

# A study on the role of selective attention, vigilance and ambivalence over emotional expressiveness for predicting pain severity in patients with chronic musculoskeletal pains

Bitra Nasrollahi<sup>1</sup> Mohsen Dehghani<sup>2</sup> Masoud Ghasedi<sup>3</sup> Mohammad Ali Mazaheri<sup>4</sup>

PhD of General Psychology<sup>1</sup>, PhD Student of General Psychology<sup>3</sup>, Islamic Azad University, Science and Research Branch, Tehran, Iran. Assistant Professor Department of Psychology<sup>2</sup>, Family Research Center, Associate Professor Department of Psychology<sup>4</sup>, Shahid Beheshti University, Tehran, Iran.

(Received 4 Feb, 2013)

Accepted 25 Aug, 2013)

## Original Article

### Abstract

**Introduction:** When there is a pain requiring focused clinical attention and is associated with emotional and functional disorders, it is called pain disorder. The present study aims to study the role of selective attention, vigilance and ambivalence over emotional expressiveness for predicting pain severity in patients with chronic musculoskeletal pains.

**Methods:** The study population included 180 patients with chronic musculoskeletal entered the study by accessible method sampling from 2 hospitals in Tehran (Iran): Imam Khomeini and Atyeh. They completed Selective Attention Test, questionnaires for Vigilance and Ambivalence over emotional expressiveness and Pain severity Scale.

**Results:** Step-by-step multivariate regression analysis showed that ambivalence can significantly predict emotional expressiveness in patients with selective attention and vigilance were not significant.

**Conclusion:** In musculoskeletal chronic pain, ambivalence can be considered as an emotional determinant influencing pain severity.

#### Correspondence:

Bitra Nasrollahi, PhD.

Department of Psychology  
Science & Research Branch,  
Islamic Azad University

Tehran, Iran

Tel: +98 912 5864955

Email:

Unique\_363@yahoo.com

**Key words:** Attention – Patient - Chronic Pain

**Citation:** Nasrollahi B, Dehghani M, Ghasedi M, Mazaheri MA. A study on the role of selective attention, vigilance and ambivalence over emotional expressiveness for predicting pain severity in patients with chronic musculoskeletal pains. *Hormozgan Medical Journal* 2014;18(5):341-350.

### Introduction:

International Association for the Study of Pain (IASP) defines pain as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage". Two factors should be considered in the experience of pain: tissue damage (as sensory dimension) and unpleasantness (as emotional dimension). In fact, the two dimensions indicate that emotional and cognitive determinants

play a remarkable role in identifying the experience. Pain is a subjective experience and due to the unpleasant sensation and emotion might be associated with a variety of emotional symptoms and disorders (particularly mood and anxiety disorders) simultaneously. Chronic pain as a persistent pain experience – is usually accompanied by depression, anxiety and aggression. Experiencing chronic pain is associated with other experiences such as chronic

fatigue, sleep disorders, withdrawal from daily activities and mood disorders (1).

As it was noted above, pain is defined as a sensory and emotional experience (2-4).

Therefore, primary pain is separate from secondary pain. The secondary pain includes negative emotions (like discomfort) resulting from cognitive processes of the individual and the interpretations of meanings and assessment of pain upcoming outcomes (4). Studies on the cognitive components influencing the perception and persistence of chronic pain indicate that such items in all the patients as how they consider the meaning of pain, the disease, physical disability due to a painful experience, dimensions, the quality and severity of the incidence and the effectiveness of treatment play some roles. Those beliefs as a part of psychosocial background of individuals play a major role in pain experience, quality prediction and the physical disabilities resulting from them, and ultimately, acceptance and the effectiveness of common treatments for chronic pain and its associated problems (5).

Investigating distortion and change in information processing (including attention, memory and perception bias) - in a variety of emotional disorders such as anxiety and depression disorders - has been the general policy of studies since 1980. The studies indicate that attention bias specifically exists in anxiety disorders (6).

