Original Article

The effectiveness of cognitive-behavioral therapy in improving symptoms of children with chronic tic disorder

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Abstract

Background: The Chronic tic disorder is a single tic or several sudden tics that continue several times a day for more than a year and it can be simple or complex. Children with tic disorder stigmatized and consider the judgment of others very much, which could impair their quality of life. The purpose of this study was to explore the effectiveness of cognitive-behavioral therapy (CBT) in improving the symptoms of children with chronic tic disorder.

Method: This research was a single case type A-B-A with multiple baseline design and follow-up. The study population was 10–13-year-old boys with tic disorder who referred to Astan-e-Mehr Psychiatric Clinic in Mashhad in 2018-2019. Sampling was done through purposive sampling method in which three cases (one with simple and two with complex tic disrder) were selected using a clinical interview by a clinical psychologist. The subjects responded to the Global Tic Severity Scale in baseline situations, intervention sessions, and one month after the intervention. The CBT was performed in 14 sessions. Data analysis was performed using trend chart method and the effect size.

Results: The results of each subject showed a significant difference between the intervention position and baseline for three subjects with paroxysmal nocturnal dyspnea (PND) 100% for subject number one, 78% for subject number two and 86% for subject number three. Also, in the follow-up situations, the performance of all subjects was maintained.,

Conclusion: the CBT could be effective in improving the symptoms of children with chronic tic disorder.

Keywords: Cognitive Behavioral Therapy; Single-Case Studies as Topic; Tic Disorders.
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Introduction

In recent years, in addition to considering the physical growth of children, paying attention to their social and emotional personality and intelligence development has increased. Childhood and adolescent disorders can delay or prevent their social evolution. Obviously, children's social evolution is influenced by various factors such as genes, environment and culture, behaviors of parents and teachers, and relationships with peers. Therefore, paying attention to the disorders of this period is of great importance (1). Tic disorder is a kind of childhood disorders. According to version 5 of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), tic disorders are a group of

neurodevelopmental disorders common in childhood and adolescence, which can be described as a sudden, recurrent, inconsistent, fast and repetitive movement or phonation. Tics occur periodically and follow a decreasing and increasing pattern in frequency, intensity, location, and complexity, and change hours, days, and months individually (2).

Tics can be as simple as blinking, kicking, jaw or neck movements, sniffing, snoring, clearing the throat, and coughing, or as complex as smirking, touching, shrugging, ugly gestures, echoes, or repetition (3). Tic disorder includes four diagnostic categories of Tourette's disorder, chronic or vocal tic disorder, temporary tic disorder, and other specific and unspecified tic disorders, which are classified according to the type of symptoms, frequency, and pattern of their occurrence over time (4). In this case, children with tics often have low self-esteem and overemphasis on the judgment of others; therefore, the level of fear, anxiety, guilt, frustration, anger, humiliation and rejection in children, adolescents and their families increase. The prevalence of tic syndrome in children is 10 times more than in adults, starting on average between the ages of 4 and 6 and peaking between the ages of 10 and 12. Also, the ratio of boys to girls varies from 4 to 1; thus, in all disorders, boys have a higher level of prevalence from 1.06 to 4.5% in boys and 0.25 to 1.7% in girls (5).

The onset of simple tics outdates complex tics, and motor tics often begin years before appearing vocal tics (6). They usually follow a series of distressing bodily sensations known as sensory phenomena, which create an involuntary need to perform a tic. Sensory phenomena include feelings of excessive unhappiness or happiness, imperfection, stress, tingling or itching, heat, increasing energy, or even a mental image that correlates with the severity of the tic (7). Family and genetic studies indicate that people with a first-degree relationship with chronic tic disorder and Tourette syndrome have a higher risk (approximately 35%) of suffering from chronic tic disorder or the obsessive-compulsive disorder (8). Environmental factors of tic disorders were associated with infections (e.g., streptococcus, Lyme disease, viral infection), postpartum issues (e.g., maternal smoking, paternal age, severe maternal nausea, maternal stress), and prenatal issues (e.g., forced childbirth, use of forceps, prematurity, umbilical cord, jaundice) (9). The cognitive-psychophysiological factors are based on empirical findings that people with tic disorders with rigid inflexible thoughts have problems in optimal planning and in particular inhibition of response and thus intensification of motor-sensory activations (10).

