

DR. AZRIN # 115

Habit reversal for the treatment of Tourette Syndrome

NATHAN H. AZRIN and ALAN L. PETERSON

Nova University, School of Psychology, 3301 College Avenue, Fort Lauderdale, FL 33314, U.S.A.

(Received 8 December 1987)

Summary—Habit reversal has been found effective for the treatment of individual tics. The present study used habit reversal to treat three subjects with the multiple tics of Tourette Syndrome. Tic frequency was reduced over a 6–8-month period by 93–95% in the clinic setting and by 64–99% in the home setting with a concurrent decrease in severity. The procedure holds promise as a treatment for Tourette Syndrome.

Tourette Syndrome is a disorder that consists of multiple motor and one or more vocal tics subject to only partial voluntary control. Motor tics may include movements such as eye blinking, head jerking, shoulder shrugging and facial grimaces. Common vocal tics include coughing, throat clearing, barking, sniffing, snorting and coprolalia. The average age of onset of Tourette Syndrome symptoms is 7 years and the disorder is three times more common in males than in females (Bauer and Shea, 1984; Cohen, Leckman and Shaywitz, 1984). The DSM-III-R diagnostic criteria for Tourette Syndrome includes the following: (1) Both multiple motor and one or more vocal tics present at some time during the illness, although not necessarily concurrently; (2) the tics occur many times a day (usually in bouts), nearly every day or intermittently throughout a period of more than 1 year; (3) the anatomic location, number, frequency, complexity, and severity of the tics change over time; (4) onset before age 21, and (5) occurrence not exclusively during Psychoactive Substance Intoxication or known central nervous system disease, such as Huntington's chorea and postviral encephalitis (American Psychiatric Association, 1987).

Diagnostic problems in Tourette Syndrome have been common. One survey on misdiagnosis in a major metropolitan area found 80% of Tourette Syndrome patients to be self-diagnosed, never having been accurately diagnosed by a physician or psychologist (Shapiro, Shapiro, Sweet and Brunn, 1975). The average delay in diagnosis for Tourette Syndrome from onset of symptoms was 16 years. One of the problems in accurate diagnosis has been lack of knowledge by the appropriate health care individuals—Tourette Syndrome was not even listed in the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders until its 1980 revision (American Psychiatric Association, 1980). Another problem has been that although Tourette Syndrome symptoms may be exhibited at a high frequency outside of the clinical setting, it is a fairly common occurrence for symptoms to be reduced or absent when patients are seen for evaluation by health care professional (Bauer and Shea, 1984; Cohen *et al.*, 1984).

Pharmacological treatments have been shown to reduce the frequency of Tourette Syndrome tics by approx 50% (Ross and Moldofsky, 1978; Shapiro and Shapiro, 1984), but also lead to unwanted side effects in about 80% of the cases (Jagger, Prusoff, Cohen, Kidd, Carbonaire and John, 1982).

Numerous behavioral approaches have been used in treatment outcome studies of TS including massed negative practice, contingency management, relaxation training, self-monitoring, and habit reversal (see reviews by Azrin and Peterson, 1988; Turpin, 1983). All of these studies have been controlled case studies usually with one or two subjects, no out-of-office recordings, insufficient information regarding the diagnostic criteria, short duration of follow-up, lack of data regarding individual tic changes, lack of observer reliability measures, no measures of severity of tic symptoms, and sometimes no direct measures of tic frequency. Taken together, however, tic frequencies have been shown to be reduced by behavioral procedures by approx 45% in those studies of TS patients in which direct frequency counts of tics were reported and data were collected over at least a 6 month period (Doleys and Kurtz, 1974; Hutzell, Platzek and Logue, 1974; Turpin and Powell, 1984).

Habit reversal is a behavioral treatment approach that has been found effective in reducing individual tics by more than 90% in studies with many subjects (Azrin and Nunn, 1973; Azrin, Nunn and Frantz, 1980), but its effectiveness with the multiple tics of Tourette Syndrome has not yet been adequately determined. Bullen and Hemsley (1983) employed habit reversal to treat a Tourette Syndrome individual and reported that at times the subject was tic-free; however, direct measures of tic frequency were not reported and no systematic follow-up was conducted. Habit reversal was shown in another study (Franco, 1981) to reduce tic frequency in the clinic by more than 90% in two subjects with Tourette Syndrome, but only the major tic was treated; no data was provided on ancillary tics, the effects outside the clinic, or long-term effects. The purpose of the present study was to evaluate in a more definitive manner the effectiveness of the habit reversal method in reducing the multiple tics of Tourette Syndrome individuals by using direct frequency counts of tics in the clinic and at home over an extended duration.

