EFFECTIVENESS OF SELF-HYPNOSIS ON THE RELIEF OF EXPERIMENTAL DENTAL PAIN: A Randomized Trial

THOMAS GERHARD WOLF, DOMINIK WOLF, DAGNA BELOW, BERND D’HOEDT, BRITA WILLERSHAUSEN, AND MONIKA DAUBLÄNDER

UNIVERSITY MEDICAL CENTER OF THE JOHANNES GUTENBERG UNIVERSITY MAINZ, GERMANY

Abstract: This randomized, controlled clinical trial evaluates the effectiveness of self-hypnosis on pain perception. Pain thresholds were measured, and a targeted, standardized pain stimulus was created by electrical stimulation of the dental pulp of an upper anterior tooth. Pain stimulus was rated by a visual analogue scale (VAS). The pain threshold under self-hypnosis was higher (57.1 ± 17.1) than without hypnotic intervention (39.5 ± 11.8) (p < .001). Pain was rated lower on the VAS with self-hypnosis (4.0 ± 3.8) than in the basal condition without self-hypnosis (7.1 ± 2.7) (p < .001). Self-hypnosis can be used in clinical practice as an adjunct to the gold standard of local anesthesia for pain management, as well as an alternative in individual cases.

The treatment of patients in the dental setting is influenced by many different factors. In addition to dental treatment options, including techniques, materials, and instruments, the psychological skills of the dentist and his or her medical staff are very important, particularly in the management of fear, stress, and pain (Carr & Goudas, 1999). Patients with bad experiences during previous dental treatments require special care. Despite the steady progress of the development of local anesthetics—proven and used worldwide—there is still a need for research of pain-management alternatives. Local anesthetics still retain the undisputed best capabilities for successful and reliable pain relief. Nevertheless, their application also entails risks and side effects. The most frequently observed complications such as dizziness, restlessness, tremor, nausea, and palpitations are often only temporary and for the most part require no further treatment. But needle breakage, bleeding,
hematoma, infection, necrosis, nerve lesions, and allergies to additives and preservatives are also possible, and these are only a few examples of the potential negative events that can occur during dental treatment. Therefore, risk factors must be kept to an absolute minimum.

For the relief of pain, alternative methods must be safe and effective. Desjardins (2000) described the use of hypnosis in a clinical setting as challenge of a medical and psychological nature related to anxiety and pain. It was determined that there is a reduction of the intensity of pain under hypnosis (Desjardins, 2000). A broad variety of hypnotic methods exists. Studies about the use of hypnotic-focused analgesia for acute pain relief showed an increased pain threshold during hypnosis and also in the posthypnotic state (Facco et al., 2011). Additionally, during treatment in adults with multiple sclerosis, a decreased average pain intensity was observed through the use of self-hypnosis, relative to cognitive restructuring. A combination of both methods showed an even greater beneficial effect (Jensen et al., 2011). Hypnosis is also employed in dental treatment. The use of hypnotherapy in dentistry on treatment of dentin hypersensitivity compared with other conventional therapies such as desensitizer and fluoridation did not show significant differences in success rates (Eitner, Bittner, Wichmann, Nickenig, & Sokol, 2010). This confirms the beneficial effects of hypnosis on pain relief and body parameters. In this study, self-hypnosis is evaluated in an experimental setting for the relief of acute dental pain. Dental pulp consists of two components of pain. The first is rapid and sharp and the second is dull pain related to activation of A delta-, A beta-, and C-type nociceptive primary afferents. Seventy to eighty percent of human pulpal axons are unmyelinated. The A and C fibers can be activated by a certain external stimulus, in this study by electrical stimulation (Närhi et al., 1992). The intradental nerve fibers respond to different stimuli. The electrical stimulation induces sharp pain in human teeth with mostly A delta fibers and only few C fibers (Närhi, 1990). Experimental electric irritation using a pulp-testing device both for pain threshold and a standardized pain stimulus were examined. The effectiveness of self-hypnosis is evaluated in this randomized, controlled clinical trial in relation to pain reduction. The results should demonstrate whether self-hypnosis can substitute for or augment local anesthesia for pain management.

