



Effectiveness of Conventional Cognitive-Behavioral Therapy and Its Computerized Version on Reduction in Pain Intensity, Depression, Anger, and Anxiety in Children with Cancer: A Randomized, Controlled Trial

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Abstract

Background: Experiencing painful procedures during life is inevitable. Poor pain management is associated with negative effects on the quality of life, remaining for a long time after the experience. Long-term negative effects of pain possess a significant cost burden on society. Nowadays, computers are globally available, and computerized psychological interventions can reduce negative emotions.

Objectives: The present study aimed at examining the effectiveness of conventional cognitive-behavioral therapy (CBT) and its computerized version on reduction in pain intensity, depression, anger, and anxiety in children with cancer.

Methods: The present randomized, controlled, clinical trial was performed on three groups of conventional CBT, computerized CBT (cCBT), and control. Children with cancer, referring to Shafa Hospital of Ahvaz, Iran, constituted the study samples. A total of 15 children aged 9 - 12 years were assigned to each group by using the lottery method. All three groups received routine medical treatments during the study, but the two intervention groups also received psychological interventions as a complementary treatment. The control group received routine medical treatment and underwent cCBT intervention after the study. The data-i.e, pre- and post-tests, were collected by a masters' student in clinical psychology that was blind to the study objectives. Data were analyzed by MANCOVA, ANOVA, and t-tests of differential scores.

Results: The findings of the study indicated that both interventions could reduce negative emotions associated with cancer (i.e., pain, anger, anxiety, and depression) in children compared with the control group ($P < 0.0001$). In addition, there were no significant differences between the two intervention groups ($P < 0.01$). It means both interventions were useful to reduce pain and enhance adjustment.

Conclusions: The cCBT can be utilized in case of no access to psychologists and psychological services.

Keywords: Anger, Anxiety, Cancer, Children, Depression, Pain, Psychological Intervention

1. Background

Since the last decade, the epidemiology of pain in children is considered. Childhood pain is important because of the challenges in daily life and its effects on the future. For instance, children experiencing abdominal pain are at increased risks of somatic symptoms, mental disorders, and hospital admissions for unexplained medical reasons during adolescence (1). Children with cancer often experience pain due to disease progression or treatment side effects. The prevalence of pain in such children is estimated

at 25% - 50%, depending on the stage of the disease and the cause of the pain (2).

The memories of painful experiences in children may affect the way they react to later painful experiences and accept medical interventions. What is remembered about past painful events plays a pivotal role in predicting and responding to future problems (3).

Painful procedures are accompanied by negative emotions. The prevalence of anger and depression is higher in individuals experiencing chronic pain compared with healthy people (4). Chronic pain is common in children

(5, 6). It can be accompanied by a significant disability (7) and may continue to adulthood. Psychological treatment includes various types of interventions for different purposes (e.g., relieving pain and/or distress and improving self-efficacy). Management of pain and distress, rather than increasing functional abilities, is usually the primary outcome of such interventions (8). Cognitive-behavioral therapies (CBT) are effective in many chronic pain difficulties (9).

Significant portions of children receive inadequate assessment and management of pain in hospitals (10-13). It particularly occurs in the context of procedural pain (11, 14). Experiencing pain of greater than moderate intensity in childhood is associated with short- and long-term adverse physiological and psychological effects. Uncontrolled pain in newborns can change the process of pain, and perception can affect physiological, social, and neurocognitive development outcomes. In contrast, effective pain control strategies are associated with faster and more complete recoveries, as well as cost reductions to the health system (9). Despite the dramatic growth of therapeutic research, solution-focused interventions relying on the evidence of effective tools for pain assessment and guidelines, management practice in hospitalized children still remains a concern (13, 15).

Due to the advancement of technology and the needs of health care, various therapeutic methods, such as internet-based and computerized CBT (cCBT), are developed (16). Internet-based therapy is effective in several disorders, such as anxiety and depression (17). For children and adolescents, the research on cCBT is still limited (18), but their results are promising (19-24). In some studies, the acceptance of treatment from the perspective of patients is investigated (25, 26); cCBT is accepted as a therapeutic approach, which can overcome barriers, such as time constraints (27, 28).