METHOD

Subjects

Three persons volunteered to participate in the present study in response to a local newspaper article. As shown in Table 1, all subjects met the DSM-III-R diagnostic criteria for Tourette Syndrome (American Psychiatric Association, 1987).

In addition, Subjects 1 and 2 had previously been diagnosed by recognized neurological Tourette Syndrome researchers. They also had previously taken Tourette Syndrome medications and Subject 2 was taking Haloperidol at the start of the

Table 1. Subject characteristics

Characteristics	Subject 1	Subject 2	Subject 3
Age	42 years	28 years	37 years
Sex	Male	Male	Male
Age of onset	10 years	13 years	14 years
Motor tics	Head jerks Eye squints	Head jerks Head shakes Arm jerks Leg jerks	Head jerks Eye tic Shoulder shrug Nose wrinkle
Vocal tics	Barking Coughing Throat clearing	Barking Coughing Sneezing	Throat clearing Coughing Sniffing Nose exhalation
Current TS medications	None	Haloperidol	None
Previous TS medications	Haloperidol	Pimozide Clonidine Clonazepam Oxazepam	None

study. Subject 3 differed from the other two subjects in that he had never previously been formally diagnosed as having TS, as is not uncommon considering the frequent diagnostic problems in Tourette Syndrome patients noted previously. He differed as well in that his tics occurred at a low rate in the clinic as was also noted previously as not uncommon and may be the reason he had not previously been diagnosed. He did, however, meet all of the DSM-III-R diagnostic criteria at the start of the study and was therefore included to avoid overselectivity of only the most usual patterns. The high level of his tics outside of the clinic setting was substantiated by the reports of his spouse and a relative.

Recording

At the beginning and end of each session, the subjects were videotaped through the one-way mirror of the treatment room for a 10-min period. They had been informed that videotapes would be taken but were not aware of the precise time. Each videotape was scored subsequently by trained raters. Recording reliability was assessed by having two raters independently score several of the videotapes. An interobserver reliability criterion level was set at 80% or better for each type of individual tic and videotapes were rescored if raters failed to reach the criterion level. The tics were also recorded at home by the subjects and their spouses at a specified time and duration (about 20 min) each day. Again, the Subjects were informed that their tics would be recorded by their spouses, but were not made aware of the specific time period.

Procedure

An AB design was employed with each subject serving as his own control. Each subject was treated individually during 1-h treatment sessions scheduled weekly using the habit reversal procedure (Azrin and Nunn, 1973, 1977; Azrin *et al.* 1980), which consists of several components: awareness training, self-monitoring, relaxation training, and competing response training. Each procedure is described briefly below.

Awareness training and self-monitoring

The initial procedure used when employing habit reversal was Awareness Training, which focuses on increasing the subjects' awareness of (a) frequency and severity of the tics, (b) environmental variables influencing the symptoms, and (c) the specific movements involved in the tics. The subjects and their spouses were instructed to record the incidence of each different tic for a specified duration each day. The duration of the home recording period was adjusted depending on the frequency of tics. For high frequency tics, a 10-min period each day sufficed; for low frequency tics, subjects kept records for the entire day.

The second part of Awareness Training was the Response Description Procedure. The subject described the details of each tic to the therapist, using a mirror or videotape if necessary. This procedure helped insure the subjects were aware of all of the tics currently being exhibited and the specific movement involved in each. Sometimes subjects were reluctant to view themselves on a videotape or in a mirror; however, being able to effectively control tic symptoms required the subjects to be keenly aware of all tic movements. Having to observe oneself on videotape or in a mirror also helped increase the subjects' motivation to perform the required treatment procedures.

In the third component, the Response Detection Procedure, the therapist taught the subjects to detect the occurrence of each tic by alerting the subject when an instance of the tic occurred.

The fourth awareness procedure was the Early Warning Procedure wherein the subjects were given practice in self-detection of the earliest signs or sensory preconditions of a tic (Bullen and Hemsley, 1983).

