NÖRO PSİKİYATRİ ARŞİVİ

Attentional Bias and Training in Social Anxiety Disorder

Sosyal Anksiyete Bozukluğunda Dikkat Yanlılığı ve Eğitimi

Nurhan FISTIKCI[1], Ömer SAATCİOĞLU[2], Ali KEYVAN[1], Volkan TOPÇUOĞLU[3]

[1]Department of Psychiatry, Bakirkoy Research and Training Hospital for Psychiatry, Neurology and Neurosurgery, İstanbul, Turkey
[2]Department of Clinical Psychology, Işık University, Istanbul, Turkey
[3]Department of Psychiatry, Marmara University Training and Research Hospital, Istanbul, Turkey

ABSTRACT

Cognitive behavioral therapy (CBT) is one of the most effective treatment modalities for social anxiety disorder (SAD), showing a high level of clinical evidence supporting its effectiveness. On the other hand, lack of the desired benefit from this treatment in some patients causes continuation of the search for new techniques. Recent research studies have focused on attentional bias and attention training in SAD. Attention processes in SAD have been a major target of interest and investigation since the introduction of the first cognitive models explaining SAD. In the first model, it was highlighted that attention was self-focused. The relationship between threatening stimuli and attention was considered in the subsequent models. Attentional bias towards threat may take place in several ways, such as facilitated processing of threat, difficulty in disengaging attention from the threat and avoidance of attention from the threat. After these descriptions regarding the phenomenology of the disorder, treatments to modify attention, processes were developed. In spite of conflicting results, investigations on attentional training are promising. Attention processes, attentional bias and attentional training in SAD are discussed in this review.

Keywords: Social anxiety disorder, attention, attentional training

ÖZET

Bilişsel davranışçı terapi (BDT) sosyal anksiyete bozukluğunda (SAB) kanıt düzeyi yüksek, en iyi sonuç alınan tedavi yöntemlerinden biridir. Öte yandan, bazı hastalarda bu tedaviden istenilen yararın elde edilememesi, yeni teknikler arayışının devamına neden olmaktadır. SAB'da son araştırmalar dikkat yanlılığına ve dikkat eğitimine odaklanmıştır. SAB'da dikkat süreçleri rahatsızlığın bir bilişsel bozukluk olarak açıklandığı ilk modellerden bu yana araştırmaların hedefi olmuştur. İlk modelde, dikkatin kişinin kendi üzerine odaklı olduğu vurgulanmıştır. Tehdit edici uyaranlar ve dikkat arasındaki ilişki daha sonraki modellerde kabul edilmiştir.Tehdite yönelik dikkat yanlılığı tehditin kolaylaştırılmış işlenmesi, dikkatin tehditten uzaklaştırılmasında zorlanma, dikkatin tehditten kaçırılması şeklinde oluşabilir. Hastalık sürecine getirilen bu açıklamalar sonrasında, dikkat süreçlerini değiştirmek için tedaviler geliştirilmiştir. Çelişkili sonuçlara rağmen, dikkat eğitimi araştırmaları ümit vericidir. Bu derlemede SAB'da dikkat süreçleri, dikkat yanlılıkları ve dikkat eğitimi konuları tartışılmıştır.

Anahtar kelimeler: Sosyal anksiyete bozukluğu, dikkat, dikkat eğitimi

INTRODUCTION

Social anxiety disorder (SAD) is a prevalent (1) disorder which may cause severe disability (2). According to the cognitive model, individuals with SAD experience anxiety in social situations, due to their cognitive distortions that they will be rejected or fall into an embarrassing condition (3). Cognitive behavioral therapy (CBT) is one of the treatment methods that are proven to be effective in SAD (4). Classical CBT includes detection and changing of dysfunctional cognitions and gradual exposure (5). Although classical CBT methods have been proven to be effective to some extent in patients with SAD, it does not cause a significant decrease in symptoms in one third of the patients (6). For this reason, search for more effective CBT methods for treatment of SAD continues. One of the most interesting among these new methods is attentional training, which is used to change attention processes.