Interventions applied to pain management are generally expensive (29). CBT is one of the most popular and effective pain management therapies utilized in many psychiatric disorders, such as depression and anxiety (30). It is proved that CBT is an acceptable intervention for the ones experiencing pain. CBT was designed to reduce pain, distress, and disability more than 40 years ago; it is now comprised of a set of commonly used treatments for depression, anxiety disorders, and chronic pain (6). The basic principles of CBT for controlling the pain include patient-based assistance to indicate how behavior and cognition can affect the perception of pain. During treatment, patients are encouraged to learn coping skills and reconstruct cognitions and apply coping skills to a wide range of daily activities (31). One of the negative aspects of treatment with CBT is often related to developing countries;

high cost and inaccessibility make it an unavailable treatment. As the internet spreads across the globe, CBT can be implemented as internet-based interventions (20).

Babies are born in this technological era; they use computers, smartphones, laptops, and computer games as part of their daily routine. They easily move into this environment and feel comfortable inside it. Therefore, it seems that the use of technology is effective in solving youth psychological problems. However, in spite of its beginning state, research in the current area is increasing at a higher pace. There are several reasons why teenagers are reluctant to receive such treatments—e.g., confidentiality concerns, shyness, and embarrassment of presence in mental health institutions, and belief in not being perceived or taken seriously. Restrictions on information about the appropriateness of this form of intervention and other factors such as financial worries, lack of access to services and long waiting lists are also among the barriers for people who need psychological help (32).

The use of technology can eliminate almost all of the abovementioned obstacles. Families can use computer-based programs at home for the sake of confidentiality; they receive treatment without fear of being seen in mental health clinics. Also, technology-based interaction has a non-inhibitory effect, which is due to anonymity; people tend to disclose themselves more often in this environment (33). Therefore, young people probably feel that their records are kept more confidential in a computer environment, and they are more comfortable to expose their personal information in such environments. A vast majority of young people (at least in the developed countries) have access to computers and the internet; and the younger generation, especially teenagers, also use the internet to receive text advice and consultations. They can eliminate the obstacles arising out of face-to-face therapy (34). In addition, most technology-based applications are consistently used. They are more accessible, and the user should not wait for treatment. They can also be used on a large scale. Therefore, technology is likely to be accepted in the youth population as a way to get help for emotional challenges they deal with them. Hence, technology can eliminate the obstacles of face-to-face therapy (35).

The experience of pain in cancer is widely recognized as a major threat to the quality of life; relief of pain is a priority in oncology care. By the disease progression, pain management should be presented at different levels from the disease onset, even for those who are in the final stages of life (36).

2. Objectives

Cancer is one of the most painful chronic disorders in children. Because of the significant impact of childhood cancer on both the patients and their families, a computer program is designed to help children to cope more effectively with the circumstances. Because of some limitations in the availability of psychological services for such patients, cCBT may be a suitable alternative to conventional CBT due to more accessibility. Therefore, the current study aimed at examining the effectiveness of conventional CBT and its computerized version on the reduction in pain intensity, depression, anger, and anxiety in children with cancer.

3. Methods

The present randomized, controlled, clinical trial was performed on all patients with cancer, referring to Ahvaz Shafa Hospital, from October 2018 to the end of December 2018. The inclusion criteria were: patients with one type of cancer, age range from 9 to 12 years, literate, and fluent in Persian; the exclusion criteria were: patients with a developmental, psychiatric disorder, autism spectrum disorders (based on the diagnosis of a psychiatrist), and a history of seizure. At first, patients willing to participate in the study were randomly (using the lottery method) assigned to three groups of conventional pain (CBT), pain (cCBT), and control. Both interventions (CBT and cCBT) were performed as individual psychotherapy. The sample size was determined in the present study based on similar studies on the control of the negative psychological effects of cancer (14).

