

Experimental

THE PHYSIOLOGICAL CORRELATES OF BODY PIERCING BY A YOGA MASTER: *CONTROL OF PAIN AND BLEEDING*

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ABSTRACT

A Yogi master was psychophysiologicaly monitored while he pierced his neck and tongue with skewers to demonstrate control of pain and bleeding. Measurements included respiration rate (RR), heart rate (HR), diaphragmatic and thoracic breathing, electrodermal activity (EDA) and electroencephalography (EEG) from Cz and Fz. The Yogi reported no pain during piercing and no bleeding was observed. In general he had elevated HR and low unresponsive EDA throughout the session. His respiration rate averaged 7 brpm during the slow breathing meditation prior to and following the piercing but elevated to approximately 25 breaths per minute during piercing. His EEG showed predominate alpha of 10 Hz during meditation. Alpha, sensory motor rhythm (SMR), and beta elevated at Cz during piercing with no change in delta or theta. Alpha and beta elevated at Fz during piercing with no change in SMR, delta or theta. While he stayed in alpha during the piercing, there was a broader range of alpha activation ranging from 10 to 14 Hz. This demonstration suggests a finding of conscious self-regulation, as opposed to disassociation, for controlling attention and responsiveness to painful stimuli. It could be hypothesized that clients with chronic pain could be taught how to control pain using the mind/body in a similar manner.

KEYWORDS: Yoga, pain, electroencephalography, respiration, voluntary control

INTRODUCTION

Many yogi adepts often learn to regulate pain and bleeding. Overcoming their own fears, they obtain mastery over mind and body, and demonstrate control of consciousness. This mastery indicates the ability to consciously focus while detaching from external distractions or internal sensations and desires, while inhibiting “normal” physiological responses.

What is the psychophysiology of pain? Researchers explored EEG responses to pain.¹⁻³ Chen summarized the research in EEG and pain by saying “. . . the sporadic EEG reports are not sufficient to establish EEG changes with cerebral process in human pain.”³ Chen reported that studies using healthy subjects experiencing tonic pain have relatively consistent findings of: a) increase in low frequency delta power, b) rare change in theta power, c) decrease in alpha power and d) increase in high frequency beta power.³ He recommends using EEG coherence and spatial patterning as better tools for studying EEG and pain. Chen’s review suggests that pain must account for physics, physiology and psychology components while Williams also included psychosocial components.^{3,4} Davis’ work suggested that at least four regions of the brain are responsible for pain and a complex neural network must be considered when attempting to distinguish different aspects of pain.⁵

How is it that a subject experiences stimuli that should be felt as pain, and then reports no pain? Hypnosis has long been reported as being able to reduce or eliminate a client’s subjective rating of pain.^{6,7} The subjective states of being hypnotized include: feeling of mental relaxation, absorbed and sustained focus on attention on one or few targets, relative absence of judging, monitoring and censoring, suspension of usual orientation toward time, local and sense of self and ones’ own responses are experienced as automatic.⁶ Autonomic correlates of hypnosis include less EDA response to pain, an increase in delta EEG activity in occipital regions.^{8,9} The role of distraction as the reason for lower pain ratings during hypnotic procedures has received less support than the narrowing of attention that appears mainly focused in the fronto-temporal cortex.⁶ However, the type of hypnosis and hypnotizability of the client results in different regions of the brain responding.^{8,10} Ray and DePascalis using evoked potential methodology further confirmed that the effect of hypnosis on pain

reduction occurred less in the early process associated with the sensory experience.⁷ It has more influence on the later components of the EEG that are associated with cognitive and affective processes.

