



# Positive Psychology Intervention to Improve Recovery after Renal Transplantation: A Randomized Controlled Trial

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## Abstract

There is an increasing body of evidence proving that transplanted patients' perceptions of their disease and their emotional state may have an influence on their physical recovery, but there are relatively few psychological interventions specifically developed to support their healing process. The aim of our study was to explore the effectiveness of a positive psychology intervention programme on the pre- and postoperative psychological state of kidney transplant patients. Clinical trial registration number: NEP-PSZICH-001, 13.15.2014. A total of 40 kidney transplant patients were assessed using the Spielberger Anxiety Inventory, Beck's Depression Inventory, Transplanted Organ Questionnaire, Brief Illness Questionnaire and the Posttraumatic Growth Inventory during a 1-year follow-up. Medical parameters were collected throughout the 1-year period after transplantation. Compared to the control group, patients in the intervention group had lower anxiety and depression, and higher Posttraumatic Growth scores, and they had shown more positive attitude toward the transplant and their illness. We consider it as our most outstanding result that the estimated glomerular filtration rate and serum creatinine levels were significantly better among patients receiving positive psychology intervention, both after 6 months and after one year following their kidney transplantation. The findings show that mental functioning and general well-being of kidney transplant patients improved after our positive psychology intervention programme, and these improvements were also associated with better kidney functions in the long run.

**Keywords** Anxiety · Depression · Illness representation · Positive psychological intervention · Posttraumatic growth · Renal transplantation

## Introduction

There is an increasing body of evidence proving that transplanted patients' perceptions of their disease and their emotional state may have an influence on their physical recovery (Calia et al., 2011; Corruble et al., 2011). The interactions of these psycho-immunological mechanisms in these processes are extremely complex. A great amount of research data confirm that psychosocial interventions may have a

positive effect on personal development and posttraumatic growth (Calhoun & Tedeschi, 2000). In the case of patients with chronic kidney disease and/or awaiting kidney transplantation, it is also proven that psychological interventions reduce depression and increase patients' quality of life (Chan et al., 2016; Griva et al., 2018; Rodrigue et al., 2011). At the same time, there are only a few comprehensive studies so far that have investigated the effects of psychological state of the patient and/or the impact of psychological intervention on physical recovery and the extent of the transplantation's success (Calia et al., 2011; Corruble et al., 2011). General well-being and quality of life after transplantation are known to be primarily affected by depression and anxiety, rather than by the physical state of the patient (Nickel et al., 2002). Therefore, the treatment and prevention of these problems would be especially important. Depressive symptoms may also be associated with decreased patient adherence, resulting in the malfunctioning of the kidney allograft, and may

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contribute to long-term mortality after transplantation (Chilcot et al., 2014; Corruble et al., 2011; Foster et al., 2017). Furthermore, non-adherence to immunosuppressive therapy is a prevalent risk factor after kidney transplantation (Sanders-Pinheiro et al., 2018).

Previous findings also suggest that posttraumatic growth may serve as a protective factor in relation to consequent health outcomes (Kuenemund et al., 2016; Schmidt et al., 2012), but only a few studies have examined personal growth in the context of transplantation (Segatto et al., 2013; Yorulmaz et al., 2010).

The transplanted organ is not only immunologically, but also psychologically extraneous for the recipient, and the integration of the graft into the body image is a criterion for emotional and psychological well-being (Látos et al., 2012; Shimazono, 2013). Successful integration is influenced by several factors, such as the formation of positive emotions and fantasies about the organ and the donor, and the ability to alter negative psychological contents (Consoli, 2012; Látos et al., 2012). Reversing the negative illness perception of patients may have a positive effect on their recovery, predict self-care behaviours with regard to diet and medication (Dalebout et al., 2011; O'Connor et al., 2008), and their education reduces anxiety and depressive symptoms (Ye et al., 2011).

