Comparison of impulsivity with self-report and behavioural method in patients with Opioid Use Disorder

Lale Barlas¹, Başak Ünübol², and İhsan Dağ³

¹. Hacettepe University, Department of Psychology, Ankara, Turkey
². University of Health Sciences, Erenköy Mental Health and Neurological Diseases Training and Research Hospital, Department of Psychiatry, Istanbul, Turkey

Summary

Background: Impulsivity levels of individuals using substances is generally higher than the control groups. One of the most widely used behavioural paradigms to evaluate impulsivity in substance use disorder is delay discounting. Aim: This study aims to assess individuals with opioid use disorder in terms of impulsivity, decision-making, and behavioural activation/inhibition and compare them with those of healthy control subjects. Methods: The case and control groups consisted of 49 and 48 individuals, respectively. Impulsivity was measured with the Barratt Impulsivity Scale (BIS-11), behavioural activation/inhibition (BIS/BAS) and Addiction Profile Index (API). Subsequently, the behavioural delay discounting task was administered to both groups. Results: The majority of the group with opioid use disorder was male, single, unemployed, had an education level of middle school or below and a low or moderate socioeconomic level. They first used opioids at an average age of 21.42 years with an average daily dose of 2.95 grams heroin. The case group showed higher levels in the attention and motor impulsivity and in BAS-fun seeking subscales. The case group also displayed more significant delay discounting rates. Conclusion: By evaluating the relationships between these different impulsivity measures, this work aims to gain insight into the dynamics underlying the decision-making processes in individuals with opioid addiction that can hopefully be implemented in treatment approaches.

Key Words: Opioid use disorder; addiction; impulsivity; delay discounting

1. Introduction

Illegal substance use causes both acute and chronic health problems [14, 33]. When evaluated from an individual perspective, substance use disorder is one of the deadliest disorders among all psychopathologies, and the most deadly kind of substance abuse is opioid use disorder [4, 5, 9, 27, 29, 38].

In the U.S., deaths due to an overdose in 2017 exceeded 70,000, and two-thirds of those cases were due to opioids [52]. One of the major studies carried out in our country, the "TUBIM GPS Survey", examined the prevalence of substance use in Turkey; the lifetime prevalence of substance use was found to be 2.7% in 2011 [57].

Impulsivity is defined as a tendency to react quickly and in an unplanned way to internal and external stimuli, without assessing their negative effects on self and others [43]. It has been reported that individuals with childhood disorders distinguished by impulsivity, such as attention deficit hyperactivity disorder and behavioural disorder, will probably use substances more frequently in the future [10, 16, 44, 58]. Impulsivity levels of individuals using alcohol, cocaine, stimulants and opioids have been shown to be higher than those in the control groups [42, 48].

Impulsivity is a multidimensional structure. The prominent subdimensions of impulsivity in the framework of addiction are reward sensitivity [39] and behavioural inhibition [41, 51]. The study of impulsivity in terms of inhibition and activation is theoretically based on Gray's theory of susceptibility to...
reinforcement [23, 24]. It is thought that the behavioural activation system (BAS) plays a role in impulsivity because it causes positive emotions in response to rewarding stimuli. It has been suggested that the behavioural inhibition system (BIS), which is sensitive to punishment, has a role in preventing negative results, while it also plays a role in the phenomenology of impulsivity in this context [11]. It has been argued that high BAS and low BIS levels may both be risk factors for substance addiction [20, 36]. One of the most widely used behavioural paradigms applied to evaluate impulsivity in substance use disorder is delay discounting.

Delay discounting is the fall in the subjective value attributed to a substance, which is directly correlated with the extent of the delay in receiving a reward. Even if no change in the objective value of the reward occurs, the value that the individual attributes to taking a substance will continue to fall, in parallel with the increase in the delay elapsing before the reward is received. This situation can be expressed as 'the tendency to prefer smaller and quicker rewards rather than larger awards that involve a delay' [49]. It has been observed that the depreciation rates of a reward that had been delayed were higher in individuals dependent on alcohol, nicotine, opioids and stimulants, and in those with schizophrenia, major depressive disorder, obesity and gambling disorder than in control groups [3, 6, 13, 50].

