Effects of tic suppression: Ability to suppress, rebound, negative reinforcement, and habituation to the premonitory urge

Matt W. Specht [a],[*], Douglas W. Woods [b], Cassandra M. Nicotra [a], Laura M. Kelly [a], Emily J. Ricketts [b], Christine A. Conelea [b], Marco A. Grados [a], Rick S. Ostrander [a], John T. Walkup [a]

[a] Department of Psychiatry and Behavioral Sciences, Division of Child and Adolescent Psychiatry, Bloomberg Children's Center, Level 12, Johns Hopkins Hospital, 1800 Orleans Street, Baltimore, MD 21283, USA
[b] Department of Psychology, University of Wisconsin-Milwaukee, 224 Garland Hall, 2441 E. Hartford Ave., Milwaukee, WI 53211, USA

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ABSTRACT

The comprehensive behavioral intervention for tics (CBIT) represents a safe, effective non-pharmacological treatment for Tourette's disorder that remains underutilized as a treatment option. Contributing factors include the perceived negative consequences of tic suppression and the lack of a means through which suppression results in symptom improvement. Participants ($n = 12$) included youth ages 10–17 years with moderate-to-marked tic severity and noticeable premonitory urges who met Tourette's or chronic tic disorder criteria. Tic frequency and urge rating data were collected during an alternating sequence of tic freely or reinforced tic suppression periods. Even without specific instructions regarding how to suppress tics, youth experienced a significant, robust (72%), stable reduction in tic frequency under extended periods (40 min) of contingently reinforced tic suppression in contrast to periods of time when tics were ignored. Following periods of prolonged suppression, tic frequency returned to pre-suppression levels. Urge ratings did not show the expected increase during the initial periods of tic suppression, nor a subsequent decline in urge ratings during prolonged, effective tic suppression. Results suggest that environments conducive to tic suppression result in reduced tic frequency without adverse consequences. Additionally, premonitory urges, underrepresented in the literature, may represent an important enduring etiological consideration in the development and maintenance of tic disorders.

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Recently, a multi-site, randomized controlled trial found a specific cognitive-behavioral therapy, the comprehensive behavioral intervention for tics (CBIT), to be more effective than psychoeducation and supportive therapy in the treatment of children with tic disorders (Piacentini et al., 2010). Despite its efficacy, CBIT and its predecessor, habit reversal training, remains underutilized (Marcks, Woods, Teng, & Twohig, 2004). The present study focuses on addressing specific barriers to underutilization.

Barriers to widespread acceptance of CBIT as a front-line intervention include clinician, patient, and family fears regarding the perceived negative consequences of tic suppression. Many physicians (55%) believe that tics are not suppressible and a preponderance of health care providers (77%) believe that tic suppression will subsequently result in an increase or 'rebound' in tic frequency (Burd & Kerbeshian, 1987; Marcks et al., 2004; Woods, Conelea, & Himle, 2010). There has also been concern that suppressing a particular tic may worsen other non-targeted tics.

Reduction in total tic severity in the CBIT for children with tic disorders study (Piacentini et al., 2010) suggests that tic suppression, as part of a comprehensive treatment approach, is effective in reducing total tic severity and improving symptoms. An independent line of research has begun to address fears regarding the perceived negative consequences of tic suppression (Himle & Woods, 2005; Meidinger et al., 2005). Single-case behavioral analytic studies suggest that children are capable of suppressing tic symptoms for prolonged periods of time (40 min) when contingently reinforced for effective suppression, even without being provided robust suppression strategies (Woods & Himle, 2004; Woods et al., 2008). Also, there does not appear to be a subsequent increase (rebound) in tic symptoms during post-suppression "tic freely" periods (Himle & Woods, 2005; Meidinger et al., 2005). Lingering concerns regarding the negative effects of tic suppression hinge on the shortcomings associated with single-case studies (i.e., lack of statistical analysis and limited generalizability).

* Corresponding author. Tel.: +1 410 614 4236, +1 410 409 6751; fax: +1 410 955 8691.
E-mail address: mspecht1@jhmi.edu (M.W. Specht).

In addition to concerns about the negative effects of tic suppression, there is a significant question regarding *how* behavioral treatments produce durable decreases in symptom severity (Woods et al., 2011). Genetic and biological contributions and the efficacy of biological interventions are undisputed. However, preliminary evidence suggests that the maintenance and exacerbation of tics as well as tic reduction following non-pharmacological treatment can, in part, be explained via operant conditioning principles. The negative reinforcement hypothesis of tic maintenance suggests that tics persist, in part, because tic completion results in a temporary reduction in the unpleasant "premonitory urge" (i.e., unpleasant feeling or sensation). A single-case study appears to confirm this notion in that premonitory urge ratings were higher during periods of tic suppression and lower during periods of tic completion (Himle, Woods, Conelea, Bauer, & Rice, 2007). The "urge habituation" hypothesis predicts that while tic suppression may initially result in an increase in premonitory urge severity, *continued* tic suppression (a component of CBT for tics) results in an eventual reduction of premonitory urge ratings, thereby breaking the negative reinforcement cycle and resulting in symptom improvement. Indeed, a recent study found that average urge ratings decreased significantly within and between exposure and response prevention treatment sessions for tics (Verdellen et al., 2008).

