

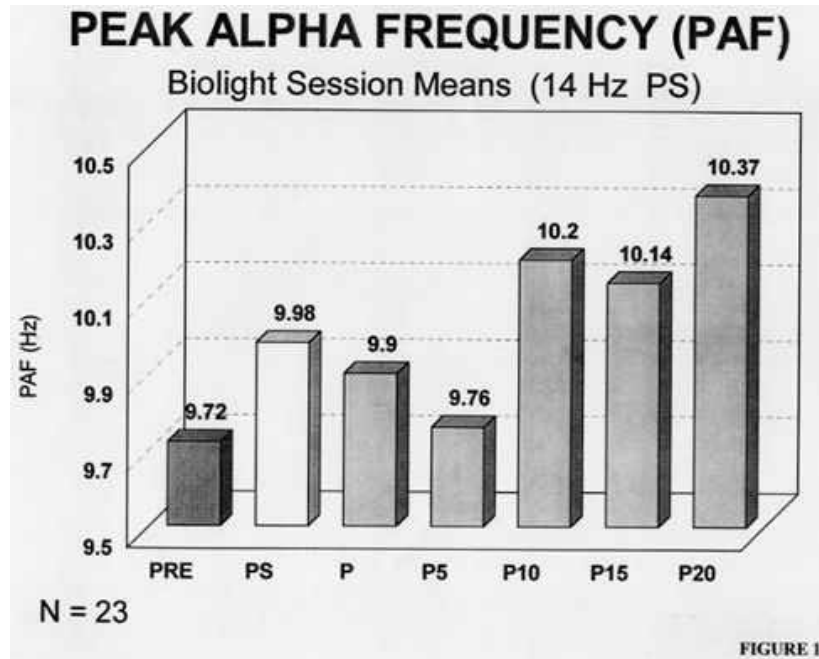
METHOD:

Subjects sat in a straightback chair with eyes closed during the 15 minute sessions and for the 20 minute post-stimulation periods. A pre-stimulation sample of resting, eyes closed EEG was taken from Cz. The EEG effects were monitored with a monopolar montage with linked ear reference and quantified with a Lexicor NRS-IIA and QEEG Neurolex software. Stimulation duration was 20 minutes, after which the subject's EEG was measured at intervals over the post-stimulation period out to 20

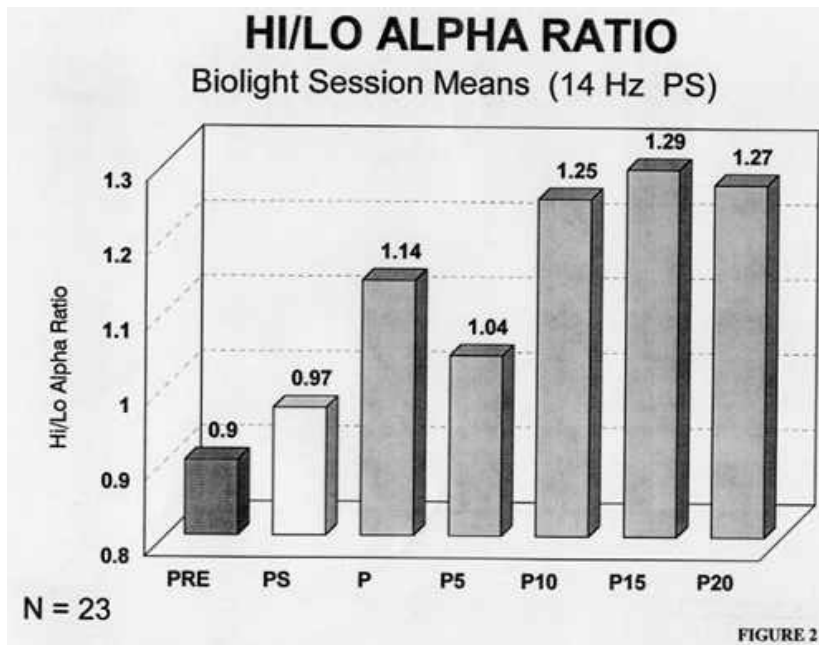
minutes. Subjects were later questioned informally as to their cognitive state just after the session and then about how they felt over a period of hours afterward.

RESULTS:

The effects on peak alpha frequency (PAF) (single band dominant alpha within the 8-13 Hz range) are shown in Figure 1.



This important variable was seen to increase in the subjects especially at approximately 15 - 20 minutes post-stimulation. The same was true for the high/low (A3/A1) alpha ratio ((1-13 Hz magnitude)/(7-9 Hz magnitude)) seen in Figure 2.



Both of these parameters have been shown to decrease with age in elderly individuals, especially those who report and/or show cognitive deficits (Roubicek, 1977; Schreiter-Gasser, et al, 1993). The delay in the production of enhanced PAF and High/Low alpha in the post-stimulation period supports subjects' verbal reports of an initial period of grogginess followed by a longer period of up to 3 - 4 hours of increased cognitive sharpness.

CONCLUSIONS:

1. Peak alpha frequency (PAF) is increased by 14 Hz photic stimulation.
2. High/Low alpha ratio (AVAI) is also increased by 14 Hz photic stimulation.
3. Both effects seem to occur after some 15 - 20 minutes post-stimulation.
5. This groggy period (10 - 15 minutes) is followed by a much longer period of 3 -4 hours of increased (over baseline) cognitive clarity.
4. The immediate post-stimulation subjective report is one of grogginess.
6. Since elderly individuals with cognitive deficits tend to show decreased PAFs and High/Low alpha ratios, they should benefit from this application.

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