Information processing bias among chronic patients is the subject of various studies. Pincus and Morley in an extensive review reported evidences of memory and perception bias to pain related stimuli in patients with chronic pains (7). Attention to pain and vigilance as cognitive determinants along with a group of associated experiences influence individual's cognitive bias towards neutral stimuli and the stimuli with emotional effect inducing pain. Considering the role of attention in chronic pain, this subject is one of the underlying aspects in this field (8). Selective attention, in fact, is the individuals' tendency to pay attention to the interested topics and ignoring others. Attention to pain has different aspects which can be considered for the diagnosis and treatment of chronic pains. However, individuals' selective attention to traumas which cause chronic

pain is a topic studied more than other topics in this field. Chronic pain results in bias towards stimuli, which in a sense encompass the characteristics of the pain causing stimuli. Accordingly, the individual becomes hypersensitive and remains vigilant to those triggers (9). Such a selective attention and hypersensitivity to the stimuli result in pain prioritization related stimuli in the individual's cognition and information processing system. It costs ignorance and loss of attention to other stimuli which might be necessary for individual's daily performance. The effective range of this phenomenon can even be extended to individual's emotional and unconscious activities. It influences individual's reactions against such emotions in an interactional way (10).

According to the fundamental nature of emotions, pain and emotions can simply affect on each other in patients with chronic pains. Nowadays, researchers have shown much interest in ambivalent role toward expression of emotion and its relationship with chronic diseases (11). Ambivalence over emotional expressiveness is a kind of tendency to uncertainty in expressing emotion. This may be defined as rapidly changing emotional feelings, or simultaneously severe and contradictory to an object or individual (13). In other words, the individual experiences a combination of positive and negative emotions concerning emotion and emotional expressiveness. Ambivalence over emotional expressiveness includes various tendencies ranging from the tendency to express but with an inability to fulfill, expression without actual inclination toward expressing the emotion and consequently remorsefulness. There is a relationship between emotional expressiveness and physical disorders. This relationship is described based on the activity of hypothalamus-hypophysis axis and adrenal which is the main stress-disease interaction regulator. The effect of negative emotional expressiveness (anger) and defensiveness influence the cardiovascular reaction in which the risk of disease may increase. Hence, the level of cortisol and adrenocorticotrophic hormone is high in individuals with high anger discharge and defensive states at the same time. In other words, those who feel anger but avoid it fearing from the

social outcomes experience the activity of autonomic nervous system (ANS). Therefore, the signs and symptoms of disease in emotional ambivalent individuals are likely increased because of fear from social outcomes, reduction of social support or self-humiliation for receiving social support (12).

Among patients with chronic pain, those who are not able to have an appropriate explanation for the cause of the pain become angry, disappointed and desperate. But fearing from the negative outcomes of expressing the emotions, such patients restrain their emotions. Moreover, these patients become angrier and may even quit the treatment when the medication and even surgery are not effective remedies for their pain treatment. These patients, may lose their control and take their anger to the close people under pressure circumstances. They then feel regret (13).

Patients suffering from several ambivalence over emotional expressiveness experience higher levels of psycho-cognitive stresses and anger. Also experience more problems in their emotional management. In those patients, anger may trigger a vicious circle resulting in mental rumination. This overcomes the patient's emotional life and creates more problems in managing their emotions. So, in patients with chronic pain, ambivalence over emotional expressiveness may be related to the severity of pain (14).

According to the fundamental nature of emotions, pain and emotions may simply affect on each other in patients with chronic pains (15). In general, pleasant emotions reduce pain while unpleasant ones increase it. Moreover, emotions influence the attention path (16). This as well can include attention to pain (17).

As mentioned earlier, chronic pain in suffering people results in individual's bias towards stimuli encompassing the characteristics of the stimuli causing pain. Such selective attention and vigilance leads to the processing of those stimuli; therefore, individual attention to the necessary stimuli and their processing are cognitively neglected.

Vigilance is a concept in which often increases our knowledge about medically unjustifiable chronic pain. In patients with chronic pains, vigilance is defined as the attention to the pain in

comparison with other information. However, from developmental view, pain vigilance can be considered a natural process, because it allows the individual to endeavor to respond the physical threat as much as necessary and sufficiently (18). Researchers indicated that the discomfort from which chronic patients suffer are resulted from interactions between ongoing pain, mental activities, limited sources of attention, the individual's excitation capacity and negative emotions. Therefore, based on the earlier studies vigilance and selective attention to stimuli associated with pain increase the pain severity in patients with chronic pain (19). Attention is a mechanism based on which sensory events are selected and find its way into awareness domain. This mechanism plays a key role in perception. Earlier studies on attention and pain confirm limited capacity of human cognition. Considering that sensory stimuli including those provoking pain receptors are far more beyond human cognition capacity, so to conduct purposeful behavior only some of the stimuli must be selected and then creep into awareness domain. Therefore, vigilance and attention to stimuli associated with pain result in processing, and the individual becomes aware of them (20). With regard to what mentioned above, the present study investigates the role of selective attention, vigilance and ambivalence over emotional expressiveness for prediction of pain severity in patients suffering from musculoskeletal chronic pains.