**Method**

Thirty-seven healthy volunteers aged 21 to 54 years (mean age = 27.7 years, \( SD = 7.85 \)) were included in this study. The subject group included 24 female and 13 male subjects. They were informed and recruited through notices on the campus of the Johannes Gutenberg
University Mainz and the grounds of the University Medical Center of the Johannes Gutenberg University Mainz. A randomization of subjects was performed by the Institute of Medical Biometry, Epidemiology, and Information Science of the Johannes Gutenberg University Mainz (IMBEI). The study was approved by the ethics committee of the State Medical Association of Rhineland-Palatinate (No. 837.291.10 [7300]). All participating subjects had to be older than 18 years; participation was otherwise independent of age, gender, or ethnicity.

Other inclusion criteria were also applied to the subjects. These included the condition of the anterior tooth tested: It had to be healthy, vital, and without dental treatment. Subjects’ stress level should be low and they should be of good general health, without medication and in a good condition. The tested teeth were front, middle, and lateral incisors and canines of the first or second quadrant, FDI—nomenclature 13 to 23, corresponding universal numbering system 6 to 11. Only one tooth was selected and included in the study. Subjects also had to comprehend the study intellectually, had to answer questionnaires and had to sign informed-consent documents.

Subjects with a history of drug abuse were excluded. On the day of the examination, the consumption or use of any medication, alcohol, nicotine, or coffee was prohibited. A randomization was performed, whether the subjects should be investigated first with or without self-hypnosis.

Pain threshold and a targeted, standardized pain stimulus were tested with the Vitality Scanner 2006 (SybronEndo, Glendora, CA) (hereinafter called Vitality Scanner). The stimulus is perceived by subjects as an increasing intensity of pulsating pressure, warmth, or tingling. The display starts at 0 and increases up to 80. A dial regulates the speed, which represents a continuous increase in stimulus intensity. The pain threshold can be tested through interruption of the contact between the probe tip and the tooth. The targeted, standardized, and reproducible pain stimulus could be used when the maximum of 80 was reached.

During the entire trial, the hemodynamic parameters were monitored using Task Force® Monitor Impedance Cardiography (ICG), electrocardiography (ECG), and oscillometric (oscBP) and continuous blood pressure measurements (contBP). The Task Force® Monitor (CNSystems Medical AG, Grad, Austria) is a diagnosis-supporting device that measures and records the hemodynamic parameters of a subject.

Three visual analogue scales (VAS) following the tests of the standardized, targeted pain stimulus were given to the subjects and filled in.

There were a total of 12 pulp testings—six tests with self-hypnosis and six tests without. The six tests contained three times the pain threshold and three times the defined, implemented, standardized pain
stimulus (see Figure 1). The subjects were instructed in self-hypnosis in this trial for acute experimental dental pain relief. It was not a psychotherapeutic or long-term intervention. After the subject had been equipped with electrodes, the person was asked to name three words that he or she associates with a pleasant, relaxing location and condition. For absolute control of the subjects during the experiment, the left hand was the “protective hand,” which remained cataleptic in the established position. In case of a hand signal from the protective hand, the experiment was to be stopped immediately. The subjects were asked to dissociate from their bodies and to mentally go to the desired trance site and enjoy this with all senses. This site was open to anything the subject wished to experience and with any sense: visual, auditory, kinesthetic, olfactory, and gustatory. The subjects were trained using different general suggestions for relaxation and as soon as the inner resources were selected for the experimental procedure and the subject gave subconscious permission, the tests began with the pulp tester for pain threshold. The pain threshold was measured three times; next, the vitality scanner, set at the maximum intensity, was applied to the tooth continuously. If the pain was unbearable, the subjects were free to separate from the device and, thus, to interrupt the contact between tooth and pulp tester. After the three tests and the pain exposure, the dissociation of the subjects by association of mind and body was undone. General relaxation suggestions ended the investigation. Then, the subjects marked the visual analogue scales (0–10) for the three tests.

