

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/6385118>

Elucidating Tourette's Syndrome: Perspectives from Hypnosis, Attention and Self-Regulation

Article in *The American journal of clinical hypnosis* · May 2007

DOI: 10.1080/00029157.2007.10524506 · Source: PubMed

CITATIONS

22

READS

150

4 authors, including:



Kimberley L Norman

2 PUBLICATIONS 25 CITATIONS

SEE PROFILE

Elucidating Tourette's Syndrome: Perspectives from Hypnosis, Attention and Self-Regulation

Amir Raz, Vancouver Coastal Health Research Institute
Shari Keller, Columbia University and Fairleigh Dickinson University
Kim Norman, Barnard College
Diana Senechal, New York City Teaching Fellows Program

Abstract

Biological psychiatry favors drug treatment over non-pharmacological intervention and shapes the way clinicians both treat and understand Tourette's Syndrome (TS). However, drug treatments for TS involve side effects and are potentially toxic to the central nervous system. Moreover, current pharmacological treatments are largely ineffective and at best only provide a modest symptom reduction. In this paper, we describe how non-pharmacological treatments such as focused attention can modulate, reduce, or indeed entirely eliminate the symptoms of TS as well as elucidate the underlying neural mechanisms. Showing that the symptoms of TS are susceptible to self-regulatory interventions such as hypnosis, we propose that attentional training could be used to both treat the disorder and better understand it.

Keywords: Tourette's syndrome, attention, self-regulation, cognitive inhibition, top-down control.

Please address correspondence to:

Amir Raz, Ph.D., ABPH
McGill University
Institute of Community & Family Psychiatry
Sir Mortimer B. Davis — Jewish General Hospital
4333 Cote Ste Catherine Rd.
Montreal, Quebec H3T 1E4 Canada
Email: dramirraz@gmail.com

Introduction: Understanding TS

Tourette's Syndrome (TS) is a developmental neuropsychiatric tic disorder with an onset during childhood. Early symptoms appear as simple tics, which gradually increase in number, frequency, and forcefulness, peaking around the age of 11 or 12. The symptoms can appear as subtle motor tics of the face, such as eye blinking, nose twitching, facial grimacing, and lip licking, but can also affect other head and neck structures. A number of patients have vocal tics, which manifest in noises or sounds, or the use of inappropriate words, also known as coprolalia. These symptoms gradually decline over the course of adolescence. By the age of 18 years, 90% of TS patients have experienced a substantial reduction in tic symptoms and about 40% of TS patients are completely free of symptoms (Spessot & Peterson, 2004).

Along with the clinical symptoms of TS comes social and emotional scarring. School children with TS are often ridiculed because of their tics, and these children tend to see themselves as less attractive than their peers. Children with TS are usually viewed by both classmates and teachers as less popular, more withdrawn, and more aggressive than most other children. Although symptoms are significantly reduced during the course of adolescence, the highly visible and audible bodily manifestations of TS may become particularly problematic during this period of heightened interest in and awareness of one's body. As a result, most teenagers continue to suffer from impaired academic or social functioning, lack of self-esteem, and decreased functional well-being. Indeed, a stigma such as TS can have profound psychological effects during this developmental stage, which in turn may impair the formation of an individual's self-image and identity (Woods & Marcks, 2005).

Numerous studies have been conducted exploring the morphometric and genetic bases of TS. Research indicates that the symptoms of TS may arise from anatomical and functional disturbances in the Cortico-Striatal-Thalamo-Cortical (CSTC) circuits. Studies using methods such as electrical stimulation have implicated indirectly the role of CSTC components in producing tics, and more recently, neuroimaging technologies have more directly outlined the pathophysiology involved in TS. In addition to these morphometric studies, a good deal is known about the genetic diathesis that contributes to the development of TS. Nonetheless, despite the abundance of research examining its origins and development, an effective treatment for TS is yet to be found.

Evidence suggests that TS is part of a larger class of disorders known as Impulse Control Disorders (ICDs), which includes Attention Deficit Hyperactivity Disorder (ADHD) and Obsessive-Compulsive Disorder (OCD). Indeed, "pure" TS is rare and most patients with TS present co-morbid ADHD, OCD, or both. It is possible that a common mechanism, such as impaired self-regulation processes, causes these disorders, in which case, it is likely that a treatment for TS may be generalized and applied to other ICDs. The lack of an effective cure for this devastating syndrome, along with the vast therapeutic potential that such a cure could have, warrants closer examination of TS treatments.

History of Treatment

Like many other clinical disorders, TS has always been interpreted and treated in light of the prevailing zeitgeist (Kushner, 1999). From the early 1920s up until the 1960s, popular and scientific understanding of TS was shaped by psychoanalytic theory, and psychotherapy was the primary treatment approach to the disorder. Theories about the etiology of TS often portrayed tics as a manifestation of anal and erotic impulses, arguing that TS patients derived narcissistic pleasure from tics by displacing genital sensations to other body parts. Others postulated that tic movements were indirect expressions of hostility and

aggression, often in response to overly controlling and demanding parents. Psychotherapy under the psychoanalytic paradigm strove to uncover these base impulses and early fixations, and relieve the tension that led to ticking symptoms (Zahm, 1982). While some case reports indicate successful treatment, psychoanalytic theory largely failed to address the organic and chemical aspects of the disorder.

Since the emergence of modern psychopharmacology in the early 1950's, drug therapy has been steadily replacing psychotherapy as the treatment of choice for TS. Indeed, as pharmacological specificity increases, this shift towards drug treatments is scientifically warranted. However, the pharmaceutical industry presents an unrefined version of drug specificity that far outstrips existing data (Raz, 2006). This pharmacological thrust has become a bias in its own right that has shaped the way we both treat and understand TS. Physicians tend to focus on the biological underpinnings of TS and emphasize its neurological origins. As a result, the most popular treatments for TS are pharmacological.

One of the most common pharmacological treatments for TS is haloperidol, a flagship dopamine antagonist. Introduced over half a century ago, haloperidol's clinical value is offset by adverse extrapyramidal side effects. These undesired effects can become so pronounced that they may discourage many patients from utilizing this treatment option. Patients taking the drug commonly suffer from motor dysfunction such as severe restlessness, abrupt contraction of muscles, as well as muscle weakness and aches. Other side effects include dryness of the mouth, constipation, urinary retention and blurred vision. Some patients have reported persistent weight gain due to endocrine complications, increased appetite and reduced sex drive. Research has shown that the use of haloperidol can lead to poor academic performance, as students taking the drug often suffer from apathy and cognitive impairment. As a result of these side effects, many people suffering from TS do not receive appropriate treatment, shedding doubt on haloperidol's efficacy for treating the disorder. The absence of viable alternative drugs, as well as the lack of understanding of TS, warrants a closer examination of other treatment options.

In the present paper, we propose a new understanding of TS and call for more careful consideration of non-pharmacological treatments. In children and adults with TS, attentional modulation has been the most powerful influence on their emotional state and tic symptoms (Raz & Buhle, 2006). In our experience, during highly focused attentional planes, patients calm down, tics abate and sometimes disappear completely, with comprehensive reproducibility. It is imperative that we investigate the neural bases of these effects. In addition to attentional and hypnotic interventions being used to treat TS, we believe that understanding the mechanism behind their effectiveness will enhance our understanding of the disorder.

Current Approaches: Pharmacological Treatments

In order to appreciate the current methods of treating TS, it is necessary to illustrate the state of pharmacological care. Many drugs have been prescribed to treat the symptoms of TS, with the earliest treatment being haloperidol. Approved by the Federal Drug Administration (FDA) in 1968, this antipsychotic butyrophenone successfully eliminated tic behavior in many patients. However, despite the success of haloperidol in treating TS, its adverse side effects were just as devastating as the symptoms it was intended to relieve.

