

Effect of Progressive Muscular Relaxation on Stress and Disability in Subjects with Chronic Low Back Pain

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Abstract:

Introduction: Back pain is the major cause of activity limitation in people younger than 45 years. 70-85% of population suffer from back pain at some time in life. Approximately 5-10% of patients with low back pain develop chronic low back pain. It has become a diagnosis of convenience for many people who are actually disabled for work-related, or psychological reasons. Chronic low back pain has a high prevalence in many countries around the world and it affects 10% of adult population.

Purpose of the study: To see the effect of progressive muscular relaxation on stress and disability associated with chronic low back pain.

Methodology: 30 subjects were included in the study with age group 18-30 years. All the subjects were randomly selected according to inclusion and exclusion criteria. All the subjects were randomly assigned into two groups, one experimental and other was control group. Subjects of experimental group were received progressive muscular relaxation, hot pack and only hot pack in control group. Outcome measures were noted as stress using DASS, Disability using Quebec pain disability scale and pain using VAS. All the measurements were done before the treatment session and after 1st week, 2nd week, 3rd week and 4th week

Result: Progressive muscular relaxation showed significant differences than control group for VAS, Stress and disability.

Conclusion: It was concluded that Use of Progressive muscular relaxation as a treatment associated with a reduction in perception of pain, stress and improvement in wellbeing for the chronic low back pain patients.

Keywords: Chronic low back pain, stress, disability, Progressive muscular relaxation.

I. Introduction

Low Back Pain (LBP) is the main cause of disability (C.G. Maher 2004)⁶ and a common reason for lost work days (Stewart et. al. 2003, Ricci et al 2006)^{38,30}. An estimated 149 million days of work per year are lost because of LBP (Guo et. al. 1999)¹⁵. Approximately 10%-20% of patients with Low Back Pain develop chronic Low Back Pain, defined as pain and disability persisting for more than 3 months (C.G. Maher, 2004)⁶.

Back pain in general affects 70-85% of all people at some time in their lives, but 90% of affected individuals recover, typically within 12 weeks (Shekelle et. al. 1995)³⁵. Recovery after 12 weeks is slow and uncertain, and this subset of patients with CLBP accounts for major expenses in the health care and disability systems (Anderesson 1999, Shekelle 1995)^{2,36}. Unfortunately chronic LBP is prevalent in many countries around the world (C.G. Maher, 2004)⁶.

In a Finnish study, 38.7% of patients with undefined LBP had to reduce their leisure-time activities (Helliövara et. al., 1989)¹⁸ and in another study, 47% of LBP patients spent less time on household chores during the week prior to the study. So 35% of the patients, the household chores were taken over by others (Lamer et. al., 2005)²³. Nearly one-third of the patients refrained from participating in sporting activities because of their LBP (Duequesnoy B et al, 1998)¹⁰. Low back pain (LBP) is the main cause of absenteeism and disability in industrialized societies (C.G. Maher, 2004)⁶.

Chronic pain patients also deal with a broad range of secondary pain-related challenges, such as job loss, marital strain, and social isolation, which further compromise adjustment and negatively affect subjective well-being (Jessi Dezzuter, 2010).¹⁹ Chronic back pain is a more difficult problem, which often has strong psychological effect and more disabling because of its physical limitation and psychological effect (George E Ehrlich, 2003)¹² that's why the CLBP is a stress factor in itself but when pain, stress and depression become overwhelming and stress seems to become prominent (Hanne Ellegaard, 2012).¹⁷

Chronic low back pain is a multifactorial phenomenon (Wadell, 1987)⁴⁰ and many therapeutic approaches exist. (Lorimer Mosely, 2002)²⁵ exercise produces large reductions in pain and disability. There are

multiple disciplinary rehabilitation techniques which are effective treatment options for chronic LBP. (C.G.Maher,2004)⁶