The fifth awareness procedure was Situation Awareness Training which focused on helping the subjects become more aware of the situations in which tics were more frequent or severe. Information gathered during self-monitorings was helpful in implementing this procedure. The subjects identified the situations, persons, and places in which symptoms were better or worse. By being aware of the situations in which tics were more severe, subjects were prepared to implement the appropriate procedures immediately upon entering the situation or even shortly prior to entering the situation.

Relaxation training

The subjects were given relaxation training consisting of progressive muscular relaxation (Jacobson, 1938), deep breathing (Cappo and Holmes, 1984), visual imagery (Suinn, 1975) and self-statements of relaxation (Schultz and Luthe, 1959). The subjects were taught the relaxation procedures during the first treatment session and were instructed to practice them at least once per day for a 10- to 15-min period. They were also instructed to employ the relaxation procedures, for 1-2 min on a cue-controlled basis (Goldfried, 1973) whenever they felt anxious or had emitted a tic.

Competing response training

The primary habit reversal component was the Competing Response Procedure in which a competing response was identified that was antithetical to a tic or did not allow the tic to occur.

The tics and the specific competing responses used for the subjects in this study are as follows:

Head jerk. Isometric contraction of the neck flexors, (sternocleidomastoid group), pull the chin slightly down and in, and maintain the head in an eyes forward position.

Shoulder shrug. Isometric contraction of the shoulder depressors to strengthen the muscles which work in opposition to the upward jerking movement. Push elbow in toward hip.

Head shake. Slow isometric contraction of the neck muscles with the eyes forward until the head can be maintained perfectly still.

Arm jerk. Push hand down on thigh or stomach and push elbow in towards hip.

Leg jerk. If sitting, place feet flat on floor and push downwards. If standing, lock knees.

Nose wrinkles. Pull upper lip down slightly and press lips together.

Eye blink. Systematic, voluntary, soft blinking consciously maintained at a rate of one blink per 3-5 sec. Frequent downward shifting of gaze about every 5-10 sec.

Oral vocal tics (barking, coughing, throat clearing, coprolalia, sneezing). Slow rhythmic deep breathing through the nose while keeping the mouth closed. Exhalation should be slightly longer than inhalation (e.g. 5 sec inhalation, 7 sec exhalation). The flow of air should not stop at any point other than when shifting from inhalation to exhalation and vice versa.

Nasal vocal tics (sniffing, nose exhalation). Same as above except slow rhythmic deep breathing through the mouth.

The tic that was the most frequent or most disruptive was treated first after the relaxation training. At least one session was devoted to training the individual to employ the Competing Response Procedure both during the session and during the following week in the subject's natural home setting. In subsequent sessions, each additional tic was treated one at a time until a specific competing response had been established for each tic.

Contingency management

The family was instructed to reinforce the subject by having them comment favorably on the improved appearance of the subjects during tic-free periods or significant reductions in symptoms. The subject's motivation was further increased by using the habit inconvenience review, in which the therapist and subject reviewed in detail the inconveniences, embarrassment and suffering that resulted from emitting the tics as well as the positive aspects of eliminating tics. The information was written on a card carried by the subjects to be reviewed frequently as a reminder of the reinforcers available. As the subjects improved, they were encouraged to participate in enjoyable social activities that were previously avoided because of the social disruptiveness of their tics.

Generalization training

During each treatment session, the subjects were given practice and instruction on how to control the tics in everyday situations. First the subjects practiced the specific procedure in the session until it could be correctly executed. To teach the subject to be aware of tics in situations outside the office setting, the symbolic rehearsal procedure was used in which the individual imagined common and tic-eliciting situations and that he detected the urge to emit a tic, and then performed the required exercise. Additionally, after the cue-controlled relaxation or competing response procedure had been taught to the subjects, the procedures were employed by the subject for the duration of each treatment session. If the subject failed to detect a tic or self-initiate a procedure, the therapist prompted the subject to implement the appropriate procedure. Prompts from the therapist were not provided during the initial portion of each treatment session when videotapes were taken of the subjects.

RESULTS

The results are shown in Fig. 1 for each subject in both the home and clinic settings. The clinic data in Fig. 1 represents results from videotapes taken before the start rather than after the end, of each treatment session. Therefore, the data is a conservative estimate of tic frequency and is not confounded by any within session decreases in tic frequency that occurred as a result of treatment.