Operant conditioning differentially affects the reported pain and EEG responses of chronic pain patients and healthy controls.¹¹ This suggests that susceptibility may play a role in chronic pain. Moreover, motivation also appears to play a role in pain tolerance. In voluntary piercing, Spafford, von Baeyer and Hicks reported that one's motivation to obtain body piercing along with an accurate expectation of what pain was to occur during the process moderated the pain tolerance of children.¹²

Pain may also be inhibited by the application of pain to another area of the body. Reinert, Treede and Bromm suggested that inhibition of pain through the application of pain is more likely due to activation of specific inhibitory pain control system rather than release of endogenous opiates.¹³

A possible explanation for yogis not reporting pain may be that they learned during meditation practice either not to attend to the painful stimuli or to inhibit their physiological responses. Kjaer, Bertelsen, Piccini, Brooks, Alving & Lou showed that for trained individuals the meditative state does differ from a rest period in an increase in dopamine, decreases in respiration rate, heart rate, heightened EDA, and a concomitant increase in EEG theta activity.¹⁴ They summarized their biochemical findings with other meditation EEG research which found theta is the characteristic feature of meditation. In addition, there were increases in EEG alpha power and higher coherence of the alpha and theta frequencies.^{15,16}

Previous studies of adepts who inserted skewers through their bodies show very limited change in autonomic reactivity and an increase in occipital alpha electroencephalograph (EEG) activity.¹⁷⁻¹⁹ Studying adepts who demonstrate voluntary pain control may offer clinical intervention strategies to be applied with chronic pain patients.

This study explored the psychophysiological correlates of voluntary control of pain and bleeding during neck and tongue piercing with non-sterile metal skewers. The study was conducted as part of a lecture demonstration on control

of pain and bleeding in front of a public audience of approximately 100 people at the annual meeting of the Association for Applied Psychophysiology and Biofeedback in Las Vegas, March 2002.

METHOD

SUBJECT

The subject was a 62 year-old male Japanese Yogi with 36 years of experience practicing various forms of yoga. He is founder and Chief Executive Director of his own school of yoga and Institute for Research of Subconscious Psychology in Fukuoka and Tokyo, Japan. The Indian Yoga Culture Federation bestowed the title of Yoga Samrat upon him in 1983 after he demonstrated that he had reached the highest level of proficiency in his discipline. Previously, he was also a subject in studies that explored the psychophysiology of meditation and slow breathing. During those studies, his breathing pattern during meditation was about 6 breaths per minute with a significantly increased phase-locked respiratory sinus arrhythmia.²⁰ In addition, he demonstrated that he easily could breathe 2 breaths per minute (brpm) across a 20-minute trial.²¹

EQUIPMENT

Three 3 mm diameter non-sterilized skewers of 45 cm in length were used for insertions. The first was inserted into the skin in the neck followed by two skewers inserted through the tongue.

The physiological data were collected with a ProComp+ with Biograph 2.0 software (Thought Technology, Ltd.). Abdominal and thoracic respiration patterns were recorded with strain gauges placed at the level of the umbilicus (abdominal) and just below the axilla (thoracic). Monopolar EEGs were recorded with silver/silver chloride electrodes from Cz and Fz referenced to linked ears with the ground on the left mastoid. The electrode impedances were less than 5K ohm. The high pass and low pass frequencies were .05 Hz and 64 Hz with the sampling rate of 256. Artifacts were rejected by visual

inspection of each 1 sec segment of data. The data were analyzed in traditional band widths of delta (2-4 Hz), theta (4-8 Hz), alpha (8-13 Hz), SMR (13-15 Hz) and beta (15-20 Hz).

One hertz bins were used in graphing the power spectral analysis. Blood volume pulse (BVP) was recorded with a photoplethysmograph from the distal phalange of the left middle finger and heart rate (HR) was derived from the BVP signal. Electrodermal activity (EDA) was recorded from the left palmar surface.

PHYSIOLOGICAL DATA ANALYSIS

Heart rate data were computer derived from the BVP signal from artifact free epochs. Respiration rate (RR) was counted by hand from artifact free epochs and linked to the time markers of the Biograph recording.

