Summary of published, peer-reviewed findings of Valkee (+ non-published findings)

1. Transcranial bright light and symptoms of jet lag: a randomized, placebo-controlled trial

Authors: Jurvelin H, Jokelainen J, Takala T.


Summary: This randomized, double-blind, placebo-controlled field study demonstrates that intermittent transcranial bright light exposure via ear canals alleviates jet lag symptoms. A total 55 healthy male subjects completed the study. Subjects were required to travel by plane from Finland (time zone: +2) to North America (time zone: -5 to -8) and stay a minimum of 1 week in their destination time zone. During the post-travel period, subjects were exposed to TBL or placebo treatment four times per day 12 min each at predetermined times. TBL or placebo exposures were administered every 2 h between 08:00 and 14:00 on travel day 0 and every 2h between 10:00 and 16:00 on post-travel days 1-6. The subjects were randomly assigned to the bright light treatment (N=25) group or the placebo (N=30) group. The study set-up for the placebo group was the same except that the bright light device was inactive. The effect of TBL on jet lag symptoms was measured after traveling eastwards. Symptoms of jet lag were measured by the Visual Analog Scale (VAS), the Karolinska Sleepiness Scale (KSS), and the Profile of Mood States (POMS). There were a significant reduction of overall jet lag symptoms, subjective sleepiness, fatigue, inertia and forgetfulness when comparing the TBL group (N=25) to the placebo group (N=30).

2. Effects of bright light treatment on psychomotor speed in athletes.

Authors: Tulppo MP, Jurvelin H, Roivainen E, Nissilä J, Hautala AJ, Kiviniemi AM, Kiviniemi VJ, Takala T.

Journal: Front Physiol. 2014;5:184

Summary: Recent fMRI findings suggested that transcranial bright light (TBL) might have physiological effects on brain functions in humans. The present study investigated if TBL treatment was able to improve psychomotor speed in professional ice hockey players in a randomized, placebo controlled design. A total of 22 pro hockey players (N=11 TBL group; N=11 placebo group; overall mean age ± SD: 25 ±5 yrs) received either 12 min of TBL or placebo every morning between 8 and noon for a period of 24 days. Psychomotor speed using a visual warning signal paradigm was tested before and after trial completion and data were analyzed for mean reaction time and mean motor time. Results showed that psychomotor speed, particular motor time, improved after 24 days of TBL treatment compared to placebo in a group of professional ice hockey players.

3. Transcranial bright light exposure via ear canals does not suppress nocturnal melatonin in healthy adults –a single-blind, sham-controlled, crossover trial.
Summary: The present study investigated the effects of transcranial bright light (TBL) on melatonin and cortisol secretion in healthy volunteers. 8 subjects (3F, 5M; mean age ± SD: 27± 5 yrs) were exposed to TBL during the night-time in a randomized, placebo controlled study design. Subjects reported to the laboratory in the evening (21 h) and were subjected to the same light/dark rhythm in both conditions (16L:8D; lights off at 23 h, lights on at 07 h) prior to the TBL or placebo exposure form 01:10-01:34 h. Saliva and urine samples for melatonin and cortisol were collected at noon, 18, 21, 22, 23, midnight, 01, 02, 03, 06, 07, 08, and 09h. Results clearly showed that neither melatonin or cortisol secretion nor the circadian rhythm of both endocrine markers was affected by the nocturnal exposure to TBL compared to placebo. This is in line with recent findings showing no melatonin suppression due to TBL exposure in the late evening (Bromundt et al., 2013).


Summary: Resting state functional brain activity provides a method to detect an existing neurobiological substrate for various disorders, including Seasonal Affective Disorder (SAD). For this purpose, a total of 90 subjects (45 SAD patients; 45 healthy controls) underwent an fMRI to determine functional connectivity of various brain areas in the resting state. A total of 47 resting state networks (RSNs) were investigated. The results showed a clear difference in functional connectivity between SAD patients and healthy, age, gender and ethnicity-matched controls in 11 out of the 47 tested RSNs. The SAD patients showed increased functional connectivity in attentional, visual, and sensomotoric RSNs. These findings support previous findings of psychomotor, attentional, and cognitive impairments seen in SAD patients. Interestingly enough, the same brain areas showed increased activity in healthy controls when exposed to TBL.

5. Stimulating brain tissue with bright light alters functional connectivity in brain at the resting state.


Summary: 50 healthy subjects were randomized into two groups (N=24 experimental group, N=26 control group) and either received 12 min of transcranial bright light therapy or sham, i.e. no light, while being subjected to Functional Magnetic Resonance Imaging (fMRI). The results of the fMRI showed a clear increase in neural connectivity of the visual cortex and senso-motoric areas of the
cortex under the transcranial light compared to the sham group. This suggests the brain to be light perceptive. In addition, these were the same brain areas that showed increased connectivity in the studies by Abou-Elseoud et al. (2011; 2014).


Summary: In this initial pilot study, 13 SAD patients were subjected to a daily dose of 8-12 min of transcranial bright light therapy for 3 weeks. Depressive and anxiety symptoms were measured using standard questionnaires such as the 17-item Hamilton Depression Rating Scale (HAMD-17), the Beck Depression Inventory-21 (BDI), and the 14-item Hamilton Anxiety Rating Scale (HAMA) prior to the 4 week trial and afterwards. When comparing the depression and anxiety score between week zero (baseline) and week 4 (study endpoint), results showed a significant reduction in reported symptoms on all three measures. The findings suggest that transcranial bright light therapy might be an alternative to the traditional light therapy and should be explored in more depth.