## The Benefits of Positive Psychology Interventions

Research into the relationships between positive psychological constructs and clinical outcomes has grown substantially since Hoodin et al. (2006) found that pretransplant optimism appeared to effect short term survival of patients, which suggested that these data might have practical implications for transplant teams. In contrast to psychological distress, positive psychological well-being (including optimism, hope, gratitude, perseverance) has been independently associated with better health related quality of life and superior health outcomes in diseased and healthy populations (Amonoo et al., 2019; Chida & Steptoe, 2008). Although most of the studies in the literature focus on the effects of chronic negative emotions on the immune system, many studies also draws attention to the immune enhancing benefits of positive emotions (D'Acquisto, 2017; Pressman & Black, 2012). Fuelled by the emergence of positive psychology (Seligman & Csikszentmihalyi, 2000), the field of posttraumatic growth has now become a major topic of research (Calhoun & Tedeschi, 2006; Joseph & Linley, 2008). Existing literature suggests that Positive psychology interventions (PPIs) significantly impact recovery in a variety of medical populations (Chida & Steptoe, 2008; Huffman et al., 2015) and may be effective in enhancing posttraumatic growth and positive

mental health (Joseph et al., 2012). Interventions that aim to promote optimism, emotional well-being, positive mood and related positive psychological constructs may significantly impact health outcomes of transplanted patients as well. Therefore, our aim in this study was to explore the role of pre- and postoperative positive psychology interventions on recovery of kidney transplant patients.

## Materials and Methods

### Participants

A total of 40 patients with chronic renal failure were involved in our study ( $N = 40$ ; average age 49.35;  $SD = 10.13$ ). Inclusion criteria were: age 18–70 years, chronic kidney disease, medically approved for kidney transplantation. Exclusion factors included clinical levels of depression and anxiety, or other psychiatric disorders. Data were collected at the Nephrology-Hypertension Centre and the Department of Surgery of the University of Szeged Medical Centre, where a psychologist is a member of the renal team.

### Study Design

A randomized controlled trial was implemented to address the objective of this study. The participants were involved in the research when they were registered on the kidney transplantation waitlist (Fig. 1). After the baseline assessment, they were randomly assigned to either the psychological Intervention group (IG) ( $N = 20$ ) or the Control group (CG) ( $N = 20$ ). Members of both groups filled out the psychological questionnaires, but while the CG only received basic medical care without special psychological treatment, the IG took part in four individual intervention sessions, at the following points of the research: when the participants were put on the transplantation waitlist (T1), and in the first (T2), sixth (T3), and twelfth months (T4) after their surgery (Table 1). The average length of the sessions was 90 min. Therapists were PhD level psychologists with at least a 5-year experience in transplantation care. The research protocol was approved by relevant institutional research ethics committees (clinical trial registration number: NEP-PSZICH-001).

### The Four-Step Positive Psychology Intervention

We have developed a complex, intensive, personalized psychological intervention programme for patients before and after kidney transplantation, to support positive emotions and posttraumatic growth, to reduce concerns about the organ and the illness, to correct negative illness perceptions, and thereby increase the chances of success of

the transplantation. (Table 1). Patients took part in four individual positive psychology sessions, each lasting 90 min. In the sessions, we applied verbal and nonverbal techniques, e.g., the PRISM-D drawing technique, developed by us (Sándor et al., 2020), art therapy, and relaxation techniques to facilitate coping and recovery, to elaborate losses, to repair the injured body image and to restore positive self-esteem.

PPIs are usually divided into seven main categories (savouring, gratitude, kindness, empathy, optimism, strengths, and meaning) (Parks & Titova, 2016). Based on earlier research findings (Látos et al., 2016) and our clinical experiences, we have developed a positive psychology intervention programme which contains four of these PPI dimensions:

- (1) *Empathy-oriented interventions to strengthen positive emotions* Organ transplantation may bring intensive emotions to the surface: the feeling of guilt toward the donor, concerns about one's health and the body. The first goal of our programme was to strengthen positive emotions by working through them and decreasing the emotional and cognitive distress related to the diagnosis and the course of the disease, and to elaborate on the losses, fear, and ambivalence.
- (2) *Meaning oriented interventions to re-evaluate and synchronize different roles* Fears about changes in social connections frequently appear and often lead to the denial of disease and adherence problems. Therefore, the patient has to accept the sick role and integrate it into the self in order to be able to cope with the disease and to find new meanings in these integrated roles and functions after recovery.
- (3) *Value-oriented interventions to strengthen internal resources* A chronic disease and the loss of physical functions of the body require a grieving process just as any other loss. Long lasting states of anxiety and depression put a burden on patients and drain their resources (Látos et al., 2016; Shimazono, 2013). After transplantation, the stability of the body image and boundaries, as fundamental internal personal resources, should be restored to support the internal capacities for the psychological integration of the organ and its functioning (Látos et al., 2012; Nickel et al., 2002).
- (4) *Optimistic interventions to develop reasonable expectations* One of the biggest challenges of transplantation is that due to their vulnerable condition, patients either have excessive expectations or little trust in the procedure. Our intervention aims to decrease the sense of vulnerability, so that the patient can approach the transplantation with greater trust and optimism, and adapt more easily to the conditions after surgery.