Studies have shown that tics can cause hard pressures on a child's physical, social, emotional, family, and academic dimensions that people experience severe dysfunction and reduction of the quality of life (11). Therefore, performing appropriate treatment measures can help these children interact properly with their environment. One of the psychological interventions on children with tic disorders is cognitive behavioral therapy (CBT) training. CBT training is an effective treatment for many disorders in children and adolescents (12). This treatment is a psychological training intervention developed, Techniques of treatment session is assigned to awareness training, muscle differentiation, relaxation, reducing sensory-motor arousal, motor-planning style, cognitive reconstruction, behavioral reconstruction, cognitive-behavioral reconstruction, and finally generalization of new behavior to situations where the risk of tic is high and recurrence prevention (13).

Overall, the CBT training helps children to identify distorted thought patterns and dysfunctional behaviors, and to be able to change these distorted thoughts of dysfunctional behaviors by using organized precise behavioral discussions and tasks.

Previous studies have shown that the CBT can be used to treat anxiety disorders, depression, disordered behavioral disorders, attention deficit /hyperactivity disorder, tic, and defect in social skills (14). For example, in their observations showed that the CBT can be effective in treating tic disorders (15). we did not find any research on the effectiveness of CBT in reducing the number, frequency, severity, complexity, interference, and disorder of tics so far while it seems that each of the mentioned variables has a separate role in tic disorders (16, 17).

According to above mentioned studies, the goal of this study was to determine the effectiveness of CBT in improving the symptoms of chronic tic disorders in children. Furthermore, it is the reduction of sensory-motor activation and behavior planning style, i.e., the emotions that are experienced with muscle activation in the areas affected by the tic, and how a person stimulates or feels, it strengthens this feeling and creates the need to more stimulation in him (especially when the person learns the behavior planning style).

Method

Participants: This study was a single case of A-B-A with multiple baselines and a follow-up design. The population were included all boys in the age group of 10 to 13 years with chronic tic disorder (simple/ complex) who referred to Astan-e-Mehr Clinic in Mashhad in 2018. In this study, the sample group consisted of three children with chronic tic disorders who entered the treatment plan through purposive sampling after conducting a diagnostic interview based on DSM-5 by a clinical psychologist. The research design was single subject. The inclusion criteria included drug abuse, inexperience in the previous divorce, divorce litigation, lack of physical and psychological illness. The exclusion criteria included missing more than two sessions of intervention sessions, being under another treatment simultaneously with this intervention, and taking any particular medication.

Instruments: Yale Global Tic Severity Scale (YGTSS): This scale, is a new measurement tool for measuring tic severity. A semi-structured clinical interview with acceptable reliability and validity has been shown to measure the severity of tic symptoms over the past week. Motor and acoustic tics are evaluated separately from 0 to 5 in several scales of number, frequency, intensity, complexity and interference. The disorder score also indicates a separate score from 0 to 50 with higher scores indicating higher levels of overall tic-related disorders that have shown strong psychometric properties with good internal consistency, excellent intermediate reliability, and high convergent and divergent validity. Total scores can vary from 0 to 75 (4).

In this study, the intervention was performed in the first four sessions with awareness training to determine the baseline, and the patients' condition was evaluated in terms of the considered