PROCEDURES

After the sensors were attached, the Yogi sat in a lotus position and the physiological signals were projected with an LCD projector behind and to the side of him as shown in Figure 1. The Yogi controlled the timing of the sequence of events while two investigators recorded the specific time of each event. Recordings began when the Yogi began his meditation on stage and continued until he finished the demonstration. The sequence of events consisted of: pre-baseline eyes closed meditation, self-insertion of the skewer through the neck, a short rest (rest1), sequentially insertion of two skewers through his tongue, a short rest period (rest2), sequentially removal of the skewer from his neck and then from his tongue, post baseline eyes closed mediation. The time periods for each event ranged from 10 seconds to 1 minute.

RESULTS

The Yogi successfully pierced his neck and tongue as is shown in Figure 2 and reported that he experienced no pain. His eyes were closed for the majority of the piercing. After he removed the skewers, two members of the audience



Figure 1. Subject sitting on stage in front of about 100 professionals while beginning the study with his physiological signals projected to the side and behind him.



Figure 2. Subject with skewers through his neck and tongue.

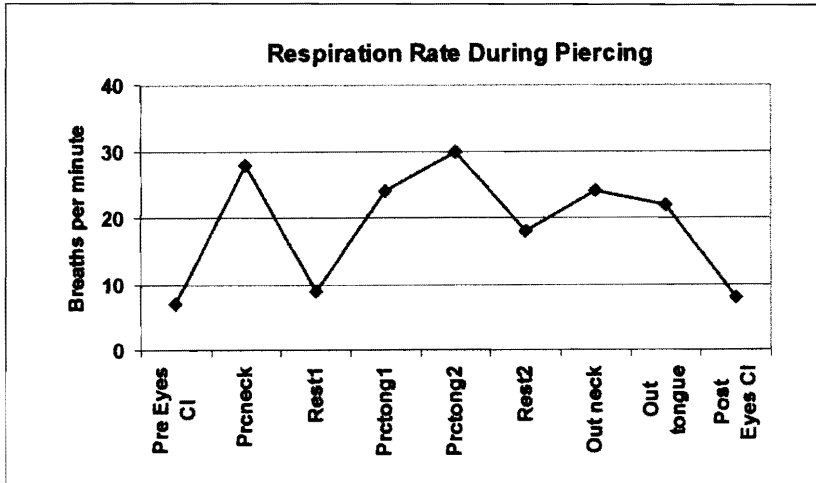


Figure 3. Respiration rate across conditions.

confirmed that there was no bleeding. A two day follow-up, showed neither post-piercing inflammation nor infection.

PHYSIOLOGICAL DATA

The Yogi's RR was approximately 7 brpm during his meditation and was about 25 brpm during piercing (Figure 3). During the entire procedure his HR remained high: ranging from approximately 106 brpm in meditation to around 115 brpm during piercing (Figure 4). His EDA remained low throughout and showed very little response. There was a pattern of higher EDA during rest periods and post-demonstration meditation than during piercing (Figure 5).

The EEG at Cz showed increases in alpha, beta and sensory motor rhythm (SMR) with no change in theta or delta (Figure 6). The EEG at Fz showed increases in beta but little change in any other bandwidth (Figure 7). During eyes closed baseline there was an increase in the alpha band as shown in the power spectral display (Figure 8), while during piercing the Cz alpha increased and broadened as is shown in the power spectral displays (Figure 9).