As Chronic low back pain is a multifactorial phenomenon (Wadell,1987)⁴⁰ and stress factor in itself (Henna Ellegaard,2012)¹⁷ Progressive Muscle Relaxation (PMR) is a popular technique known for its muscle tension relieving effects and consists of a series of exercises involving tensing and relaxing muscle groups. (Khanna et. al.2007)³. It was developed by American physician Edmund Jacobson in the early 1920s. So it has physical and mental component. (Pawlow et al, 2002)²⁹

Relaxation reduce pain or pain perception and tension, create a pleasant mental state, reduce anticipatory anxiety, reduce anxiety as a response to stress, increase parasympathetic activities, increase knowledge concerning muscle tension and autonomous stimuli, improve concentration, increase the feeling of control, improve the ability to block inner talk, energize and improve sleep, decrease the cardiac index, lower blood pressure, warm or cool body parts, enhance performance of physical activities and help in the relationship with other so the Progressive Muscular Relaxation has long-term benefits which improve of quality of life of patients (Andersson et al,2006,Wilk C et al 2001,Dehadri et al ,2009, Ghafari et al,2009, Sheu S,2003)^{1,41,9,14,37}

Need of the study was to focus on reduction of psychosomatic symptoms and disability associated with chronic low back pain. Aim and purpose of the study was to see the effect of progressive muscular relaxation on stress and disability associated with chronic low back pain. In study it was hypothesised that there will be a significant effect of progressive muscular relaxation on stress and perceived disability in chronic low back pain.

II. Methodology

Sample

30 subjects were included in the study with age group 18-30 years. All the subjects were random selected according to inclusion and exclusion criteria and were included in the study who have low back pain more than 12 weeks. Subjects were excluded if they had back pain attributed to any specific pathology Eg. Disc herniation, trauma etc. and nerve root irritation, major past surgery. Ethical approval was taken from ethical committee of "SBSPGI" to conduct study and informed consent was taken for each subject to be included in the study. All the subjects were randomly assigned into two groups; one experimental and other was control group. Subjects of experimental group were received progressive muscular relaxation, hot pack and only hot pack in control group. Outcome measures were noted as stress using DASS, Disability using Quebec pain disability scale and pain using VAS. All the measurements were done before the treatment session and after 1st week, after 2nd week and after 4th week.

Methods

Measurement of pain: Pain was measured by using VAS. To measure the VAS for pain subjects were instructed to mark on a 10 cm scale which is divided into 10 equal segments where 0 represent no pain and 10 represent intolerable pain. The entire subject has to mark the point according to their severity of pain²⁸.

Measurement of stress: Stress was measured by using DASS. The DASS is a 42-item questionnaire which includes three self-report scales designed to measure the negative emotional states of depression, anxiety and stress. Each of the three scales contains 14 items. DASS questionnaire was given to subjects in a printed form, and were asked to use 4 point severity scale, to rate the extent of their depression, anxiety and stress.²⁷

Measurement of disability: Disability was measured by using Quebec pain disability scale. The Quebec Back Pain Disability Scale is about how back pain affected the daily life. This questionnaire includes 20 items which is affected by back pain. Subjects were asked to use 5 point severity scale to rate the extent of their disability.⁷

Application of PMR: It is a systematic technique developed by Dr. Edmund Jacobson (1938), used for achieving a deep state of relaxation. Subjects were made to lie down comfortably and asked to close their eyes. Subjects were instructed to listen and follow the instruction carefully. Relaxation involved tensing the specific muscle groups of body for 7-10 sec., followed by releasing them for 15-20sec. The sequence of muscle groups involved is given in Table 1.