More recent treatment protocols for individuals with TS include other types of pharmacological agents, but much like haloperidol, these medications have limited efficacy and are associated with adverse side effects that may undermine the benefits they provide (see table in the Appendix for a detailed description of some common pharmacological treatments and their efficacy). Given that drugs are the mainstay of treatment for TS and that little improvement in their

clinical specificity has been made, individuals with TS face a difficult prognosis. Thus, it is essential to explore alternative approaches to relieving TS symptomatology.

Non-pharmacological treatments

Non-pharmacological methods have also been effective in treating TS and may offer an attractive treatment alternative. Importantly, non-pharmacological interventions lack the side effects associated with drugs and are non-invasive. Moreover, these treatments have an impact on the neural level, as demonstrated in recent neuroimaging studies in which hypnotic suggestions affected focal brain function (Raz, Fan & Posner, 2005). However, despite the many benefits that non-pharmacological treatments provide, research in this area has been sparse and valuable clinical findings have not received the attention they deserve. Our goal is not to ignore the benefits of any one approach, but rather to seek the most effective treatment possible, regardless of current and past trends.

Psychotherapy

Psychotherapeutic interventions are useful for addressing the low self-esteem, anxiety, depression, and social difficulties that individuals with TS often experience. A psychotherapist can help patients develop a sense of mastery at school or work and can teach coping strategies that reduce stress, which is known to exacerbate the symptoms of TS. People with TS can learn how to explain their symptoms to others and how to deal with other people's reactions to their own behavior. Despite the importance of such interventions in treatment, however, few empirical studies document widespread efficacy of traditional psychotherapy in treating TS (King, Scahill, Findley, & Cohen, 1999).

Behavioral therapy

Behavioral therapies, including massed negative practice, operant techniques, anxiety management, awareness training, habit reversal, the Tic Inhibition Evaluation System (TIES), and hypnosis, have all been at least somewhat successful in treating TS.◇ In what follows we highlight the application of these behavioral methods to treating the symptoms of TS (Piacentini & Chang, 2001; Piacentini & Chang, 2005).

Massed negative practice (MNP) is the most widely tested of these treatments. In MNP, a specific tic is performed repeatedly in a rapid, voluntary, and effortful manner. This is continued for a designated length of time, and is interspersed with brief rest periods. As a result, fatigue eventually develops and the patient's ability to voluntarily produce the tic is reduced. Although there is some evidence that MNP relieves tics successfully, it is unclear whether or not this effect is durable. Some practitioners found that about half of the studies using MNP report moderate decreases in tic frequency on an acute basis (Peterson, Campise, & Azrin, 1994). In a subsequent controlled trial, a 33% reduction in tics was observed on the first day of treatment, but only 17% of the patients remained tic-free at a follow-up four weeks later (Young & Montano, 1988) (but see also (Robertson, 2004; Storms, 1985). Most studies report no decrease in tic frequency, and a significant number of subjects even report an increase in tics as a result of MNP. Although additional studies are warranted to make any definite conclusions, it seems that MNP has limited therapeutic value (Robertson, 2006).

Anxiety management has been explored as another behavioral therapy for TS. It involves methods to control and reduce anxiety, an emotional component that aggravates tics. One type of anxiety management is relaxation training, which consists of progressive muscle relaxation, deep breathing, and visual imagery. A pilot study investigating relaxation therapy

used 23 participants with TS, 16 of whom completed a three-month study (Bergin, Waranch, Brown, Carson, & Singer, 1998). Subjects were randomly assigned to either a relaxation training group or a minimal therapy control group. While participants in the relaxation training group showed significant improvement in relaxation during the course of the study, no significant reduction in tics was noted at six-weeks following completion of the study, and even less so at a three-month follow-up. It seems that while these techniques yield modest improvements in tic-behavior, they are short-lived and might not generalize outside of the training period.

Another approach to anxiety management is Exposure Plus Response Prevention (EPRP). This treatment utilizes desensitization techniques, whereby individuals with TS are taught to resist ticquing in the presence of a premonitory urge. The desired outcome is eventual habituation of these urges, leading to a decrease in tic expression. Results of EPRP are promising and suggest that it should be further explored as a potential treatment for TS (Zahm, 1982).

Another behavioral treatment is awareness training, which involves increasing a subject's awareness of his own tic behavior with the purpose of facilitating self-control. Awareness is created through the use of videotapes, mirrors, wrist counters, or notebooks, which are used to record tic occurrences. Awareness training can also involve performing a conscious response following each tic. Although little evidence exists documenting any long-term benefits, the literature provides tentative support for the usefulness of awareness training in the acute treatment of tics (Raz & Norman, 2004).

Habit-reversal training (HRT), consisting of eight intervention components, is yet another form of behavioral therapy used to treat TS. The primary component, competing response practice, teaches individuals to produce incompatible physical responses as soon as they feel the urge to tic. Similar to awareness training techniques, four of the components focus on increasing awareness of tic behavior. Two components serve to promote motivation and compliance and one addresses generalization training. Literature reviews concluded that HRT can yield impressive reductions in tic frequency of up to 90% at home and up to 80% in clinical settings (Piacentini & Chang, 2001; Piacentini & Chang, 2005).

Operant conditioning, in the form of contingency management, has also been used to alleviate the symptoms of TS. In this technique, environmental contingencies are manipulated by positively reinforcing tic-free intervals and punishing tic behavior. The efficacy of this technique is unclear, and its effects are confounded because it is often delivered as part of a multicomponent treatment package. Furthermore, the durability and generalizability of contingency management have yet to be demonstrated.

One especially promising behavioral technique for alleviating tics is the Tic Inhibition Evaluation System (TIES). In a recent study, participants were tested under five different conditions, including a verbal instruction condition in which subjects were instructed to suppress tics, and a condition with both the verbal instruction and differential reinforcement (Woods & Himle, 2004). This latter condition was the same as the verbal instruction condition, with the addition of a ten-second differential reinforcement procedure in which a reward token was delivered via a token dispenser for every ten seconds the subject went without exhibiting target tics. Subjects were told that a camera would monitor their tics via motion sensors. In reality, however, the camera was inactive and the child was tracked and rewarded by a researcher sitting behind a one-way mirror. A follow-up study (Himle & Woods, 2005) showed that the differential reinforcement-enhanced instruction produced a greater reduction in tics (76.3% reduction from baseline) than verbal instruction alone (10.3% reduction from baseline), lending additional support that the TIES is a promising treatment for TS.

Finally, hypnosis is another non-pharmacological option for helping individuals with TS. Although an adjunct to treatment rather than treatment in its own right, hypnosis is particularly

interesting because hypnotizability, or the susceptibility to hypnotic suggestions, peaks at the time when TS symptomatology is at its worst – around 12 years of age. At this age, children begin to recognize and report the premonitory urges that precede tics (Himle, Woods, Piacentini, & Walkup, 2006; Woods, Piacentini, Himle, & Chang, 2005), and approximately 30-60% of these individuals develop obsessive thoughts and compulsive rituals (Robertson, 2004). A closer examination of the relevant literature provides substantive insights into hypnosis in the context of TS and elucidates why it may be an effective addition for those individuals who need it the most.

Hypnosis as a lens into understanding TS

Here we examine hypnosis not only as a treatment for TS but also as a means of understanding the mechanisms that subserve it. The characteristic tics that individuals with TS experience are generally considered to be involuntarily generated. However, evidence from both the TIES and hypnosis suggests that under certain conditions, these tics might be voluntarily suppressed (Himle & Woods, 2005; Himle, Woods, Piacentini, & Walkup, 2006; Woods & Himle, 2004). Combined imaging assays of hypnosis provide us with further insights into the nature of volition (Raz, Fan, & Posner, 2005).

Hypnosis blurs the distinction between volitional and non-volitional action (Raz & Norman, 2004). In common wakefulness, unlike under hypnosis, we have the illusory experience of free will. This experience arises at least in part from post-hoc attributions that we make about our actions, based on the notion that they follow from our intentions (Kirsch & Lynn, 1997). In reality, however, these actions contain a great degree of automaticity of which we may be unaware (Shehan & Orne, 1968).

