

Attentional Bias Assessment in Patients with Alcohol Use Disorder: an eye-tracking study

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Introduction: Alcohol use disorder (AUD) represents a major general health concern with important consequences for individuals' psycho-social functioning. Many studies suggest that cognitive processes such as attentional bias (AB) are heavily involved in the phases of acquisition, maintenance and relapse precipitation in AUD. AB is described as an implicit selective attention when processing visual information in favor of desired cues, which may elicit craving for alcohol and facilitate drinking-related behaviors. In line with recent studies of the applications of human-computer interaction in the field of psychology, the current study aimed to assess attentional bias towards alcohol-related images using eye-tracking technology. Specifically, we explored the first gaze towards alcohol-related images versus neutral images in patients with short-term and long-term abstinence. **Method:** 24 outpatients ($M_{age} = 53$, $SD = 11.65$) from the Addictive Behavior Unit of the Hospital Clinic of Barcelona participated in the study. The inclusion criteria were diagnoses of AUD and normal or corrected-to-normal visual acuity. Participants were divided according to their abstinence period, with the cut-off point being set at four months. Fourteen patients had been abstinent for less than four months ($M = 1$, $SD = 0.96$), and 10 for longer than this period ($M = 14$, $SD = 8.17$). The self-reported abstinence period was supported by the results of urine analyses performed in all patients. Participants completed the Alcohol Use Disorder Identification Test ($M = 19.75$, $SD = 9.34$) and the Visual Attention Task (VAT). The VAT consisted of images related to alcohol consumption versus neutral images such as office objects. The EyeTribe eye-tracking technology was used to record eye movement activity during the VAT. **Results:** Our data indicated a statistically significant difference between patients with short-term and long-term abstinence regarding their first fixation towards alcohol-related and neutral images. Patients abstinent for less than four months had a tendency to look first at images related to alcohol consumption, whereas patients abstinent for more than four months were more likely to look first at neutral images, regardless of their AUDIT score. **Conclusions:** Patients with short-term abstinence had a greater AB than patients with long-term abstinence. The first gaze seems to be a sensitive parameter for differentiating between patients with low and high AB. The use of eye-tracking technology suggests that AB is important in clinical assessment and should be addressed in treatment as well as in relapse prevention. We consider that the eye-tracking technology is a promising instrument for assessing current addictive behavior. **Keywords.** Attentional bias, eye-tracking, alcohol use disorder

1. Introduction

Alcohol use disorder (AUD) is a major general health concern, with important consequences for individuals' psycho-social functioning [1]. Many studies suggest that

cognitive processes such as attentional bias (AB) are heavily involved in the phases of acquisition, maintenance and relapse precipitation in AUD [2-4]. It has been suggested that AB may be an important variable in terms of abstinence period [3]. AB is described as an implicit selective attention when processing visual information in favor of desired

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cues [5]. It has been suggested that this implicit cognitive processing may elicit craving for alcohol or an intense desire to consume it [6] and may further facilitate drinking-related behaviors [7]. A growing body of literature emphasizes that AB has clinical implications in substance craving and should be addressed in the assessment [8], treatment [3] and relapse prevention [9] of addictive behaviors.

There is considerable interest at present in the application of new technologies in the field of clinical psychology and particularly in substance use disorders [10,11]. The eye-tracking (ET) technology is a useful tool for exploring eye-movement activity in relation to drug-seeking behaviors [4]. It complements classical methods to explore AB such as the Stroop task or the visual probe task [5]. Although ET has been implemented in various studies, for instance, obesity [12], bulimia nervosa [13] or anorexia nervosa [14], tobacco use disorder [15] or cocaine use [16], more research is needed to gain greater insights into its usefulness as a clinical instrument in addictive behaviors. Despite the fact that there are many publications on eye-tracking and alcohol use in general population, there is less research focused on the applications of eye-tracking in clinical settings with patients diagnosed with alcohol use disorder [17].

The current study aimed to assess AB towards alcohol-related images using ET technology. Specifically, we examined the first gaze towards alcohol-related images versus neutral images in patients diagnosed with AUD with short-term and long-term abstinence.

2. Method

a. Participants

Twenty-four outpatients ($M_{age} = 53$, $SD = 11.65$) from the Addictive Behavior Unit of the Hospital Clinic of Barcelona participated in the study after providing informed consent. The inclusion criteria were diagnosis of AUD and normal or corrected-to-normal visual acuity. Participants were divided according to their abstinence period, with the cut-off point being set at four months. Fourteen patients had been abstinent for less than four months ($M = 1$, $SD = 0.96$), and 10 for longer than this period ($M = 14$, $SD = 8.17$). The self-reported abstinence data were supported by the results of urine analyses performed in all patients.

b. Instruments

- *Alcohol Use Disorder Identification Test (AUDIT)* [18]. The Spanish version of AUDIT [19] is a 10-item scale that determines the severity of alcohol dependence and risk consumption. Responses to each item are scored from 0 to 4 and the maximum score is 40.
- *Visual Attention Task (VAT)*. The VAT comprises images related to alcohol consumption versus neutral images such as office objects. Alcohol-related images were selected based on the Spanish National Health Survey on Alcohol Consumption 2012 (Encuesta Nacional de Salud 2011/12. Consumo de alcohol) [20], which found beer to be the most consumed alcoholic beverage, followed by wine and liquors. Neutral images were office objects like colorful pencils, sticky notes, writing boards and other office-related images. The 144 stimuli (12 images related to alcohol x 12 neutral images) were presented to the subjects as a false visual memory task. This false task consisted of 18 trials (eight pairs of images per trial) in which the subjects had to state whether they had seen a

certain image or not. All pairs of images were counterbalanced, that is, each image appeared the same number of times on both sides of the screen. Each pair of images appeared on the screen for three seconds. After each pair of images, a gray-background image appeared for one second with a fixation point in the center of the screen aiming to return to a focal point.