This current study builds on prior single-case studies by using improved methods, which allow for statistical analysis, and was designed to a) replicate previous findings regarding the ability to suppress tics, b) replicate the absence of a subsequent 'rebound' in tics following prolonged suppression, c) replicate prior findings regarding the negative reinforcement hypothesis with respect to tic maintenance and, d) examine the urge habituation hypothesis in treatment-naive youth with tic disorders. Specific hypotheses were that a) tic frequency would be significantly lower during periods of tic suppression, compared to periods of tic completion, b) there would be no statistical difference in frequency before and after periods of prolonged tic suppression, c) average urge severity ratings would be statistically higher during initial tic suppression than during periods of tic completion, and d) urge severity would return to a statistically non-significant level in comparison to tic completion levels by the end of 40 min of tic suppression.

Method

Participants

Children and adolescents (ages 10–17 years) were recruited at Johns Hopkins University, School of Medicine and the University of Wisconsin-Milwaukee (UWM) via referrals from local clinicians, fliers and bulletin boards, community seminars, and the Tourette Syndrome Association of Greater Washington and Pennsylvania newsletters.

Eligible participants were generally healthy males or females who met the Diagnostic and Statistical Manual of Mental Disorder-Fourth Edition-Text Revision (DSM-IV-TR; APA, 2000) diagnostic criteria for Tourette's disorder or chronic motor or vocal tic disorder (collectively referred to as Chronic Tic Disorders, henceforth). All participants (a) had a primary chronic tic disorder diagnosis, (b) had no history of more than 3 weeks of behavioral treatment for tics or other treatment in which suppression strategies were a primary component, (c) had moderate to severe tic severity determined by a minimum total score of ≥14 for both motor and vocal tics or ≥10 if motor or vocal tics only on the Yale Global Tic Severity Scale (YGTSS, Leckman et al., 1989), (d) possessed low-average range or better intellectual functioning defined by a two-scale score of ≥75 on the Weschler Abbreviated Scale of Intelligence (Psychological Corporation, 1999), (e) reported the presence of a noticeable premonitory urge on the Premonitory Urge for Tic Scale (PUTS, Woods, Piacentini, Himle, & Chang, 2005), (f) were currently exhibiting one or more motor and/or vocal tics at a rate of at least 1 tic per minute. Children with significant Oppositional Defiant Disorder (ODD) or Conduct Disorder symptoms, as determined by the Anxiety Disorders Interview Schedule-Research Lifetime Version (Silverman & Albano, 2002), were excluded from the study. Children with other co-occurring conditions (e.g., obsessive-compulsive disorder [OCD], attention-deficit/hyperactivity disorder [ADHD]) were *not* necessarily excluded provided they met all other eligibility requirements. Pharmacological tic and/or urge suppression would unnecessarily confound results; therefore, potential participants were excluded if they reported on a medication history form a current regimen that included (a) antipsychotics, (b) anti-hypertensives, (c) benzodiazepines, or (d) selective serotonin reuptake inhibitors.

Materials

Tic detector

During all conditions, the child was seated alone in a room facing the *tic detector*, which is an electronic token dispenser housed in a rectangular enclosure with a clear, plastic receptacle attached to the front to gather dispensed tokens. Following the protocol established by Woods and Himle (2004), the child was told that the machine had the ability to monitor and count tics through the web camera mounted on top. The child was also told that when the two lights on the front of the tic detector were illuminated, the detector had started "counting" tics. In reality, two research assistants controlled the tic detector behind a one-way mirror. The rationale for this manipulation was that it allowed researchers to engage in counting tics and rewarding suppression without the child being aware of direct observation, which may have altered tic frequency. This, in turn, allowed for a more accurate and valid assessment of tic frequency. Parents were informed of this manipulation and its purpose during the consent process and were instructed not to inform their child. Immediately following participation in the study, the deception was thoroughly explained and demonstrated to the child. All children signed a debriefing form following the explanation.

Urge thermometer

Using a well-established method (Himle et al., 2007), we measured the premonitory urge by asking participants to provide an overall rating of the urge experience at regular intervals (every 10 s) via the "urge thermometer". Prior to all study conditions, participants were given identical instructions for the urge thermometer. Participants were instructed to state their urge ratings aloud when the urge thermometer appeared. The *urge thermometer* is a rating scale adapted from the "feelings thermometer" for anxiety severity from the Anxiety Disorders Interview Schedule-Research Lifetime Version and was modified to evaluate urge intensity via urge ratings during all conditions (Himle et al., 2007). The scale was presented in an automated fashion at 10-s intervals using identical Microsoft PowerPoint slides displayed on a computer monitor next to the tic detector in the experimental room. Prior research has used longer intervals (30 s) between urge ratings reports to reduce the possibility that movement required to verbally report ratings may result in or disguise tics; however, reporting urge ratings did not appear to reliably elicit or obscure tic symptoms (Himle et al., 2007). In the current study, shorter intervals between urge ratings (10 s) allowed for the collection of ratings during each segment of tic suppression (15 s) and thus more accurate data regarding urge intensity. The scale ranges from 0 to 9,