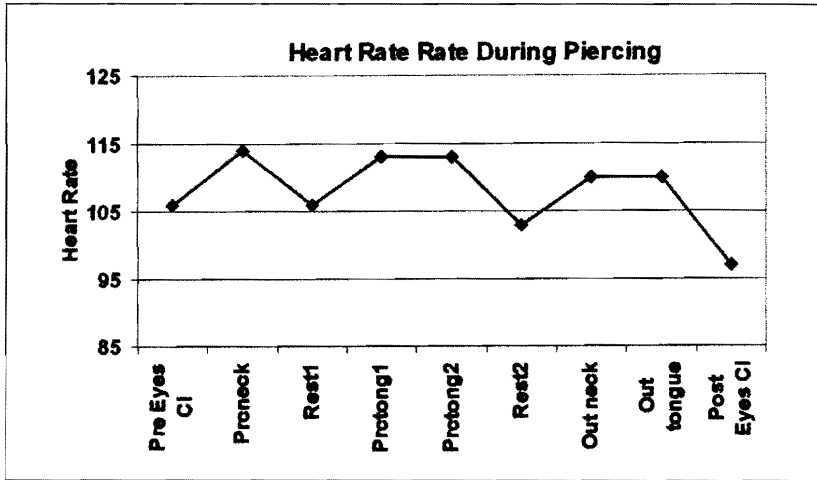


Figure 4. Heart rate across conditions.

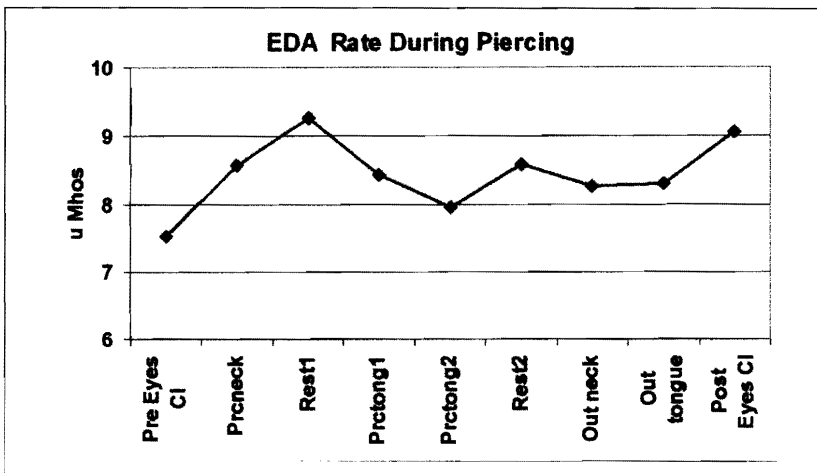


Figure 5. Electrodermal activity across conditions.

SUBJECTIVE EXPERIENCE

The Yogi (M.K.) reported that he used a meditative focused strategy in order not to experience pain or bleeding. From his perspective, pain sensations are

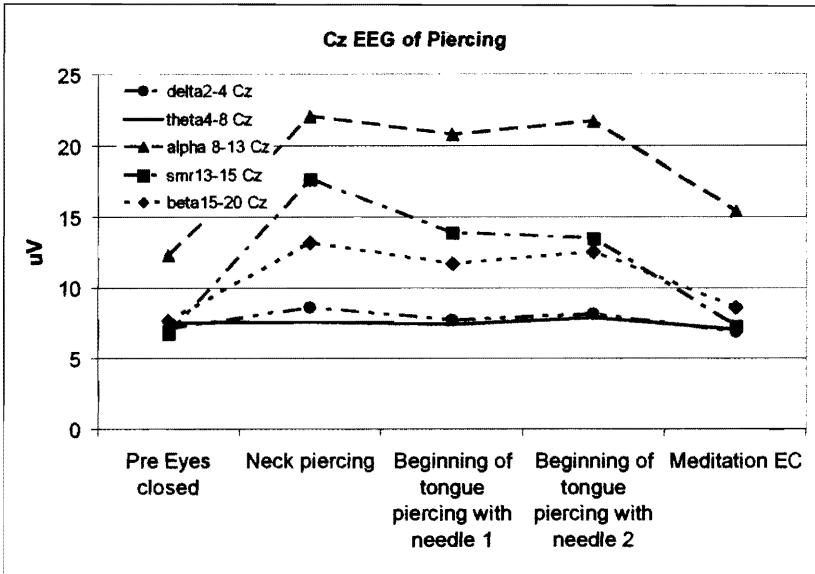


Figure 6. EEG activity across conditions for Cz.

