HYPNOSIS AND LOCAL ANESTHESIA FOR DENTAL PAIN RELIEF—ALTERNATIVE OR ADJUNCT THERAPY?—A RANDOMIZED, CLINICAL-EXPERIMENTAL CROSSOVER STUDY

THOMAS GERHARD WOLF, DOMINIK WOLF, ANGELIKA CALLAWAY, DAGNA BELOW, BERND d’HOEDT, BRITA WILLERSHAUSEN, AND MONIKA DAUBLÄNDER

University Medical Center, Mainz, Germany

Abstract: This prospective randomized clinical crossover trial was designed to compare hypnosis and local anesthesia for experimental dental pain relief. Pain thresholds of the dental pulp were determined. A targeted standardized pain stimulus was applied and rated on the Visual Analogue Scale (0–10). The pain threshold was lower under hypnosis (58.3 ± 17.3, \( p < .001 \)), maximal (80.0) under local anesthesia. The pain stimulus was scored higher under hypnosis (3.9 ± 3.8) than with local anesthesia (0.0, \( p < .001 \)). Local anesthesia was superior to hypnosis and is a safe and effective method for pain relief in dentistry. Hypnosis seems to produce similar effects observed under sedation. It can be used in addition to local anesthesia and in individual cases as an alternative for pain control in dentistry.

According to the International Association for the Study of Pain (IASP), pain is described as “an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage” (Merskey, 1994, p. 2010). In order to diagnose orofacial pain, both a comprehensive examination of all participatory structures of the masticatory system and careful consideration of the patient’s history are required. Acute pain sensations and chronic maxillofacial pain must be distinguished from each other. The gold standard for pain management in dental medicine is local anesthesia (Malamed, 2006). However, psychological aspects play an
important role, in particular fear of “the shot,” in addition to side effects and contraindications. Among the complications are bleeding and hematoma, discomfort, temporary or persistent disruptions in function of the anesthetized nerve, paresis of parts of the musculature, or even infections. Short-term side effects such as an increase in heart rate, sweating, and dizziness are observed relatively often, generally as a result of the adrenalin contained in the local anesthetic solution. Nevertheless, there are also rare and serious complications such as allergic reactions to the contents of the solution that can result in shock, intoxication, and stoppage of circulation (Daubländer, Müller, & Lipp, 1997). Material failures such as broken needles or incorrect techniques in the application can occur. Despite correct, conscientious use and preventive measures, many of the complications cannot always be avoided (Haas, 1998; Mercado & Weinberg, 2011). In recent years, an alternative therapeutic possibility in medicine and dentistry—hypnosis—has received increasing attention worldwide (Jugé & Tubert-Jeannin, 2013; Lu, 2002). It is implemented in a number of different situations for stress and anxiety reduction as well as for pain management (Abdeshahi, Hashemipour, Mesgarzadeh, Shahidi Payam, & Halaj Monfared, 2013; Armfield & Heaton, 2013). Here, the pain-reduction effect is produced through hypnotic focusing of consciousness by a modulation of the control of the psychological, physiological, and neurological experience of pain, which in the individual life of a human being is conditioned and discarded involuntarily (Erickson, 1967). In search of nonpharmaceutical and minimally invasive alternatives, the subjective, individually experienced pain threshold and pain intensity will be examined in this crossover study in a clinical-experimental manner. Two methods, hypnosis and local anesthesia, will be compared to each other. Thus, it will be determined in this study whether the implementation of hypnosis for pain management could replace or augment infiltration anesthesia in dental medicine as an alternative method.

**Method**

In this study, 34 subjects in the age range of 21–54 years ($M = 27.8 \pm 7.97$) were accepted. Of these, 22 were women and 12 men. These subjects were recruited and informed about the study through posters on the campus of the Johannes Gutenberg University in Mainz and of University Medicine Mainz. After approval by the ethics commission of the state chamber of physicians of Rhineland-Palatinate, the experiments were carried out on two separate days. On Day 1, the subjects were led through hypnosis, and, on the other day, they were treated with a local anesthetic. Randomization was performed by the Institute of Medical Biostatistics, Epidemiology and Informatics of the Johannes Gutenberg University Mainz (IMBEI). During this process, the
experiment was randomized to hypnosis or local anesthetic as well as whether hypnosis would be used at the outset or not. There were different inclusion criteria for participation in this clinical-experimental study. These were as follows: healthy, vital, and not previously treated lateral incisor or canine in the upper jaw according to World Dental Federation (FDI nomenclature 13–23, Universal Numbering System 6–11; no medication; intellectual comprehension of the study; informed consent; of adult age; and no allergy to the local anesthetic. In addition, the subjects must have no previous experience in hypnosis. On the respective day of the examination, the use of drugs as well as alcohol, nicotine, and coffee were prohibited. The same tooth was selected and tested in both experimental runs.