Table 1 Instructions for Progressive Muscle Relaxation training³

Muscle Group Instructions

Hand	Clench your left hand and feel the tension Relax and let hand hang loosely, Same for right hand.
Wrists	Bend hand back, hyperextending your wrists. Relax.
Upper arms	Bend elbow towards your shoulders and tense biceps muscle. Relax.
Shoulders	Bring shoulders up toward yours ears. Relax, let your shoulder drop down.
Forehead	Wrinkle your forehead, raise your eyebrows. Relax.
Eyes	Close your eyes tightly. Relax.
Jaws	Clench your jaws tightly. Relax.
Tongue	Press your tongue against the roof of your mouth. Relax.
Mouth	Press your lips together tightly. Relax.
Neck	Turn your head so that your chin is over your right shoulder. Straighten and relax
Neck and Jaws	Bend your head forward, pressing your chin against your chest. Straighten and relax.
Chest	Take a deep breath and hold it for 5 seconds, slowly exhale and relax Abdomen Tighten your stomach muscles. Relax. Back Arch your back. Relax.
Thighs	Stretch your legs in front of you. Tighten your thigh muscles. Relax
Hamstrings	Push your heels down into floor, tighten your hamstring Muscles Relax.
Feet	Calves Point your toes toward your head. Relax Curl your toes toward the bottom of your feet. Relax

Application of hot pack: A hydro collator pack is a silica gel filled pack. They are heated by being placed in a special tank of water warmed to 75-80°C. Subject was made lie down to supine. Hot pack was wrapped in towelling before being applied to the lumbar area so that some four and eight layers, depending on towel thickness, intervene between the pack and skin. Hot pack was applied to lumbar area of subject with chronic low back pain for 10 minutes.

Data Analysis: Independent sample t-Test between the groups, ANOVA test within the group-A and within group- B and Post hoc test using multiple comparison test within the group were done for pain, Stress and disability in starting day, 1st week, 2nd week, 3rd week and 4th week.

Result: t-test between the groups showed significant differences for pain, stress and disability. [table 5.1]. ANOVA showed significant differences for pain stress and disability in both groups within the Group-A [table 5.2] and Group-B [table 5.3]

Table 5.1 t-test between the groups

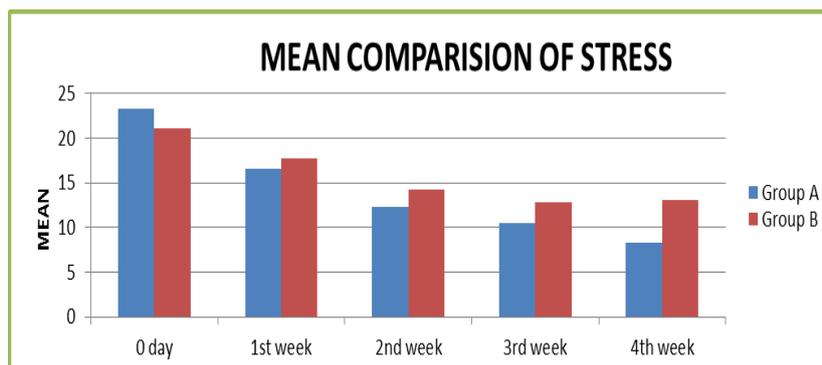
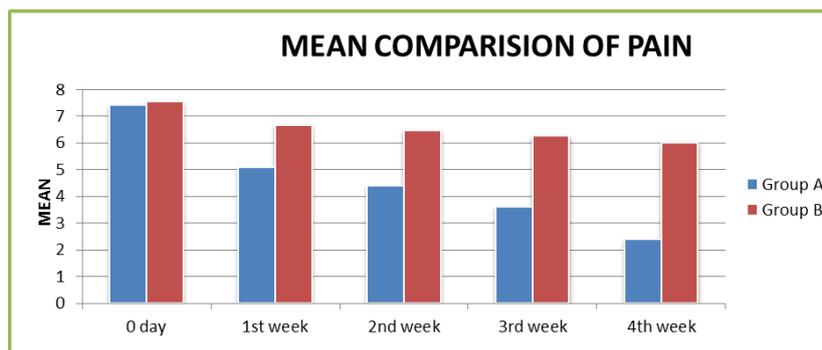
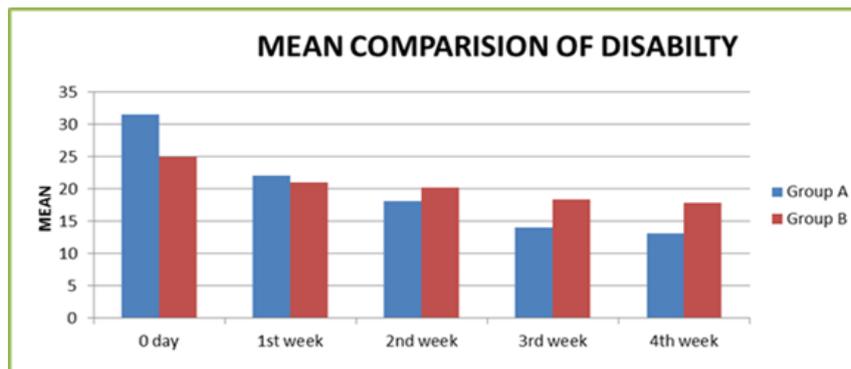
	VAS	Stress	Disability
t-value	9.000	3.550	2.199
p-value	0.001	0.001	0.001