The habit reversal treatment resulted in an immediate reduction in tics and further reductions occurred as the treatment progressed. For Subject 1, the multiple tics were reduced by 74% during the first month of treatment in the clinic setting and by 66% at home. At the eighth month, a reduction of 95% occurred in the office and 64% at home. For Subject 2, the multiple tics were reduced during the first month by 84% in the clinic setting and by 51% at home. During the sixth and final month, the tics were reduced by 93% in the clinic and by 87% at home. For Subject 3, tic frequency was reduced by 70% in the home setting during the first month of treatment and decreased each month to a 99% reduction during the eighth month. Data are not shown for the clinic recordings of Subject 3 since his tics occurred at a near-zero frequency throughout the study in the clinic setting.

The data was also analyzed for each tic for each subject to determine whether the overall reductions were attributable to only one of the major tics. The analysis showed that during the final month of treatment, all tics were reduced by at least 57% for all three subjects. Analyses were also conducted to evaluate the efficacy of the habit reversal procedure in reducing motor versus vocal tics. During the last month, the various motor tics were reduced by 57-100% and the various vocal tics by 68-100%.

The reductions in tic frequencies at home versus the clinic were also compared. At home, the tics were reduced by 64-99% by the final month of treatment whereas in the clinic the tics were reduced 93-95%.

To determine the within-session change in tics, the tic frequency at the beginning and end of each treatment session was compared. During the pretreatment baseline period, the within session tic frequency increased between the beginning and end of each session by an average of 12% for Subject 1 and by 76% for subject 2. During the treatment sessions, a mean reduction of 47% was found within session for Subject 1 and 73% for Subject 2.

The sessions were decreased in frequency from the initial weekly schedule as progress was shown. The three subjects received 27, 10 and 22 sessions, respectively.

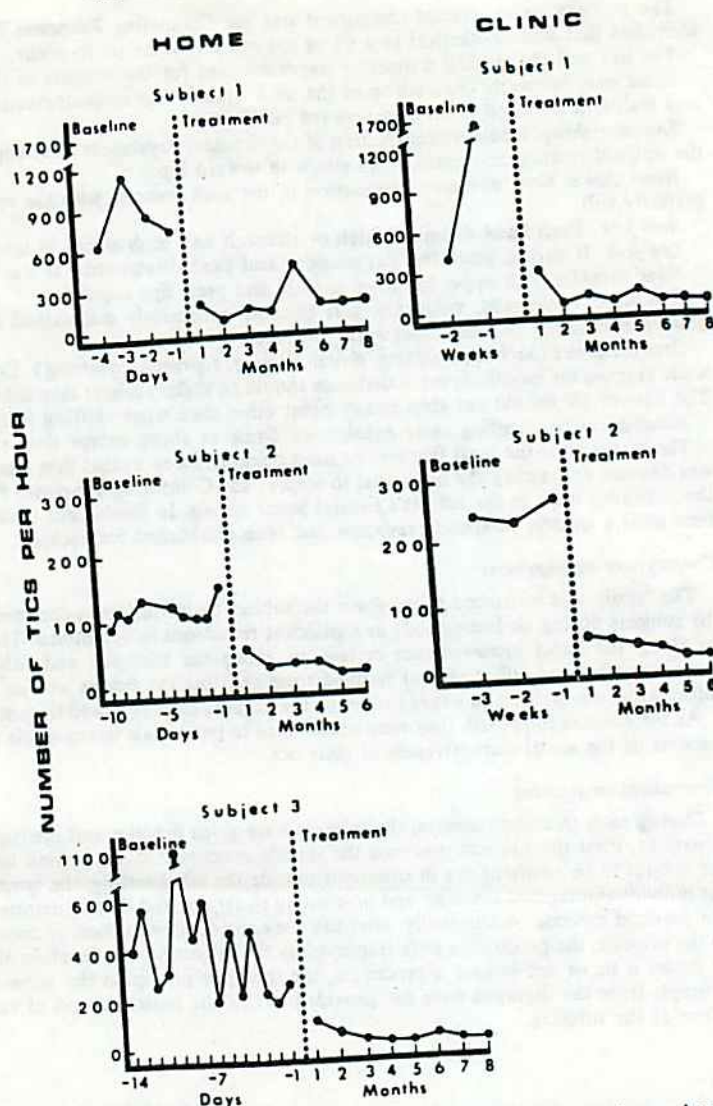


Fig. 1. Number of Tourette Syndrome tics per hour measured during the baseline and treatment periods in the home (left column) and clinic (right column) settings for each of three subjects.