Attention processes in SAD have become an area of research since the first cognitive models of the disorder. The advances in attentional training methods have brought a large amount of publications on this subject. For these reasons, attention processes in SAD, attentional bias, and attentional training were discussed comprehensively in this review.

Anxiety and Attention Processes

Bias occurring in the processing of information on danger plays an etiological role in anxiety disorders (7,8). Anxiety develops as a result of detection of threatening stimuli, activation of the archaic danger mode, secondary activation of thought and other reflective modes, respectively, according to the first anxiety model of Beck and Clark (9). Various cognitive and behavioral activities to provide safety follow these steps. Directing the attention toward a threat was explained by automatic processes, except for Wells and Matthews (10), according to whom, direction of attention toward threat is determined by a meta-cognitive belief such as "It is important

Correspondence Address/Yazışma Adresi: Dr. Nurhan Fıstıkcı, Department of Psychiatry, Bakirkoy Research and Training Hospital for Psychiatry, Neurology and Neurosurgery, İstanbul, Turkey Phone: +90 533 526 13 66 E-mail: nurhanfistikci@gmail.com

Received/Geliş Tarihi: 07.05.2014 **Accepted/Kabul Tarihi:** 13.07.2014

to monitor threats." In the model by Williams et al. (11), the decision that the threat level of the information to be processed is strong or weak is determined by the affective decision mechanism, after which sources are directed at processing the stimulus. In the anxiety model of Mogg and Bradley (12) significance evaluation mechanism automatically assesses the threatening stimuli and targets engagement system allocates attention toward the stimuli. The attention system in the anxiety model of Eysenck et al. (13) also operates automatically. The activity of the attention network related to threats is facilitated automatically and task-related attention system cannot work. In another model, pre-attention threat assessment system evaluates the environmental stimuli. The threatening stimuli are directed into a source allocation system and physiological stimulation occurs. After this, the threat assessment system evaluates the threat contextually and analyzes the present coping sources. If the level of threat is perceived as high, attention remains focused on the threat (14). Yiend and Matthews (15) claimed that anxiety is not decisive in the initial perception of threat, and the main difference between anxious and nonanxious individuals is the delay in separating attention from dangerous stimuli. Attentional bias related to threat in anxiety disorder was found to be reliably detectable by various experimental paradigms in a meta-analysis, even if the effect size was low (14).

Experimental Tasks Used To Reveal Attentional Bias

In the literature, several tasks have been used to evaluate attention processes in anxiety disorders. The emotional Stroop test, dot-probe paradigm, and emotional spatial cueing test are frequently used in experimental paradigms investigating the attentional bias in relation with threat in anxiety. Thus it can be useful to summarize them briefly.

The emotional Stroop test is a modified form of classical Stroop test. The Stroop effect reflects the performance difference in color naming between concordant (i.e., the word "red" written in red color) and discordant (i.e., the word "red" written in green color) stimuli. The Stroop effect defines the failure in focusing on the targeted dimension of the color. When pictures are used instead of words, the individual is asked to name the color of the face showing a neutral or angry expression. If there is bias about the threat, there is a delay in expressing the color of the related faces. But this delay is attributed to a voluntary avoidance of threatening stimulus or to the negative load of the stimulus, rather than trapping of attention by the threat (16,17). In order to overcome these problems, McLeod et al. (16) designed the dot-probe paradigm. In the paradigm of perception of probe (which may be a point or a line), neutral photographs (for example a tree) or a threatening face expression are used on the left and right sides of the screen. These photographs are simultaneously shown on the screen and fade away quickly (generally in 500 milliseconds) and a probe is shown on the right or left side of the screen. It is intended that the individual should follow this probe as quickly as possible. In other words, the patient is asked to direct his attention at the probe that appears on the screen. The participant should respond to a neutral stimulus (probe) in the dot-probe paradigm. Thus, development of a delayed response due to vigilance or other biased conditions is blocked (18).

