Original Article

Does frequency of exercise therapy sessions affect pain response in patients with chronic mechanical neck pain?

Nehad Mohamed Abd EL nabi Mousa[1], Reda S Eweda[2,3], Alaa Eldin AbdElhakim Balbaa[2]

[1]Department of physical Therapy, Mansoura University Hospital, Egypt, [2]Department of orthopedic physical Therapy , Faculty of Physical Therapy, Cairo University, Cairo, Egypt, [3]Faculty of Medical Rehabilitation Sciences, Taibah University, Al-Madinah Al-Munawarah, Saudi Arabia.

Correspondence: Nehad Mohamed Abd EL nabi Mousa, Department of physical Therapy, Mansoura University Hospital, Egypt.

ABSTRACT

Background: Chronic neck pain is a common condition affecting many large proportion of population all over the world and in our society. Many physical therapy approaches were used to treat neck pain, and there is high evidence that exercises are effective, but there still is a great debate about which type is more effective. Also there is little evidence about the best parameters of exercises such as frequency, and intensity. Purpose: to investigate the effect of exercising therapy frequency on patient's ache response in instances of persistent mechanical neck pain. Methods: Thirty sufferers recognized as persistent mechanical neck ache have been assigned randomly into equal groups. They have been assessed by pain severity through the usage of visible analogue scale, earlier and after remedy. The primary experimental group (a) received exercise sessions three times a week; while the second experimental organization (b) acquired the equal remedy instances twice a week. Results: In both groups, there was a significant decrease in pain intensity. In addition, there was no significant statistical difference in pain intensity between both groups. Conclusions: It was concluded that exercise therapy twice a week is equally effective as three times per week in patients with chronic mechanical neck pain.

Keywords: Mechanical neck pain, endurance exercise, exercise therapy frequency

Introduction

Neck pain (NP) is a widespread condition that is associated with great socioeconomic burden [1-12]. Chronic neck pain is more common in the working age population in modern industrialized countries [2-4,13-17].

Mechanical neck disorders (MND) are disorders that are not related to a systematic problems or serious disease, these disorders may be due to abnormality in muscle, ligament, joint, disc, or degenerative involvement [5,18-24]. An altered pattern of muscle activation, such as deep cervical extensor and flexor muscles is evident in neck pain patients [6,25-31].

NP causes are not specified[7, 8,32]. A recent study demonstrated that in young adults, almost 1/3 wake up with NP or difficulty once a week[9,33-39].

Neck muscles' faintness was proposed as a contributor to persistent NP[7,40-43]. Elements influencing posture along with postural recognition and muscle characteristics may be poor in patients with NP. Scapular alignment is frequently related to concomitant weak spot of some or all portions of the trapezius as well as rhomboids and levatorscapulae. These impairments increase compressive loading of the cervical spine[10,44-49].

There's a stated discount in the electricity and staying power capacity of the neck flexor muscle masses in sufferers with distinctive NP syndromes[11-14,50].

Changes in muscle strength in neck pain populations are well documented. However, muscle endurance impairments are not as well defined[15,51-55]. A decrease in endurance of neck extensor muscles in patients with nonspecific neck pain has been described by[7,56-60].

More myoelectric manifestations of muscle fatigue of the sternocledomastoid and anterior scalene muscular tissues had been established in chronic neck ache sufferers with a symptomatic manipulation[16,61].

The intention of the cutting-edge study turned into investigating the impact of selected staying power training application frequency on patients' pain response in cases of persistent mechanical neck ache.