In contrast, under hypnosis, subjects do not experience their actions as following from their own intentions and instead, the *hypnotic suggestion* becomes the driving force propelling the behavior. Subjects subsequently construe their actions as non-volitional, attributing them to the hypnotic operator rather than to their own will. A question of authorship arises whereby the subject no longer sees herself as the sole “author” of her actions (Wegner, 2002) and discounts the experience of conscious will (Kirsch & Lynn, 1997).

Albeit counterintuitive, it is precisely this perception of external control, which follows from the presence of the hypnotic operator, that empowers one with an extraordinary capacity for self-regulation, heretofore untapped (Wegner, 2002). In the case of TS, by attributing control to an external agent, individuals gain a sense of control over formerly “uncontrollable” tics. In order to better understand how this occurs, consider the often-experienced phenomenon that paying too much attention to performance paradoxically interferes with it. For example, a skilled golfer will likely perform suboptimally if she pays close attention to every muscle and body part instead of just swinging at the ball. Similarly, individuals suffering from TS likely go through life paying close attention to suppressing their tics. Instead of producing the desired effect, this state of heightened attention may interfere with successful suppression. In contrast, when the individual perceives an external agent of control, she pays less attention to her tics and thus succeeds in suppressing them.

The success that subjects have had in suppressing their tics using the TIES lends additional evidence that the transfer of control to an external agent is precisely what endows subjects with enhanced forms of control over the self. While TIES research emphasizes the reinforcement aspect of the token dispenser as the mechanism driving

tic reduction, we believe that it is actually the inactive camera that causes this to occur. The participant's belief that the camera is monitoring his behavior enables him to stop paying attention to his own tics. He effectively relinquishes control over the tics to an external entity which paradoxically empowers him with an enhanced sense of control over his involuntary motor bursts.

Given these findings, it seems appropriate to re-contextualize TS. While it has long been assumed that tics are the product of a neurobiological dysfunction and are therefore involuntary and uncontrollable, it seems that under certain conditions, TS patients may be able to gain some control over, and even suppress their tics. Thus, the distinction between volition and non-volition becomes less clear and TS tics, formerly classified as involuntary, may be more controllable than hitherto suspected.

Relevant Neuroimaging Data of Hypnosis

In distinguishing between automatic and controlled processes, cognitive scientists describe automatic processes as being either innately involuntary or becoming automatized through extensive practice (Parsons-Fein, 2006). For example, reading words is a purportedly automatic process for proficient readers and the Stroop Effect is consequently considered the "gold standard" of automated performance (MacLeod, 1992). Although the question of whether it is possible to regain control over an automatic process is generally left unasked, we have provided compelling data showing that a specific posthypnotic suggestion reduced and even removed Stroop interference in highly hypnotizable individuals (Raz, Moreno-Iniguez, Martin, & Zhu, in press), indicating that suggestion can derail a seemingly automatic process.

In addition to evidence from neuroimaging data that hypnotic suggestion can dissolve the barrier between automatic and controlled processes, recent neuroimaging studies have reported hypnotic suggestion to be a powerful influence with specific neural correlates (Raz, 2004; Raz, Fan, & Posner, 2005). In one study, hypnotic suggestion modified subjects' perception of color: highly hypnotizable subjects perceived color in gray-scale patterns and only detected shades of gray in color images. Positron emission tomography (PET) scans showed that the color area of the brain was activated when subjects were asked to perceive color, whether they were actually shown the color or the gray-scale stimulus. Likewise, the same brain region showed decreased activation when subjects were told to see gray scale, whether they were actually shown the color or gray-scale stimuli. These findings demonstrate that hypnotic suggestion causes distinct changes in the neural level (Kosslyn, Thompson, Costantini-Ferrando, Alpert, & Spiegel, 2000). Thus, evidence supports the notion that through hypnosis and perhaps other methods of attentional modulation, volitional control can be regained over ostensibly involuntary processes.

A Taste of Clinical Data on Hypnosis for TS

There are multiple clinical reports and single case studies since the 1950's documenting the effectiveness of hypnosis in treating TS. These reports reveal a general trend of increasing effectiveness in hypnotherapy over time, as methods become more systematized. Most patients who remained in treatment received at least some benefit, ranging from a temporary reduction in severity, frequency, or number of tics during hypnosis, to a complete recovery from all symptoms in all situations. Details of the reports demonstrate that the role of motivation in hypnotherapy on the part of both the patients and their parents (if involved) is critical. Those who derive secondary gain from their tics (e.g., to manipulate others, elicit sympathy, or provide excuses for anticipated failure) typically do

not fully engage in the hypnotic process. The following paragraphs provide a handful of examples that demonstrate the putative role of hypnosis for many individuals suffering from TS. A more complete list of case studies is available in the Appendix.

Zahm illustrated the effectiveness of hypnotic intervention with an eleven-year-old male patient who suffers from TS (Zahm, 1987). The patient entered therapy for his eye-blinking and nose-twitching facial grimaces. The hypnotic coach first obtained a baseline frequency of the tics by videotaping the boy in the office. Twelve hypnotherapy sessions were then given over a period of six weeks, which focused on the more severe eye-blinking tic. The author notes that a biweekly treatment schedule is ideal, as it affords an earlier mastery of hypnotic techniques, permits greater encouragement for home practice, enhances commitment to the treatment process, and yields a more rapid awareness of treatment gains. The patient proved reasonably adept with hypnosis, and his parents were supportive of his new skills. He was also encouraged to practice self-hypnosis at home, and was provided with a practice-monitoring sheet to serve as both a reminder as well as a subtle pressure to continue his hypnosis routine. The patient remained committed to his treatment, and by the end of the twelfth session, tic frequency had been significantly reduced from the initial baseline. A stressful family move to a different neighborhood resulted in a brief increase in his tics, but he was able to employ his new hypnosis skills to cope with the change, and managed to resume his rapid improvement.

In another study published the same year the authors present four children with TS, ages six-and-a-half to ten years, who were referred to them for self-hypnosis training using Relaxation/Mental Imagery (RMI) techniques (Kohen & Botts, 1987). All four children, three of whom were on haloperidol, were followed from October 1981 to December 1985. They all experienced frequent motor and vocal tics, many of which were socially embarrassing and isolating. Following questions about their history, patients were induced into hypnosis and encouraged to "begin pretending" to be in a pleasant place. The children were led through a process of selecting and modifying imagery to enhance particular images, as well as deepening their involvement in hypnosis. The hypnotic coach also gave suggestions for progressive relaxation, allowing room for the patient to make choices about how relaxation would occur (e.g., from head down to toes or from toes up to head), in order to build a sense of personal deliberation. The children were repeatedly reminded of their internal control and assured that they were following the suggestions correctly. Biofeedback was also occasionally used in conjunction with RMI to further emphasize each child's ability to manipulate his or her body. The clinicians centered on metaphors for control of movement. For example, three children were told to imagine an internal "STOP" sign that their bodies and tics must obey. All patients were also given a personal audiotape early on in therapy, which was created using their own chosen imagery to encourage practicing RMI at home. A twenty-four-month follow-up revealed that three out of four children had shown sustained improvement in their symptoms, with a substantial reduction of medication in one, cessation of medication in another and no initiation of medication in the third. The fourth patient demonstrated initial success, but failed to return for an in-person follow-up and RMI practice, apparently due to parental interference and skepticism. The mother's own personally unacknowledged tic disorder is suspected to have played a role in this reaction. These cases provide valuable support for self-hypnosis in combination with biofeedback, relaxation, and/or analogous techniques as a successful treatment for TS symptoms.

Daniel Kohen describes a variety of self-hypnosis strategies that have been successfully applied to help thirty-five different children and adolescents cope with the stress of TS (Kohen, 1995a), including the four described earlier (Kohen & Botts, 1987).