In the dot-probe paradigm, when the target probe follows the threatening stimulus, this may cause an increase in performance in marking the probe. The cause of this increase may be an inability of detachment of attention from the threatening stimulus or a fast shift of attention to the threatening stimulus.

The emotional spatial cueing task was developed in order to delineate the real cause of this incident (19). The stimuli have emotional loads in this paradigm and each stimulus is given with a cue. The target stimulus generally comes after the cue in this paradigm. Rarely, the target is placed in the opposite region with the cue. The aim here is to differentiate the two conditions: an inability of detaching the attention from the threatening stimulus and a fast shift of attention toward the threatening stimulus (19).

Attention Processes In Sad

Attention processes have remained the focus of interest since the first description of the cognitive model of SAD. Attention was claimed to be self-focused in the first model reported (5). Rapee and Heimberg (20) stated that individuals with SAD showed selective attention toward threats such as disapproval or criticism. Clark and Wells (5) on the other hand, have claimed that individuals with SAD directed their attention from the threat toward self in response to a social threat. The threat is mostly the bodily sensations of the individuals themselves (21) or imitations, gestures, or behaviors of others showing disapproval for individuals with SAD (22).

In the initial studies of attentional bias in SAD, the Stroop test was used. Individuals with SAD were found to show a prolonged reaction time in words related to social threats (23,24). Gilboa-Schechtman, Foa, and Amir (25) found that individuals with SAD could select angry faces easier than happy faces in visual search. Mansell et al. (26) have found that individuals avoided emotional faces during social evaluation. However, many studies have shown the presence of a hypervigilance toward angry faces in SAD (27,28). According to some anxiety models, attention may be directed toward cues of threat, but this does not continue, and avoidance of the stimulus triggering anxiety may be seen after a while. This is known as the "vigilance-avoidance" model (29). The presence of different mechanisms that have an effect on attention may explain these differences about directing attention. For example, behavioral inhibition, fight-flight response, and defensive behaviors may have an effect on attention (30). Amir et al. (31) have found that patients with SAD had difficulty in detaching their attention from words containing social threats. Patients with SAD find disgusting facial expressions more negative than angry faces and have difficulty in detaching their attention from them. The difficulty in detaching attention is more specific for threatening faces rather than neutral stimuli. This difficulty in detaching attention may cause development of rumination in the patient with SAD about a threat against himself/herself, with a possible recovery of negative memories of the patient's past (32). Individuals with social anxiety show hypervigilance when they detect stimuli containing a social threat. Individuals with social anxiety direct their attention, especially toward disapproval by others, including sensations and behaviors about anxiety (22,33). This causes an excessive pursuit of threat in individuals with SAD and the persistence of the condition (34). According to the study by Heeren et al. (35) including 79 patients with generalized SAD, the main problem in SAD was found to be the inability of detaching attention from threatening stimuli, which is effective in persistence of the disorder.

Attentional bias directed toward threat may occur in several forms: facilitation of directing attention toward the threat, difficulty in detaching attention from the threat, and avoidance of threat by attention. Facilitated attention is directing attention toward a threat stimulus easier or faster. In the presence of difficulty in detachment of attention from the threat, attention is trapped by threat and cannot be directed toward another direction. In attentional avoidance, attention is directed in the opposite direction of the threatening stimulus (36).

Attentional Training In Sad

One of the most intensely studied areas in SAD has been attentional bias and attentional training in recent years. Computer technology is used in this training. The presence of a bias toward threatening stimuli in SAD is

well known. This bias may be related to the interpretation of the stimulus or the attentional bias may be over-focusing on the threatening stimulus or avoidance of attention (22,37,38,39). There are many studies that have found the bias as disengagement of attention from the threatening stimulus (40,41). Attentional bias may be decreased with an effective cognitive behavioral therapy (42). The reoccurrence of attentional bias is an indication of an increase in anxiety in social phobia (43). All of these data suggest that interventions targeting attention processes may be beneficial in SAD.