In the literature, features related to impulsivity, disability in BIS/BAS systems and the selection of dependent groups were examined separately; it must be added that no other study addressing these three mechanisms grouped together as a whole has been found to date. The present study is the first to have been published in Turkey in which individuals with opioid use disorder have been evaluated by reference to the reward paradigm. This contributes to the originality of the present study. In this study, the construct of impulsivity has been assessed both behaviourally and by applying several self-report scales.

**Aim:** In the present study, one main aim has been to compare the impulsivity levels, impulsive selection patterns, and behavioural inhibition and activation systems of individuals affected by opioid dependence, with healthy individuals included in a corresponding control group.

### 2. Methods

#### 2.1. Sample

Patients who were receiving inpatient treatment at the Istanbul Erenköy Mental and Neurological Diseases Training and Research Hospital AMATEM (Alcohol, Substance Treatment Centre) Addiction Clinic according to the DSM-5 classification criteria, after having received a diagnosis of opioid use disorder, were included in the study. This clinic has 36 beds, while detoxification and psychosocial support was provided, too. The standard in-patient treatment at the center consists of Agonist Opioid Treatment (AOT) along with psychosocial support. The diagnosis interview was assigned to a physician who had been following the case history of patients in the clinic, independently of this study. All the interviews of those included in the control group took place in the textile factory where the study participants were working.

Sociodemographic information form, BIS-11 and BIS/BAS scales were administered to 49 individuals with opioid use disorder and 48 individuals constituting the control group, proceeding in a random order, in order to prevent the sorting and transportation effects that may arise from the order of application followed in utilizing the assessment tools. API was another scale applied to the sample group, whose members had reported opioid use disorder. The scales were applied no later than the first week following the hospitalization of each patient, once an individual's withdrawal symptoms had disappeared. After the completed scale questionnaires had been processed, the Paradigm of Delay Discounting was applied to both groups. Each test took 45 to 60 minutes. All the applications were carried out by the same professional (a clinical psychologist).

#### 2.1.1. Inclusion/Exclusion Criteria

**Study group:** Individuals were selected by applying the following purposeful sampling inclusion criteria: Being between the ages of 20-60, being an inpatient with a diagnosis of opioid use disorder, being in the first week following hospitalization, volunteering to participate in the study. Exclusion criteria: Having a comorbidity such as dementia, delirium, psychotic or organic disorders that could impair cognitive functions, having withdrawal symptoms and/or regularly consuming other substances besides opioids.

**Control group:** Individuals with sociodemographic characteristics similar to those found in the study group were a key element in the project. In-
dividends working in a textile factory were selected through random sampling. Inclusion criteria: Being between 20 and 60 years old, being similar to those in the study group in terms of age, gender and socio-economic level. Exclusion Criteria: Having a history of substance use, dementia, delirium, psychotic or organic disorder that might impair cognitive functions.

2.2. Instruments

2.2.1. Sociodemographic Data Form

This form was created by the authors to obtain information about the demographic variables of the participants. In the form, personal data such as age, gender, educational level, income level, and marital status are requested.

2.2.2. Addiction Profile Index (API)

This index was first developed by Ögel, et al. to measure the characteristics and severity of addiction in an individual with alcohol and substance abuse. It has 5 subdimensions including alcohol and substance use characteristics, addiction diagnosis criteria, effects of substance use on each patient’s life, craving for substance use and motivation to stop using the substance. It consists of 37 questions. The questions must be answered by choosing one of a five-point, Likert-type range of evaluations. In our study, only the alcohol-substance use dimension of API characteristics was used [46].