He provides one case report in which a fourteen-year-old male who experienced multiple motor tics and throat-clearing, was induced into hypnosis using a biofeedback device monitoring finger temperature. His ability to alter the temperature of his finger and imagine his brain as the “boss” of his body served as metaphors to control his tics.

Deepening proceeded with multi-sensory mental imagery and progressive relaxation. In the context of a story, the author then introduced the idea of the internal “STOP” sign that could bring a tic to a halt as soon as the patient imagined it. Using these metaphors, he learned self-hypnosis and was encouraged to practice ten to fifteen minutes a day.

Additionally, an audiotape was recorded for home use at the third session. His symptoms showed some improvement, but they reappeared at full strength along with a few new movements after he neglected to follow through with the regular practice periods. A new tape was then prepared, instructing the patient to imagine himself tic-free sometime in the future, suggesting that he might forget how to tic, and applying the “STOP” sign in a more abrupt fashion. This resulted in his tics diminishing significantly within the next two weeks. At a one-year follow-up, the patient remained improved with only an occasional reappearance of tics in association with stress, and he seemed confident that his self-hypnosis techniques would eliminate symptoms as soon as they appeared.

Finally, personal communications from practitioners around the world support the putative role of hypnosis and attention training in treating TS (e.g., in north America: Roger D. Freeman of the University of British Columbia, Theodore Shapiro of the Weill Medical College of Cornell University and Ran D. Anbar of SUNY Upstate Medical University).

Conclusion

As a drug-free, minimal risk option that has shown increasing promise for alleviating the tics of TS, hypnosis may shed light on this syndrome as well as related ICDs. In addition, it is likely to elucidate the power of suggestion and the nature of volition. In children and adults with TS, my colleagues and I have never seen any more powerful influences on the emotional state and tic symptomatology than changing the attentional plane. During highly focused attention, patients calm down and tics disappear. We have been able to observe these phenomena with comprehensive reproducibility. It is imperative for us to learn about the neural bases of these effects as there are no treatments in existence for TS that are not potentially toxic to the central nervous system. Moreover, drug treatments are largely ineffective and provide minimal reduction in symptoms. Documenting the efficacy of focused attention in modulating, reducing, and entirely eliminating the symptoms of TS as well as studying the brain mechanisms by which they occur, would be a great boon to patients suffering from TS. Furthermore, this research could be generalized to understand other impulse control disorders and the neural mechanisms of attention, affect, and cognitive control. We plan to soon report on such data.

Appendix

Table: A sketch of leading drug treatments alongside both the desired and side effects.

Drug	Desired effect	Side effect
Haloperidol	Successfully eliminates tic behavior in many patients (Zahm, 1982)	Adverse side effects (e.g. cognitive dulling)
Typical neuroleptics & antipsychotic agents (dopamine antagonists)	Relief of symptoms in 70-80% of cases	Adverse side effects similar to those observed with haloperidol (Erenberg, Cruse, & Rothner, 1987; Shapiro, et al, 1989; Silva, Munoz, Daniel, Barickman & Friedhoff, 1996)
Alpha-adrenergic receptor agonists, e.g. clonidine (Cohen, Detlor, Young & Shaywitz, 1980; Leckman et al., 1991); and guanfacine (Chappell, et al., 1995; Fras 1996)	Some improvements in symptoms	Sedation, delayed onset of action, inconsistent therapeutic response (Shapiro, Shapiro & Eisenkraft, 1983)
Atypical antipsychotics, e.g. risperidone	Has both potent serotonin 5-HT ₂ and dopaminergic antagonist properties	No major side effect, but more research is necessary (Bruun & Budman, 1996; Chappell, Scahill & Leckman, 1997; Lombroso, et al, 1995)
Selective serotonin Reuptake inhibitors (SSRIs), e.g. paroxetine, sertraline, fluoxetine	Several studies suggest efficacy (Bajo, Battaglia, Pegna & Eellodi, 1999; Kurlan, Como, Deeley, McDermott & McDermott, 1993) Other studies suggest that SSRIs might worsen tics (Hauser & Zesiewicz, 1995)	From dry mouth to suicidality (Raz, 2006)
Nicotine, clonazepam, cannabinoids	Double-blind studies suggest limited efficacy (Lang, 2001)	Addictions, etc.
Injections of botulinum toxin in affected muscles	Reportedly relieve symptoms (Kwak, Hanna & Jankovic, 2000)	Tissue decay, etc.

Clinical Case Studies

In an early study, Eisenberg, Ascher, and Kanner (Eisenberg, Ascher, & Kanner, 1959) described their clinical experiences with seven cases of TS patients. They reported that pharmacological therapy, including antipsychotics, sedatives, and muscle relaxants, had all been ineffective for treating tic symptoms, but that psychological treatments had been helpful to most of the patients. Only one individual out of the seven was given hypnotherapy. The patient, a twelve-and-a-half year old male, experienced “spasms of all parts of his body,” screaming and barking noises, eyelid, nose, and mouth tics, elbow-bending, arm-thrusting, and jumping movements which frequently resulted in falls. Barbiturates and bromides were administered but had little effect in controlling his symptoms. The patient was easily induced into a hypnotic “trance”, and for a total of five sessions, the hypnotic operator gave post-hypnotic suggestions that his tics would be diminished. Under hypnosis, all movements, as well as the barking and stuttering vocal tics, disappeared completely. Although the suggestions appeared to have a definite effect for several hours afterwards, the symptoms did eventually return at their full intensity when several stressful medical investigations were scheduled later that day. This case study suggests that at least temporary relief of tic symptoms is possible using this method. The family left town before more treatment plans could be formulated, but a brief note three months later reported that there had been some improvement in his overall symptoms. Out of the other six patients, four showed little improvement, and one improved his ability to control his tics in response to stress. The only patient to achieve a complete recovery from TS symptoms stated that the psychotherapy he had received had played a significant role in his treatment.

Schneck (Schneck, 1960) described the case of an eighteen-year-old female with TS who exhibited involuntary and explosive movements of her head, neck and limbs, coprolalia, shrieking, barking, and sneezing noises. She had obtained no benefit from taking barbiturates, amphetamines or Thorazine, and it seemed that the Thorazine may have even made her worse. Throughout several months of psychotherapy, she remained superficial and evasive, with no reduction in tic frequency. At this point, the patient requested hypnotherapy. Under hypnosis, she responded well to suggestions for relaxation, and movements either decreased or disappeared. When verbalization was encouraged, voluntary and involuntary movements returned. Posthypnotic suggestions for control over tics resulted in fewer movements between sessions, but there was “no remarkable change.” The hypnotic coach noted that her feelings of anxiety appeared to increase as movements diminished. The patient’s mother sharply criticized her efforts, and when she began to encourage her daughter to continue hypnotherapy, the patient abruptly terminated treatment. The author explains that the patient’s multiple movements and vocal utterances seemed to be an outlet for intense aggressive feelings that were impossible for her to manage, particularly those towards her mother.