Attentional training is one of the techniques for altering cognitive bias. The most frequently used procedure is the dot-probe paradigm. Attentional training is generally executed as 8 sessions of 20-minute duration. These training sessions are usually applied in parallel with CBT sessions. In these trainings the probe is generally placed after neutral stimuli. The patient may be trained to redirect his/her attention away from threatening stimulus, toward nonthreatening ones with the probe-finding paradigm. The probe frequency after the neutral stimuli is increased and the patient's attention toward the neutral stimulus is reinforced. Another method is to concentrate attention deliberately on the threatening stimulus. When the probe appears opposite the place where the threatening face is positioned, the individual cannot detach the patient's attention from the threatening face (44).

Response to probes opposite to threatening cues in SAD is slower than nonthreatening cues (31). Heeren et al. (45) found that training for directing attention toward nonthreatening stimuli was more effective than training for directing attention toward threatening stimuli in SAD in their study on 57 patients with generalized SAD. In a meta-analysis of 12 studies and 467 participants, therapies on attentional bias were found to be effective in the treatment of anxiety disorder (46).

In many studies, attentional training was found to be effective in SAD (44,47,48,49,50). In the study by Li et al. (51), attentional bias was found to decrease after 7 days of attentional training on emotionally positive faces in individuals with SAD. In addition, such training decreased the fear that the individual reported to experience during social interactions (51). Similarly, Amir et al. (49) enabled individuals with SAD to pay attention to neutral faces or a control task after one session of training. Training toward focusing on neutral faces was found to be more effective. In their study on 36 patients with SAD, Schmidt et al. (52) detected a significant decrease in social anxiety of individuals after attentional training with neutral faces. These results were replicated in a double-blind, placebo-controlled study (44). In this study, which included 44 patients with SAD and after attention modification, half of the patients had improved to such an extent that they could not fulfill SAD diagnostic criteria after treatment. Recently, directing attention toward nonthreatening stimuli was investigated by Heeren et al. (45), and this training has caused a decreased anxiety which could be measured as self-report, behavioral, and physiological. Decrease in anxiety was more than directing attention toward the threat. In the study by Klumpp and Amir (50), training of both directing attention toward the threat and away from threat was found to decrease anxiety.

In the most recent studies about attentional training in SAD, internet or smartphones were used to deliver the treatment. For example, in a randomized controlled trial, attention bias modification training was delivered via smartphones, and this training compared to control training in a double-blind design, also including a waitlist condition in social anxiety. Both training groups showed greater reductions in social anxiety than the waitlist (53). A recently concluded trial examined effects of an internet-based attentional training on self-report measures, behavioral data, and diagnostic status in individuals with social phobia (N=56). The findings questioned the effectiveness of internet-based attentional training in social phobia because the effect was insignificant (54). Attention training via internet is studied in sixty-eight individuals seeking treatment for SAD. In this controlled study, the effectiveness of attention training with internet was also found to be low (55). As a result, internet-based attention training cannot be recommended as stand-alone intervention for SAD.

Electrophysiological changes occurring during dot-probe paradigm were investigated in an interesting electrophysiological study in 12 patients with SAD and 15 healthy controls, and patients with SAD were found to show a hypervigilant behavior, with the contribution of the fusiform gyrus in the reaction against angry faces in the early phases, and a decrease in visual processing of stimuli with prominent emotional content was detected in the late phase. This was considered as attentional avoidance (56). In a study involving 30 adults with a high level of anxiety and 30 adults without anxiety in their study, Eldar and Bar-Haim (57) trained the participants in directing their attention away from the threat in modified probe perception paradigm and also evaluated them with EEG. According to their results, attentional training does not have an effect on the early attention or direction, but does have an effect on top-down attentional control.

In conclusion, attention processes are important parameters in the conceptualization of SAD; especially, the relationship between threatening stimuli and attention is important in the mechanisms underlying this disorder. It must be kept in mind that attention training is not a first-line treatment for SAD and should always be combined with CBT or other evidence-based treatment modalities. Nevertheless, attentional training may be beneficial because it exerts a positive effect on information processing, by redirecting attention processes trapped by threat in social environments toward other relevant stimuli.