c. Procedure

Participants were informed of this study during their regular visits with their appointed psychiatrist or psychologist. If they agreed to participate, they were referred to the researcher in charge of the study. First, they were informed about the technology used in the study and then they were asked to sign the informed consent. Personal data such as AUD history, medication and last consumption data were also collected. Reported medication included disulfiram, anxiolytics and anti-depressants. Patients were then asked to complete the AUDIT ($M = 19.75$, $SD = 9.34$) and the VAT. The VAT was displayed on a 19-inch monitor. The distance between the eye-tracking device and the participant was 60 cm. A chin rest was used to avoid head movements. All participants were administered a calibration task in the beginning in order to correctly map eye positions. Subsequently, instructions appeared on the screen informing participants that they were about to explore neutral and alcohol-related images. After each trial, participants were asked to report whether a certain image on the screen belonged to the previously presented trial and answered “yes” or “no”. The procedure lasted approximately 20 minutes. To record eye movement activity during the VAT, we used the EyeTribe eye-tracking technology.

d. Statistical analysis

Open and Gaze Mouse Analyzer (Ogama) software was used to analyze the raw EyeTribe eye-tracking data and to determine areas-of-interest (AOI) of each image. As a common form to determine AB is by exploring first gaze, this variable was computed within each AOI of images. Then, the Student t test was applied to explore the differences between patients' AB according to their abstinence period using the SPSS Statistical Package (v.23).

3. Results

T test for independent samples showed that there was a statistically significant difference between patients with short-term and long-term abstinence, $t(22) = 2.49$, $p = .02$. Figure 1 indicates that patients with short-term abstinence showed a bias in their first fixation towards images related to alcohol, but patients with long-term abstinence did not.

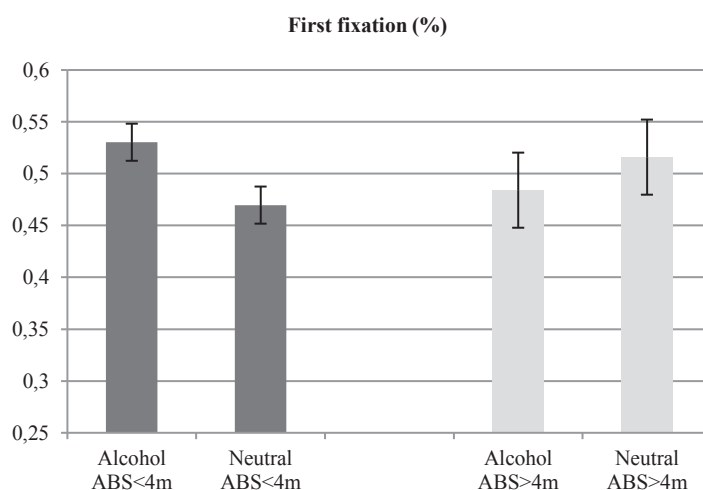


Figure 1. AB data in patients with AUD with ± 4 ABS (abstinence) months

4. Conclusions

A statistically significant difference was found between AUD patients with short-term and long-term abstinence (± 4 months) in terms of their first fixation towards alcohol-related images and neutral images. Patients who were abstinent for less than four months had a tendency to look first at images related to alcohol consumption, whereas patients abstinent for more than four months did not show any differences between alcohol-related images and neutral images. These findings corroborate those of previous studies using the visual probe task [21], the Go/No-Go Association Task [22], or the Stroop paradigm [23], which have supported AB towards alcohol-related images in individuals with alcohol misuse. AB modulates alcohol-seeking behaviors [24] and alcohol craving [25], resulting in approach behavioral tendencies [17], which may further increase the motivation to drink alcohol [3]. As our results corroborate those of previous research, we consider that AB towards alcohol-related content should be targeted in treatment approaches, as well as in prevention programs.

Interestingly, patients with long-term abstinence showed a slight tendency to look first at neutral images as it can be appreciated in Figure 1. This confirms previous work in which long-term abstinent patients displayed a negative bias when they focus their selective attention towards the control images and implicitly showed an inclination towards avoidant behavior. It has been suggested that this avoidance tendency is an outcome of patients' own perceptions regarding the loss of their self-control over alcohol consumption [25]. This may indicate that the less patients acknowledge alcohol-related stimuli, the less able they are to build new coping skills for use when they are engaged in real-life situations with alcohol content [26]. The results of this study show that patients with short-term abstinence had a greater AB than patients with long-term abstinence. The first gaze seems to be a sensitive parameter for differentiating between patients with low and high AB. The use of the eye-tracking technology suggests that AB is important in terms of clinical assessment and should be addressed in treatment as well as in relapse prevention. We conclude that the eye-tracking technology is a promising instrument for assessing current addictive behavior.

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6. References

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