The collected data in this study were analyzed with SPSS Statistics software (IBM Corp., Version 20.0, Armonk, NY). The Wilcoxon test for dependent, not normally distributed, nonparametric test procedures was used both for pain threshold and standardized pain stimulus tests. Due to multiple testing, Bonferroni correction \( p < .025 \) determined
the statistical significance. The asymptotic significance was $p < .001$. Additional factors (i.e., sympathetic activity/hemodynamic parameter) were statistically analyzed using the Mann-Whitney $U$ test and at a significance level of $p < .05$.

**Results**

Twenty-seven subjects were tested on Canine 13, 2 subjects on Canine 23, 6 subjects on 11, and 1 subject on each of the incisor teeth 21 and 12. The increase in the pain threshold under self-hypnosis compared to the testing without self-hypnosis was statistically significant. The mean pain threshold *without* self-hypnosis was 39.5 ($SD = 11.8$). The mean pain threshold *with* self-hypnosis was significantly higher at 57.1 ($SD = 17.1$) ($p < .001$) (see Figure 2). The value of the pain threshold in which the subjects signaled the first sensation of pain is significantly higher under hypnosis, which corresponds to a reduction in pain sensitivity. In some tests, the pain threshold of the patient was at 80, the highest level of the electrical stimulation device and thus at the maximum, which may also be referred to as pain relief.

For standardized pain stimulus testing, the subjects received the maximum (80) impulse from the device tested on the tooth. After the tests, the subjects received three visual analogue scales for rating the

![Figure 2](image.png)

*Figure 2.* Comparison of the subjective intensity of a targeted, standardized pain stimulus on the Visual Analogue Scale without self-hypnosis (WITHOUT) and with self-hypnosis (WITH).
intensity of pain. In the subjects who wanted to stop the experiment before reaching the peak because of the unbearable pain intensity, values were used with the maximum of 10.0 on the visual analogue scale in the evaluation. In each case, the means of the tests with self-hypnosis and without self-hypnosis were compared. The pain under hypnosis compared to the testing without the use of hypnosis showed a reduction that was statistically significant ($p < .001$).

In this study, several cardiovascular parameters were monitored. We noticed decreased sympathetic activity and no effects on heart rate or mean arterial blood pressure while testing subjects under self-hypnosis.

The mean rating of the pain stimulus on the VAS without self-hypnosis was $7.1 \pm 2.7$ mm. The average rating of the pain stimulus on the VAS with self-hypnosis was $4.0 \pm 3.8$ mm (see Figure 2). Several subjects showed complete pain relief. The mean pain ratings showed a significant difference. Cardiovascular changes in heart rates and mean arterial blood pressure during the tests could not be observed. However, differences were found in sympathetic activity. The sympathetic activity under self-hypnosis was lower than in basal condition without self-hypnosis. A decreased sympathetic activity can be observed while testing with self-hypnosis (see Figure 3).

**Discussion**

The means of choice for safe and effective anesthetization for acute dental pain in dentistry is local anesthesia. But it also poses a number of risks and side effects (Daubländer, Müller, & Lipp, 1997). Thus, it can be stated that there are situations in which its use is very risky and poses a threat to the integrity of the patient. Besides the steady and significant development of local anesthetic preparations and medicines, a search for alternatives for the purposes of scientific research is needed.