The study objectives were described to the parents, and written consent was provided by the parents. For ensuring the presence of the participants, the subjects signed an agreement, including the number of sessions and the estimated duration. All three groups received routine medical treatment until the end of the study, but two intervention groups also received psychological interventions as a complementary therapy. The control group just received the routine medical treatment, and after the research, they received the cCBT.

The CBT group attended six 45-minute psychological sessions (session 1: introduction of the program and psychoeducation about cancer; session 2: relaxation training; session 3: negative thought control; session 4: behavioral activation and self-rewarding; session 5: anger control techniques; session 6: physical activation and goal setting). The cCBT group received a guidebook including parents section and homework, as well as a compact disk containing the contents of all six CBT sessions. Psychoeduca-

tion and training were provided via texts, animations, and games. After the last session in the sixth week, the participants were reevaluated. The therapeutic package was designed based on the articles (8-14) in this area and the content of the handbook of Pain Management (37). Three clinical psychology experts confirmed the content validity of the package (Supplementary information about the design and implementation of the two interventions is being published in a separate study). In order to reduce the bias, the data (i.e., pre and post-tests) were collected by a master student in clinical psychology who was blind to the study objectives. Then, the results were analyzed using MANCOVA, ANOVA, and t-test of differential scores by SPSS version 20.

3.1. Data Collection Instruments

3.1.1. The Wong-Baker Faces Pain Rating Scale

Children can verbally describe their pain intensity qualitatively, which reflects their experience, and gradually calibrate their pain by applying different scales (37). This scale, designed by Wong and Baker in 1998, presents different numbers of faces to measure the varying levels of pain. There are six pictures of a child's face, each showing a degree of pain intensity. The left-hand side of the scale represents the absence of pain, and the last right-hand image indicates the most severe pain. Numerically, number 1 means no pain, 1-2 mild pain, 3-4 slightly more pain, 5-6 moderate pain, 7-8 severe pain, and 9-10 the most intense pain imaginable. The validity and reliability of the scale are confirmed in numerous studies (38). The Persian version of Wong-Baker Faces Pain Rating Scale is also used in various studies (39). In the study by Nick Fried, the correlation coefficient was reported as 82%.

3.1.2. Children's Depression Inventory

CDs designed by Janbozorgi consists of 21 items in 13 subscales. It is the only Iranian questionnaire developed based on the Diagnostic and Statistical Manual of Mental Disorders. Items are scored based on a Likert scale from 0 to 4 for subscales 1-12, and between 0 and 1 for subscale 13. To calculate the total score, the item scores of subscale 13 are summed up and divided by 9, and the result is summed up with the scores of the rest subscales. A score higher than 9 is considered as a severe depression in CDs. It was used in a study on 1551 children and adolescents in Tehran, Iran, and its Cronbach's alpha coefficient was reported as 0.84 (40).

3.1.3. The State-Trait Anger Expression Inventory

STAXI was developed by Spielberger. It is applicable to children aged 9-18 years (41). In a descriptive study by

Brabadi and Heidarinab, with a sample size of 556, the convergent and divergent validities of this scale were calculated by Pearson correlation. The scores of this scale are correlated with children's depression, apparently anxiety in children, aggression, and lawless behavior. The reliability of the instrument was also assessed using Cronbach's alpha and test-retest coefficients in an interval of two weeks. The Kaiser-Meyer-Olkin (KMO) was 0.82 based on the sample size, which was satisfactory. The Bartlett test of sphericity showed a χ^2 -score of 1679.73, indicating the significance of this value ($P < 0.0001$) with a degree of freedom of 45; the obtained results supported the reliability of the inventory (42).