2.2.3. Barratt Impulsivity Scale (BIS-11)

This scale was first developed by Patton, Stanford and Barratt, with the aim of assessing the level of impulsivity and its 3 subdimensions (acting in unplanned ways, attention impulsivity, motor impulsivity) [48]. The scale comprises 30 items, and provides a range of four Likert-type evaluations as possible answers in each case. High scores indicate a high level of impulsivity. The Turkish adaptation was prepared by Güleç et al. [26].

2.2.4. Behavioural Inhibition System / Behavioural Activation System Scale (BIS/BAS)

This scale, originally developed by Carver and White, has two subscales – behavioural inhibition and behavioural activation [8]. The behavioural activation subscale itself has three subscales: reward responsiveness, fun-seeking, and drive. In all, the scale comprises 24 items to be evaluated by choosing the most appropriate answers, out of four, to the Likert-type questions that form the BIS/BAS questionnaire. High scores resulting from applying the scale indicate high levels of BAS and BIS. The Turkish adaptation was prepared by Şişman [55].

2.2.5. Delay Discounting

Within the behavioural paradigm developed by Kirby, Petry and Bickel, participants are asked to choose between smaller rewards that come sooner and larger ones that involve certain delays [35]. The rewards are hypothetical. Monetary rewards range from 1 to 1,000 TL, with delays lasting between 1 week and 25 years; Today I will offer you different prizes and ask you to choose between them. You will not get the rewards that I am offering you, but I still ask you to choose one or other of them, as if you would really receive one. I'll show you two cards. Suppose you will be awarded the prize on the card on the left today, and the prize on the right card at a later. Show what your chosen award is with your finger. Remember, the decision is completely up to you. Please make the choice you would actually make in real life, not the one you think I am expecting you to make.

The questions are asked verbally, and the monetary and temporal values accompanying each question can be printed on the table by pressing the cards. For example, while asking the question “Would you prefer to receive 990 TL today or 1,000 TL after 1 week?”, four cards with ‘990 TL’, ‘1,000 TL’, ‘today’ and ‘1 week’ are placed on the table. Cards that determine the time that will pass are placed under the cards that determine monetary values. Individuals show their preference for one of two scenarios either verbally or by pointing with their fingers.

The first choice to be made is always between ‘1,000 TL’, ‘one week later’ and ‘990 TL today’. Most individuals prefer not to wait a whole week for an extra 10 TL and choose to receive 990 TL at once. This shows that a lower value is attributed to the delayed monetary reward: Each participant then has to choose between 1,000 TL after 1 week and 960 TL today. In this way, the value of the delayed reward is reduced gradually, until the individual chooses to wait 1 week; at that point the value that the individual chooses to wait for is recorded. Using the same time delay, the opposite of the first procedure is now applied: Do you prefer to receive 1,000 TL after 1 week or get 20 TL today? Most individuals respond to this first question by choosing to wait, after which the value of the money to be received is raised. This time, the first value that the individual chooses to receive today is recorded.

After two values have been recorded for a one-
week delay, a 2-week delay now becomes the topic of questioning. In this way, two ‘indifference points’ are obtained from the individual for each delay period (1 week, 2 weeks, 1 month, 2 months, 6 months, 1 year, 5 years, 25 years). Then these two values are averaged, so that each individual has an average value for each delay. This procedure allows the variable k to be derived through the equation \( V = \frac{A}{1 + kd} \) (where \( V \) is the objective value of the delayed reward, also known as the ‘indifference point’, \( A \) is the nominal amount of the delayed reward, \( k \) is a free parameter that measures sensitivity to changes in delay, and \( D \) is the length of the delay). As the empirically derived \( k \) value rises, the discounted value falls more rapidly as a function of the delay.