Conflict of Interest: The authors declared no conflict of interest.

Financial Disclosure: The authors declared that this study has received no financial support.

Çıkar Çatışması: Yazarlar çıkar çatışması bildirmemişlerdir.

Finansal Destek: Yazarlar bu çalışma için finansal destek almadıklarını beyan etmişlerdir.

REFERENCES

1. Kessler RC, Berglund P, Demler O, Jin R, Merikangas KR, Walters EE. Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the national comorbidity survey replication. Arch Gen Psychiatry 2005; 62:593-602. **[CrossRef]**
2. Stein M, Kean Y. Disability and quality of life in social phobia: Epidemiologic findings. Am J Psychiatry 2000; 157:1606-1613. **[CrossRef]**
3. Özgüven HD, Sungur MZ. Sosyal fobi. Turk Psikiyatri Derg 1998; 9:128-138.
4. Norton PJ, Price EC. A meta-analytic review of adult cognitive-behavioral treatment outcome across the anxiety disorders. J Nerv Ment Dis 2007; 195:521-531. **[CrossRef]**
5. Clark DM, Wells A. A cognitive model of social phobia. Heimberg RG, Liebowitz MR, Hope DA, Schneier FR, (eds). Social Phobia: Diagnosis, Assessment, and Treatment. New York: Guilford Press; 1995; s.69-93.
6. Davidson JR, Foa EB, Huppert JD, Keefe FJ, Franklin ME, Compton JS, Connor KM, Lynch TR, Gadde KM. Fluoxetine, comprehensive cognitive behavioral therapy, and placebo in generalized social phobia. Arch Gen Psychiatry 2004; 61:1005-1013. **[CrossRef]**
7. Beck AT. Cognitive Therapy and the Emotional Disorders. New York: International Universities Press; 1976.
8. Eysenck MW. Anxiety: The Cognitive Perspective. Hove, UK: Psychology Press; 1992.
9. Beck AT, Clark DA. An information processing model of anxiety: Automatic and strategic processes. Behav Res Ther 1997; 35:49-58. **[CrossRef]**
10. Wells A, Matthews G. Attention and emotion: A clinical perspective. Hove, England: Lawrence Erlbaum Associates; 1994.