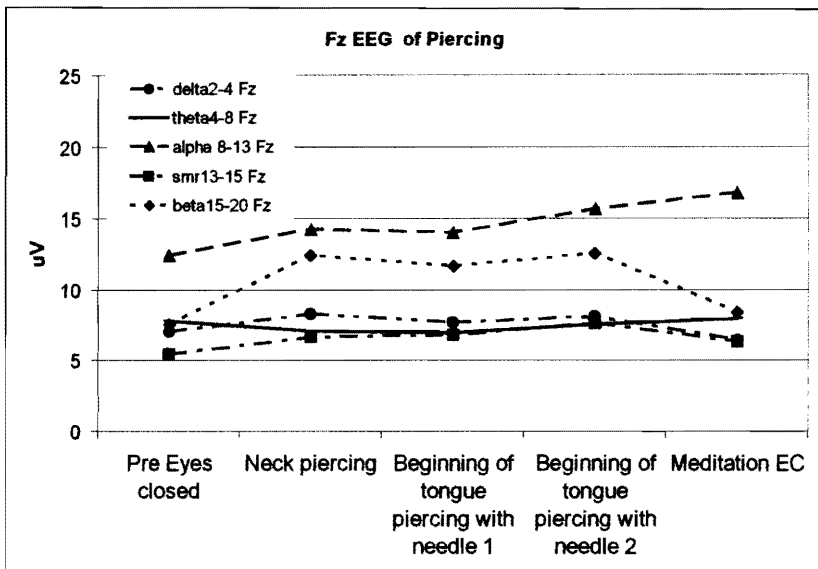


Figure 7. EEG activity across conditions for Fz.



Figure 8. EEG power spectrum during eyes closed pre-baseline when he was breathing about 7 brpm.

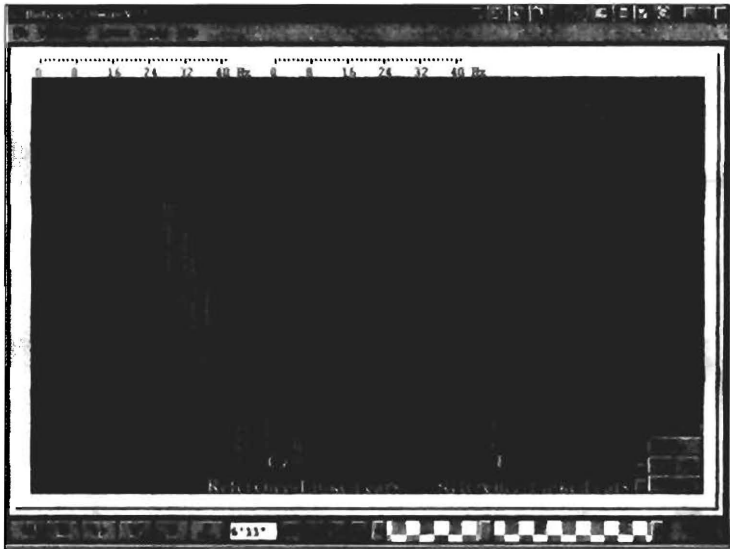


Figure 9. EEG power spectrum during neck piercing.

a normal defensive reaction within one's body and can be inhibited by controlling one's autonomic nervous system. When inserting the skewer, he reported piercing *only while slowly exhaling* and not moving while inhaling. The first skewer was pierced within two cycles of breathing. After controlling his breathing, the same procedure was carried out for the second and third skewers. No pain was felt but the sense of the skewer entering the body could be perceived. It was as if this sense was spreading out to the whole tongue. After the piercing was completed, he meditated for a couple of minutes and then invited the audience to take photos. Although he was bathed in the light of camera flashes, he reported no pain and no bleeding was observed. Then, *while exhaling*, he slowly pulled out the skewers from the tongue and throat. He reported that he could only sense the physical coldness of the steel.