In both test runs, the respective pain threshold was measured and a standardized pain stimulus was applied, which was evaluated by the subject on the visual analog scale (VAS, 0–10). The pain manipulations were performed using the SybronEndo Vitality Scanner 2006 (SybronEndo, Glendora, CA 91740, USA) (hereinafter called Vitality Scanner). This is a device for pulp testing that can release independent, electronically stable, constant electrical impulses from battery voltage. Once there is contact between the tip of the probe and the tooth to be tested, the intensity of the electric stimulus automatically increases. This is visible on the indicator of the device, which registers dimensionless values from 0 to 80. The subject experiences this stimulus as an increasing, pulsating pressure, heat, or itching. The device increases gradually to the maximum of 80 until contact between the probe tip of the device and the tooth is interrupted. Both experimental runs were documented and recorded by using a monitoring device that measures and records noninvasively the hemodynamic parameters of a subject (Task Force® Monitor, CNSystems Medizintechnik AG, Graz, Austria). Such hemodynamic parameters as impedance cardiography (ICG), finger plethysmography, electrocardiography (EKG), as well as oscillometric (oscBP) and continuous blood pressure measurement (contBP) for every heartbeat (beat-to-beat) could be measured continuously and in real time.

On the day of the experiment in hypnosis, the subjects were induced into a hypnotic state. Through association with three ideas of a pleasant, relaxing place or condition, the subjects were guided by general suggestions into a trance. A so-called “automatic responding protective hand” (“cataleptic”) was installed; by using this with hand movements, the subjects could signal for an interruption of treatment at any time through their own volition. The subject was to imagine that he or she was dissociated from the body and to perceive the desired trance place through visual, auditory, kinesthetic, olfactory, and gustatory sensation. The inner resources were to be activated through imagination and the tests to be carried out during hypnosis. After subsequent association
back into the body and into the “here and now;” the self-hypnotic state was ended.

On the day local anesthesia was tested, the subjects received infiltration anesthesia by means of the computer-driven anesthesia injector, The Wand™ (Milestone Scientific Inc., Livingston, NJ, USA) for examination of the experimental parameters. The device, equipped with microprocessors, injects the anesthetic at a controlled pressure and gives the precise dosage amount with regulated speed of flow. In the clinical test, 1 ml Ultracain® D-S (Articain 4% + Adrenalin 1:200.000, Sanofi-Aventis, Frankfurt am Main, Germany) was administered to the subjects.

The data from this study were processed using the software program IBM SPSS Statistics Version 20.0 (IBM Corp., 2011). For discrete variables a descriptive analysis was performed and medians, means, standard deviations, minimums, and maximums were collected. For group comparisons, the Wilcoxon signed-rank test was used. The significance level was \( p < .05 \).

**Results**

During induction into hypnosis, differences in subjective individual pain threshold (the subjectively individual pain intensity) were observed in comparison to infiltration anesthesia and found to be statistically significant, \( p < .001 \) (see Figure 1).

Here, the pain threshold had a mean value of 79.4 (±3.6) with a minimum of 59 and a maximum of 80 after local anesthetic. The pain

![Figure 1](image)

*Figure 1.* Subjective individual pain threshold during local anesthesia (left) and hypnosis (right) after stimulation with the pulp stimulation device (0–80; \( n = 34 \)). The subjective individual pain threshold was statistically significantly lower during hypnosis compared to local anesthesia (80.0) (Wilcoxon Test; \( p < .001 \)).
threshold during hypnosis by comparison had a mean value of 58.3 (±17.3; min: 34.3; max: 80.0). With one exception, the values for local anesthesia were all at a maximum of 80, thus complete analgesia was achieved. Test subjects used the VAS (0–10) to rate the subjective, individually experienced pain intensity of the above-threshold stimulus. After maximum stimulus with the pulp stimulus device (maximum value: 80) during hypnosis (3.9 ± 3.8, min: 0.0; max: 10.0), the rating was statistically significantly higher than in the test with local anesthetic (0.0 ± 1.7, min: 0.0; max: 10.0) (see Figure 2). Only 1 subject there had a subjectively experienced sensation of pain after injection of the local anesthetic. Here, too, the values during hypnosis show a wide distribution; in six cases, complete analgesia was possible (~18% of the test subjects).