The present study should evaluate the effectiveness of self-hypnosis for acute experimental dental pain relief. The participating subjects had no previous knowledge or experience with hypnosis before. All subjects took part voluntarily; therefore, a selection bias must be considered. The chosen method in this study was electrical stimulation of the dental pulp with a pulp-testing device without histological damage to the nerve. This subjective experience of pain can be sufficiently reliably used to assess the acute pain and thus also for experimental dental pain (Bijur, Silver, & Gallagher, 2001). Therefore, pain measurements must be reproducible, precise, and predictively valid (Jensen, Karoly, & Braver, 1986). We confirmed that pain is a dynamic complex
phenomenon and not only an end product of a linear sensory transmission system. Ascending and descending systems in the human brain are processed (Katz & Melzack, 1999). Human dental pulp is represented in the primary somatosensory cortex (Kubo et al., 2008). For pain perception, primary somatosensory cortex (S1) plays a role for discrimination, localization, and sensory detection of pain (Bushnell et al., 1999). We can affirm that electrical stimulation for pain threshold is a practical, reliable, and objective method for measurement (Notermans, 1966). According to the present study, self-hypnosis cannot be used as an equivalent for local anesthesia. Only in some cases, 6 of 37 subjects, a complete absence of pain was reported. Other authors have observed similar effects of pain modulation through conventional hypnosis (Huet, Lucas-Polomeni, Robert, Sixou, & Wodey, 2011; Spanos, Barber, & Lang, 2005). Both a statistically significant reduction in the perception of pain intensity and a statistically significant increase of the pain threshold could be observed in the measurements taken while the subjects were under self-hypnosis. So far, except for a study by
Facco et al. (2011), there is no other data in the literature on the effects of hypnosis on the pain threshold of the tooth in investigations about acute dental pain relief. In that study, a lower premolar was tested using a dental pulp-testing device while the subject was given hypnotic suggestion and intervention with posthypnotic suggestions. A significant increase in pain threshold under hypnosis and posthypnosis was found. These results are consistent with the present study but posthypnotic effects were not included. Benhaiem, Attal, Chauvin, Brasseur, and Bouhassira (2001) and Sharav and Tal (2006) also investigated pain threshold under hypnosis and arrived at similar results to those in this study but outside the dental setting. Benhaiem et al. (2001) examined the pain threshold by thermal stimulation at both the upper and lower extremities. Langlade Jussiau, Lamonerie, Marret, and Bonnet presented, under similar experimental conditions to the present study, an increase in the pain threshold under hypnosis that causes the analgesic effect of hypnosis by a weakening of the A-delta and C nerve fibers (2002). Lu et al. observed that, in particular, patients with acute pain benefit from hypnosis, whereas patients with psychogenic pain benefited even more (Lu, Lu, & Kleinman, 2001). The reported pain relief on a 10-point scale was reduced with hypnosis by a mean of 4.8 units. Compared to our results, self-hypnosis showed a lower pain reduction from $7.1 \pm 2.7$ mm to $4.0 \pm 3.8$ mm and 6 of 37 subjects showed complete pain relief. These results from experimental dental settings show a big difference from the result of a study of Abdeshahi, Hashemipour, Mesgarzadeh, Shahidi Payam, and Halaj Monfared (2013). In that study, third molars were extracted under hypnosis. From 24 participating subjects, only 2 subjects reported pain after induction of hypnosis (Abdeshahi et al., 2013). This high effect of hypnosis on pain relief is contrary to the results in our study with self-hypnosis. A possible explanation could be the different motivation of the subjects. In our study, there was only the benefit of taking part in a study and learning self-hypnosis, while in the study of Abdeshahi et al. a regular dental oral-maxillo-facial surgery was performed. This effect is important for the current dental practice. A modulation of the pain perception through hypnotic intervention could be confirmed anyway in this experiment. Because nociceptive stimuli are strongly influenced by context, hypnosis and the dental setting may influence pain perception (Rainville, Carrier, Hofbauer, Bushnell, & Duncan, 1999; Rainville et al., 1999). The cortical network, also called the “pain matrix,” represents the activity by nociceptive stimulus in the human brain (Legrain, Iannetti, Plaghki, & Mouraux, 2011).