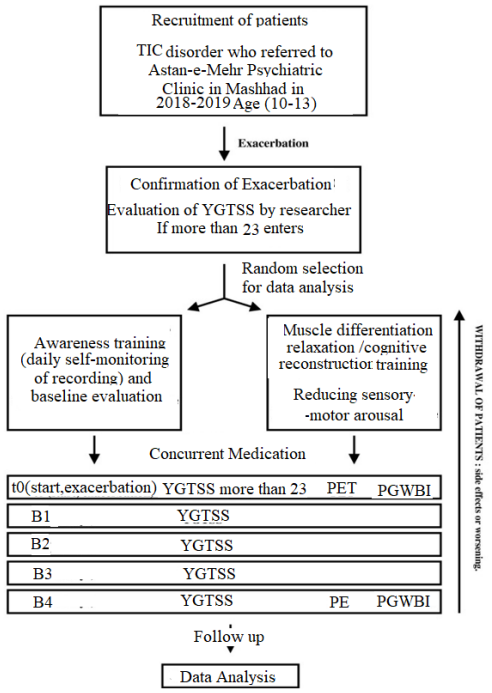

Figure 1: The CONSORT flow diagram of the patients in this trial

Table 1. This treatment was performed on the subjects during 14 sessions

Sessions	Description and goals of treatment
Sessions 1 to 4	Awareness training (daily self-monitoring of recording) and baseline evaluation
Sessions 5 to 9	Muscle differentiation training and relaxation /cognitive reconstruction training
Session 10	Reducing sensory-motor arousal / behavioral planning style / cognitive reconstruction
Session 11	Behavioral reconstruction (determining situation readiness and eliminating coping strategies)
Session 12	Cognitive-behavioral reconstruction (behavioral and cognitive integration in the reconstruction of an action)
Session 13	Generalization (use in unforeseen situations and stressful behaviors)
Session 14	Prevention of recurrence (not knowing the catastrophe in case of recurrence)

indicators. From the first, second and third subjects, 2, 3 and 4 baselines were taken, respectively. This treatment was performed on the subjects during 14 sessions and in order to study the changes of the subjects in sessions 6, 8, 10, 12 and 14, an evaluation was performed. 2 sessions were held per week (Table 1). The research started on September 23 and the sessions ended on November 23. The sessions were held at Astan-e-Mehr Counseling Center in Mashhad. Subjects were contacted one month after the end of the treatment intervention and re-performed on each of them at the YGTSS (fig. 1).

Data analysis was performed using trend chart method and determining the size of the effect.

Results

Table 2 shows the characteristics and medical history of participants of the study. The raw scores of repeated measurements during baseline, intervention, and follow-up sessions are presented in (Table 3).

Based on the data of subject A, the middle line, the trend line and their stability chamber are obtained as follows (Figure 1):

Minimal brain dysfunction (MBD) is an indicator of the change in the level of behavior between the two baseline positions and the intervention. Here, mean baseline reduction (MBLR or MBD) is used to investigate the quality of intervention results on reducing behavioral problems; MBD is calculated as follows: The difference between the mean baseline observations and the treatment divided by the mean baseline multiplied by 100.

Table 2. characteristics and medical history of the participants

ID	sex	Age	Grade	IQ*	Birth order	Maternal pregnancy	Delay in development	Previous background	Age to start ticking	Tick type	Duration of Tick for now	Comorbidity	Most tick positions	Current drugs
1st	Boy	11	5th	115	First	Hard and stressful	No	Hyperactivity disorder in the child, anxious father	One year old with blinking	Simple movement: Sudden and rapid movement of the head up and down, screw up and pull forward the mouth	About 1 year	No	Anger Stress Fatigue Hot sun	No
2nd	Boy	12	6th	113	First	Hard and stressful	No	Separation anxiety in the child, parents with a history of depression, perfectionist mother	Four years old with blinking	Simple movement: Rapid rotation and movements of the head and neck Smelling and rubbing hands together	About 1.5 years	No	Positive emotions: happiness, surprise, watching TV, and eating	No
3rd	Boy	12	6th	111	First	Hard and stressful	No	Nail-biting in the child, anxious mother, perfectionist father	5.5 years old with neck extension	Sophisticated movement: Stretching the neck Twitching his ears Emoticon	About 1.5 years	No	When talking to others	No

IQ: Intelligence quotient

Table 3. The trend of changing the scores of the Yale Global Tic Severity Scale in subjects

Participants	Baseline 1	Baseline 2	Baseline 3	Baseline 4	Session 6	Session 8	Session 10	Session 12	Session 14	One-month follow up
Subject a	35	44	-	-	30	22	12	8	6	7
Subject b	49	55	59	-	46	33	38	33	32	30
Subject c	42	47	48	51	33	21	30	19	12	15

$$MBLR = M_B - M_A / M_A \times 100; \ 15.6\text{-}39.5 \div 39.5 \times 100 = -60.50 \quad (1)$$

The resulting number is negative which indicates a reduction in the symptoms of simple tics in the intervention position. Also, the value of the number shows a 60% reduction in symptoms; thus, the effect of the intervention on reducing the symptoms of simple tics of this subject was good. Based on the data of subject B, the middle line, trend line and stability chamber are obtained as follows (Figure 2):