11. Williams JMG, Watts FN, MacLeod C, Mathews A. Cognitive psychology and emotional disorders. Chichester, UK: Wiley; 1988.
12. Mogg K, Bradley BP. A cognitive-motivational analysis of anxiety. Behav Res Ther 1998; 36:809-848. **[CrossRef]**
13. Eysenck MW, Derakshan N, Santos R, Calvo MG. Anxiety and cognitive performance: Attentional control theory. Emotion 2007; 7:336-353. **[CrossRef]**
14. Bar-Haim Y, Lamy D, Pergamin L, Bakermans-Kranenburg MJ, van IJzendoorn MH. Threat-related attentional bias in anxious and nonanxious individuals: a meta-analytic study. Psychol Bull 2007; 133:1-24. **[CrossRef]**
15. Yiend J, Mathews A. Anxiety and attention to threatening pictures. Q J Exp Psychol A 2001; 3:665-681. **[CrossRef]**
16. MacLeod C, Mathews A, Tata P. Attentional bias in emotional disorders. J Abnorm Psychol 1986; 95:15-20. **[CrossRef]**
17. De Ruiter C, Brosschot JF. The emotional Stroop interference effect in anxiety: Attentional bias or cognitive avoidance? Behav Res Ther 1994; 32:315-319. **[CrossRef]**
18. Navon D, Margalit B. Allocation of attention according to informativeness in visual recognition. Q J Exp Psychol A 1983; 35:497-512. **[CrossRef]**
19. Fox E, Russo R, Bowles R, Dutton K. Do threatening stimuli draw or hold visual attention in subclinical anxiety? J Exp Psychol Gen 2001; 130:681-700. **[CrossRef]**
20. Rapee RM, Heimberg RG. A model of social phobia. Behav Res Ther 1997; 35:741-756. **[CrossRef]**
21. Pineles SL, Mineka S. Attentional biases to internal and external sources of potential threat in social anxiety. J Abnorm Psychol 2005; 114:314-318. **[CrossRef]**
22. Pishyar R, Harris L, Menzies R. Attentional bias for words and faces in social anxiety. Anxiety Stress Coping 2004; 17:23-36. **[CrossRef]**
23. Hope DA, Rapee RM, Heimberg RG, Dombeck MJ. Represent of the self in social phobia: Vulnerability to social threat. Cognit Ther Res 1990; 14:177-189. **[CrossRef]**
24. Lundh LG, Ost LG. Recognition bias for critical faces in social phobics. Behav Res Ther 1996; 34:787-794. **[CrossRef]**
25. Gilboa-Schechtman E, Foa EB, Amir N. Attentional biases for facial expressions in social phobia: The face-in-the-crowd paradigm. Cogn Emot 1999; 13:305-318. **[CrossRef]**
26. Mansell W, Clark DM, Ehlers A, Chen YP. Social anxiety and attention away from emotional faces. Cogn Emot 1999; 13:673-690. **[CrossRef]**
27. Bradley BP, Mogg K, Falla SJ, Hamilton LR. Attentional bias for threatening facial expressions in anxiety: Manipulation of stimulus duration. Cogn Emot 1998; 12:737-753. **[CrossRef]**
28. Mogg K, Bradley BP. Some methodological issues in assessing attentional biases for threatening faces in anxiety: A replication study using a modified version of the probe detection task. Behav Res Ther 1999; 37:595-604. **[CrossRef]**
29. Mogg K, Mathews A, Weinman J. Memory bias in clinical anxiety. J Abnorm Psychol 1987; 96:94-98. **[CrossRef]**
30. McNaughton N, Gray JA. Anxiolytic action on the behavioural inhibition system implies multiple types of arousal contribute to anxiety. J Affect Disord 2000; 61:161-176. **[CrossRef]**
31. Amir N, Elias J, Klumpp H, Przeworski A. Attentional bias to threat in social phobia: Facilitated processing of threat or difficulty disengaging attention from threat? Behav Res Ther 2003; 41:1325-1335. **[CrossRef]**
32. Buckner J, Maner JK, Schmidt NB. Difficulty disengaging attention from social threat in social anxiety. Cognit Ther Res 2010; 34:99-105. **[CrossRef]**
33. Pineles SL, Mineka S. Attentional biases to internal and external sources of potential threat in social anxiety. J Abnorm Psychol 2005; 114:314-318. **[CrossRef]**
34. Hofmann SG. Cognitive factors that maintain social anxiety disorder: A comprehensive model and its treatment implications. Cogn Behav Ther 2007; 36:195-209. **[CrossRef]**
35. Heeren A, Lievens L, Philippot P. How does attention training work in social phobia: Disengagement from threat or re-engagement to non-threat? J Anxiety Disord 2011; 25:1108-1115. **[CrossRef]**
36. Koster EHW, Crombez G, Verschuere B, De Houwer J. Attention to threat in anxiety-prone individuals: Mechanisms underlying attentional bias. Cognit Ther Res 2006; 30:635-643. **[CrossRef]**