He reported that the process of pain and bleeding control consisted of focused concentration while meditating to regulate breathing. He experienced the skewer, one's spirit, and one's body as a unified "one." At the same time, he focused his consciousness and will on the concept "it is not painful" rather than focus on "piercing." Furthermore, he stated it was necessary not to be hostile against foreign objects or skewers that enter his body. It meant releasing emotions such as anxiety and fear as soon as possible and being prepared for the skewer to enter the body. He prayed and uttered to the skewer, "You are gently entering my body." He believed that by the communication between the skewer and the receiving body, the unification of ego, mind and soul is completed, which allowed the piercing procedure without pain.

DISCUSSION

The Yogi was able to pierce his neck and tongue with skewers while reporting no pain and no post-trial bleeding was observed. He did not show the typical EEG responses to pain as reported in the literature (no change in delta EEG and his alpha EEG increased rather than decreased although his beta EEG did increase).³ Some of his responses are similar to that of hypnotized individuals (no change in EDA activity, absorbed, focused attention, and elevated beta) but he did not report suspension of time or sense of self or feelings of automatic responses nor did his EEG decrease in delta or beta. The increase in alpha/low beta further supported that he was conscious and aware during the piercing and this state was different from his typical meditative state.

The Yogi reported that for him the skewer, his spirit and body are one—with much effort, strong emotional consciousness, will power and prayer of “becoming one with the skewer”—to eliminate pain. He overrode the thoughts and emotional associations of “it is painful” or “it will induce bleeding.” He suggested that no bleeding occurs because he relaxed the tissue and tongue so much during the piercing that most likely the skewer wove around the small blood vessels as opposed to piercing them. From the Yogi’s perspective, this belief system is transmitted to the autonomic nervous system that controls the body’s defense system. Through breathing, meditation and mental concentration, he communicated with his sensory and autonomic nerves to release the sense of pain. His thought pattern fits the narrowing of attention and absorption reported and lack of EDA activity reported in hypnosis.⁶

His heart rate was consistently higher (approximately 115 bpm) than during previous meditation research study when it was approximately 75 bpm.²⁰ The high heart rate may have been due to jet lag, performing in front of a critical audience or a “performing” response. He did show higher heart rate and respiratory rate during piercing than baseline conditions. Interestingly, his respiration rate during his eyes closed pre- and post-baseline meditation (approximately 7–8 brpm) was similar to the finding reported in his previous meditation study.²⁰ This breathing rate during meditation is significantly lower than his normal resting baseline of about 18 brpm and similar to what research has described for experienced meditators.^{15,20} The faster breathing rate, between 24 and 30 brpm, during the piercing and removal of the skewers, is about a 30 percent increase over his habitual breathing rate as observed from earlier studies. This relative increase in breathing rate is unlike the meditative state and appears similar to the changes observed when people are attending and concentrating while working at the computer as compared to sitting quietly.¹⁵ Based on our previous work of performance at the workstation, individuals’ respiration rate increases between 20 to 30 percent when individuals focus their attention and perform computer tasks.²² Hence, the subject’s increase in breathing during piercing may represent the focusing of attention.

If one does not need to pay attention, it may be possible that the breathing rate may not increase. In a previous study where another experimenter pierced a subject through the arm, there was no increase in respiration for the subject being pierced.²³ We interpret this difference that the other subject could just

passively focus and dissociate while our subject had to attend and be in control to accomplish the task of piercing.

In general the EEG power spectral displays suggested an ability to quiet the mind in meditation both pre- and post-piercing with a predominance of low alpha, and little movement artifact. The increase in alpha and beta at Cz and Fz during actual piercing is interesting. During piercing one is able to see movement artifacts in the display but also a tendency for the alpha activity to broaden to include high alpha and low beta. His elevated frontal beta suggests that the Yogi was not in an altered state of consciousness but was fully aware and processing information, which may have been necessary for the actual piercing. Yet, there continued to be an increase in central alpha, and SMR which suggests relaxation or absorbed attention. This increase in alpha has been previously found by Anand, Chhina, and Singh in their study of two yogis who showed persistent alpha activity both before and during the periods in which their hands were immersed in cold water.²⁴