Table 5.2 Anova within the group-A

	F value	P value
VAS	48.893	0.001
stress	20.548	0.001
disability	13.729	0.001

Table 5.3 Anova within the group-B

	F value	p-value
VAS	4.605	0.001
Stress	10.954	0.001
Disability	9.492	0.001



III. Discussion

Chronic low back pain is common cause of disability and associated with psychological effect. This study is an experimental study which aims to find out the effect of Progressive muscular relaxation on stress and disability in subjects with chronic low back pain. The present study showed significant difference on the effect of progressive muscular relaxation on stress and disability in subjects with chronic low back pain.

John A Astin (2004)²¹supported that Relaxation therapy may be an appropriate adjunctive treatment for chronic low back pain.**Mark A Jackson, Karen H Simpson (2006)**²⁶supported the use of some psychological approaches to manage chronic pain and this approach reduces pain and disability-related behaviour and improves function.

Bruce Robinson (2012)⁵added that Relaxation closes the pain gate and the mechanism of pain gate described by **Melzak and wall**³⁴. According them there is a gate-like mechanism in the dorsal horns of the spinal column, known as the substantiagelatinosa so this "gate" controls the flow of pain sensations that pass through on their way up to the thalamus and limbic system and then to the cerebral cortex ,where experience of pain occurs³³. **Rohads CJ (2013)**³²supported that relaxation of muscle releases endorphin, on dorsal horn of spine, they block the electrical activity of the nerve fibres going up the spine to the brain, which closes pain gate and perception of pain reduces.

When pain occur it causes constant state of attention which leads to sympathetic activation, also called ergotropic or fight or flight response which releases stress hormone such as adrenaline and cortisol, blood pressure and heart rate goes up, respiration becomes shallow and the rate increases, the capillaries do contract. (**Rohads CJ 2013,**)³².**Jacobson (1941)**¹¹asserted that relaxation of muscles would lead to relaxation of the

mind, because an emotional state fails to exist in the presence of complete relaxation of the peripheral parts involved, so the peripheralist mechanism of Jacobson is popular neurophysiologic explanation of relaxation.

Pawlow (2011)²⁹ added Progressive Muscular Relaxation entails a physical and mental component. The physical component involves the tensing and relaxing of muscle groups over the legs, abdomen, chest, arms and face. In a sequential pattern, with eyes closed, the individual places a tension in a given muscle group purposefully for approximately 10 seconds and then releases it for 20 seconds before continuing with the next muscle group and the mental component requires that the individual focuses on the distinction between the feelings of the tension and relaxation, so the contraction of skeletal muscle fibres leads to the sensation of muscle tension, the result of a complex interaction of the central and peripheral nervous system with the muscular and the skeletal system and relaxation is the absence of perceived muscle tension. According to **Jacobson (1941)**^{11,13}, complete muscle relaxation is incompatible with having any thoughts or feelings, the relationship of muscle tension, relaxation and autonomic nervous system that reduction in skeletal muscle tone leads loss of a ergotropic tone of a hypothalamus and diminution of hypothalamic discharges which consequently leads to dominance of trophotropic system, also called parasympathetic activation which include reductions in HR and BP, increased activity of the digestive system by which nutrition absorption increases, and muscle endurance increases. **(Benson 1975,)**⁴ **Liza (2011)**²⁴ supported that progressive muscular relaxation reduces stress response.