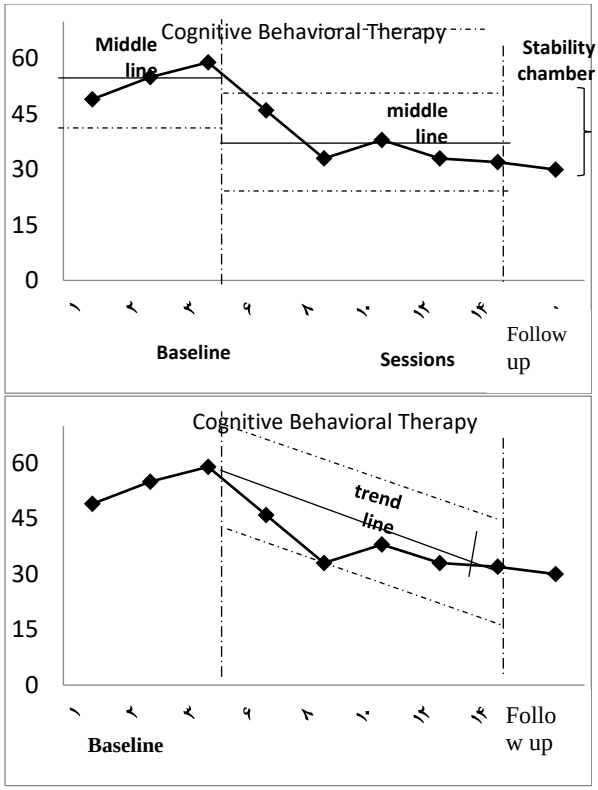

Figure 2. Midline, trend line and stability chamber of subject B

$$MBLR = M_B - M_A / M_A \times 100; \ 36.4 - 54.3 \div 54.3 \times 100 = -32.96 \quad (2)$$

The resulting number is negative, indicating a reduction in the symptoms of complex tics in the intervention position. Also, because the number is small, the rate of improvement is small and the effect of the intervention on reducing the symptoms of complex tics in this subject was low.

Based on the data of subject C, the middle line, trend line and stability chamber are obtained as follows (Figure 3):

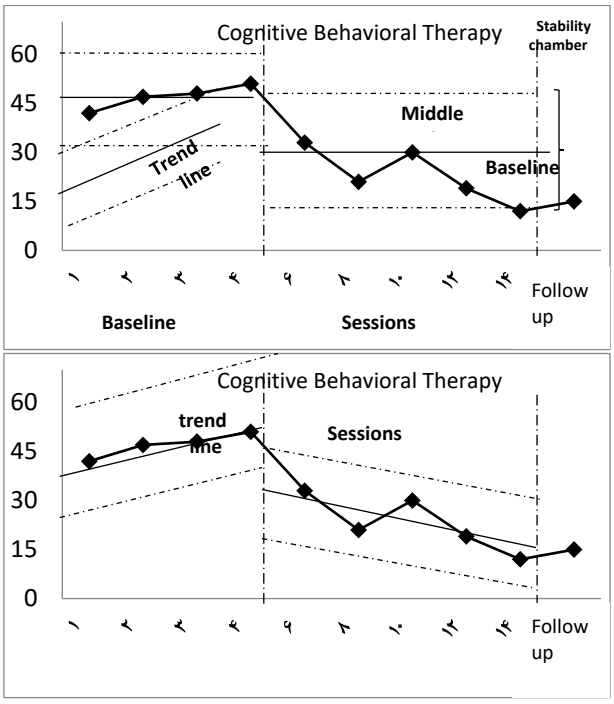

Figure 3. Middle line, trend line and stability chamber of subject C

$$MBLR = M_B - M_A / M_A \times 100; \quad 23 - 47 \div 47 \times 100 = -51.06 \quad (3)$$

The resulting number is negative which indicates a reduction in the symptoms of complex tics in the intervention position. Also, the value of 50% indicates a reduction

Table 4. Intra-situational and inter-situational visual analysis variables of subjects in baseline position and intervention

Intra-situational								Inter-situational		
	Subject A		Subject B		Subject C			Subject A	Subject B	Subject C
Sequence of position	A	B	A	B	A	B	Comparing position	A to B	A to B	A to B
Length of level position	2	5	3	5	4	5	Direction	Descending to ascending	Descending to ascending	Descending to ascending
Medium	39.5	12	55	38	47.2	30	Changing stability	Stable to stable	Stable to stable	Stable to stable
Mean	39.5	15.6	54.3	36.4	47	23	Relative change	39.5-22	55 to 33	47.5-21
Range of changes	35-44	6-30	49-59	32-46	42-51	12-33	Absolute change	44 to 6	59 to 32	51 to 12
Range of changes of stability chamber 20% of medium per position	Stable	Stable	Stable	Stable	Stable	Stable	Change of medium	39.5 to 12	55 to 38	30 to 47.5
Relative change	39.5-39.5	22-8	54.5-55	33-33	47-47.5	21-19	Change of mean	39.5 to 15.6	54.3 to 36.4	47 to 23
Absolute change	44-35	6-30	59-49	32-46	52-42	12-33	Overlapping of data			
Direction	Ascending	Descending	Ascending	Descending	Ascending	Descending	PND	100%	78%	86%
Stability							POD	0	22%	14%