In our intervention programme, each session had a special focus on the above described four PPI dimensions. In our study, we investigated the efficiency of the 4-step intervention programme, with respect to psychological variables and the successfulness of the transplantation.

## Psychological Tests and Measurements

To measure indicators of psychological change during the intervention, we used the Transplanted organ questionnaire (TOQ) which measures the representations and emotions of recipients in connection with the transplanted organ (Corruble et al., 2012). It consists of three scales: the 'Psychological rejection' scale reveals negative emotions regarding the new organ and examines the psychological difficulties of its acceptance. The 'Donor scale' asks about concerns in connection with the donor, and the 'Positive attitude' scale contains questions targeting the positive idealization of the transplanted organ. In addition to TOQ, we used the Brief illness perception questionnaire (BIPQ) that includes eight items (Broadbent et al., 2006). Five of the items assess cognitive illness representations: consequences, timeline, identity, personal and treatment control. Two of the items assess emotional representations and one item assesses illness comprehensibility. The Spielberger State-Trait Anxiety Inventory (STAI-S; STAI-T) was administered to measure the level of anxiety (Spielberger et al., 1970). Beck's depression inventory (BDI) was also used to assess the severity of depressive symptoms (Beck et al., 1961). We also administered the Posttraumatic Growth Inventory to assess positive outcomes following a struggle with highly challenging life circumstances (Tedeschi & Calhoun, 1996).

## Medical Parameters

Medical parameters (serum creatinine and eGFR levels) were collected from the routine clinical blood tests and biopsy results (acute rejection episodes) throughout the 1-year period after transplantation. Human leukocyte antigen (HLA) donor mismatches, cold ischemia time, donor age, duration of chronic kidney disease (in months), the recipient's cardiovascular disease and/or diabetes mellitus were also recorded in the research.

## Statistical Analyses

Data were analysed using IBM SPSS 23.0 for Windows. Descriptive statistics were calculated for all variables. The Shapiro–Wilk tests were used to test for normal or abnormal distribution of the data. To reveal the pattern of relations among the variables, Spearman's and Pearson's correlations were used. Group comparisons were performed with Independent T-test and Mann–Whitney test. Repeated

measures ANOVA were used to understand whether there is a difference in the psychological and medical variables amongst kidney transplanted patients after the psychological intervention programme (e.g., at three points of time: serum creatinine levels 1, 6 and 12 months after transplantation). Results were considered statistically significant when the  $p$  value was less than 0.05.

## Results

### Baseline Characteristics and Randomization Check

The patients were randomly divided into a Control group (CG) ( $N=20$ ; average age 49.5;  $SD=10.62$ ) and an Intervention group (IG) ( $N=20$ ; average age 49.2;  $SD=9.89$ ). Baseline sociodemographic and medical characteristics (type of dialysis, HLA MM, and primary disease: diabetes, hypertension or polycystic kidneys) were similar across the two groups ( $p>0.005$ ). 50% of the sample consisted of men and 50% were women. There was no significant difference between the groups in terms of education ( $p=0.383$ ), 55% ( $N=22$ ) of the patients graduated from high school or had a college degree, and 45% ( $N=18$ ) received elementary education or vocational training. Regarding marital status, 87.5% ( $N=35$ ) were living in a stable relationship, 12.5% ( $N=5$ ) had no stable relationship. 100% ( $N=40$ ) of the group had children. As for economic activity, 25% ( $N=10$ ) of the patients were active and 75% ( $N=30$ ) were inactive.