If pain persists, it causes long term release of stress hormone which begins to cause damage; inhibiting the digestive system, restricting nutritional absorption, causing muscle fatigue and increasing pain. **(Rhoads CJ 2013)**³² and a vicious circle may be initiated when the pain is catastrophically mis-interpreted. In case of chronic pain it is not possible to avoid the pain but possible to avoid the perceived threat (pain), in this case the activities that are assumed to increase pain or (re)injury. These dysfunctional interpretations give rise to pain-related fear, the three main components of fear are interpretation of the stimulus where pain as threatening, increased sympathetic arousal, and defensive behaviour **(Rachman, 1974)**¹⁶ and associated safety seeking behaviours such as avoidance/escape, that can be adaptive in the acute pain stage, but paradoxically worsen the problem in the case of long-lasting pain which leads to the disability **(Vlayen, 1995, Vlayen 2004)**^{39,20}. **Rhoads CJ (2013)**³² supported that relaxation of muscles releases neurotransmitters such as dopamine, serotonin, nor adrenaline, acetylcholine, GABA, and endorphins. These are often called the "feel good" hormones because they cause a feeling of contentment and well-being. **Andersson et al, (2006)**¹, **Wilk C et al (2001)**⁴¹, **Dehadri et al, (2009)**⁹, **Ghafari et al, (2009)**¹⁴, **Sheu S, (2003)**³⁷ supported that Relaxation reduce pain or pain perception and tension, create a pleasant mental state, reduce anticipatory anxiety, reduce anxiety as a response to stress, increase parasympathetic activities which promotes rest and repair, decrease the cardiac index, lower blood pressure, and enhance performance of physical activities. **Deborah I Jones (2003)**⁸ supported that Progressive Muscular Relaxation is used as management of disability with chronic pain.

Hot pack increases tissue temperature, which leads to increases in local blood flow due to sympathetic vasodilation. Increase in blood flow supply more oxygen and antibodies, so local metabolism increases by which pain, muscle spasm reduces. Another mechanism for reducing pain, it increases small non-myelinated C fibre activity that inhibits nociceptive signal within the spinal cord and brain stem and also decreases γ - fibre activity in muscles reducing the sensitivity of muscles spindle to stretch which reduces muscle spasm **(Kanui TI, 1987)**²². Heat increases flexibility of collagen tissues so stiffness in joint and muscles reduced that's why joint Range of motion increased **(Robertson et. al. 2005)**³¹ and muscle got relaxed Positive changes in muscle activity causes the feeling of well-being associated with psychological factor which lead to mental relaxation. **Sandra E. Lewis, Paul S. Holmes, P Steve R. Woby et al (2012)**³⁴ supported that hot pack has positive short term effect on stress and disability. Limitation of study that was the beginning of relaxation the patient may have problem in concentrating.

IV. Conclusion

The result of the study was concluded that Use of Progressive muscular relaxation as a treatment associated with a reduction in perception of pain, stress and improvement in wellbeing for the chronic low back pain patients.