in symptoms; hence, the effect of the intervention on reducing the symptoms of complex tics of this subject was good. (Table 4) shows the results of intra-situational and inter-situational visual analysis of the data of subjects A, B and C according to the proposed form in the book titled "Methodology of Case-Single Designs in Behavioral and Medical Sciences".

Discussion

This study investigates the effectiveness of CBT in improving symptoms of children with chronic tic disorder. The study has contributed of new findings in the research field on effects of CBT for tics. These results are in line with data from the literature which have highlighted the efficacy of both CBT in the treatment of tic disorders. Indeed, a large series of studies, including many randomized controlled trials (RCT), have previously demonstrated the efficacy of PT in the treatment of tics (14, 16). Behavioral therapy is also a well-known treatment for patients affected by tic disorders of moderate or high severity (4).

Piacentini et al. (18) conducted a study on 25 children comparing Habit Reversal Training (HRT) to awareness training with the results indicating only minimal benefit of HRT over awareness training. Verdellen et al. (19) compared HRT to exposure and response prevention in a group of 43 patients affected by Tourette's Syndrome (TS) aged 7–55 years. Both treatments showed statistically significant improvement. The first report about the efficacy of Behavior Therapy (BT) dates back to a paper by (12). These authors investigated the efficacy of HRT in 10 TS patients aged 6–36 years compared with a waiting list and found that all the subjects showed substantial improvement, with a mean percent reduction in tics of 93%. Reduction occurred for both vocal and motor tics in children and adults. Findings of the analysis of charts of all three subjects show the effectiveness of this treatment in reducing the symptoms of chronic tic disorder. The analysis of different experimental situations showed that all three participants in this study had a difference in position B, i.e., CBT, compared to baseline a position. The charts of all three participants in position B have a downward trend that shows a reduction in the symptoms of chronic tic disorder (PND 100% for subject 1,

78% for subject 2 and 86% for subject 3). Also, the chart of the data of each subject showed that in all three subjects, the symptoms of chronic tic disorder in the follow-up position did not return to the level of the baseline position. The results of this study are consistent with studies that confirm the efficacy and effectiveness of this treatment in patients with tic disorders. In the first stage, they are consistent with the results of O'Connor (13) who used this treatment as a group in chronic tic disorder and habit disorders; the participants reported a control between 75 and 100%. The results of the present treatment are also consistent with the results of studies that have shown the effectiveness of this treatment, for example (9, 14). The explanations for reducing symptoms are awareness training, which alone can make a significant improvement. In this section, people learn to record their tics on a daily basis and in a table. In addition to teaching awareness to children, learning relaxation and differentiation of the muscles has the greatest effect on reducing the severity of tics.

With cognitive reconstruction, behavioral reconstruction, and cognitive-behavioral reconstruction, one realizes that certain strict beliefs underlie a stressful practice style. Using cognitive and behavioral reconstruction, when the tics interrupt the natural flow of speech and behavior, individuals can control and replace them with the appropriate social response in a way that attracts the least attention and can do their normal behavior. Another possible explanation for reducing tics is motivation and generalization training. Continuous practice of this CBT, in addition to making the person have more control over tics, it reduces them and increases his self-esteem. Besides, another factor that has increased the effectiveness of this treatment is the existence of sessions to deal with the recurrence of the disease and to prevent the onset of the symptoms of disorder and to deal with them. According to the report of patients, sessions of coping with recurrence played an important role in reassuring them to stabilize recovery and also counteracting the possible onset of the disorder in the future, and this factor led to patients' calm and reassurance and doubled their positive attitude toward the effectiveness of this treatment. As a result, it acted as an effective factor in the treatment.

Authors' contributions

Study concept and design: MA, AB; Data gathering: MA, AM; Data analysis: AB; MA; Writing manuscript: MA, AB, AM; Revise manuscript: MA, AB, AM; Approve manuscript: MA, AB, AM**.**

Conflict of interest

None declared.