3.1.4. The State-Trait Anxiety Inventory

STAI was developed by Spielberger et al., in the United States in 1973 to measure the anxiety of 9 - 12-year-old children, and is widely used as a standard test in various research. Mami Yanlou (2000) assessed the reliability of STAI in a study performed under the supervision of professors of psychology using a re-test method. The reported correlation coefficient of this instrument for Iranian children was 0.83. Yaghoobi et al., assessed and reported the reliability of STAI as 89%. The reliability of the instrument was also calculated by Cronbach's alpha coefficient for both obvious (84%) and hidden (82%) anxiety scales (43).

4. Results

In the current study, MANCOVA was used to examine the significance of the difference between the mean scores of the intervention and control groups. Prior to the implementation of MANCOVA, its assumptions (i.e., normality, homogeneity of variances, and homogeneity of regression slopes) were examined. Based on the results of the Shapiro-Wilk test, the normality of the data was confirmed ($P > 0.05$). In addition, the Levin test results were not significant for all the variables (i.e., depression, anxiety, anger, and pain), indicating that the variance of scores was consistent. In addition, the interaction between dependent variables and consistency was not significant (0.692), implying that the assumption of the homogeneity of regression slopes was true.

Table 1 shows the mean and standard deviation \pm SD of the variables in pre- and post-tests. In addition, MANCOVA was used to examine differences among the three groups. The results of this analysis are presented in Table 2.

The results of Table 2 show no significant difference between the two intervention groups and the control group in terms of depression, anxiety, anger, and pain ($P < 0.01$). In other words, the study variables were homogenous in the three groups in the pretest.

The results of Table 3 show a significant difference between the two intervention and the control groups in the post-test in terms of depression, anxiety, anger, and pain ($P < 0.0001$). In other words, CBT and its computerized version could reduce depression, anxiety, anger, and pain in the post-test.

In order to investigate if CBT and its computerized version differed in the severity of pain, depression, anger, and anxiety in children with cancer, a series of t-tests were used. In addition, a series of t-tests were used to examine whether cognitive-behavioral therapy and its computerized version differ in their effectiveness in reducing pain, depression, anger, and anxiety in children with cancer. Table 4.

As Table 4 shows, the two methods of intervention used in the present study did not differ significantly in terms of the changes made into the dependent variable. However, it is shown that in CBT, the difference of anger score between pre and post-tests was greater than that of cCBT, which means the CBT was more effective in the reduction of anger reduction.

5. Discussion

An effective pain management program should target different dimensions of pain experience (44). Various manner focusing on mental abilities and reduction of symptoms include hypnosis, music therapy, thought stopping skills, and other supportive psychotherapy methods (45). CBTs are among the most well-known methods to treat chronic pain and many psychological disorders, such as anxiety and depression (29, 34). The underlying principles of CBT help the patient understand how cognition and behavior affect the experience of illness, and teach coping skills and cognitive restructuring. Therefore, along with all the efforts made to get rid of the negative effects of cancer, experts should pay more attention to the psychological aspects of cancer.

Several studies are conducted in Iran on pain management interventions in children, which were effective in controlling and reducing pain severity and its associated psychological variables, such as anxiety and depression. A study compared the effect of distraction and touch therapy on the intensity of pain among children aged 5 - 10 years. There were two intervention groups, and controls only underwent routine pain management therapies. The obtained results showed no significant differences between the intervention groups, but both the groups had significantly lower pain intensity than controls (46). In a study entitled "Investigation of the effect of distraction using bubbles on injection-induced anxiety in school-age children with thalassemia". In this study, the intervention

Table 1. Mean and Standard Deviation of the Variables in the Pre- and Post-Tests

Variable	No.	Mean \pm SD		
		CBT	cCBT	Control
Depression				
Pretest	45	15.07 \pm 7.360	16.20 \pm 4.329	15.93 \pm 5.574
Posttest	45	8.60 \pm 5.962	10.93 \pm 3.011	16.27 \pm 5.637
Anxiety				
Pretest	45	35.13 \pm 6.058	34.40 \pm 8.975	35.00 \pm 6.141
Posttest	45	25.80 \pm 5.685	26.93 \pm 6.692	34.40 \pm 7.149
Anger				
Pretest	45	18.47 \pm 3.758	16.07 \pm 4.284	19 \pm 2.903
Posttest	45	15.27 \pm 2.987	14.13 \pm 3.482	18.33 \pm 2.845
Pain				
Pretest	45	6.40 \pm 1.595	6.73 \pm 1.860	6.80 \pm 1.656
Posttest	45	5.60 \pm 0.828	5.33 \pm 0.817	6.60 \pm 1.454