Materials and Methods

Thirty female patients diagnosed with chronic mechanical neck pain, assigned randomly into two equal study groups. Group (A) consisted of 15 patients with mean age (30.93±7.03) years, and BMI values of (27.47±4.53) Kg/m, and Group (B)

Access this article online	
Website: www.japer.in	**E-ISSN:** 2249-3379

How to cite this article: Nehad Mohamed Abd EL nabi Mousa, Reda S Ewida, Alaa Eldin AbdElhakim Balbaa. Does frequency of exercise therapy sessions affect pain response in patients with chronic mechanical neck pain?. J Adv Pharm Edu Res 2018;8(1):7-12.
Source of Support: Nil, Conflict of Interest: None declared.

consisted of 15 patients with mean age (28.8±5.34) years, and BMI values of (29.38±5.01) Kg/m2, were enrolled into this clinical trial. Patients were interviewed and the study goal was explained. Patients that agreed to participate in this study were asked to fill a consent form. This study was approved by the Ethics Committee for scientific research of the Faculty of Physical Therapy, Cairo University.

Patients participated in the study if they had the following criteria: Patients with chronic mechanical neck pain more than three months who had palpable cervical joint tenderness up to manual pressure of the cervical spine[17].

Patients were randomly assigned into two groups (A and B); each group consisted of fifteen patients. Group (A) received endurance exercises for neck flexors and extensors and active correction to scapular muscles three times per week, while group (B) received the same exercise program two times per week.

Pain severity was evaluated before and after the treatment. Pain intensity was evaluated by using a 10 cm visual analogue scale (VAS). The patients were asked to make a mark on the 10 cm line and the distance length was measured on the mark of the patient (18-25).

Treatment procedures:

The patients in both groups received the same exercise program which consisted of active scapular correcting exercises and endurance strengthening exercises for neck flexors and extensors. None of the exercise sessions were longer than 30 minutes for 6 weeks, all subjects were advised and requested to practice their exercise treatment program once per day for the duration of the trial. The exercises occupied a period of no longer than 10-20 minutes per day, and they were performed without any provocation of neck pain[21,26,27]. The treatment exercise program will be as the following protocol.

Active scapular correcting exercise

This exercise is according to the work of [22, 28,28]. The active interventions involved an adaptation of the conventional (grad 3) muscle test for lower trapezius[23].

The intervention was performed in prone position, with the arm rested on the plinth and the elbow in 45 degree of flexion. The examiner passively positioned the scapula in a natural position on the chest wall and will ask the patient to hold the position for 10 seconds. This procedure was repeated for 10 repetitions with a 10 seconds rest interval between each contraction.

Endurance strengthening exercise

Flexor muscles endurance strength training

This exercise was applied according to the work of[17,30-35]. A progressive resistance exercise program for neck flexors performed in supine position was included in the endurance strength training regime, with the head supported in a comfortable resting position. In order to perform cervical flexion, the patient was instructed to lift his head while maintaining a neutral upper cervical spine. He slowly moved the head and neck through as full range of motion as possible without causing discomfort or reproducing his symptoms. This exercise regime had two stages. The first stage was 2 weeks and, the second stage was the next 4 weeks as recommended for initiating a weight program in previously untrained subjects[24,36-39].

In stage one, all the subjects performed 12-15 repetitions with a weight that they can lift 12 times on the first training session (12 repetitions maximum) and progressed to 15 repetitions. They maintained at this level for the remaining two weeks.

In stage two, the subjects performed 3 sets of 15 repetitions of the initial 12 repetitions maximum load. One-minute rest intervals were provided between the sets. In case of easily achieving repetitions, weighted sand bags were applied to the patient's forehead in 0.5 kg increments as required. If the patient was unable to perform repetitions of the head lift maneuver, then the neck flexors were de-loaded by reducing the vertical component of the head weight vector. The upper body parts (trunk and neck) were inclined up from the horizontal in a way that the patient could perform the required repetitions of the movement.

Neck extensors endurance strengthening exercise

We applied the same protocol of neck flexors to neck extensor from prone position on the elbows' position[25,40-43]. The patient was instructed to let the head and neck move into flexion, then return to the starting position without causing discomfort or reproducing his symptoms. The neck flexor exercise regime had two stages. The first stage was 2 weeks and, the second stage was the next 4 weeks as recommended for initiating a weight program in previously untrained subjects[24,44].