Polites, Kruger, and Stevenson (Polites, Kruger, & Stevenson, 1965) report a case of a fifteen-year-old male TS patient whose tics were extremely severe and frequent, involving almost every skeletal muscle in his body. During waking periods, he could be observed having tics incessantly, and he had a habit of running up and down the halls of the clinic, often hurling himself into the air and then falling hard onto the floor. Furthermore, the patient’s speech was interspersed with grunts, gulps, and streams of obscenities. After a three-week period of observation, the experimenters applied a series of sequential treatments. First, a total of thirty carbon dioxide treatments were given at the rate of four times a week, which produced no changes in his symptoms. Next, the experimenters attempted to

influence his symptoms through hypnotic suggestion. The patient proved to be a difficult subject to hypnotize, but after several sessions, he was able to enter a "medium trance", in which he could experience skin sensations, odors, and loss of sensation without external cause. During hypnosis, his tics decreased in both frequency and severity, and some ceased altogether until he was aroused. The experimenters gave simple suggestions that he would feel increasingly better after the sessions. Twenty-two meetings of this type took place over seven weeks, however no discernable improvement in symptoms outside the hypnotic sessions was observed at this time. The experimenters responded by expanding the hypnotic suggestions, adding that for a certain period during each day, he would find his ability to control his jerking tics strengthened, his ability to concentrate on controlling them more focused, and the "urge to have jerks" would be weaker. In the beginning, these designated "special periods" lasted for one hour, and later increased to two hours in length. After some time, the experimenters added a second one-hour period, soon to increase to two hours, and eventually a third hour of suggested symptom improvement. On the assumption that the tics may serve some desired emotional purpose for the patient, he was told that he would experience an increase in tic movements for the five minutes before each period. Finally, he was told that these periods would seem to last longer than the one or two hours that actually passed. After the patient had received a total of sixty hypnotic suggestions, the experimenters reported that his targeted tics had improved 40-50% during the intervals between the "special periods" and 60-70% during these periods themselves. No attempts were made to influence his coprolalia through hypnosis, and no change occurred in its frequency or severity. The patient returned four times for biweekly follow-up sessions before terminating therapy. He underwent a gradual relapse in some of the simpler tics and a slight increase in coprolalia six months later without any apparent external cause, but he did not experience a recurrence of total-body tics. One month later, he was started on Stelazine and tics slowly improved up to 95% one and a half years afterwards.

Erickson (Erickson, 1965) presents an interesting and unusual sequence of hypnotic suggestions in the case studies of two TS patients in their mid-thirties, who came to him demanding hypnotherapy. Both of them had experienced an acute onset of symptoms shortly before their visits to the author. The first patient, a female, had found herself suddenly impelled to utter a variety of obscenities during a church sermon, and shortly after she experienced a compulsive need to grimace, gesticulate, and posture. The therapist induced the patient into a hypnotic trance, and proceeded with the usual sequence and progression of suggestions that had proven to be most effective in the past. These suggestions, however, were cleverly elaborated and embellished with obscenities and vulgarities that "far exceeded the worst she had uttered." The patient responded to this in horror, yet more importantly, with silence, as this unexpected display by the therapist captured her attention. Within ten minutes, she allowed herself to enter a hypnotic trance and received suggestions that she was afraid, disoriented, and completely dependent on her hypnotic coach, as a representation of comfort and reliability. An age regression technique reoriented her to a time two years before, and she was instructed to remain regressed after awakening. In the presence of the patient's husband, the hypnotic operator explained the symptoms of TS and informed her of the possibility that she might develop such a condition in the future. He then explained her regressed situation, and informed her that this process would effectively serve to control her problem if she would give her full cooperation. The hypnosis practitioner urged her to be content with minor progress rather than demanding a miraculous cure. Finally, he described the type of motor movements and the nature of the utterances that she would willingly permit

in her daily life. He also taught the patient ten posthypnotic cues by which she would enter hypnosis, and go into a regressive state again. The patient agreed, yet was unable to respond to the cues she was taught, because of anxiety about her condition. She responded by requesting that the author remain in control of her situation. A further course of therapy was then outlined, consisting of periodic visits to the hypnotic operator's office and the development of a pattern of behavior that would meet the compulsions to tic and simultaneously enable her to live a reasonable and fully functional daily life. She was given instructions to regularly practice her vocal tics as well as some of the author's obscene language in whispers. Eventually the patient learned to express the urge to tic through coughing, gasping, voluntarily belching, and crossing her legs violently. She also made a habit of turning on her car radio to high volume and yielding to her vocal tics completely. Due to a brief relapse one month later, she increased the frequency of this ritual for a short period until she felt the need to tic diminish. She continued therapy for two years, and the compulsions to tic became gradually milder and less frequent. At the time of termination and at least five years later, the patient remained free of her TS symptoms.

A second TS patient treated by Erickson, a male, presented with milder symptoms than the first. He had recently found himself involuntarily bursting into a string of obscenities whilst grinding his teeth and shaking his fists. He soon discovered that any sight pertaining to religion or religious thought was enough to trigger these symptoms. Additionally, a single utterance of profanity would precipitate an uncontrollable explosion of coprolalia. The patient sought the assistance of the author, who responded by designing a program that trained the patient in the selective sensory exclusion of tic-provoking stimuli. While under hypnosis, he was given suggestions that allowed him to ignore any religious factors associated with objects or people. For example, a church might be perceived as a non-threatening "white building", and religion-related speech and obscenities as "nonsense syllables." The patient attended hypnosis sessions biweekly for three months, and with decreasing frequency during the months following for a total of two and a half years. Over the last nine months, he was allowed to recover gradually from the sensory inhibition. His symptoms had vanished as well as any memory of his hypnotherapy sessions.

Lindner and Stevens (Lindner & Stevens, 1967) report the success of hypnosis in treating the TS symptoms of a 19-year-old male. The patient's mother stated that his barking sounds and repetitive cough-masked coprolalia had led to his failure in school and work. The frequent contortions of his face and body were evident on the first meeting. He was given psychotherapy for eight months, which focused on his relationship with his overprotective and dominating mother. He became extremely agitated when the therapist introduced the possibility that he might feel great anger towards his family members, which resulted in him developing a sense of helplessness that only exacerbated his tics. At that point, psychotherapy was prematurely terminated, and hypnosis was introduced. The patient readily entered deeply into hypnosis and under this condition, he was able to identify and express his angry, aggressive and destructive feelings towards his mother and general authority. Together with the hypnotic coach he was able to explore these emotions, and posthypnotic suggestions urged him to express his feelings more openly in the course of day-to-day living. Considerable effort was put into assuring the patient that should he confront and resist the stifling control and infantilism of his mother, allowing his angry reactions to come forward, he would no longer need to express these feelings through his tics. During the course of hypnotherapy, his symptoms decreased rapidly until they were barely noticeable. A conversation with the patient's mother nine years later revealed that his

symptoms had remained minimal, and that he was well and back at work. This is an example of successful integration of psychotherapy and hypnotherapy.

Fernando (Fernando, 1967) presents four case reports of TS patients, two of which were treated with hypnosis. A 27-year-old male, exhibiting grimacing tics, movements of the upper limbs, barking sounds, and coprolalia, received four sessions of hypnotherapy with direct suggestions for improvement. In addition, he underwent ten carbon dioxide inhalations.

His symptoms decreased, but neither method produced any lasting benefits. A second patient, a 31-year-old male presented with frequent grimacing tics, movements of his limbs, jerks of his whole body, coprolalia and loud barking noises. Seven sessions of direct suggestion under hypnosis for symptom improvement, much like the first case, produced no lasting effect. However, all of his tics completely disappeared during hypnosis, and for five to ten minutes afterwards. McKinnon (McKinnon, 1967) found similar results in the case of an adult male TS patient afflicted with a variety of tics, including coprolalia, upward jerking of his head, and jumping movements of his hands, legs and pelvis. In his case, hypnotherapy only temporarily produced a partial relief from symptoms, whereas another study, conducted by Shapiro, Shairo, Bruun, and Sweet (Shapiro, Shapiro, Bruun, & Sweet, 1978), found hypnotherapy to be entirely ineffective for treating the symptoms of TS.

Clements observed a twelve-year-old male TS patient who had sought help for his "habits" of involuntary grimacing, blinking, touching his eyeglasses, the uncontrolled blurting of the word "beep", and later coprolalia (Clements, 1972). He was prescribed haloperidol and hypnotherapy was attempted, but neither of these methods produced any improvement in his symptoms. After three months, a cessation of the drug treatment resulted in an intense exacerbation of symptoms, so the dosage was maintained while psychotherapy was initiated.