## Methods:

The present study is a fundamental research to predict the pain severity based on cognitive and emotional variables. The population of the study included all the patients with musculoskeletal chronic pains referred to orthopedics ward at Atyeh hospital and physiotherapy clinic at Imam Khomeini hospital in Tehran from January 2011 to August 2011. The method for sampling was accessibility of patients. Since there was not precise information concerning the statistical size of the research population, similar studies were used for estimating sample size. So, 180 patients with musculoskeletal chronic pain –ranging from 18 to 68 years old- were chosen. The inclusion

criteria was pain complaint for last 6 months. The exclusion criteria were age less than 18 and more than 65 years old, history of trauma to the Central Nervous System (CNS) within last year, inability to work with computer and taking drugs (Sedatives and Psychotropic drugs) affecting on CNS.

#### **Study process:**

Patients were referred to the researchers after diagnosis by physicians. The study questionnaires were submitted to the patients for completion. Then they were tested for selective attention by the use of a software after required instructions. After data collection, statistical analyses were carried out.

#### **Tools:**

##### **Visual-probe test**

The first test to study the selective attention to some of specific stimuli was Visual-probe paradigm test. In this test, developed by MacLeod et al (1986), threatening and non-threatening word pairs were simultaneously displayed on the computer monitor. After a short time (usually 500 ms) the words disappeared and then a dot was displayed instead of one of them. The dot can appear at the spatial position of each word with equal probability. Next, the participants were asked to indicate the location of the dot on the screen. The response time could be considered as an indicator for bias. Quick response to the dot which was exactly in place of the emotional or threatening word indicated attention to such words, and latency to response to the words indicated avoiding such stimuli. The strength point of this test is that a neutral response is given to a neutral stimulus and the participant is asked to press the button in response of seeing a meaningless dot. Visual-probe test is a computer-based test in which a pair of portraits (one demonstrating pain and the other one neutral) is used instead of using word pairs. Initially, a fixation point was used in which the individual must look at it in the beginning – is displayed at the center of the screen for a short period of time. After disappearance of this point, two images (one above and one below the point) are appeared. One of the portraits shows a happy person or a person

in pain, and the other shows the portrait of the same person in normal or neutral state. The images are randomly selected from a collection of images. Their above or below position is also randomly selected. After a short period of time, the portraits are quickly disappeared and the fixation point appears at its previous position. After disappearance of the point, an arrow - with direction towards right or left and up or down the fixation point – is displayed exactly at the location of one of the previous images. The person is asked to specify the direction of the arrow by the use of the button on the keyboard. In this test, if the result of subtracting the mean of heterogeneous turns is positive, it means that the person has paid attention to the image. Otherwise, it means he/she has lost the attention (21). Based on Khatibi's study the correlation of score of the individuals within a 2-week period was considered as high validation and estimated from 0.81 to 0.93.

To carry out the present study pictorial dot probe task software – developed by Khatibi et al. (2009) – was used. First, the participants were asked to sit at a desk considered for performing the test. After ensuring the comfort of the patient in his/her position, instructions were briefed. After setting the software, they were asked to read the text carefully on the display in the beginning of the test. The process of the test was described to the participants in the initial text. Should there were any other ambiguities concerning the method of performing the test for the participants, they were answered and the work process was explained to them. This test is carried out in 2 stages to measure selective attention to painful stimuli and happy stimuli. Emotional faces of individuals in pain were followed by the same individual's face in normal status to study the selective attention to painful stimuli. In the 2<sup>nd</sup> stage, to study selective attention to happy stimuli happy portraits were followed by the same individual's portrait in normal status.