In stage one, all the subjects performed 12-15 repetitions with a weight that they can lift 12 times on the first training session (12 repetitions maximum) and progressed to 15 repetitions. They maintained at this level for the remaining two weeks.

In stage two, the subjects performed 3 sets of 15 repetitions of the initial 12 repetitions maximum load. One-minute rest intervals were provided between sets. In case of achieving the repetitions easily, the weighted sand bags were applied to the patients' forehead in 0.5 kg increments as required. If the patient was unable to perform repetitions of the head lift maneuver, then the neck extensors were de-loaded.

Results

Data analysis

Statistical evaluation was performed by SPSS version 22 (SPSS, Inc., Chicago, IL). The current test elaborated two independent variables, the first one was the (treatment exercise); within subject factor which had two levels (group A receiving selected endurance training exercise and active scapular correcting exercise for 6 weeks, and group B receiving the same program), and the second one was the (frequency of the exercise sessions) among subjects' factor which had two levels (pre, post). In addition, this test involved one test-dependent variable (pain severity).

Physical characteristics

The current study was conducted on 30 patients (19 females and 11 males) suffering from chronic mechanical neck pain. They were appointed arbitrarily into two equivalent investigation groups. Group A consisted of 15 patients with mean age, body mass, height, and BMI values of 30.93±7.03 years, 75.73±11.76kg, 166.3±8.72 cm, and 27.47±4.53 Kg/m2, respectively. Group (B) consisted of 15 patients with mean age, body mass, height, and BMI values of 28.8±5.34 years, 81.6±13.82 kg, 166.8±6.73cm, and 29.38±5.01 Kg/m2, respectively. As indicated by the data obtained from (t test), there were no significant differences ($p>0.05$) in the mean values of body mass, height, and age between the tested groups (table, 1).

*SD: standard deviation, P: probability, S: significance, NS: non-significant

Overall effect

Statistical analysis using 2x2mixed design (MANOVA) indicated that, there was no significant difference between groups of the exercise, the 1st variable (independent) the pain severity (VAS (F=0.731, P=0.579)). However, there were significant effects of the measuring periods (the 2nd independent variable) of pain severity (F=1713.069, P=0.0001*). The interaction between the two independent variables was not significant, which indicates that the effect of the treatment exercise (first independent variable) on the dependent variables was not influenced by the exercise frequency (second independent variable) (F=0.806, P=0.533) (table 2).

Table 2. The 2x2mixed design Multivariate Analysis of Variance (MANOVA) for dependent variable at different measuring periods between both groups

Source of Variation	F-value	P-value
Treatment exercise	0.731	0.579
Exercise frequency	1713.069	0.0001*
Interaction	0.806	0.533

*Significant at alpha level <0.05.

II- Multiple pairwise comparison tests (Post hoc tests)

Pain intensity

A-Within groups:

As presented in table (3) and illustrated in figure (1), within-group comparisons of the mean ± SD values of VAS in the "pre" and "post" tests were 6.6±0.91 and 2.98 and ±0.69, respectively in group (A).

Table 1: Physical characteristics of patients in the tested groups (A&B)

Items	Group A	Group B	Comparison		S
	Mean ± SD	Mean ± SD	t-value	P-value	
Age (years)	30.93±7.03	28.8±5.34	0.935	0.358	NS
Body mass (Kg)	75.73±11.76	81.6±13.82	-1.252	0.221	NS
Height (cm)	166.3±8.72	166.8±6.73	-0.175	0.862	NS
BMI (kg/m2)	27.47±4.53	29.38±5.01	-1.094	0.283	NS

Data obtained from the multiple pairwise test (Post hoc test) illustrated that, there was a significant reduction of VAS at post treatment compared with pretreatment (P-value =0.0001*). While, the mean ± SD values of VAS in the "pre" and "post" tests were 6.18 ±0.77 and 2.64±0.59, respectively in group (B). However, there was a significant reduction of VAS at post-treatment compared with the one at pre-treatment (P-value =0.0001*).