In addition to the parameters for pain threshold and the standardized pain stimulus, another focus of this study was on cardiovascular parameters of the tests, respectively the changes in sympathetic activity (Lfnu RRI), heart rate (HR), and mean arterial blood pressure (MBP).
Significant effects were detected under self-hypnosis in the form of a reduction in sympathetic activity in both test runs, in pain threshold, and in pain stimulus. There were no significant effects on heart rate and mean blood pressure. As opposed to this, several studies have found that by reducing pain, a positive change in heart circulation parameters was recorded. In a study by Casiglia et al. (2007), cardiovascular and peripheral resistance differences were determined by a temperature test. The use of hypnotherapy with relaxation music showed an anxiolytic effect and a reduction of diastolic blood pressure and heart rate compared to the control group (Eitner, Sokol, Wichmann, Bauer, & Engels, 2011); this is also contrary to the present study. Our expectations for an increased sympathetic activity under painful irritation were fulfilled in testing without self-hypnosis. Under self-hypnosis, however, a surprising decrease was documented, although the heart rate as well as the mean arterial blood pressure did not show any clear differences. Different reasons for the cardiovascular results under self-hypnosis must be discussed. Reducing aspects might be the selected subject population, the only short irritation by the electrical stimuli, the hypnotic intervention, and the experimental setting without dental treatment. An intensifying aspect might be fear of pain. When considering the results collected, one important aspect is the age of the subjects, which was on average about 28 years. This must be taken into account in a more detailed analysis of the data. On closer inspection, hypnosis is an umbrella term for a conglomerate of hypnotic methods for trance induction and targeted presentation, for example, a hypothetical situation and suggestions. In this study, self-hypnosis was used to simulate a situation that would allow an evaluation in clinical form of acute pain during instructions for self-hypnosis. Hutt (1996) has written about the use of hypnosis, which, along with the increasing acceptance of various forms of alternative medicine, has gained in importance more and more as a supplement to conventional medical practice. There is a large variety of methods, hypnotic patterns, and techniques in the literature. In the area of self-hypnosis in dentistry, however, there are no data on pain threshold and measurement of a standardized pain stimulus. This study therefore enters new territory. Furthermore, this method should be evaluated and tested to ascertain whether to continue to pursue this kind of self-hypnosis in a dental setting and whether it should be used in future studies. The results of self-hypnosis for pain reduction in this study allow integration into clinical practice. Milling (2008) reports in a review that research using standardized measures of hypnotic suggestion showed large individual differences in these variables. Its usefulness for further use in clinical trials can therefore be questioned. People of medium suggestibility, which represents about a third of the population, showed similar results as the highly suggestible group of subjects (Milling, 2008). For this reason the suggestibility of
the subjects has not been studied or recorded in this study. Medical hypnosis in the dental setting cannot fulfill the same role as the safe and effective pharmacological solution of local anesthesia. It is rather to be seen as a therapeutic option for anesthesiologists, surgeons, and even dentists (Hermes, Hakim, & Sieg, 2004; Hermes, Trübger, Hakim, & Sieg, 2004). In other dental studies of pain, the authors describe hypnosis as a good alternative and method in combination with different therapies (Jensen et al., 2011). Thus, clinical trials need to be conducted, particularly in relation to the learning curve for self-hypnosis, to examine, to explain, and to discuss other phenomena under standardized conditions and effects.

**Conclusion**

The aim of this study was to investigate and evaluate the effect of self-hypnosis on experimental acute dental pain relief in a clinical setting by means of dental-pulp testing. The effect of using self-hypnosis during painful manipulation of vital teeth has the attribute of sedation and, has, as is often described in the literature for other hypnotic procedures, an anxiolytic effect. Self-hypnosis allows a comfortable and relaxing treatment. It is an easy method to experience medium trance states and to modulate and reduce experimental dental acute pain. A complete elimination of pain and thus treatment without any pharmacological drugs was possible only in some cases. Self-hypnosis cannot be used routinely as safe and effective like anesthetics. However, it can be easily used and is recommended as adjunctive therapy in a clinical setting. Further studies about the clinical outcome and pain-reducing effects with different treatments are required.