### Examining the Effectiveness of the Programme

Means and standard deviations are broken down by group and time in Table 2. There were no baseline (T1) differences between the groups across the psychological measures (each  $p>0.05$ ). Table 3 shows results of repeated measures ANOVA for all dependent variables over times of measure in the participants. Mauchly's test indicated that the sphericity assumptions were met ( $p>0.05$ ) for those variables. The ANOVA results demonstrated that there were significant differences in variables between four times of measurement. It was found that illness perception total score showed the highest partial Eta-Squared (0.743), followed by consequences (0.602), emotional response (0.594), personal control (0.504), trait anxiety (0.485), concern (0.476), identity (0.447), depression (0.437) and treatment control (0.428) (Table 3). Bonferroni comparisons revealed that after the individual positive psychology intervention depression, trait anxiety and negative illness perception significantly decreased from the baseline.

### 1-Month After Transplantation (T2)

The CG had higher depression, anxiety and TOQ 'Psychological rejection' and lower 'Positive attitude' scores than the IG (each  $p<0.05$ ) (Table 2). Relative to the CG group, the IG had lower BIPQ total scores ( $p=0.001$ ;  $t=3.46$ ), 'Consequences' ( $p=0.005$ ;  $Z=-2.81$ ), 'Emotional response' ( $p=0.025$ ;  $t=2.33$ ) and 'Timeline' ( $p=0.004$ ;  $Z=-3.05$ ) scores, which means that they see their illness as more threatening and report more concerns related to it. Creatinine levels of the groups showed a difference in tendency ( $p=0.071$ ;  $Z=-1.81$ ).

### Six-Months After Transplantation (T3)

Significant differences were also detected between the two groups at this point of time (Table 2). Emotional and mood states of the IG appeared to be considerably stable (lower BDI, STAI and BIPQ scores, each  $p<0.05$ ). Patients who did not attend psychological intervention showed a less positive attitude ( $p=0.007$ ;  $Z=-2.65$ ) and more negative emotions ( $p=0.001$ ;  $Z=-3.39$ ) with regard to the transplanted organ, which indicates serious difficulties of its acceptance. Regarding creatinine levels ( $p=0.007$ ;  $Z=2.69$ ), the CG showed higher results, and the intervention group reached higher eGFR values ( $p=0.007$ ;  $t=-2.86$ ). Both results show improved functioning of the kidney allograft in the intervention group.

### 12-Months After Transplantation (T4)

The CG also had lower anxiety, depression and BIPQ scores (each  $p<0.05$ ) (Table 2). Regarding the Posttraumatic Growth Inventory, the IG showed significantly higher results especially in relationship to others ( $p=0.039$ ;  $t=-2.11$ ) and personal strength ( $p=0.002$ ;  $t=-3.24$ ). There was also a significant difference in TOQ 'Positive attitude' ( $p<0.001$ ;  $Z=-4.02$ ) and 'Psychological rejection' ( $p=0.04$ ;  $Z=-1.95$ ) scales between groups. Compared with control subjects, IG achieved significantly higher levels of eGFR ( $p=0.041$ ;  $t=-2.11$ ) and serum creatinine ( $p=0.011$ ;  $t=1.67$ ) one year after transplantation.

## Discussion

We have designed a 4-step positive psychology intervention programme with individual sessions specifically developed to support the healing process of transplanted patients. The aim of our study was to explore the effectiveness of this intervention programme on the pre- and postoperative psychological status of kidney transplant patients, starting from the organ waiting list through transplantation.

We hypothesized that there would be notable differences between medical and psychological results in the intervention (IG) and control group (CG) after the positive psychology intervention. The results show that our program has both short and long-term benefits (with moderate to large effect sizes): depression, trait anxiety and negative illness perception significantly decreased from the baseline.

Previous research results show that psychological intervention can lead to a reduction of depression and anxiety (Griva et al., 2018; Ye et al., 2011). These psychological indicators show a correlation with medical results that measure kidney functioning (Chilcot et al., 2014; Szeifert et al., 2010). Our results are in accordance with previous research as the CG had a significantly higher result for both anxiety and depression compared to the IG. Previous research also suggests that negative mood factors can also influence physical health through the complex pathways connecting psychological factors and physical illness (Dobbels et al., 2008; Novak et al., 2010; Rocha et al., 2001; Zelle et al., 2012).

We consider to be our most important finding that differences were also present in the medical results of the two groups. The higher eGFR value and lower creatinine level measured after 6 and 12 months in the IG confirm that the implanted organ worked more effectively in members of this group. There was no difference between groups one month after transplantation regarding medical data. We only found a tendency in creatinine levels, which may suggest that the positive effect of the psychological intervention appears in the long term.