2.3. Data analysis

Statistical analyses were made using SPSS v.20.0 software. Mann-Whitney U analysis was applied to compare opioid usage characteristics (marital status, education, employment status) and scale scores in terms of gender. Kruskal-Wallis analysis was applied to compare the socioeconomic level with opioid usage characteristics and scale scores. Pearson Correlation Analysis was applied to determine the relationship between age, age at onset of substance use, year and amount of initial use and scale scores at those times. The relationships between age at onset of use, year of initial use and its amount, together with a figure for ‘k value’, were first examined by Pearson Correlation Analysis. The relationships, first between BIS-11 and BIS/BAS, and then expanded to include the ‘k value’, were examined by Pearson Correlation Analysis, while Mann-Whitney U analysis was used to compare intravascular use, scale scores and ‘k values’. Mann-Whitney U analysis was then applied to compare item use method, scale scores and ‘k values’. Mann-Whitney U analysis was used for the third time to compare outpatient and inpatient treatment and scale scores. It was then used for the fourth time to compare study and control groups in terms of BIS-11 and BIS/BAS, and in terms of the ‘k value’. Lastly, all the various results were evaluated as to their significance by applying \( p < 0.05 \) as the cut-off level.

3. Results

The case group consisted of 49 people, comprising 43 men and 6 women between the ages of 18 and 49. Thirty-two (65.3%) were primary or secondary school graduates, 15 (30.6%) were high school graduates and 1 (2%) was a university graduate; 62.3% were single, 42.9% had a moderate socioeconomic level and 44.9% were unemployed. When the forensic histories of the participants are examined; 18 (35.2%) had a probation history and 8 (15.7%) had a history including time spent in prison in the past. Thirteen people (26.5%) had a history of self-harm.

The control group consisted of 48 people, including 44 men and 4 women between the ages of 18 and 56. 17 (35.4%) were university graduates, 16 (33.3%) had completed their education at high school, while the education of 14 (29.2%) had reached primary or secondary school level; 43.8% were single, and 56.3% had a moderate socioeconomic level.

3.1. Comparison in terms of Opioid Usage Features within the Group

When the participants in the study group were compared in terms of marital status, a statistically significant difference was observed only in terms of opioid duration (\( U = 85,000, p < 0.05 \)). It was observed that the mean ranking (ranking average = 25.43) of the married participants was higher than that of the singles’ opioid usage times (mean ranking = 16.04). There was, however, no significant difference in terms of scale scores. In order to check whether this difference is age-related, an age comparison was made in terms of marital status. Accordingly, it was seen that married participants (average ranking = 32.72) had a higher ranking average in terms of age than that of single participants (ranking average = 18.58) (\( U = 92,500, p < 0.05 \)).

It was observed that there were no significant differences in opioid use characteristics or scale scores based on the level of education or employment status, given that (\( p > 0.05 \)).

There was no significant difference either in terms of socioeconomic level, opioid usage characteristics or scale scores (\( p > 0.05 \)).

It was noted that there was a significantly positive relationship between age and duration of use (\( r = 0.67, p < 0.01 \)), whereas no significant relationship was found between age and other variables.

3.2. Investigation of Opioid Usage Features

Other findings on the opioid use characteristics of the case group can be seen in Table 1. Relationship analysis between BIS-11 and BIS/BAS, age at onset of use, years of use and amount consumed can be seen in Table 2.
It was found that the only significantly positive correlation was that between age at onset of opioid use and the BIS-11 motor impulsivity sub-dimension ($r = 0.35$, $p < 0.05$). It was noted that there were no significant correlations between opioid use properties (age at onset of substance use, years of use and amount consumed) or the ‘k value’ ($p > 0.05$).

Another finding was that there was no significant relationship between the BIS-11 and BIS/BAS scores recorded for the study group or the ‘k value’ ($p > 0.05$).

There was a statistically significant difference in the duration of substance use and on the question of whether intravenous injection had been used ($U = 121,000$, $p < 0.05$). It was observed that the mean rankings (average ranking = 23.78) of the group that used the substance intravenously were higher than those of the participants who never resorted to intravenous injection (average ranking = 16.76).