There were 80 trials in this stage of the test (40 trials for consistent turns and 40 for inconsistent trials) presented in fully randomized order for each subject. The recorded times for each subject were automatically saved in a file associated to the software. It was transferred to MS Excel software (2007) for analysis. By the use of the software,

consistent and non-consistent turns were separated in each test turn (pictures demonstrating a face in pain and happy face). Then using sub-criterion formula, selective attention to each of the stimuli was calculated for each participant. Calculating formula of attention index: the indices of selective attention (inconsistent turns - consistent turns/2). If the result of this formula is positive, attention of the subject is to the presented stimulus, and if it is negative, it means the attention of the subject is not to the presented stimuli.

#### **Vigilance questionnaire:**

McCracken's vigilance questionnaire was used to measure vigilance in this study. It is a 16-item questionnaire with Likert's scaling. Each response is scored from 0 to 5. Cronbach's alpha was 0.87 which shows the predicted relationship with values associated with attention to pain and coping strategy (22).

In the present study the reliability of the vigilance scale was obtained by Cronbach's alpha.

#### **Ambivalence over emotional expressiveness**

Kingvamonetz test was used for the measurement of ambivalence over emotional expressiveness. It is a 28-item questionnaire where items 1 to 16 are related to ambivalence over emotional expressiveness and items 17 to 28 are associated with ambivalence over entitlement expressiveness. The range of responses for each item has 5 degrees including never, seldom, sometimes, often and always. Scoring takes up Likert method. In other words, 1, 2, 3, 4 and 5 were used for never, seldom, sometimes, often and always respectively. None of the items are inverse. Therefore, scoring for all the scale is equal and the total score ranges from 28 to 140. Higher score is the indicative of higher degree of ambivalence over emotional expressiveness. The validity of the score was assessed by internal consistency and calculation of Cronbach's alpha coefficient. Its value for the total scale and subscales of ambivalence over emotional expressiveness and ambivalence over entitlement expressiveness were respectively 0.87, 0.87 and 0.77. In the present study, the reliability of the scale for ambivalence and emotional expressiveness was 0.86 in general, and for the subscales of positive ambivalence over emotional

expressiveness and ambivalence over entitlement expressiveness was respectively calculated as 0.83 and 0.72.

#### **Pain Severity Questionnaire:**

To measure the pain severity, visual pain severity scale was used which included a non-rated axis from 0-100 and individuals were asked to mark the perceived severity of pain visually.

Higher score indicates more severe pain. In the present study, subjects specified their perceived pain in the previous week, at the time of test and their prediction for pain in the upcoming week on three separate axes. The scale was earlier used in different studies and the validity score was estimated above 90% (23, 24).

#### **Results:**

Before presenting descriptive and analytic indicators, some of the demographic findings are mentioned. Mean age was  $46.2 \pm 13$ . Trial group included 70.6% female and 29.4% male. The most frequent educational degrees were diploma, junior high school education, and baccalaureate with respectively 40%, 29% and 20%. And the minimum frequency was for master and doctorate degrees. From the view point of marital status, 86.7% of the subjects were married and 13.3% single. From the view point of distribution of subjects, there were 114 individuals from Imam Khomeini and 66 people from Atyeh hospital. From the point of view of the pain location in the trial group, the frequency from the highest to the lowest order was from back, knee, foot, hand and shoulder. Some subjects reported pains in different locations simultaneously. The mean for the pain duration was 74.3 months.

To evaluate the role of selective attention, vigilance and ambivalence over emotional expressiveness in pain prediction, multivariate regression with step by step method was used. In this method, the variables were entered the model in a specific order indicating theoretical considerations of previous findings.

Table 1 presents the order for elimination and addition of the variables used in the model.

As shown in Table 1, except ambivalence over emotional expressiveness variable, others have been eliminated.

Table 2 reports the statistical data eliminated from each model.

As shown in Table 2, negligible amount, which is a measurement for indicating correlation between prediction variables, is closer to 1. This indicates that there is not a stronger relation between that variable and other predicting variables.

It is to say that before entering the variables into the model, one-to-one correlation of variables was evaluated. Correlation coefficient was significant. Table 3 presents a summary of regression model results.

As shown in Table 3, model 1 which has entered the score for ambivalence over emotional expressiveness justifies 14% of variance (Square R = 0.14). Other variables were eliminated because they did not cause significant increased stronger prediction model. Therefore, it can be concluded that statistically ambivalence over emotional expressiveness can significantly predict pain severity in patients, while vigilance and selective attention cannot predict pain severity.