Conflict of Interests: Nil

References

- [1]. Anderson RE Seniscal CA: comparison of selected osteopathic treatment and relaxation for tension-type headaches. *Headache* 2006, 46(8):1273-80
- [2]. Andersson GB: Epidemiological features of chronic low-back pain. *Lancet*. 1999, Aug 14, 354(9178):581-5.
- [3]. Archana Khanna, Maman Paul and Jaspal S. Sandhu: Efficacy of two relaxation techniques in reducing pulse rate among highly stressed females, *Calicut Medical Journal* 2007, 5(2):293-300
- [4]. Benson H Greenwood MM, Klemchuk H: The relaxation response: psychophysiological aspects and clinical applications. *Int J Psychiatry Med*. 1975, 6(2):87-98
- [5]. Bruce H Robinson: The psychobiology of pain, *Acupuncture today* 2002, 13(02): 1-5

- [6]. C.G. Maher : Effective physical treatment for chronic low back pain, *OrthopClin N Am*2004, 35(1):57–64
- [7]. Chung-Wei Christine Lin, James H. McAuley, Luciana Macedo, Dominique C. Barnett, Rob J. Smeets, Jeanine A. Verbunt : Relationship between physical activity and disability in low back pain : A systematic review and meta-analysis, *PAIN*, 2011, 15(2):607–613
- [8]. Deborah L Jones Takeshi, Stephan: Stress Management and workplace disability in US, Europe and Japan. *J occup Health*2003, 45(1): 1-7
- [9]. Dehdari T, Heidarnia A, Ramezankhani A, Sadeghian S, Ghofranipur F: Effects of progressive muscular relaxation training on quality of life in anxious patients after coronary artery bypass graft surgery. *Indian J med res*2009, 129(5): 603-608.
- [10]. Duequesnoy Ballaert FA, Verdoncq B: Psychosocial and occupational impact of chronic low back pain *Rev Rhum Engl Ed*1998, 65(1):33-40.
- [11]. Edmund Jacobson : The physiological conception and treatment of certain common psychoneurosis. *Am J Psychiatry*1941, 98(2): 219-226.
- [12]. George E Ehrlich : Low back pain , *Bulletin of the World Health Organization*, 2003, 81, (9):671-675
- [13]. Gessel AH, Edmund Jacobson, the founder of scientific relaxation. *Int J Psychosom*.1989 36(1-4) : 5-14
- [14]. Ghafari S, Ahmadi F, Nabavi M, Anoshirvan K, Memarian R, Rafatbakhsh M: Effectiveness of applying progressive muscle relaxation technique on quality of life of patients with multiple sclerosis, *J clin Nurs*.2009, 18(5): 2171-9
- [15]. Gou H R Tanaka S, Halperin WE, Cameron LL: Back pain prevalence in US industry and estimates of lost workdays, *Am J Public Health*.1999, 89(7):1029-35.
- [16]. H Rachman, S Hodgson synchrony and desynchrony in fear and avoidance. *Behav Res therapy*1974, 12(4): 311-318.
- [17]. Hanne Ellegaard and Birthe D Pedersen: Stress is dominant in patients with depression man chronic low back pain. A qualitative study of psychotherapeutic interventions for patients with non-specific low back pain of 3--12 months' duration, *BMC Musculoskeletal Disorders*, 2012, 13 (166):1471-2474
- [18]. Heliövaara M Sievers K, Impivaara O, Maatela J, Knekt P, Mäkelä M, Aromaa A: Descriptive epidemiology and public health aspects of low back pain. *Ann Med*, 1989, 121(5): 327-33
- [19]. Jessie Dezutter, Linda A. Robertson, Koen Luyckx Dick Hutsebaut : Life Satisfaction in -Chronic Pain Patients: Stress-Buffering Role of the Centrality of Religion , *Journal for the Scientific Study of Religion*, 2010, 49(3):507–516
- [20]. Johan W.S. Vlaeyen, Steven J. Linton: Fear-avoidance and its consequences in chronic musculoskeletal pain: a state of the art, *PAIN*2000, 85(3):317-332.
- [21]. John A Astin: Mind body therapies for management of pain, *Clinic j Pain*, 2004, 20(1): 27–32.