In terms of substance use method, there was a significant difference in BIS-11 'attention' scores ($U = 61,000$, $p < 0.05$). Accordingly, it was observed that those with intravenous use had a significantly higher mean of BIS-11 'attention' (average ranking = 25.88), compared with participants relying on foil use (average ranking = 17.10).

It was also observed that opioid usage characteristics and scale scores did not differ significantly according to whether they received previous outpatient treatment (Table 3).

### 3.3. Comparison of Intergroup BIS-11 and BIS/BAS Scale Scores

A further major finding was that the study group had higher average rankings and was statistically differentiated in terms of BIS-11 'attention', BIS-11 'motor impulsivity', BIS-11 'total score', as well as the BAS fun-seeking sub-dimension (Table 4).

### 3.4. Comparison of Intergroup 'k values''

When the case and control groups were compared in terms of the ‘k value’, it was seen that the study group had higher average rankings in terms of $k_7$, $k_{14}$, $k_{60}$, $k_{180}$, and that they differed statistically ($p < 0.05$) (Table 5).
It can be seen in the studies that the average age of drug addicts falls between the ages of 20 and 30. It is known that a low level of education is an important risk factor in substance abuse [56]. In our study, it was found that a majority of those in the study group had secondary or lower educational levels, in line with previous studies [2, 53].

In our study, the average age at which substance abuse starts was found to be 21.42. Considering the literature, Sproule et al. 23.6, Nebioglu et al. 19.7±4.4, reported data consistently in line with the current study. The 20s can be considered a risky age bracket in terms of opioid addiction.

In our present study, it was found that the most common technique of heroin use was foil (59.2%), followed by intravenous injection (iv) (16.3%). In parallel, in the study conducted by Nebioğlu et al., and published in 2013, it was found that all of the 84 addicted opioid addicts who were under treatment were using foil [45]. These frequencies are in line with global trends, while specifying the main distribution technique used at the time in Turkey [21].

### 3.5. Examination of the reward in terms of ‘k value’ as a result of delay

The calculations quoted here were based on the median of each ‘k value’ (Figure 1).

### 4. Discussion

In our study, the impulsivity levels, impulsive selection patterns and behavioural inhibition and activation systems of individuals with opioid dependence were compared with the control group. It was observed that 87.82% of the study group were male, and a majority (65.3%) had only primary or, at most, secondary schooling, while 42.9% were living at a middle socioeconomic level; of these, the socioeconomic level of as many as 34.7% was assessed as middle-lower. The average age of participants in the study group was calculated as 27.4±6.41. When the literature is analysed, the average age of those in study samples in projects conducted with substance addicts is consistent with the present study. Accordingly, Doğanavşargil et al. determined 27.58±10.43 and Bilici et al. 30.1±15 [7, 15]. It can be seen in the studies that the average age of drug addicts falls between the ages of 20 and 30.

It is known that a low level of education is an important risk factor in substance abuse [56]. In our study, it was found that a majority of those in the study group had secondary or lower educational levels, in line with previous studies [2, 53].

In our study, the average age at which substance abuse starts was found to be 21.42. Considering the literature, Sproule et al. 23.6, Nebioğlu et al. 19.7±4.4, reported data consistently in line with the current study. The 20s can be considered a risky age bracket in terms of opioid addiction.

In our present study, it was found that the most common technique of heroin use was foil (59.2%), followed by intravenous injection (iv) (16.3%). In parallel, in the study conducted by Nebioğlu et al., and published in 2013, it was found that all of the 84 addicted opioid addicts who were under treatment were using foil [45]. These frequencies are in line with global trends, while specifying the main distribution technique used at the time in Turkey [21].
but no significant relationships emerged with other subdimensions. Motor impulsivity is defined as the tendency to act with the motivation of the moment, without taking into account any of the likely consequences [48]. Due to many developmental and social factors, the 20s can be considered as a risky age span in terms of substance onset and addiction [28]. However, according to the present study finding, as motor impulsivity increases, age at onset of substance use increases too. This suggests that the risk factor may be impulsivity for people starting substance use even after the risky age period has passed.