Table 2. Results of the One-Way ANOVA to Compare the Study Variables in Pretest

Variable	Sum of Squares	df	Mean Square	F	P Value
Depression					
Intergroup	10.533	2	5.267	0.146	0.864
Intragroup	1512.267	42	36.006		
Total	1522.800	44			
Anxiety					
Intergroup	4.578	2	2.289	0.044	0.957
Intragroup	2169.333	42	51.651		
Total	2173.911	44			
Anger					
Intergroup	73.244	2	36.622	2.686	0.080
Intragroup	572.667	42	13.635		
Total	645.911	44			
Pain					
Intergroup	1.378	2	0.689	0.235	0.791
Intragroup	122.933	42	2.927		
Total	124.311	44			

and control groups were compared. The mean score of anxiety in the two groups did not show any significant differences before the intervention, but the mean score of the intervention group was significantly lower than that of the control group after the intervention. It indicates that the intervention was effective in reducing anxiety (47). Several studies also show that distraction during injection reduces the behavioral responses to pain, physiological indices, and intensity of pain (48). Other methods used to

reduce pain include the use of an ice pack, music, and relaxation (49). The results of a study indicated that all of these interventions were effective. Only one study in Iran was conducted on the reduction of pain intensity through psychological interventions in patients with cancer. In this study, the effect of play therapy techniques was investigated on decreasing anxiety and increasing positive emotions and the level of general adaptation in 9 - 12-year-old children with leukemia. The results showed that the inter-

Table 3. The Results of MANCOVA on the Mean Posttest Scores of the Variables (Internal and Comparative in the Test and Control Groups)

Source	Variable	Observed Power	df	Type III Sum of Squares	Mean Square	F	P Value	Partial Eta Squared
Pretest	Depression	1	1	544.509	544.509	129.642	0.0001	0.77
	Anxiety	1	1	1026.844	1026.844	82.618	0.0001	0.69
	Anger	1	1	216.820	216.820	161.215	0.0001	0.81
	Pain	1	1	24.485	24.485	45.790	0.0001	0.55
Group	Depression	1	1	404.005	202.002	48.095	0.0001	0.72
	Anxiety	1	1	637.205	318.607	25.633	0.0001	0.57
	Anger	1	1	53.550	26.775	19.909	0.0001	0.51
	Pain	0.97	1	10.110	5.055	9.453	0.0001	0.33

Table 4. The Comparison of Pre- and Post-Test Differential Scores in Research Variables

Variable	Mean \pm SD	t	df	P Value
Depression		1.057	28	0.300
CBT	6.47 \pm 15.07			
	5.27 \pm 8.60			
Anxiety		1.178	28	0.249
CBT	9.33 \pm 35.13			
	7.47 \pm 25.80			
Anger		2.271	28	0.031
CBT	1.93 \pm 15.27			
	3.20 \pm 18.47			
Pain		-1.230	28	0.229
CBT	0.80 \pm 6.40			
	1.40 \pm 5.60			

vention was effective in reducing anxiety and increasing the level of positive emotions, and improved general adaptation (50).