A measure of tic severity was obtained by having observers rate a random selection of twenty 1-min segments of pre- and post-treatment videotapes. Severity was rated on a 0 to 100% scale, with 0% being perfectly normal, accepted, and regular motor movements and vocalizations and 100% indicating odd, strange, and abnormal motor and vocal tics. The pretreatment tics of Subjects 1 and 2 received average ratings of 71 and 91%, posttreatment, the tics were rated as 2 and 5%, respectively.

Interobserver agreement for the clinic recordings was 88%. The agreement between the subjects and their spouses for the home recordings was 89%.

During the second month of habit reversal treatment, Subject 2 self-initiated a reduction in the amount of TS medication. haloperidol, he was taking. By the third month of treatment, he stopped taking haloperidol altogether. No increase in tic frequency was evident during this period (see Fig. 1).

DISCUSSION

The present study was more definitive than previous behavioral studies of Tourette Syndrome in that it included: (a) a larger number of subjects, (b) information regarding diagnostic criteria, (c) measures of treatment effectiveness in both the clinic and home settings, (d) objective measures from videotape or direct observations, (e) data on individual tics as well as motor versus vocal tics, (f) measures of changes in severity of tic symptoms, and (g) measures of observer reliability.

The habit reversal method reduced the multiple tics of all three subjects relative to the pretreatment baseline as well as within the treatment sessions, thereby indicating that the effect was attributable to the treatment and not the simple passage of time. The reduction occurred at home as well as in the clinic as recorded by the subjects, their spouses, and the experimenters thereby indicating the generality of the improvement. The absolute magnitude and speed of the reductions obtained here were less than that obtained with individual tics employing the same method in previous studies (Azrin and Nunn, 1973; Azrin *et al.*, 1980) indicating greater resistance to treatment of Tourette Syndrome. The subject least benefited

(Subject 1) had previously undergone open-heart surgery after which pains in the tissues of the chest region occurred when he employed the competing response for his head tic, possibly because of injury to the sternocleidomastoid muscles, or associated nerves. These muscles are important in controlling the head jerk and his failure to improve as much as the others may, therefore, be due to factors other than Tourette Syndrome.

Other possible experimental designs were considered in the design of this study. The original design was both an AB and multiple baseline across behaviors design. However, the multiple baseline design was of limited usefulness because: (a) generalization across tics occurred when the competing response was employed for individual tics, (b) the duration (two sessions) between treatment for different tics proved insufficient, and (c) relaxation training and cue-controlled relaxation were general procedures that reduced all tics to a certain extent and did not focus on specific tics. A multiple baseline across settings design could have been used; however, it is doubtful that the subjects would have limited the use of the procedures to a particular setting once they found the procedures to be effective in another situation. This interaction between tics may be a bane for some experimental designs, but can be considered clinically positive in that it obviates the need to treat each tic entirely separately.

Perhaps the most notable features of Tourette Syndrome is the presence of vocal tics, such as uttering obscenities, barking, coughing, etc. Special difficulty had been anticipated with these unusual vocal tics but the results showed that the treatment reduced both the motor and vocal tics and to a fairly comparable degree.

Another notable feature of Tourette Syndrome is the reported waxing, waning, and changing of symptoms. At the start of the study it was thought that these features might be a problem during treatment in that as one symptom was treated another symptom might emerge. However, no changing of symptoms or "symptom substitution" occurred in the study as a result of treatment.

One subject in the present study (Subject 2) spontaneously stopped taking Tourette Syndrome medication after finding habit reversal to be effective in reducing his tics. For the other two subjects, the procedure was effective in the absence of Tourette Syndrome medication. These results suggest that a behavioral treatment of Tourette Syndrome may be useful as an alternative, and not merely an adjunct, to drug treatments.

Acknowledgements—This research was supported in part by a grant from the Tourette Syndrome Association. We gratefully acknowledge the assistance of Sheri Stewart, Jane Heikinen, and Joni Starr in scoring videotapes and compiling data and Nancy Smith, Ann Lazlow, Charlotte Vanook and Mindy Shoemaker in providing typing and administrative support.