- [22]. Kanui Ti : Thermal inhibition of nociceptor-driven spinal cord neurones in the cat: a possible neuronal basis for thermal analgesia. *Brain Res*.1987, 402 (1): 160-3.
- [23]. Lamers Meering WJ, Severens JL, Brouwer WB: The relationship between productivity and health-related quality of life: an empirical exploration in persons with low back pain. *Qual Life Res*.2005,-13.
- [24]. Liza Varvogli, Christina 14 (3):805 Darviri: Stress Management Techniques: evidence-based procedures that reduce stress and promote health, *Health science journal*2011, 5(2):74-89
- [25]. Lorimer Moseley: Combined physiotherapy and education is efficacious for chronic low back pain, *Australian Journal of Physiotherapy*, 2002, 48(2):297-300
- [26]. Mark A Jackson and Karen H Simpson, *Chronic back pain Oxford Journals Medicine* 2006, 6,(4):152-155
- [27]. Nicho MK, Asghari A, Blyth FM: What do the numbers mean? Normative data in chronic measures, *Pain*.2008, 134(1-2):158-73.
- [28]. Ninna Dufour, Gorm Thamsborg, Alex Oefeldt, Charlotte Lundsgaard, and Steen Stender: A Randomized, Clinical Trial Comparing Group-Based Multidisciplinary Biopsychosocial Rehabilitation and Intensive Individual Therapist-Assisted Back Muscle Strengthening Exercises. *SPINE*, 2010, 35(5): 469–476
- [29]. Pawlow LA and John JE : The impact of abbreviated progressive muscle relaxation on salivary cortisol, *Biol Psychol*, 2002 60 (1):1-16
- [30]. Ricci JA, Stewart WF, Chee E, Leotta C, Foley K, Hochberg MC : Back pain exacerbations and lost productive time costs in United States workers , *Spine*, 2006, 31(26):3052-60
- [31]. Robertson VJ, Ward AR, Jung P: The effect of heat on tissue extensibility: a comparison of deep and superficial heating. *Arch Phys Med Rehabil*, 2005, 86 (4):819-25.
- [32]. Rohads CJ: Mechanism of Pain Relief through Tai Chi and Qigong, pain relief, *JPAR an open access journal*, 2013 2(1): 115.
- [33]. Ronald Melzak (2001) Pain and the neuromatrix in the brain, *Journal of Dental Education* 65, (12):1378-1782
- [34]. Sandra Paul S. Holmes, PhD, Steve R. Woby, PhD, Jackie Hindle, MCSP, Neil E. Fowler, PhD : Short-Term Effect of Superficial Heat Treatment on Paraspinal Muscle Activity, Stature Recovery, and Psychological Factors in Patients With Chronic Low Back Pain. *Arch Phys Med Rehabil*, 2012, 93(2):367-371.
- [35]. Shekelle PG, Markovich M, Louie R: An epidemiologic study of episodes of back pain care, *Spine (Phila Pa 1976)*.1995, 20, (15):1668-73.
- [36]. Shekelle PG, Markovich M, Louie R: Comparing the costs between provider types of episodes of back pain care *Spine (Phila Pa 1976)*.; 1995, 20(2):221-6;
- [37]. Sheu S, Irvin BL, Lin HS, Mar CL: Effects of progressive muscle relaxation on blood pressure and psychosocial status for clients with essential hypertension in Taiwan. *Holistic nursing practice*, 2003, 17(1):41-7.
- [38]. Stewart, Ricci JA, Chee E, Morganstein D, Lipton R.: Lost productive time and cost due to common pain conditions in the US workforce, *JAMA*, 2003, 290, (18):2443-54.
- [39]. Vlaeyen JW, Kole-Snijders AM, Boeren RG, van Eek H, : Fear of movement/(re)injury in chronic low back pain and its relation to behavioral performance, *Pain*1995, 16,(3):163-172
- [40]. Wadell G: Volvo award in clinical sciences. A new clinical model for the treatment of low-back pain. *Spine (Phila Pa 1976)*. 1987, 12(7): 632-44.
- [41]. Wilk C, Turkoski B: Progressive muscle relaxation in cardiac rehabilitation: a pilot study, *Rehabilitation nursing*, 26(6): 238-242