The patient experienced difficulties discussing personal problems, he denied the experience of any emotions, desires, sensations, or interests, and developed concerns over the amount of time and money invested in his therapy. After three years, the patient agreed to his therapist's request for him to resume hypnotic therapy. Regardless of hypnotizability, the therapist applied a prolonged induction technique followed by suggestions for relaxation only. By the third session, the patient's tics disappeared completely from the time of induction until the end of the session, which was pointed out to him on each occasion. Suggestions were then expanded to include a time period of fifteen to thirty minutes after termination of hypnosis when his tics would not be necessary, which was regularly successful. He was also told that he would allow his mind to dwell on his feelings, including anger and hostility, and when he was ready to deal with these feelings, his mind would allow his tics to subside.

The therapist proceeded to suggest that tics would only be necessary during morning classes, and later proposed that they could be omitted entirely when he was at school.

Within a few weeks, his coprolalia diminished almost completely, and tics occurred only at home or at public places in the presence of his parents. Nine weeks after beginning hypnotherapy, the patient was in full control of his motor and vocal tics and over the next few months, haloperidol was gradually discontinued. This case supports the notion that hypnotherapy can be effective for those who resist psychotherapy or have difficulty expressing their feelings.

Spithill treated a twenty-one-year-old male referred by a physician because of severe bilateral eye-blinking, accompanied by a less-worrisome occasional facial grimace. Despite the presence of these motor tics, no TS diagnosis had been made. After an interview, the author hypothesized that the patient's tics were indicative of an inner tension, which had likely resulted from a highly traumatic event. His symptoms led to social embarrassment and

isolation, undermining his sense of self-worth. Taking these factors into account, the author devised a treatment plan, which aimed to reduce tics first through cognitive therapy. If this approach was not sufficient on its own hypnosis would be added, and as a last resort, behavioral therapy with massed practice would be used. The patient attended a total of seventeen therapy sessions over a thirteen-week period. The first five sessions consisted of regular psychotherapy, and brought about some improvement in self-esteem and social relationships, but no reduction in the frequency of eye-blinks was observed. At session six, the author induced a light hypnotic trance, during which the patient discussed his anxieties about his blinking behavior. Posthypnotic suggestions were given to facilitate his transition into hypnosis at the next meeting, and during the third attempt at hypnosis, the author noticed that the patient's defenses had been reduced. He was able to recall an experience at church camp at the age of six when he had been humiliated in front of the other children, which was the day he started to blink abnormally. The memory was explored in depth, and the tics disappeared by the end of the hypnosis session, not recurring until two days prior to the fourth hypnotic treatment when his relationship ended with his girlfriend. The fourth hypnosis session focused on identifying the particular situational factors that triggered anxiety, relating particularly to the recent event involving his romantic involvement. During the fifth and last session, the author post-hypnotically suggested that the patient could, on command, enter a deep hypnotic state using the same relaxation procedures that worked in the previous sessions, yet remain alert and in touch with his environment. The client later reported being able to carry out his process on his own. A six-year follow-up on this patient revealed he had remained free of tics for three years, after which he suffered a relapse for five months, with long periods of remission during a painful divorce. He re-entered psychotherapy for two months and symptoms had not returned up until the time of the report's publication.

Storms describes his treatment sequence for a twenty-five-year-old male TS patient, who exhibited multiple tics including head-snapping, grunting, screaming some of the syllables of his words, and a routine involving swallowing air, belching, and putting his fingers down his throat (Storms, 1985). After fifty-two sessions of massed practice behavioral therapy brought no improvement in his symptoms, and after a trial of haloperidol was unsuccessful due to severe side effects, the therapist gave hypnotic suggestions to improve the patient's confidence and self-esteem. A second attempt at massed practice was then made, this time simply concentrating on eliminating a single specific tic, the head-snapping motion. At the end of twenty-five focused practice sessions five and a half months later, all tics were virtually absent. The patient continued working with the author to deal with interpersonal and family problems for twelve more sessions, until he reported feeling "better than he had in a very long time." This integration of hypnotherapy and massed practice brought successful results where massed practice alone had failed.

Young and Montano proposed a new method for the treatment of TS, integrating the behavioral therapy techniques of habit reversal and response prevention with self-hypnosis (Young & Montano, 1988). They describe this combination of behavioral therapy plus self-hypnosis (BEP SH) method as it was applied to the cases of three male TS patients, ages seven, eight, and twelve, displaying a variety of both motor and vocal tics. At the time on the initial interview, the therapist obtained a detailed description from all three patients of each of their particular tic behaviors, including when it occurred, which muscle group was involved, its frequency, intensity and duration. Baseline data were also collected by their parents at home. The BEP SH treatment design was carried out in three phases, the first of which was termed *Discrimination training and skill acquisition*. To start with, the children

were asked to identify the tics they would like to decrease first, and thereafter both parents and children were instructed to separately record the frequency of these tics at a time when they were known to occur. In addition, the children observed themselves in a mirror or face-to-face with a parent for fifteen minutes a day, in order to help them discriminate between the tics and other normal motor behaviors. Along with developing an awareness of their tics, self-hypnosis training was initiated using a muscle relaxation induction technique, with visual imagery for deepening. The children were given an audiotape of their first sessions and asked to listen to it for fifteen minute periods twice a day.

During the second phase, named *Skill application and problem resolution*, the patients were requested to identify the subjective urge that precedes their tics. Self-hypnosis, a process part of a symptom-prevention behavioral technique, helped them to focus and concentrate on this urge. They were then encouraged to prolong the time between this urge and an actual tic. Therapists also taught the children a habit-reversal technique, which determined an appropriate competing muscle response to the targeted tics, and training each individual to perform this movement in place of the undesired one. The patients were then allowed to select which of the two techniques they would like to pursue in treatment. During the third phase, *Generalization, symptom mastery and maintenance*, the children were instructed to continue self-hypnosis practice in both their imaginations and during therapy sessions, applying their chosen behavioral method during periods of high tic frequency. As recurrence of TS tics is common after initial treatment, the patients were directed to formulate a plan to successfully respond using self-hypnosis should a relapse occur.

The BEPSH method appears to be an effective procedure for the treatment of TS. The first patient's targeted tics remained extinguished at a one-year follow-up, and the second patient experienced a significant decrease in tics three months after treatment, with a slight relapse by the six-month follow-up. The third patient was free of all tics by the sixth week of the third phase. Taking a critical retrospective look at the study, the authors note that data collection was not always reliable when recording numbers of tics during high-frequency ticking periods, as they sometimes occurred at a rate that was too fast to count. In addition, a follow-up was not systematically conducted, and patient outcomes were evaluated after different periods of time. It is recommended that future studies using the BEPSH method utilize a more organized experimental design, with a contrast group and a subject size large enough to statistically analyze for a main treatment effect.

Similar results were found when the BEPSH method was applied to two more TS patients (Young, 1991). The first, a nine-year-old male, significantly decreased the frequency of eye-blinking tics after four therapy sessions over a four-week period. The second, a thirteen-and-a-half-year-old male, used the BEPSH method plus a rapid induction technique (RIT) to target his head-shaking tics. During RIT, a patient is asked to "relax your body as quickly as you can with your eyes open," which most children are able to do in five to thirty seconds on their own. Instructions were given to practice this ten times a day, and by the end of eight sessions over a sixteen-week period, the tic behaviors had been extinguished, with no recurrence at a six-month follow-up.