REFERENCES

- American Psychiatric Association (1980) *Diagnostic and Statistical Manual of Mental Disorders*, 3rd edn. Washington, D.C.
- American Psychiatric Association (1987) *Diagnostic and Statistical Manual of Mental Disorders* 3rd edn, Revised. Washington, D.C.
- Azrin N. H. and Nunn R. G. (1973) Habit reversal: A method of eliminating nervous habits and tics. *Behav. Res. Ther.* 11, 619-628.
- Azrin N. H. and Nunn R. G. (1977) *Habit Control in a Day*. Simon and Schuster, New York.
- Azrin N. H., Nunn R. G. and Frantz S. E. (1980) Habit reversal vs negative practice treatment of nervous tics. *Behav. Ther.* 11, 169-178.
- Azrin N. H. and Peterson A. L. (1988) Behavior therapy for Tourette Syndrome and tic disorders. In *Tourette Syndrome and Tic Disorders: Clinical Understanding and Treatment* (Edited by Cohen D. J., Leckman J. F. and Brunn R. D.). John Wiley and Sons, New York.
- Bauer A. M. and Shea T. M. (1984) Tourette Syndrome: A review and educational implications. *J. Autism Devl. Disord.* 14, 69-80.
- Bullen J. G. and Hemsley D. R. (1983) Sensory experience as a trigger in Gilles de la Tourette's Syndrome. *J. Behav. Ther. exp. Psychiat.* 14, 197-201.
- Cappo B. M. and Holmes D. S. (1984) The utility of prolonged respiratory exhalation for reducing physiological and psychological arousal in non-threatening and threatening situations. *J. Psychosom. Res.* 28, 265-273.
- Cohen D. J., Leckman J. F. and Shaywitz B. (1984) *A Physician's Guide to Diagnosis and Treatment of Tourette Syndrome: A Neurological Multiple Tic Disorder*. Tourette Syndrome Association, New York.
- Doleys D. M. and Kurtz P. S. (1974) A behavioral treatment program for the Gilles de la Tourette syndrome. *Psychol. Rep.* 35, 43-48.
- Franco D. D. (1981) Habit reversal and isometric tensing with motor tics. *Dissert. Abstr. Int.* 42, 3418B.
- Goldfried M. R. (1971) Systematic desensitization as training in self-control. *J. consult. clin. Psychol.* 37, 228-234.
- Hutzel R. R., Platzek D. and Logue P. E. (1974) Control of symptoms of Gilles de la Tourette's syndrome by self-monitoring. *J. Behav. Ther. exp. Psychiat.* 5, 71-76.
- Jacobson E. (1938) *Progressive Relaxation*. University of Chicago Press.
- Jagger J., Prusoff B. A., Cohen D. J., Kidd K., Carbonaire C. M. and John K. (1982) The epidemiology of Tourette syndrome: A pilot study. *Schizophrenic Bull.* 8, 267-277.
- Ross M. S. and Moldofsky H. (1978) A comparison of pimozide and haloperidol in the treatment of Gilles de la Tourtte's syndrome. *Am. J. Psychiat.* 135, 585-587.
- Schultz J. and Luthie W. (1959) *Autogenic Training: A Psychophysiological Approach in Psychotherapy*. Grune and Stratton, New York.
- Shapiro E., Shapiro A. K., Sweet R. and Brunn R. D. (1975) *The Diagnosis, Etiology, and Treatment of Gilles de la Tourette's Syndrome*. In *Mental Health in Children* (Edited by Sankar S.), Vol. 1. PJD Publications, Westbury, NY.
- Shapiro A. K. and Shapiro E. (1984) Controlled study of pimozide vs placebo in Tourette's syndrome. *J. Am. Acad. Child Psychiat.* 23, 161-732.
- Suinn R. M. (1975) Anxiety management training for general anxiety. In *The Innovative Psychological Therapies: Critical and Creative Contributions*. (Edited by Suinn R. M. and Weigel R. G.). Harper & Row, New York.
- Turpin G. (1983) The behavioral management of tic disorders: A critical review. *Adv. Behav. Res. Ther.* 5, 203-245.
- Turpin G. and Powell G. E. (1984) Effects of massed practice and cue controlled relaxation on tic frequency in Gilles de la Tourette's Syndrome. *Behav. Res. Ther.* 22, 165-178.