Different measurements were taken with respect to hemodynamic parameters. With hypnosis, a trend in the direction of decreased sympathetic nervous system (SNS) activity was determined. The values for heart rate tended to be lower during hypnosis; however, differences were not statistically significant. There were also differences in the values for mean arterial blood pressure. Here, the values during hypnosis were higher in comparison to local anesthesia.

SNS activity is a dimensionless value, which is objectively calculated by the monitoring computer indirectly by frequency analysis of the heart rate variability. The measured values of sympathetic nervous activity (51.5 ± 18.6) during hypnosis were significantly lower than under the influence of local anesthesia (61.3 ± 17.3).

After both test runs, the subjects were asked which method they would prefer for pain relief at the next dental treatment. Nine indicated

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Figure 2. Subjective individual pain intensity by standardized, reproducible testing and evaluation by test subjects on the Visual Analog Scale (VAS, 0–10)(n = 34).
that they would prefer hypnosis as their method of choice, while 25 chose local anesthesia.

Only 6 of the test subjects wanted pain relief during all dental treatments, while 28 of the subjects only wanted it if pain was anticipated (See Figure 3).

**DISCUSSION**

The use of hypnosis in the clinical context is often described as a method that, in addition to its positive qualities regarding the management of anxiety and pain, can improve quality of life, self-confidence, and physical health. It is free of side effects and can be offered to both children and adults (Adinolfi & Gava, 2013). This treatment was mentioned in dental journals and by dental associations more than 100 years ago; many dentists used hypnotic suggestion as the only method of anesthesia or in conjunction with local or systemic anesthesia during tooth filling or even extraction therapies. When local anesthesia began
to be implemented, hypnosis was still utilized, above all in nervous patients or to support, to comfort, and to increase satisfaction (Andrick, 2013; Tarján & Gábris, 2008). In the present study, the use of hypnosis for pain relief was tested and compared in a clinical experiment to a standardized local anesthesia procedure, The Wand™ system. The observed pain thresholds during hypnosis showed a broad distribution of data corresponding to a subjectively interindividual variability. However, an elevated pain threshold during hypnosis was observed in all subjects. This means that hypnosis could be used as the sole pain therapy of choice in smaller restorative procedures such as fillings and periodontal treatments in which a low level of pain is expected and little local anesthesia will be used. The results of this study confirmed those of Facco and colleagues (2011) who determined a significant increase in the subjectively experienced pain threshold during hypnotic intervention although a different hypnosis technique was used. With one exception, local anesthesia achieved absolute pain relief. This clear superiority confirms the gold standard, local anesthesia, in this experiment. Leith et al. observed this successful implementation of the infiltration technique with the analgesic articain instead of lidocaine, even in children, for safe and effective pain control (Leith, Lynch, & O’Connell, 2012). The results for subjective individual pain intensity from overthreshold stimulation according to evaluation on the VAS under local anesthesia additionally confirms this method. In hypnosis, there is also a broad variability present; a complete absence of pain was experienced by 6 test subjects (~18%). In a clinical study on extraction of the third molar in the upper and lower jaw, Abdeshahi et al. (2013) also compared hypnosis with local anesthesia. For each patient, one tooth was extracted during hypnosis and one in the opposite side in the same jaw under local anesthesia. Only 2 of 24 patients reported pain after induction into hypnosis; after local anesthesia, 8 patients reported pain during the procedure (Abdeshahi et al., 2013). The difference was statistically significant, and, thus, hypnosis was superior to local anesthesia. In addition to reducing pain, hypnosis also reduced anxiety as well as postoperative bleeding. These results are in contrast to those observed in the present study. Local anesthesia showed a strong effectiveness in comparison with hypnosis, both in the studies on pain threshold as well as those for pain intensity. This could be a result of the fact that in hypnosis, which is a variation of hypnosis, other psychological mechanisms take effect. Due to the individuality of hypnosis in the present study used, differences might appear compared to a standardized hypnosis protocol like sometimes used with recordings (compact disc) in several studies. In addition, the positive motivation necessary in medically indicated and possibly urgent necessary interventions was not present in this clinical-experimental study. The authors Abdeshahi et al. (2013), however, also admit that the patients were carefully selected and