The first goal of our positive psychology intervention was to strengthen positive emotions by reducing negative illness perceptions (the first step in our programme: empathy-oriented interventions to strengthen positive emotions), and its result is clearly reflected in the difference between BDI, STAI and BIPQ total scores of the two groups. The re-evaluated and synchronized roles (the second step in our programme) as well as reinforcement of internal resources during the intervention contributed also to the decrease in anxiety and depression, resulting in a better quality of life (Rorigue et al., 2011). Since we know that anxiety, depression, and quality of life may have a significant impact on the outcome of kidney transplantation (Chilcot et al., 2014), we can state that, through the effect on these factors, positive psychology intervention can facilitate the recovery of kidney recipients; therefore, positive psychology interventions may be recommended as part of the routine treatment.

In the Transplanted Organ Questionnaire, we found significantly higher results in the IG for positive idealization

connected to the organ; furthermore, there was a significant difference in the Psychological Rejection Scale. This result led us to conclude that the goal of psychological intervention conducted in order to strengthen positive emotions was successful, as the patients who received psychological intervention showed various signs of a positive attitude towards the organ and signals of integration (the third step in our programme: value-oriented interventions to strengthen internal resources). Since the precondition for successful integration of the graft into the body image is the graft-related positive attitude (Consoli, 2012), we can say that members of the intervention group were likely to better integrate the new organ into their body image. Adequate integration is a criterion for later emotional and psychological well-being (Látos et al., 2012; Shimazono, 2013). These results are coherent with our previous data showing that mental representation of the foreign organ influences the kidney transplantation prognosis and might have remarkable clinical implications (Látos et al., 2016). According to Corruble et al. (2011) a higher TOQ “psychological rejection” subscale was associated with increased risk of death among liver transplant recipients, because the representations of the “foreign body” is associated with certain psycho-neuro-immunological processes that could eventually have an adverse effect on transplanted organ function.

The programme also proved its effectiveness in the field of posttraumatic growth (the third step in the programme: value-oriented interventions to strengthen internal resources). Empirical studies showed that health care providers might help the recovery of patients by facilitating posttraumatic growth (Schmidt et al., 2012). For example, posttraumatic growth might provide additional perspectives for rehabilitation among stroke survivors (Kauenemund et al., 2014). We also found that posttraumatic growth might be an important factor in the healing process among kidney-transplanted patients. There were powerful changes in our patients’ relationships: the value of intimate connections increased, and the ability for intimacy became deeper. We could see this result among the members of the intervention group who showed significant growth in the PTGI questionnaire and also higher results compared to the CG, especially in relationship to others and personal strength. This confirms the findings of Tedeschi and Calhoun (1996) who claim that psychological treatment considerably facilitates personal development.

According to the measures of emotional representation on the BIPQ questionnaire, members of the CG showed more concern about their illness than the members of the



IG. In the questions that refer to the emotional relation to the illness, the CG scored higher points, which leads to the conclusion that their emotional involvement in their illness may be deeper. The factors measuring cognitive representation show that members of the CG seem more concerned about the consequences of their illness. It may suggest that the CG had a more negative overall expectation about the outcome. Previous research also suggested that a negative perception of illness was associated with increased risk of death in patients with end-stage renal disease (Chilcot et al., 2011; van Dijk et al., 2009). Our results satisfy the expectation that psychological intervention may help to manage negative emotions and ideas that had been evoked by the transplantation, as one of the goals of the sessions was to reduce patient's anxiety and fear, and to develop genuine and reasonable expectations in connection with the disease (the fourth step in our programme). We can see that the concerns about the consequences regarding the condition are reduced in members of the IG, and they developed a more realistic picture of the cause and outcome of their disease. Also, they were less negatively affected emotionally by the disease, which was most likely due to the effort of strengthening positive emotions during the intervention sessions.