37. Asmundson GJ, Stein MB. Selective processing of social threat in patients with generalized social phobia: Evaluation using a dot-probe paradigm. J Anxiety Disord 1994; 8:107-117. **[CrossRef]**
38. Maidenberg E, Chen E, Craske M, Bohn P, Bystritsky A. Specificity of attentional bias in panic disorder and social phobia. J Anxiety Disord 1996; 10:529-541. **[CrossRef]**
39. Mogg K, Bradley BP. Selective orienting of attention to masked threat faces in social anxiety. Behav Res Ther 2002; 40:1403-1414. **[CrossRef]**
40. Chen YP, Ehlers A, Clark DM, Mansell W. Patients with generalized social phobia direct their attention away from faces. Behav Res Ther 2002; 40:677-687. **[CrossRef]**
41. Stirling LJ, Eley TC, Clark DM. Preliminary evidence for an association between social anxiety symptoms and avoidance of negative faces in school-age children. J Clin Child Adolesc Psychol 2006; 35:431-439. **[CrossRef]**
42. Pishyar R, Harris LM, Menzies RG. Responsiveness of measures of attentional bias to clinical change in social phobia. Cogn Emot 2008; 22:1209-1227. **[CrossRef]**
43. Lundh LG, Öst LG. Attentional bias, self-consciousness and perfectionism in social phobia before and after cognitive-behaviour therapy. Scand J Behav Ther 2001; 30:4-16. **[CrossRef]**
44. Amir N, Beard C, Taylor CT, Klumpp H, Elias J, Burns M, Chen X. Attention training in individuals with generalized social phobia: a randomized controlled trial. J Consult Clin Psychol 2009; 77:961-973. **[CrossRef]**
45. Heeren A, Reese HE, McNally RJ, Philippot P. Attention training toward and away from threat in social phobia: Effects on subjective, behavioral, and physiological measures of anxiety. Behav Res Ther 2012; 50:30-39. **[CrossRef]**
46. Hakamata Y, Lissek S, Bar-Haim Y, Britton JC, Fox NA, Leibenluft E, Ernst M, Pine DS. Attention bias modification treatment: A meta-analysis toward the establishment of novel treatment for anxiety. Biol Psychiatry 2010; 68:982-990. **[CrossRef]**
47. Amir N, Taylor CT, Donohue MC. Predictors of response to an attention modification program in generalized social phobia. J Consult Clin Psychol 2011; 79:533-541. **[CrossRef]**
48. Price M, Tone EB, Anderson PL. Vigilant and avoidant attention biases as predictors of response to cognitive behavioral therapy for social phobia. Depress Anxiety 2011; 28:349-353. **[CrossRef]**
49. Amir N, Weber G, Beard C, Bomyea J, Taylor CT. The effect of a single session attention modification program on response to a public speaking challenge in socially anxious individuals. J Abnorm Psychol 2008; 117:860-868. **[CrossRef]**
50. Klumpp H, Amir N. Preliminary study of attention training to threat and neutral faces on anxious reactivity to a social stressor in social anxiety. Cognit Ther Res 2010; 34:263-271. **[CrossRef]**
51. Li S, Tan J, Qian M, Liu X. Continual training of attentional bias in social anxiety. Behav Res Ther 2008; 46:905-912. **[CrossRef]**
52. Schmidt NB, Richey JA, Buckner JD, Timpano KR. Attention training for generalized social anxiety disorder. J Abnorm Psychol 2009; 118:5-14. **[CrossRef]**
53. Enock PM, Hofmann SG, McNally RJ. Attention bias modification training via smartphone to reduce social anxiety: a randomized, controlled multi-session experiment. Cognit Ther Res 2014; 38:200-216. **[CrossRef]**
54. Neubauer K, von Auer M, Murray E, Petermann F, Helbig-Lang S, Gerlach AL. Internet-delivered attention modification training as a treatment for social phobia: a randomized controlled trial. Behav Res Ther 2013; 51:87-97. **[CrossRef]**
55. Boettcher J, Berger T, Renneberg B. Internet-based attention training for social anxiety: a randomized controlled trial. Cognit Ther Res 2012; 36:522-36. **[CrossRef]**
56. Mueller EM, Hofmann SG, Santesso DL, Meuret AE, Bitran S, Pizzagalli DA. Electrophysiological evidence of attentional biases in social anxiety disorder. Psychol Med 2009; 39:1141-1152. **[CrossRef]**
57. Eldar S, Bar-Haim Y. Neural plasticity in response to attention training in anxiety. Psychol Med 2010; 40:667-677. **[CrossRef]**