As the review of the literature showed, cCBT was effective in treating depression and anxiety in children and adolescents (18). Moreover, computer-assisted CBT revealed that children did not show the symptoms of anxiety after the intervention (19). The decrease in children's anxiety was also reported in three studies using internet-based and online CBTs (20, 21, 24). The findings of these studies were in line with those of the present study. In fact, two studies, with results similar to those of the current one, were randomized, controlled trials of Cool Teens CD-ROM computerized program for adolescent anxiety; 43 adolescents with anxiety were randomly gotten with the Cool Teens program, which is a cCBT for anxiety management in 12 weeks. The results advocated the positive effect of the intervention on treating anxiety in adolescents (22). A study evaluated the effectiveness of a new cCBT as SPARX (smart, positive, active, realistic, X-factor thoughts), a com-

puterized self-assistance intervention, on the reduction of depressive symptoms in help-seeking adolescents. In fact, SPARX is an alternative to routine care for adolescents with depression (23).

By summarizing the studies, few interventions for pain management and other outcomes of cancer were retrieved. In the study on the barriers to implement non-pharmacological methods of pain management in children and the strategies provided by nurses, the main reason for the lack of implementing such interventions was the shortage of staff in hospitals (51). In fact, the inadequacy of health care services in the management of the negative effect of cancer in children is obvious. Furthermore, the current study findings stated that the used therapeutic intervention had significant efficacy in reducing the negative effects of cancer in children. Moreover, there was no significant difference between the two interventions. It means that cCBT can be used as an effective intervention where psychological interventions are not available. Demographic variables, including age and level of education,

influenced treatment outcomes as moderators. Older and very educated patients benefited more from the treatment. The next generation of pain treatment methods should approach the younger and less educated subjects (52). Therefore, in the present study, the inclusion and exclusion criteria were set in a way to control this moderator variable. The current study interventions focused on different aspects of the negative effects of pain on children. Thus, different skills, such as pain evaluation, behavioral activation, problem-solving, relaxation, attention fraction, imagination techniques, and anger control, were taught via psychoeducation.

The advantage of the present study is brief sessions but wide coverage.

(This means that while it is short and concise, it is accessible to a large number of clients). In addition, in the program delivered by CD-ROM, the other advantages are accessibility and low-cost. The findings of the current study can provide a better battle against cancer in the affected patients.

5.1. Conclusion

In conclusion, the research literature on pain treatment suggests that an effective pain management program should target different dimensions of pain experience (53). Experts, therefore, should pay more attention to the psychological aspects of cancer. Systematic interventions focusing on the negative psychological aspects of cancer should be designed and implemented as a vital part of treatment for individuals with special medical conditions, such as cancer. With respect to the result of the present study in which CBT and cCBT did not differ significantly in terms of the changes made into the psychological aspects, cCBT can extendedly be used to help children with cancer. And It is essential to provide conditions for further studies and further actions to apply cCBT. It is hoped that specialists and officials pay more attention to children with cancer.

5.2. Suggestions

Lack of access to psychological services is a common problem for the majority of the people in need, especially children. Therefore, it is desirable to make more attempts to extend the use of technology in other age groups and other problems.

The current study can be the first step in using technology in psychological interventions, and more fundamental trials are suggested to present cCBT to the general population and experts.

5.3. Limitations

The main limitations in the present study were the small sample size and lack of follow-up.

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Footnotes

Authors' Contribution: Hamid, Beshlideh, and Hamedi: design of the study; Hamedi: collection of the clinical data; Beshlideh, Hamid, and Hamedi: interpretation of clinical data; Beshlideh and Hamedi: the analysis of data; Marashi, Hashemi, and Hamedi: revision of the manuscript for important intellectual content. All the authors read and approve the final copy of the manuscript.

Clinical Trial Registration Code: The present randomized, controlled trial was registered according to the policies accepted by the Iranian Committee of Medical Journal Editors (ICMJE). The trial was registered at <http://www.IRCT.ir> (IRCT20191225045896N1).

Conflict of Interests: The authors declared no conflicts of interest.

Ethical Approval: The protocol of the present randomized, controlled trial was approved by the Ethics Committee of Chamran University of Medical Sciences (Ethics code: IR.AJUMS.REC.1396.820).

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Informed Consent: Informed consent form was signed by the parents of all the study participants.

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