Culbertson (Culbertson, 1989) presents a case study of a sixteen-year-old male with TS, who was referred by his physician for hypnotherapy. The patient had struggled with the overwhelming urge to express facial grimaces, eye-twitching, chirping sounds, and inappropriate laughter ever since the third grade. Individual and family therapy had not improved his motor or vocal symptoms, nor the resultant stresses they caused at school and at home. His physician had been reluctant to prescribe haloperidol for fear of potentially

permanent side effects. Hypnotherapy was recommended as a last resort, and a short-term treatment plan aiming for strengthening self-control over tics was initiated. The plan consisted of four steps: progressive relaxation, biofeedback exercises involving intentional finger-tip temperature change, a simple method of self-hypnosis using eye-rolling and arm-levitation exercises, and lastly developing a pleasant mental image of calmness and peace. The patient attended nine sessions over the course of six months, and was instructed to practice the self-hypnosis exercises both in the morning and in the afternoon while at school. By the sixth session, his tics had significantly decreased, with an average of no more than one per class, and after two more sessions, his symptoms had disappeared completely. A six-month follow-up report revealed that his tics were minimal to non-existent when he was at home and never occurred at school.

Crawford describes his experiences as a hypnotherapist working with a fourteen-year-old male with TS (Crawford, 1992). The boy exhibited facial-grimacing, gross motor movements, and vocal tics, including coprolalia. Under hypnosis, which was induced with relaxation, the boy was able to express his anxiety and hopelessness about his future. Ego-strengthening suggestions were given to build his confidence and help him think positively about his outlook and expectations. He was told that he would get better, and a form of token economy was set up, in which rewards were given in exchange for overcoming coprolalia.

Also, a tape recording of a therapy session was made to allow the boy to hear himself. He made great progress over the next two and a half years and ultimately gained control over his verbal and motor tics. Since his termination of therapy, the author has reportedly applied hypnotherapy to two further TS patients, both of whom responded well to treatment.

Kohen provides a case report on self-hypnosis, in which a seven-year-old female with multiple motor and vocal tics learned the “computer” and “STOP” sign metaphors described earlier, which she used at hypnosis sessions with the therapist and when practicing self-hypnosis at home. New strategies for tic control were added to the suggestions, including allowing herself to be “as relaxed as a Raggedy Ann doll,” taking a trip through her body into the main “computer”, the brain, and turning off the “twitch switch,” as well as transferring the tics down the body to the hands or toes and throwing them away. The suggestions were incorporated into an audiotape to use during home practice. She also learned future projection imagery, and was told that if she concentrated on a muscle, it could “learn” to act the right way without ticking. The author stresses the importance on frequently coming up with new strategies to prevent boredom or frustration from interfering with self-hypnosis. A year after beginning treatment, the patient had one tic remaining, but she was quickly able to eliminate it with a variation of her computer metaphor. Therapist visits were reduced to once every six months and no increase in symptoms was noted. Kohen provides a more thorough report of these powerful hypnotic treatment strategies utilizing storytelling and control metaphors to manage the tics of TS (Kohen, 1995b).

Acknowledgment

This project was supported in part by a 2006 NARSAD Young Investigator Award to Amir Raz.

References

- Bajo, S., Battaglia, M., Pegna, C., & Bellodi, L. (1999). Citalopram and fluvoxamine in Tourette's disorder. *Journal of the American Academy of Child and Adolescent Psychiatry*, 38(3), 230-231.
- Bergin, A., Waranch, H.R., Brown, J., Carson, K., & Singer, H.S. (1998). Relaxation therapy in Tourette syndrome: A pilot study. *Pediatric Neurology*, 18(2), 136-42.
- Bruun, R.D., & Budman, C.L. (1996). Risperidone as a treatment for Tourette's syndrome. *Journal of Clinical Psychiatry*, 57(1), 29-31.
- Chappell, P.B., Riddle, M.A., Scahill, L., Lynch, K.A., Schultz, R., Arnsten, A., Leckman, J.F., & Cohen, D.J. (1995). Guanfacine treatment of comorbid attention-deficit hyperactivity disorder and Tourette's syndrome: Preliminary clinical experience. *Journal of American Academy of Child And Adolescent Psychiatry*, 34(9), 1140-1146.
- Chappell, P.B., Scahill, L.D., & Leckman, J.F. (1997). Future therapies of Tourette syndrome. *Neurologic Clinics*, 15(2), 429-50.
- Clements, R.O. (1972). Gilles de la Tourette's syndrome: An overview of development and treatment of a case using hypnotherapy, haloperidol, and psychotherapy. *American Journal of Clinical Hypnosis*, 14(3), 167-72.
- Cohen, D.J., Detlor, J., Young, J.G., & Shaywitz, B.A. (1980). Clonidine ameliorates Gilles de la Tourette syndrome. *Archives Of General Psychiatry*, 37(12), 1350-7.
- Crawford, A. (1992). The role of hypnotherapy in the control of Tourette's disorder. *Australian Journal of Clinical Hypnotherapy and Hypnosis*, 13(1), 21-25.
- Culbertson, F.M. (1989). A four-step hypnotherapy model for Gilles de la Tourette's syndrome. *American Journal Of Clinical Hypnosis*, 31(4), 252-256.
- Eisenberg, L., Ascher, E., & Kanner, L. (1959). A clinical study of Gilles de la Tourette's disease (maladie des tics) in children. *American Journal of Psychiatry*, 115(8), 715-23.
- Erenberg, G., Cruse, R.P., & Rothner, A.D. (1987). The natural history of Tourette syndrome: A follow-up study. *Ann Neurol*, 22(3), 383-5.
- Erickson, M.H. (1965). Experimental Hypnotherapy in Tourette's Disease. *American Journal of Clinical Hypnosis*, 69, 325-331.
- Fernando, S.J.M. (1967). Gilles de la Tourette syndrome: A report on four cases and a review of published case reports. *British Journal of Psychiatry*, 113, 607-617.
- Fras, I. (1996). Guanfacine for Tourette's disorder. *Journal of American Academy of Child and Adolescent Psychiatry*, 35(1), 3-4.
- Hauser, R.A., & Zesiewicz, T.A. (1995). Sertraline-induced exacerbation of tics in Tourette's syndrome. *Movement Disorders*, 10(5), 682-84.
- Himle, M.B., & Woods, D.W. (2005). An experimental evaluation of tic suppression and the tic rebound effect. *Behaviour Research And Therapy*, 43(11), 1443-51.
- Himle, M.B., Woods, D.W., Piacentini, J.C., & Walkup, J.T. (2006). Brief review of habit reversal training for Tourette syndrome. *Journal of Child Neurology*, 21(8), 719-725.
- King, R.A., Scahill, L., Findley, D., & Cohen, D.J. (1999). Psychosocial and behavioral treatments. In J.F. Leckman & D.J. Cohen (Eds.), *Tourette's Syndrome-Tics, obsessions, compulsions*. New York: John Wiley & Sons, Inc.
- Kirsch, I., & Lynn, S.J. (1997). Hypnotic involuntariness and the automaticity of everyday life. *American Journal of Clinical Hypnosis*, 40(1), 329-48.