## Conclusion

Summing it up these findings show that psychological functioning and general well-being of kidney transplant patients improved after our positive psychology intervention programme, and these improvements were also associated with better kidney function in this group in the long run. Overall, we can state that IG and CG show significant differences both in medical and psychological results in the long run. Psychological intervention seems to be effective in improving psychological and somatic factors; therefore, we suggest

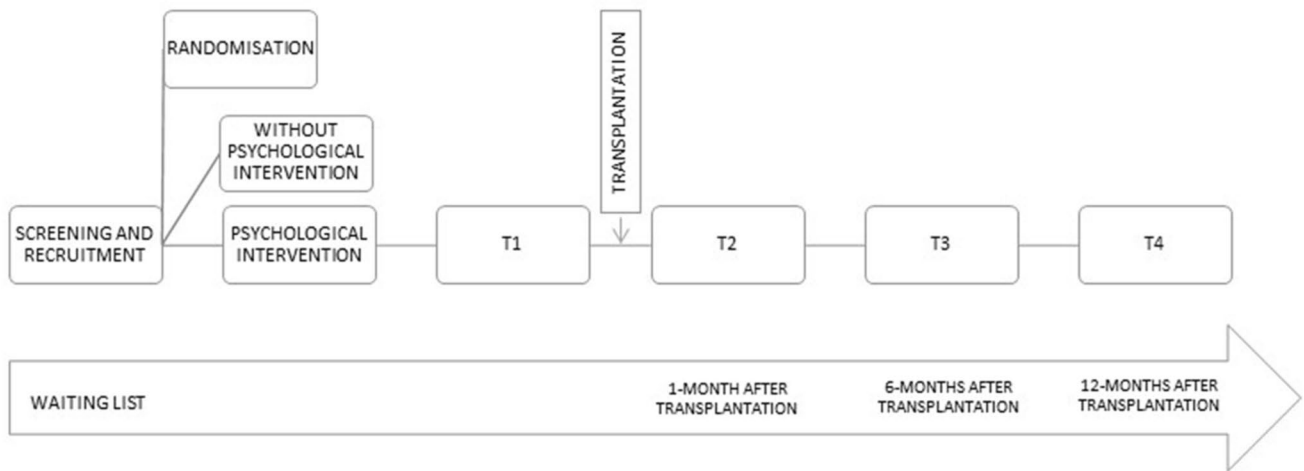
psychological interventions to be integrated into the treatment of patients who undergo kidney transplantation.

In addition to its contribution to better understanding the complex psychosomatic nature of the transplantation process, our study may also promote the development of psychological techniques to enhance recovery in kidney transplant patients. This positive psychology intervention programme may be an effective means to address emotional problems (the psychological integration of the newly acquired kidney, fear of rejection) and to contribute to the decrease in emotional distress; finally, it may improve health behaviour patterns of patients with kidney transplantation. This is a key element, because poor adherence to immunosuppressive medications is a major cause of premature graft loss among patients (Massey et al., 2013; Sellarés et al., 2012).

We hope the results will raise awareness about the necessity of psychological interventions for patients who are awaiting or have gone through kidney transplantation, as we can not only improve psychological state and facilitate personal growth but also promote adequate functioning of the graft. A comprehensive psychological intervention programme may significantly alleviate the distress of patients awaiting kidney transplantation, providing crucial help for patients to face the disease with a positive attitude, to reach a better emotional state and to improve the healing process after transplantation. Interpretation of these findings should be considered in the context of a few methodological limitations (considering the fact that this was a single-centre study with a small sample size). Statistical analysis was adequate to detect meaningful clinical change, but our small sample did not allow us to identify predictors of the healing process.

## Appendix

See Fig. 1 and Tables 1, 2, 3.



**Fig. 1** Flowchart of the positive psychological intervention trial

**Table 1** Four-step positive psychology intervention program content, session by session

Session	Topics	Description
I. 3–6 months before tx	Empathy-oriented interventions to strengthen positive emotions	<ul style="list-style-type: none"> <li>• Decrease emotional and cognitive distress related to the diagnosis and the disease</li> <li>• Elaborate losses, fear and ambivalence</li> <li>• Strengthen positive emotions by reducing negative illness perceptions</li> <li>• Restore positive self-esteem</li> </ul>
II. 1 month after tx	Meaning oriented interventions to re-evaluate and synchronize different roles	<ul style="list-style-type: none"> <li>• Integrate the sick role into the self</li> <li>• Decrease fears about changes in social connections</li> <li>• Develop positive communication skills</li> <li>• Enhance coping techniques and adherence, improving doctor-patient communication</li> </ul>
III. 6 months after tx	Value-oriented interventions to strengthen internal resources	<ul style="list-style-type: none"> <li>• Restore stability of the body image and boundaries</li> <li>• Support psychological integration of the transplanted organ</li> <li>• Explore participants’ personal values</li> </ul>
IV. 12 months after tx	Optimistic interventions to develop reasonable expectations	<ul style="list-style-type: none"> <li>• Decrease the sense of vulnerability</li> <li>• Reduce negative illness perceptions</li> <li>• Build greater trust in the transplantation</li> <li>• Develop genuine and reasonable expectations in connection with the disease</li> <li>• Build positive attitude towards the organ</li> </ul>