In our study, the amounts of substance used by the participants ranged from 1 to 7 grams per day, while their average daily use was 1.95 grams. Bilici et al. found that the usage amount of 78 heroin addicts was 1.3 grams per day [7]. Various studies have shown that daily doses of heroin fall within similar ranges [12, 25]. The dose range found in this study was between 1 and 7 grams – a surprisingly wide range. This may be because treatment of the sample had just begun, and the drug dose was being administered to a newly formed group. It had been thought that individuals might try to reach higher doses by showing their heroin doses at a higher level than the real one.

When the BIS-11 and BIS/BAS scale scores and substance use characteristics of the case group were analysed, it was seen that there was a significant relationship between the "motor impulsivity" sub-dimension of BIS-11 and age at onset of substance use, but no significant relationships emerged with other subdimensions. Motor impulsivity is defined as the tendency to act with the motivation of the moment, without taking into account any of the likely consequences [48]. Due to many developmental and social factors, the 20s can be considered as a risky age span in terms of substance onset and addiction [28]. However, according to the present study finding, as motor impulsivity increases, age at onset of substance use increases too. This suggests that the risk factor may be impulsivity for people starting substance use even after the risky age period has passed.

In our study, it was found that the BIS-11 'attention-related impulsivity' level was higher in those taking using substance(s) intravenously. Attention-related impulsivity can be defined as a lack of ability to focus on the task, competition between thoughts, and being apt to make decisions suddenly and in a distracted way [48]. Studies have revealed a strong

**Table 5. Comparison of Intergroup 'k values'**

<table>
<thead>
<tr>
<th>Groups</th>
<th>N</th>
<th>Ranking average</th>
<th>Ranking total</th>
<th>U</th>
<th>z</th>
</tr>
</thead>
<tbody>
<tr>
<td>k7 Study Sample</td>
<td>49</td>
<td>57.29</td>
<td>2807.00</td>
<td>770.000*</td>
<td>-2.93</td>
</tr>
<tr>
<td>Control</td>
<td>48</td>
<td>40.54</td>
<td>1946.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>k14 Study Sample</td>
<td>49</td>
<td>58.97</td>
<td>2889.50</td>
<td>687.500**</td>
<td>-2.54</td>
</tr>
<tr>
<td>Controls</td>
<td>48</td>
<td>38.82</td>
<td>1863.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>k60 Study Sample</td>
<td>49</td>
<td>58.91</td>
<td>2886.50</td>
<td>690.500**</td>
<td>-3.50</td>
</tr>
<tr>
<td>Controls</td>
<td>48</td>
<td>38.89</td>
<td>1866.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>k180 Study sample</td>
<td>49</td>
<td>55.80</td>
<td>2734.00</td>
<td>843.000*</td>
<td>-2.42</td>
</tr>
<tr>
<td>Controls</td>
<td>48</td>
<td>40.62</td>
<td>2019.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p <0.05, **p <0.01

**Figure 1.** The Delay Discounting of the Case and Control Group and the Rates of k values. Series Up: Case group, Series Down: Control group
correlation between iv substance use and impulsivity [22, 40]. In our study, it was found that those using substance(s) intravenously had been doing so over a longer time-span. There are studies showing that increased impulsivity is a risk factor for iv use due to prefrontal inhibition caused by long-term use [32].

Due to the devastating consequences of their behaviour, opioid addicts show greater keenness to enter treatment than other substance addicts [47]. On the other hand, when studies investigating substance use in terms of treatment process and impulsivity are examined, it is seen that opioid addicts frequently stop treatment, or start using drugs again soon after treatment stops [17, 30]. In our study, 'attention-related impulsivity', 'non-planning' and 'total scores' of those who were previously treated were higher in BIS-11. The BAS-drive subscale was also found to be higher in participants who had previously received in-patient treatment. This particular result suggests that increased impulsivity after long-term substance use may lead to the continuation of substance use.