- Kohen, D.P. (1995a). Coping with the stress of Tourette syndrome in children and adolescents: Use of self-hypnosis techniques. *Australian Journal of Clinical and Experimental Hypnosis*, 23(2), 145-157.
- Kohen, D.P. (1995b). *Ericksonian communication and hypnotic strategies in the management of tics and Tourette Syndrome in children and adolescents*. New York: Brunner/Mazel.
- Kohen, D.P., & Botts, P. (1987). Relaxation-imagery (self-hypnosis) in Tourette syndrome: experience with four children. *American Journal of Clinical Hypnosis*, 29(4), 227-237.
- Kosslyn, S.M., Thompson, W.L., Costantini-Ferrando, M.F., Alpert, N.M., & Spiegel, D. (2000). Hypnotic visual illusion alters color processing in the brain. *American Journal of Psychiatry*, 157(8), 1279-84.
- Kurlan, R., Como, P.G., Deeley, C., McDermott, M., & McDermott, M.P. (1993). A pilot controlled study of fluoxetine for obsessive-compulsive symptoms in children with Tourette's syndrome. *Clinical Neuropharmacology*, 16(2), 167-72.
- Kushner, H.I. (1999). *A cursing brain?: The histories of Tourette syndrome*. Cambridge, MA: Harvard University Press.
- Kwak, C.H., Hanna, P.A., & Jankovic, J. (2000). Botulinum toxin in the treatment of tics. *Archives Of Neurology*, 57(8), 1190-3.
- Lang, A.E. (2001). Update on the treatment of tics. *Adv Neurol*, 85, 355-62.
- Leckman, J.F., Hardin, M.T., Riddle, M.A., Stevenson, J., Ort, S.I., & Cohen, D.J. (1991). Clonidine treatment of Gilles de la Tourette's syndrome. *Archives Of General Psychiatry*, 48(4), 324-8.
- Lindner, H., & Stevens, H. (1967). Hypnotherapy and psychodynamics in the syndrome of Gilles de la Tourette. *International Journal of Clinical and Experimental Hypnosis*, 15(4), 151-155.
- Lombroso, P.J., Scahill, L., King, R.A., Lynch, K.A., Chappell, P.B., Peterson, B.S., McDougle, C.J., & Leckman, J.F. (1995). Risperidone treatment of children and adolescents with chronic tic disorders: A preliminary report. *Journal of American Academy of Child and Adolescent Psychiatry*, 34(9), 1147-52.
- MacLeod, C.M. (1992). The Stroop task: The "gold standard" of attentional measures. *Journal of Experimental Psychology: General*, 121, 12-14.
- McKinnon, R.C. (1967). Gilles de la Tourette syndrome: A case showing electroencephalographic changes and response to haloperidol. *Medical Journal of Australia*, 2, 21-22.
- Peterson, B.S., Campise, R.L., & Azrin, N.H. (1994). Behavioral and pharmacological treatments for tic and habit disorders: A review. *Journal of Developmental and Behavioral Pediatrics*, 15, 430-441.
- Piacentini, J., & Chang, S. (2001). Behavioral Treatments for Tourette Syndrome and Tic Disorders: State of the Art. In D.J. Cohen, J. Jankovic, & C.G. Goetz (Eds.), *Advances in neurology: Tourette Syndrome* (Vol. 85, pp. 319-331). Philadelphia: Lippincott Williams & Wilkins.
- Piacentini, J., & Chang, S. (2005). Habit reversal training for tic disorders in children and adolescents. *Behavior Modification*, 29(6), 803-22.
- Polites, D.J., Kruger, D., & Stevenson, I. (1965). Sequential Treatments in a Case of Gilles De La Tourette's Syndrome. *British Journal of Medical Psychology*, 38, 43-52.

- Raz, A. (2004). Atypical attention: Hypnosis and conflict reduction. In M.I. Posner (Ed.), *Cognitive neuroscience of attention* (pp. 420-429). New York: Guilford Publications.
- Raz, A. (2006). Perspectives on the efficacy of antidepressants for child and adolescent depression. *PLoS Medicine*, 3(1), e9.
- Raz, A., & Buhle, J. (2006). Typologies of attentional networks. *Nature Reviews Neuroscience*, 7(5), 367-79.
- Raz, A., Fan, J., & Posner, M.I. (2005). Hypnotic suggestion reduces conflict in the human brain. *Proceedings of the National Academy Of Sciences of the United States of America*
- Raz, A., Landzberg, K.S., Schweizer, H.R., Zephroni, Z.R., Shapiro, T., Fan, J., & Posner, M.I. (2003). Posthypnotic suggestion and the modulation of Stroop interference under cycloplegia. *Consciousness and Cognition*, 12(3), 332-46.
- Raz, A., Moreno-Iniguez, M., Martin, L., & Zhu, H. (in press). Suggestion overrides the Stroop effect in highly hypnotizable individuals. *Consciousness and Cognition*.
- Raz, A., & Norman, K.L. (2004). A social psychologist illuminates cognition. *Behavioral and brain sciences*, 27(5), 673-674.
- Raz, A., Shapiro, T., Fan, J., & Posner, M.I. (2002). Hypnotic suggestion and the modulation of Stroop interference. *Archives of General Psychiatry*, 59(12), 1155-61.
- Robertson, M. (2004). Gilles de la Tourette syndrome. *The Psychologist*, 17, 76-79.
- Robertson, M.M. (2006). Attention deficit hyperactivity disorder, tics and Tourette's syndrome: The relationship and treatment implications. A commentary. *European Child & Adolescent Psychiatry*, 15(1), 1-11.
- Schneck, J.M. (1960). Gilles de la Tourette's disease. *American Journal of Psychiatry*, 117, 78.
- Shapiro, A.K., Shapiro, E., & Eisenkraft, G.J. (1983). Treatment of Gilles de la Tourette's syndrome with clonidine and neuroleptics. *Archives of General Psychiatry*, 40(11), 1235-1240.
- Shapiro, A.K., Shapiro, E.S., Bruun, R.D., & Sweet, R.D. (1978). *Gilles de la Tourette Syndrome*. New York: Raven Press.
- Shapiro, E., Shapiro, A.K., Fulop, G., Hubbard, M., Mandeli, J., Nordlie, J., & Phillips, R.A. (1989). Controlled study of haloperidol, pimozone and placebo for the treatment of Gilles de la Tourette's syndrome. *Archives of General Psychiatry Archives*, 46(8), 722-30.
- Shehan, P.W., & Orne, M.T. (1968). Some comments on the nature of posthypnotic behavior. *Journal of Nervous and Mental Diseases*, 146(3), 209-20.
- Silva, R.R., Munoz, D.M., Daniel, W., Barickman, J., & Friedhoff, A.J. (1996). Causes of haloperidol discontinuation in patients with Tourette's disorder: Management and alternatives. *Journal of Clinical Psychiatry*, 57(3), 129-35.
- Spessot, A.L., & Peterson, B.S. (2004). Tourette Syndrome: A Multifactorial, Developmental Psychopathology. In D. Cicchetti & D.J. Cohen (Eds.), *Manual of developmental psychopathology*. New York: John Wiley.
- Spithill, A. (1974). Treatment of a monosymptomatic tic by hypnosis: A case study. *American Journal of Clinical Hypnosis*, 17, 88-93.
- Storms, L. (1985). Massed negative practice as a behavioral treatment for Gilles de la Tourette's syndrome. *American Journal of Psychotherapy*, 39(2), 277-81.
- Wegner, D.M. (2002). *Hypnosis and will: The illusion of conscious will* (pp. 271-315). Cambridge, MA: MIT Press.

- Woods, D.W., & Himle, M.B. (2004). Creating tic suppression comparing the effects of verbal instruction to differential reinforcement. *Journal of Applied Behavior Analysis, 37*(3), 417-420.
- Woods, D.W., & Marcks, B.A. (2005). Controlled evaluation of an educational intervention used to modify peer attitudes and behavior toward persons with Tourette's Syndrome. *Behavior Modification, 29*(6), 900-12.
- Woods, D.W., Piacentini, J., Himle, M.B., & Chang, S. (2005). Premonitory Urge for Tics Scale (PUTS): Initial psychometric results and examination of the premonitory urge phenomenon in youths with Tic disorders. *Journal of Developmental And Behavioral Pediatrics, 26*(6), 397-403.
- Young, M.H. (1991). Tics. In W.C. Wester & D.J. O'Grady (Eds.), *Clinical hypnosis with children*. New York: Brunner/Mazel Publishers.
- Young, M.H., & Montano, R.J. (1988). A new hypnobehavioral method for the treatment of children with Tourette's disorder. *American Journal Of Clinical Hypnosis, 31*(2), 97-106.
- Zahm, D.N. (1982). A clinical outcome study of hypnosis treatment upon the tics associated with Gilles de la Tourette syndrome. *Dissertation Abstracts International, 4*:1635B.
- Zahm, D.N. (1987). Hypnosis in the treatment of Tourette syndrome. In W.C. Wester (Ed.), *Clinical hypnosis: A case management approach* (pp. 319-331). Cincinnati: Behavioral Science Center, Inc.