**Table 2** Means and standard deviations for dependent psychological and medical measures at baseline (T1), 1 month (T2), 6 months (T3) and 12-months (T4) after transplantation

	T1 M (SD)		T2 M (SD)		T3 M (SD)		T4 M (SD)	
	Intervention group	Control group	Intervention group	Control group	Intervention group	Control group	Intervention group	Control group
Depression- <i>BDI</i>	6.1 (4.7)	6.7 (3.1)	3.2 (3.6)*	6.1 (4.1)*	2.7 (2.7)*	6.1 (3.6)*	3.2 (3.6)*	5.3 (3.0)*
State anxiety- <i>STAIS</i>	26.6 (3.8)	27.2 (5.1)	25.4 (3.1)**	33.1 (6.6)**	24.9 (3.1)**	32.7 (6.9)**	25.3 (4.2)**	30.6 (6.4)**
Trait anxiety- <i>STAIT</i>	27.4 (3.7)	28.9 (5.3)	25.6 (2.8)**	33.6 (6.1)**	25.2 (3.4)**	33.1 (6.1)**	26.2 (4.7)**	31.8 (5.4)**
Illness perception- <i>BIPQ</i>	33.1 (11.6)	32.9 (10.8)	21.5 (11.6)**	33.7 (10.6)**	21.8 (11.3)**	35.1 (10.7)**	21.7 (11.5)**	33.2 (10.6)**
Posttraumatic growth- <i>PTGI</i>	38.6 (9.2)	36.6 (9.2)	–	–	40.8 (24.1)	35.9 (10.2)	47.8 (24.7)*	35.5 (8.6)*
Concerns with donor- <i>TOQ</i>	–	–	3.7 (5.1)	4.8 (7.6)	3.7 (5.1)	5.4 (7.6)	4.2 (5.3)	4.6 (8.1)
Positive attitude toward tx- <i>TOQ</i>	–	–	21.3 (7.1)**	8.1 (4.2)**	15.5 (8.4)**	8.7 (4.9)**	15.2 (5.6)**	7.7 (3.9)**
Psychological rejection- <i>TOQ</i>	–	–	0.9 (1.6)**	3.7 (4.3)**	1.1 (1.7)**	4.5 (4.6)**	1.8 (3.2)*	4.2 (5.1)*
Serum creatinine	–	–	135.1 (38.8)	234.5 (239.5)	133.3 (41.1)*	245.2 (251.1)*	127.3 (43.9)*	234.1 (281.1)*
eGFR	–	–	45.1 (10.5)	39.1 (16.5)	45.8 (11.5)**	34.1 (15.5)**	47.8 (10.1)*	38.5 (16.8)*

Different superscripts between columns representing the same time point represent statistically significant differences between the intervention and control groups (\* $p < 0.05$ ; \*\* $p < 0.01$ )

**Table 3** The result of one-way repeated measures ANOVA for depression, state and trait anxiety, posttraumatic growth, illness perception total scores and subscales

	<i>F</i>	<i>p</i>	$\eta^2$
Depression- <i>BDI</i>	4.13	0.024*	0.437
State anxiety- <i>STAIS</i>	3.01	0.062	0.360
Trait anxiety- <i>STAIT</i>	5.029	0.012*	0.485
Posttraumatic growth- <i>PTGI</i>	1.225	0.305	0.061
Illness perception- <i>BIPQ</i>			
Timeline	0.907	0.458	0.138
Consequences	8.555	0.001**	0.602
Personal control	5.752	0.007***	0.504
Treatment control	4.235	0.021*	0.428
Identity	4.748	0.016*	0.447
Coherence	0.374	0.773	0.062
Emotional response	8.293	0.001*	0.594
Concern	5.143	0.010*	0.476

\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$

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