were to be treated surgically only by a dentist sufficiently trained and experienced in hypnosis. Armfield et al. (2013) determined that successful management of patients suffering from anxiety about dental procedures is entirely possible for clinicians. However, understanding and good rapport between doctor and patient is important. Treatment in stages, with several treatment appointments of longer duration, can also be necessary because of time-consuming reconstructive work. Nonpharmacological possibilities for both children and adults must therefore be found (Armfield et al., 2013). The authors of the present study are in agreement with the assertions made by Abdeshahi et al. and Armfield et al. that training in psychological aspects or the use of hypnosis are indispensable for successful treatment. In the present study, “face-to-face” was used to induce hypnosis. Through the standardized implementation of hypnosis in the past, it has already been possible in some studies to conduct many treatments under hypnosis (Faymonville et al., 1998; Hermes, Hakim, & Sieg, 2004; Hermes, Truebger, Hakim, & Sieg, 2005) and to gain further knowledge through the documented results and further research of the combined usable psychological-medical treatment options (Eitner, Bittner, Wichmann, Nickenig, & Sokol, 2010; Facco, Pasquali, Zanette, & Casiglia, 2013; Faymonville et al., 1997). Above all, a short induction into hypnotic trance state is important for use in dental routine treatment in practice, which in the present study was around minutes on an average. Another therapeutic option for future treatments is the combination of hypnosis and local anesthesia, both for adults and children (Fanali, Gallo, Tetè, & Salini, 1991; Faymonville, Meurisse, & Fissette, 1999; Gokli, Wood, Mourino, Farrington, & Best, 1994; Liossi, White, & Hatira, 2006). In unsuccessful treatments using a combination of local anesthesia and inhalation sedation in children, Shaw and Welbury (1996) recommend hypnosis combined with inhalation sedation for extraction therapy. The combination of hypnosis and local anesthesia has also already proved successful as an anxiety-reducing component (Morse, Schacterle, Furst, & Bose, 1981). During the application of local anesthesia in the present study, an elevation of heart rate, measured by means of arterial blood pressure and SNS activity, was observed. This could possibly be traced to the additional adrenalin contained in the local anesthesia solution or the pain upon injection. The values during hypnosis lay statistically significantly below those of local anesthesia despite the fact that the study subjects experienced more severe pain during hypnosis. Although no parameters were ascertained by means of an anxiety inventory, there is reason to believe that the lower values during hypnosis reflect the anxiolytic effect of this method. Several cardiovascular changes were also observed that have an effect on hypnotic intervention in a multidisciplinary context. Further studies on these effects, how they emerge and...
how they can be modulated, are necessary (Casiglia et al., 1997, 2006, 2007, 2012).

In this respect, it is interesting that approximately one quarter of the study subjects selected hypnosis as their method of choice for pain management in the dentist’s chair. In terms of the subjective individual pain threshold and blood pressure, the use of hypnosis is experienced as very similar to the effect of sedation (Fanini, Poglio, Marci, Iovinelli, & Antenucci, 1998). This was confirmed in this study. According to the evaluation of the data, pain relief was nearly complete with one exception for local anesthesia, but the insertion of the injection syringe was frequently described by the test subjects as very unpleasant or painful (Nusstein, Burns, Reader, Beck, & Weaver, 2004). Because the Wand™ System showed, in comparison to conventional injection, a lower pain level during injection, this technique is considered a very gentle method and because of this was used as a reference (Yenisey, 2009).

A number of dental treatments, such as filling therapies in the case of cervical defects, cause only a little or no subjectively experienced pain in patients; in such cases, hypnosis could be used. A broad spectrum of treatment indications is thus open to hypnosis. For minor procedures, adjuvant use is recommended; however, hypnosis used alone for major procedures is only possible in isolated cases. The gold standard is and remains local anesthesia.