Authors: Abou-Elseoud A, Littow H, Remes J, Starck T, Nikkinen J, Nissilä J, Timonen M, Tervonen O, Kiviniemi V.

Journal: Front Syst Neurosci 2011;5(37):1-17

Summary: 90 subjects (45 SAD patients; 45 healthy controls) underwent a fMRI to determine functional connectivity of brain areas. Results from the fMRI scans were analyzed with different mathematical models. In addition to increased neuronal connectivity within the visual and sensorimotor cortex of the SAD patients, results showed that depending on the model order and analysis, the sensitivity towards disease detection can be significantly improved and resting state brain activity might prove to be a very useful tool to detect the underlying neurobiological substrates of diseases.

8. Encephalopsin (OPN3) protein abundance in the adult mouse brain.

Authors: Nissilä J, Mänttäri S, Särkioja T, Tuominen H, Takala T, Timonen M, Saarela S.


Summary: The presence of light-sensitive opsins in the retina has been shown successfully in various studies. The present study investigates the expression encephalopsin (OPN3) proteins in brain and peripheral tissue of mice. Tissue samples of 10 mice were analysed using Western blotting and immunohistochemistry. Results showed the OPN3 protein expression could be shown in almost all brain areas as well as in the peripheral tissue analyzed. This suggests that OPN3 might be involved in the mechanism of transcranial bright light.
9. Transcranial light affects plasma monoamine levels and expression of brain encephalopsin in the mouse

Authors: Flyktman A, Mänttäri S, Nissilä J, Timonen M, Saarela S.

Journal: The Journal of Experimental Biology, 2015; 218:1521-1526

Summary: This study is the first to show that transcranial light has a significant effect on OPN3 expression in the mouse brain. The study also shows that because of transcranial light, dopamine and noradrenaline concentrations increased significantly in the plasma and adrenalin gland. Thirty adult male mice were used in this study. Mice were blind. Transcranial light was given via ear canals for 4 weeks, five times a week. Based on these findings, it is reasonable to hypothesize that light-activated molecules can also be stimulated transcranially, not only through the retina.

10. Transcranial bright light treatment via ear canals in seasonal affective disorder: a randomized controlled double-blind dose-response study

Authors: Jurvelin H, Takala T, Nissilä J, Timonen M, Rüger M, Jokelainen J, Räsänen P

Journal: BMC Psychiatry, 2014; 14:288

Summary: In a 4 week trial, 89 patients suffering from SAD were randomly assigned to one of three treatment groups and received either a low (1 lumen), medium (4 lumen), or high dose (9 lumen) of daily bright light via ear canals for 12 minutes in the morning. Depressive symptoms and cognitive performance were assessed using standard psychiatric instruments such as the Beck Depression Inventory (BDI) and the Trial Making Test (TMT) at the beginning, during, and at the end of the trial. The results showed a significant, at least 50% reduction of depressive symptoms in 74-79% of the patients according to the BDI in all three treatment groups as well as a significant improvement of cognitive performance compared to baseline.

NON-published findings:

1. Transcranial light exposure acutely alleviate anxiety symptoms in moderately depressed participants – a randomized, sham-controlled, double-blind trial

Authors: Jurvelin H, Timonen M, Lammi J, Jokelainen J, Rueger M, Takala T


Summary: Twenty-eight participants with anxiety symptoms were randomly assigned to either 12 minutes of acute transcranial bright light (TBL) or placebo exposure (double-blind) under laboratory conditions. Anxiety symptoms (STAI-Y1) were measured 5 minutes prior and 10 minutes after the exposure. Mean anxiety symptoms decreased significantly only in the TBL group. There was a statistically significant difference in decrease of symptoms between the TBL and placebo groups, favoring the TBL group. This study shows that bright light alleviates mood symptoms acutely when it is administered transcranially.
2. The effect of bright light treatment via ear canals on attention as measure of neurophysiology – a randomized controlled study.

Authors: Jurvelin H, Nissilä J, Havo M, Timonen M, Jokelainen J, Kiviniemi V, Tulppo MP, Roivainen E, Takala T.

Acta Physiol 2012, 206 suppl 691:106

Summary: Forty one university students were randomly divided into transcranial bright light (TBL) and control groups. TBL group received a daily 12-minute dose of Valkee for three weeks. The control group received no treatment. Attention performance (Cognispeed) was measured at the start and end of the study. There was a statistically significant difference found in number of subjects whose attention performance improved between the TBL and control group, favoring the TBL group.

3. The abundance and distribution of melanopsin (OPN4) protein in the human brain

Authors: Nissila J, Mänttäri S, Tuominen H, Särkioja T, Takala T, Timonen M, Saarela S.

Poster presentation in the 20th European Congress of Psychiatry (EPA), Prague, Czech Republic, 3-6 March, 2012.

Summary: The light sensitive retinal melanopsin (OPN4) has been shown to contribute to the circadian pace making effects of light. The study conducted with human cadavers showed that OPN4 is also expressed in the human brain, which suggests that the brain can itself respond to light exposure.