Table 4 presents the results of one-way variance analysis model.

As shown in Table 4, the results of one-way variance analysis of the model indicates that the model is significant considering the tolerance  $f = 29.36$  and  $0.001$  significance.

Table 5 presents standard and non-standard regression coefficient for existing variables in the model.

As shown in Table 5, B or nonstandard coefficient for prediction variable indicates predicted increase in the criterion (pain severity) for each unit increase (here, it is 0.052). B standard error is also 0.01. Beta ( $\beta$ ) coefficient for prediction variable portion (ambivalence over emotional expressiveness) in the model presents a measurement in terms of standard deviation. Beta coefficient is the predicted change in the standard deviation of criterion variable (pain severity). This table shows that if ambivalence over emotional expressiveness of a standard deviation increases, it can be predicted that pain severity increases as much as 0.376 of standard deviation.

**Table 1. The order of elimination and addition of the variables used in the model \***

Model	Variables entered	Variables eliminated
1	Ambivalence over emotional expressiveness	
2	Vigilance	Vigilance
3	Attention to consistent painful stimuli	Attention to consistent painful stimuli
4	Attention to inconsistent painful stimuli	Attention to inconsistent painful stimuli
5	Attention to consistent happy stimuli	Attention to consistent happy stimuli
6	Attention to inconsistent happy stimuli	Attention to inconsistent happy stimuli

\* independent variable (criterion): pain intensity

**Table 2. Statistical data related to variables eliminated from each model**

Model	$\beta$ Coefficient	Significance	t	Partial Correlation	Tolerance
Vigilance	0.093	0.187	1.32	0.099	0.964
Attention to consistent painful stimuli	-0.090	0.197	-1.29	-0.097	0.988
Attention to inconsistent painful stimuli	-0.097	0.146	-1.39	-0.104	0.988
Attention to consistent happy stimuli	-0.046	0.512	-0.657	-0.049	0.983
Attention to inconsistent happy stimuli	-0.029	0.679	-0.414	-0.031	0.981

**Table 3. Summary of the model results**

Model	R	R Square	Adjusted R Square	Summary of Evaluation standard
1	0.37	0.14	0.13	2.20

**Table 4. Results of One-way Variance Analysis (ANOVA) of the model**

Model	Sum of Squares	df	Mean of Squares	F	Significant
Prediction	142.67	1	142.67	29.36	0.001
Balance	864.98	178	4.85		
Total	1007.66	179			

**Table 5. Standard and non-standard regression coefficients for the variables in the model**

Variable for Prediction	Non-standard Coefficient (B)	Standard Error (B)	Coefficient B	t	Significant
Ambivalence over emotional expressiveness	0.052	0.010	0.376	5.41	0.001

## Conclusion:

The aim of the present study was to investigate the role of selective attention, vigilance and ambivalence in expressing emotions for predicting the pain severity in patients with chronic musculoskeletal pain. Pain is the most comprehensive symptom in medical practice, the most common cause of disability and the most unique motivation is to force an individual to seek medical care or to avoid it. Pain is highly influenced by psychological factors like thoughts, emotions, attention and expectation. Attention to painful stimuli, vigilance and sensitivity to pain and emotional factors are among the main psychological factors for the perception of chronic pain. In fact, anxiety, depression, fear, negative emotions, disability and even avoidance are somehow associated with attention to painful stimuli. Patients with chronic pains, painful stimuli, try to identify painful stimuli through focusing attention on them as early as possible hoping to indicate the most appropriate response shortly when confronted with the stimuli. It is clear that attention to painful stimuli with the afore-mentioned characteristics is directly or through other related variables. In general, this type of patients indicate attentional bias to pain-related visual (not lexical) stimuli. This reflects vigilance bias towards stimuli related to pain, and those who become vigilant experience more anxiety. Since pain preoccupies their mind, they cannot pay attention to other problems. Thus, they also complain of memory and concentration problems. The results of the present study on the