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Informed Consent

written informed consent was obtained.

References

1. Ceylan S. Vineland Validity-Reliability Study for Social-Emotional Early Childhood Scale and Examination of the influence of Creative Drama on five-years old Children's Social emotional Behaviors who have been attending to the Preschool Training Institutions. 2010;15(2): 36-48.
2. Abramovitch A, Hallion L, Reese H, Woods D, Peterson A, Walkup J. Neurocognitive predictors of treatment response to randomized treatment in adults with tic disorders. Progress in Neuro-Psychopharmacology and Biological Psychiatry. 2017;74(5): 9-14.
3. Gloor F, Walitza S. Tic disorders and Tourette syndrome: current concepts of etiology and treatment in children and adolescents, Neuropediatrics. 2016;47(2): 84-96.
4. Kaplan B. Kaplan and sadock's synopsis of psychiatry, Behavioral sciences/clinical psychiatry, Tijdschrift voor Psychiatrie. 2016;58(1): 78-79.
5. Zilhao N, Olthof M, Smit D, Cath D, Ligthart L, Mathews C, Dolan C. Heritability of tic disorders: a twin-family study, Psychological medicine. 2017;47(6): 85-96.

6. Gast D. Single Subject Research Methodology in Behavioral Sciences, USA: Rutledge. 2010;13(2): 159-171.
7. McGuire J, Piacentini J, Scahill L, Woods D, Villarreal R, Wilhelm S., Bothersome tics in patients with chronic tic disorders: Characteristics and individualized treatment response to behavior therapy, Behaviour research and therapy. 2015;7(1): 56-63.
8. Henning E., A parent-mediated habit reversal intervention for chronic tic disorders in children. 2017;9(6): 133-144.
9. Hoekstra P, Dietrich A, Edwards M, Elamin I, Martino D. Environmental factors in Tourette syndrome, Neuroscience & Biobehavioral Reviews. 2013;37(6): 1040-1049.
10. O'Connor K, Lavoie M, Blanchet P, St-Pierre-Delorme M. Evaluation of a cognitive psychophysiological model for management of tic disorders: an open trial, The British Journal of Psychiatry. 2016;29(1): 76-83.
11. Leclerc J, O'Connor K, J-Nolin G, Valois P, Lavoie M. The effect of a new therapy for children with tics targeting underlying cognitive, behavioral, and physiological processes. Frontiers in psychiatry. 2016;7(9): 135-148.
12. Christner R, Stewart J, Freeman A. Handbook of cognitive-behavior group therapy with children and adolescents: Specific settings and presenting problems, Routledge. 2020;11(4): 27-40.
13. O'Connor K. The cognitive-behavioral therapy for tic disorders, Translated by Danesh, E. & Saliminia, A. Tehran: Arjmand. 2012;15(8): 87-99.
14. Eskandaripour M. The effectiveness of cognitive-behavioral therapy on the depression of children with attention deficit/hyperactivity disorder, MA thesis, Department of Psychology and Educational Sciences. 2016;12(5): 19-28.
15. O'Connor K, Brault M, Robillard S, Loiselle J, Borgeat F, Stip E. Evaluation of a cognitive behavioural program for the management of chronic tic and habit disorders, Behaviour research and therapy. 2021;39(6): 667-681.
16. Song J, Hong J, Doh J, Kim H, Lim M. Cognitive Behavioral Therapy in Childhood Tic Disorder: A Case of Report, Journal of the Korean Academy of Child and Adolescent Psychiatry. 2021;22(1): 38-43.
17. Ennett S, Stark D, Shafran R, Heyman I, Krebs G. Evaluation of cognitive behaviour therapy for paediatric obsessive-compulsive disorder in the context of tic disorders, Journal of behavior therapy and experimental psychiatry. 2015;49(2): 223-229.
18. Piacentini J, Bergman RL, Jacobs C, McCracken JT, Kretchman J. Open trial of cognitive behavior therapy for childhood obsessive-compulsive disorder. J Anxiety Disord. 2002;16:207–19.10.1016/S0887-6185(02)00096-8.
19. Verdellen CW, Keijsers GP, Cath DC, Hoogduin CA. Exposure with response prevention versus habit reversal in Tourette's syndrome: a controlled study. Behav Res Ther. 2004;42:501–11.