We propose that combining yoga practices which increase diaphragmatic breathing while maintaining alpha EEG would teach clients somato-cognitive techniques to refocus their attention during painful stimuli. Using the slow breathing as the over-learned response would facilitate the recovery and regeneration following the painful situation. It would also act as a structured desensitization to painful stimuli and might be a complementary clinical approach for voluntary pain control. To develop mastery and be able to apply it under situations of stress takes training and over-learning. Yogis over-learn these skills with many years of meditation. With mastery, patients may learn to abort the escalating cycle of pain, worry, exhaustion, more pain and hopelessness by shifting their attention and psychophysiological responses.

The value of performing a piercing experience is that it may be used as a demonstration which can shift the beliefs of the observers. The performer experiences, and more importantly knows, that he has control over the mind/body and that this control can be mastered. The observers see a phenomenon that they thought was not possible. Hence, the demonstration becomes a mechanism to shift the acceptable familial and cultural beliefs that injury should cause pain, bleeding and infection and that we have little control over such an experience. This demonstration encourages observers to suspend and question their beliefs of reality.

It may offer hope to people who have chronic disorders and pain since, it suggests that there are self-regulation strategies that could be mastered to reduce or control pain stimuli. Similar observations have been reported by Kabat-Zinn in clinical treatment studies in which patients with chronic conditions improve significantly when they practice mindfulness meditation and yoga.²⁵

In summary, the demonstration illustrates that our normal preconceived notions that piercing of the body must hurt, induce bleeding and possibly infections may be incomplete. In fact, it may be possible to develop control and thereby experience a different reality, a possible reality that could be applied as a clinical tool to reduce pain and suffering.

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REFERENCES & NOTES

1. P. F. Chang, L. Arendt-Nielsen, T. Graven-Nielsen & A. C. N. Chen, Psychophysical and EEG Responses to Repeated Experimental Muscle Pain in Humans: Pain Intensity Encodes EEG Activity, *Brain Research Bulletin* **59,6** (2003), pp. 533-543.
2. P. F. Chang, L. Arendt-Nielsen & A. C. N. Chen, Dynamic Changes and Spatial Correlation of EEG Activities During Cold Pressor Test in Man, *Brain Research Bulletin* **57** (2002), pp. 667-675.
3. A. C. N. Chen, New Perspectives in EEG/MEG Brain Mapping and PET/MRI Neuroimaging of Human Pain, *International Journal of Psychophysiology* **42** (2001), pp. 147-159.
4. D. A. Williams, Acute Pain (with Special Emphasis on Painful Medical Procedures). In *Psychosocial Factors in Pain: Critical Perspectives* (R. J. Gatchel & D. C. Turk, Eds., Guilford Press, New York, NY, 1999), pp. 151-163.
5. K. D. Davis, Studies of Pain Using Functional Magnetic Resonance Imaging. In *Pain Imaging: Progress in Pain Research and Management* (K. Casey & M. Bushnell, Eds., IASP Press, Seattle, WA, 2000), pp. 195-210.
6. P. Rainville & D. D. Price, Hypnosis Phenomenology and the Neurobiology of Consciousness, *International Journal of Clinical and Experimental Hypnosis* **51** (2003), pp. 105-129.
7. W. J. Ray & V. DePascalis, Temporal Aspects of Hypnotic Processes, *International Journal of Clinical and Experimental Hypnosis* **51** (2003), pp. 147-165.
8. V. DePascalis, M. R. Maurano & A. Bellusci, Pain Perception, Somatosensory Event-related Potentials and Skin Conductance Responses to Painful Stimuli in High, Mid, and Low Hypnotizable Subjects: Effects of Differential Pain Reduction Strategies, *Pain* **83** (1999), pp. 499-508.