**Conclusion**

Both in the examinations for subjective individual pain threshold and in the evaluation of standardized subjective individual pain intensity, local anesthesia administered using The Wand™ injection system was superior to hypnosis. Activation of the SNS remained constant for the most part during injection but was higher than in the hypnosis group. Hypnosis can be considered for use in further indications. A clinical monitoring of the results produced by this experiment is to be recommended in order to monitor the effectiveness of hypnosis in a clinical dental setting in routine treatments.

**References**


Hypnose und Lokalanästhesie, um Zahnschmerzen zu lindern – Alternative oder adjuvante Therapie? Eine randomisierte, klinische Crossover-Studie

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

Abstract: Diese prospektive randomisierte klinische Crossover-Studie wurde designed, um Hypnose und Lokalanästhesie zur Behandlung von experimentellen Zahnschmerzen zu vergleichen. Die Schmerzschwellen der Zahnpulpa wurden bestimmt. Es wurde ein gezielter, standardisierter Schmerzreiz gesetzt und mittels der Visuellen Analog Skala (0–10) aufgenommen. Die Schmerzschwelle war unter Hypnose niedriger (58,3 ± 17,3; p < 0,001) und unter Lokalanästhesie maximal (80,0). Der Schmerzreiz wurde unter Hypnose höher (3,9 +/- 3,8) bewertet als unter Lokalanästhesie (0,0; p < 0,001). Die Lokalanästhesie war der Hypnose überlegen und ist eine sichere und effektive Methode der Schmerzlinderung in der Zahnmedizin. Hypnose scheint ähnliche Effekte hervorzurufen wie sie unter Sedierung zu finden sind. Sie kann additiv zur Lokalanästhesie und im individuellen Fall als Alternative zur Schmerzkontrolle herangezogen werden.

Stephanie Reigel, MD

L’hypnose et l’anesthésie locale dans le soulagement des douleurs dentaires — solution de rechange ou thérapie adjuvante? Une étude clinique randomisée et croisée

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

Résumé: Cette étude clinique prospective, randomisée et croisée, visait à comparer l’hypnose et l’anesthésie locale dans le soulagement expérimental de la douleur dentaire. On a d’abord déterminé les seuils de douleur de la pulpe dentaire des sujets. Puis un stimulus douloureux normalisé ciblé a été appliqué et évalué à l’aide d’une échelle visuelle analogue (de 0 à 10). Le seuil de la douleur était plus faible sous hypnose (58,3 ± 17,3; p < 0,001), comparativement au seuil maximal (80,0) enregistré sous anesthésie locale. Le stimulus douloureux a été perçu comme étant plus fort sous hypnose (3,9 ± 3,8) que sous anesthésie locale (0,0; p < 0,001). L’anesthésie locale s’est révélée supérieure à l’hypnose, et constitue une méthode sûre et efficace de soulagement de la douleur en médecine dentaire. L’hypnose semble produire des effets similaires observés sous sédation. Elle peut être utilisée en complément de l’anesthésie locale et, dans des cas particuliers, comme solution de rechange pour le soulagement de la douleur en dentisterie.

Johanne Reynault
C. T. (STIBC)
Hipnosis y anestesia local para el alivio del dolor dental - ¿terapia alternativa o adjunta? Un ensayo clínico aleatorizado con diseño cruzado.

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

Resumen: Este ensayo clínico prospectivo aleatorizado con diseño cruzado se diseñó para comparar la hipnosis y la anestesia local para aliviar el dolor dental experimental. Se determinaron los umbrales de dolor de la pulpa dental. Se aplicó de forma focalizada un estímulo doloroso estándar que fue evaluado mediante la Escala Visual Análoga (0–10). El umbral de dolor fue menor bajo hipnosis (58.3±17.3; \( p < .001 \)) y alcanzó el máximo (80.0) bajo anestesia local. El estímulo de dolor fue calificado más alto bajo hipnosis (3.9±2.8) que bajo anestesia local (0.0; \( p < .001 \)). La anestesia local fue superior a la hipnosis y es un método para la reducción de dolor seguro y efectivo en la odontología. La hipnosis parece producir efectos similares observados durante la sedación. Podría utilizarse adicionalmente a la anestesia local y en casos individuales como una alternativa para el control de dolor en odontología.

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