To the best of our knowledge, this is the first study to examine the relationship between BIS/BAS and opioid addiction in Turkey. The finding that achievement of the BAS fun-seeking impulse was higher in the study group than the control group is consistent with theoretical explanations. The fact that individuals showing high BAS activity are more sensitive to rewards and substances than control individuals [59], experience more frequent and severe craving [18] and use alcohol and/or substances at a higher rate and in greater amounts [19] supports the close association between BAS and substance use.

In our study, there was no significant difference between the groups in terms of BIS activation. Similarly, when the literature was examined, it was seen that there was no significant difference either between the alcohol level and the substance addicts’ and control group’s BIS levels in the study of Franken et al. [20]. In some studies, a negative correlation was found between BIS sensitivity and substance dependence [31, 54]. Based on this information, it can be concluded that the role of BIS activation in substance abuse now calls for further clarification.

In our study, which has been considered as having enhanced the reward paradigm and given priority to assessing impulsivity behaviourally, a key finding was that the opioid-addicted group preferred rewards – even those of lower value – to be taken immediately, rather than waiting for a greater reward to be received later, when compared with the control group. Accordingly, the study sample group is less worthy of the prize that will come after the weekly (k7), two-week (k14), two-month (k60) and six-month (k180) time periods, but the rewards to be obtained immediately are evaluated as being much greater than those in the control group. In the study sample participants chose to get their reward early. However, when the time periods following this were analysed, it was found that the frequency of not choosing the more valuable rewards that will come after one year (k360), or after as much as five years (k1825), does not differ from those of the control group. When past studies were examined, it was seen that the current study is consistent with their findings [37]. In the present study, in agreement with the literature, a hyperbolic curve was reached in the results obtained regarding the reward paradigm in both control and study groups [1, 34].

Limitations

The current study has some limitations. The size of the study sample and control groups can be considered a limitation. In addition, the study sample and control groups do not correspond in terms of their average age. All the impulsivity and reward sensitivity parameters assessed in our study show instability over time. Thus, timing is a very important factor when it comes to assessing patients. In our study, all individuals were evaluated in the early weeks of addiction treatment, so that it can be concluded that their personal data differ very little in the addiction table, precisely because they are still at the very beginning of treatment. In future studies, it will be very illuminating to find out the effects on key parameters that are due to assessments made at different stages of treatment.

5. Conclusions

A thorough understanding of impulsivity is critical to the effectiveness of addiction treatment. Individual impulsivity patterns have prognostic implications, both during treatment and once treatment ends. The results obtained for the study group clearly convey the message that patients in such a severe predicament systematically tolerate less waiting, considering all the various trends displayed by patients who have to cope with being dependent. It may therefore be concluded that focusing on valuable results in the long term will result in an ineffective intervention, whereas steadily focusing on short-term effects will bring much better results. This finding has compelling implications in terms of treatment.
References


**Acknowledgements**

We would like to thank all patients who made a contribution to this study.

**Role of the funding source**

There were no sources of funding in this study. This scientific article is based on the data the first author collected for her PhD dissertation under the advisorship of the third author.

**Contributors**

L.B. and I.D. were responsible for the study design and statistical analyses, L.B. and B.Ü. collected the data, L.B. and I.D. wrote the first version of the manuscript, L.B. and B.Ü. worked on revising the manuscript. All authors read and approved the final manuscript.

**Conflict of interest**

The authors have no conflicts of interest to declare.

**Ethics**

Ethics committee permissions were obtained from Hacettepe University with the GO 17/391 registration number. Before the interviews, informed consent forms were obtained after providing information about the study to all participants.

**Note**

It is the policy of this Journal to provide a free revision of English for Authors who are not native English speakers.

*Received November 19, 2020 - Accepted January 18, 2021*