9. V. DePascalis & M. Perrone, EEG Asymmetry Heart Rate During Experience of Hypnotic Analgesia in High, Low Hypnotizable, *International Journal Psychophysiology* **21** (1996), pp. 163-175.
10. W. Ray, A. Keil, A. Mikuteir, W. Bongartz & T. Elbert, High Resolution EEG Indicators of Pain Responses in Relation to Hypnotic Susceptibility and Suggestion, *Biological Psychology* **60** (2002), pp. 17-36.
11. H. Flor, B. Knost & N. Birbaumer, The Role of Operant Conditioning in Chronic Pain: An Experimental Investigation, *Pain* **95** (2002), pp. 111-118.
12. P. A. Spafford, C. L. von Baeyer & C. L. Hicks, Expected and Reported Pain in Children Undergoing Ear Piercing: A Randomized Trial of Preparation by Parents, *Behaviour Research & Therapy* **40,3** (2002), pp. 253-266.
13. A. Reinert, R. Treede & B. Bromm, The Pain Inhibiting Pain Effect: An Electrophysiological Study in Humans, *Brain Research* **862** (2000), pp. 103-110.
14. T. W. Kjaer, C. Bertelsen, P. Piccini, D. Brooks, J. Alving & H. C. Lou, Increased Dopamine Tone During Meditation-induced Change of Consciousness, *Cognitive Brain Research* **13** (2002), pp. 255-259.
15. F. Travis, Autonomic and EEG Patterns Distinguish Transcending from Other Experiences During Transcendental Meditation Practice, *International Journal of Psychophysiology* **42** (2001), pp. 1-9.
16. F. Travis, T. Olson, T. Egenes & H. K. Gupta, Physiological Patterns During Practice of the Transcendental Meditation Technique Compared with Patterns While Reading Sanskrit and a Modern Language, *International Journal of Neuroscience* **109** (2001), pp. 71-80.
17. K. R. Pelletier & E. Peper, The Chutzpah Factor in Altered States of Consciousness, *Journal of Humanistic Psychology* **17,1** (1977), pp. 63-73.
18. K. R. Pelletier & E. Peper, Developing a Biofeedback Model as a Means for Pain Control, *International Journal of Clinical and Experimental Hypnosis* **24,4** (1977), pp. 361-371.
19. E. Green & A. Green, *Beyond Biofeedback* (Delacorte Press, New York, NY, 1977).
20. P. Arambula, E. Peper, M. Kawakami & K. H. Gibney, The Physiological Correlates of Kundalini Yoga Meditation: A Study of a Yoga Master, *Applied Psychophysiology and Biofeedback* **26,2** (2001), pp. 147-153.
21. E. Peper, M. Kawakami, M. Sata, Y. Franklin, K. H. Gibney & V. S. Wilson, Physiological Correlates of Very Slow Yogic Breathing, *Proceedings of the 33rd Annual Meeting of the Association for Applied Psychophysiology and Biofeedback* (AAPB, Wheat Ridge, CO, 2002), pp. 167-170.
22. M. Huber, E. Peper & K. H. Gibney, Reducing Computer Mousing Symptoms: A Controlled Biofeedback Outcome Study, *Proceedings of the 33rd Annual Meeting of the Association for Applied Psychophysiology and Biofeedback* (AAPB, Wheat Ridge, CO, 2002), pp. 19-22.
23. E. Peper & M. Kawakami, Preliminary Observations of Voluntary Pain and Bleeding Control. In *The Theses of Mitumasa Kawakami I: The Subliminal Psychology* (M. Kawakami, Fukuoka, Japan, 2001), pp. 476-491 (ISBN4-901643-00-2).
24. B. K. Anand, G. S. Chhina & B. Singh, Some Aspects of Electroencephalographic Studies in Yoga, *Electroencephalography and Clinical Neurophysiology* **13** (1961), pp. 452-456.
25. J. Kabat-Zinn, *Full Catastrophe Living* (Delacorte Press, New York, NY, 1990).

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