**References**


die Effektivität von Selbsthypnose auf die Reduktion experimentellen Zahnschmerzes: Eine randomisierte Studie

Thomas Gerhard Wolf, Dominik Wolf, Dagna Below, Bernd d’Hoedt, Brita Willershausen und Monika Daubländer

Abstract: Diese randomisierte, kontrollierte klinische Studie untersucht die Effizienz von Selbsthypnose auf das Schmerzempfinden. Es wurden Schmerzschwellen gemessen und ein gezielter, standardisierter Schmerzreiz durch elektrische Stimulation der Zahn pulpa an einem oberen vorderen Zahn ausgelöst. Der Schmerzreiz wurde durch eine Visuelle Analog Skala (VAS) bewertet. Die Schmerzschwelle war unter Hypnose höher (57.1 ± 17.1) als ohne hypnotische Intervention (39.5 ± 11.8) (p < 0.001). Schmerz wurde auf der VAS unter Selbsthypnose geringer bewertet (4.0 ± 3.8) als unter gewöhnlichen Umständen ohne Selbsthypnose (7.1 ± 2.7) (p < 0.001). Selbsthypnose kann in der klinischen Praxis sowohl als Ergänzung des Goldstandards der Lokalanästhesie zur Schmerzbehandlung als auch als Alternative in bestimmten Fällen angewandt werden.

Stephanie Reigel, MD
L’efficacité de l’autohypnose dans le soulagement de la douleur dentaire expérimentale: un essai clinique aléatoire

Thomas Gerhard Wolf, Dominik Wolf, Dagna Below, Bernd d’Hoedt, Brita Willershausen et Monika Daubländer

Résumé: Cet essai clinique aléatoire et contrôlé a permis d’évaluer l’efficacité de l’autohypnose sur la perception de la douleur. On a mesuré les seuils de douleur, puis créé un stimulus de douleur standard ciblé par stimulation électrique de la pulpe dentaire d’une dent antérieure de l’arcade supérieure. Le stimulus douloureux a été évalué par une échelle visuelle analogique (EVA). Le seuil de douleur sous autohypnose était plus élevé (57,1; écart-type empirique (ETE) = 17,1) qu’il ne l’était sans l’intervention hypnotique (39,5; (ETE) = 11,8) (p < 0,001). La douleur a été classée moindre sur l’EVA avec l’autohypnose (4,0; ETE = 3,8) que dans l’état basal sans autohypnose (7,1; ÉTE = 2,7) (p < 0,001). L’autohypnose peut être utilisée en pratique clinique comme adjuvant à l’étalon de référence qu’est l’anesthésie locale pour la gestion de la douleur, et comme solution de remplacement dans des cas particuliers.

Johanne Raynault
C. Tr. (STIBC)

La eficacia de la autohipnosis en el alivio de dolor dental experimental: un ensayo aleatorio

Thomas Gerhard Wolf, Dominik Wolf, Dagna Below, Bernd d’Hoedt, Brita Willershausen, y Monika Daubländer

Resumen: Este ensayo controlado aleatorio evalúa la eficacia de la autohipnosis en la percepción del dolor. Se midieron los umbrales de dolor y se creó un estímulo doloroso estandarizado mediante la estimulación eléctrica de la pulpa dental en el diente superior anterior. El estímulo doloroso se evaluó mediante una escala visual análoga (VAS por sus siglas en Inglés). El umbral de dolor bajo autohipnosis fue más alto (57.1 ± 17.1) que sin la intervención hipnótica (39.5 ± 11.8) (p < .001). El dolor se describió como menos en la VAS bajo autohipnosis (4.0 ± 3.8) que en la condición basal sin autohipnosis (7.1 ± 2.7) (p < .001). La autohipnosis puede utilizarse en la práctica clínica como un adjunto al estándar dorado de anestesia local para el manejo de dolor, así como una alternativa en casos individuales.

Omar Sánchez-Armáss Cappello, PhD
Autonomous University of San Luis Potosi, Mexico