role of selective attention, vigilance and ambivalence in expressing emotions for predicting pain severity in patients with chronic pain showed that ambivalence over emotional expressiveness had the potentiality to predict the pain severity in patients with chronic pain while vigilance and selective attention did not. As much as there existed the possibility for searching, no study was retrieved to evaluate the role of ambivalence over emotional expressiveness in pain severity prediction. The present study which is one of the first studies in this field showed that ambivalence over emotional expressiveness can also predict pain severity in patients with chronic musculoskeletal pains. As discussed, earlier studies indicated that happy/pleasing emotions reduce pain severity while sad/unpleasing emotions increase pain severity. Gate control theory of pain says that large diameter nerve fibers not only go towards transmission and inhibitory cells but also to the inside of the brain. There, according to the status of brain, pain and pain severity moderating messages are transferred to the dorsal horn. This model clarifies the role of thoughts, emotions and beliefs in the thoughts associated with pain. In fact, believes, cognition and our emotions influence on the interpretation of brain from pain. Looking at pain transmission using such an approach, we can say that when sensory messages associated with pain are carried to the brain via dorsal horn, they are reprocessed. The messages enter the thalamus after pain gate is open. The messages are interpreted based on the current emotional status of the individual, the level of the individual's attention and his earlier

experience when the messages reach the brain. All the mentioned factors affect the perception of pain and the individual's response to pain (25).

According to the fear-avoidance model, fear from pain which increases in some patients with musculoskeletal pains can inhibit the level of physical activities resulting in limitation of movement (26). The most severe status of fear to physical activity can result in the fear from movement. In this type of fear which is irrational and debilitating, the patient becomes extremely concerned about the probable damages resulting from physical and moving activities (27-30). In the present study, selective attention and vigilance could not predict the severity of pain in the patients. To clarify this finding, the results of some researches can be noted. In these studies, vigilance and selective attention are the variables which do not directly increase pain severity in patients with chronic pain. These variables increase fear from movement and vulnerability. Fear from movement has a significant positive relationship with pain severity (31). Crombez, Van Damme and Eccleston (32) in a study indicated that vigilance to pain associated stimuli increase pain severity indirectly. In other words, vigilance increases avoidance tendency in which influences pain severity.

The findings of the present study may result in some important clinical outcomes. Firstly, it suggests that physicians should be aware of those patients with chronic musculoskeletal who have higher ambivalence over emotional expressiveness may report higher level of pain severity. Secondly, although further studies are needed to make the findings more complete and more specific, interactions involved in reducing the ambivalence over emotional expressiveness in patients with musculoskeletal chronic pains, may reduce problems resulting from pain. But it is important to remember that this group of variables is only a small part of variables influencing chronic musculoskeletal pains. According the view of Nicolas (33), it is not enough to just get involved in some of variables to obtain a better understanding and more information about pain. It is necessary to build new variables in the complex equation of chronic pain. In this study, we tried to study: 1) a newer variable of emotional issues for

chronicization of pain in musculoskeletal patients-ambivalence over emotional expressiveness which was less evaluated in earlier studies – and 2) emotional and cognitive factors together. Therefore, it is suggested for future studies to 1) evaluate other psychological factors influencing the experience of chronic pain, 2) to investigate patients with other types of pain including rheumatoid pains and pains in hemophilic patients. It is also suggested to investigate the biological, behavioral, emotional and social mechanism in relation to each other in future studies. Because these mechanisms in the afore-mentioned diseases interact with each other. The mechanisms can influence the life of patients. They are the reasons for personal complaints and interpersonal problems. The consequences of such problems include continuation of pain, imposing high costs on families, loss of effective workforce in society and reduced work efficiency.

#### **Limitations:**

Some samples of this study were excluded due to several reasons; on one hand, the visual dot-probe test was software-based and the test procedure was prolonged; and on the other hand, the subjects were older in age and they had a low level of literacy. In addition, it was harder to find men with chronic pain than women. It is because more women referred to physicians for treatment of chronic pains than men. Men also resisted more for participating in the study.

#### **Acknowledgement:**

This article is based on the result of a PhD thesis which was carried out with collaboration of health center at Atyeh Hospital and physiotherapy at Imam Khomeini Hospital in Tehran. I would like to express my gratitude to all the orthopedics at Atyeh Hospital, Dr. Khalil Alizadeh (the hospital president) and Dr. Hossein Malekan and Dr. Hamid Gerami; and also the Manager of Physiotherapy Clinic at Imam Khomeini Hospital Dr. Bahrami, and Dr. Keivan Darandegan who heartily helped me in this research.



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