B- Between groups:

As the effect of the tested group (1st independent variable) on VAS, multiple pairwise comparison tests (Post hoc tests) revealed that, there was no significant difference of the mean values of the "pre" tests in both groups with (P=0.181). As well, multiple pairwise comparison tests (Post hoc tests) revealed that there was no significant difference of the mean values of the "post" test between both groups with (p=0.164). Although, there was no statistical significant difference between both groups, there was clinical difference and high percent of improvement in favor of group B.

Table 3: Mean ±SD and p values of VAS pre and posttest at both groups.

VAS	Pre test	Post test	MD	% of change	p- value
	Mean± SD	Mean± SD			
Group A	6.6±0.91	2.98±0.69	3.62	55.69	0.0001*
Group B	6.18±0.77	2.64±0.59	3.53	57.11	0.0001*
MD	0.42	0.34			
p- value	0.181	0.164			

*Significant level is about at alpha level <0.05

SD: standard deviation,

MD: Mean difference,

p-value: probability value

Figure 1: Mean values of VAS pre and posttests in both groups.

Discussion

The object of the current study was to examine the effect of the selected endurance training frequency on ache severity in instances of chronic mechanical neck pain.

The results of this observation revealed that, there has been a giant decrease in pain severity. However, the results showed that, there have been no large differences among groups regarding the effect of frequency of exercise sessions on patients' outcomes.

In the current research, the study's first result for both groups showed a significant decrease in the pain severity, these finding are consistent with[26] in which therapeutic healing exercises have validated efficacy in lowering ache and perceived disability in humans with neck disorders.

On other hand, this study rejected the findings of [27, 24, 45,46] who found no effect of physical training on nonspecific neck pain in the neck area.

In the current study, the neck pain significantly was improved, this indicated that exercises made changes in VAS of patients with chronic mechanical neck pain, and this finding is consistent with the previous studies of[29, 30,47-51] which showed the same trend of decrease in VAS after exercise interventions.

The current study's first result also supported the findings of [31,52-58] who reported that both pain and neck disability had decreased in both groups who had strength training and endurance training in comparison with the control group.

Many conservative interventions are to be done for treating neck pain, which include physiotherapy modalities, and manual remedies [32, 33,59,60]. A few facts are available from the randomized managed trials on the effectiveness of these remedies [32, 34,61,62].

None of the published randomized trials evaluating the conservative treatment for neck pain thus far have blanketed an economic assessment. Two examinations comparing chiropractic and physiotherapy for sufferers with low ache and neck pain, included a price size but didn't include a complete economic consideration [33, 35,63].

There is limited proof on the most fulfilling dosage requirements for workout therapies, and other modalities used to treat neck issues [36, 37,64,65]. To deal with questions concerning the dose of therapies used to treat the neck, researchers[38,66-68]

have recommended using factorial designs and analyzing the simplest unmarried interventions[39, 40,69].

Sooner or later, dosage comparisons of similar types of exercising or exercises that cope with the equal detail can be made; these comparisons may be used to assess the impact of dosage variation of the exercise details and the magnitude of remedy results. Precise dosage facts will be clinically relevant, and unique therapeutic pointers can be drawn from such trials [41,70-73].

In a systematic review of exercises for mechanical neck disorders [41,74-76], it was suggested that forty-eight percent of the rigors within the reviews didn't file on adverse activities, and none evaluated the price of the care. More consistent reporting over many trials is needed to understand the sort and severity of pain and bad results of exercising remedies. The current study's second result which demonstrated that there was no significant difference between both groups according to the second testing variable (exercise frequency), indicating no difference between group A who received exercise treatment 3 times per week and group B who received the same exercise treatment 2 times per week, is consistent with the report of[41,77,78] who stated that, to better recognize the direct and oblique prices of the unique remedies and make decisions regarding the only and efficient kind of care, attempts to evaluate and file values related to the outcome, are needed.

Many studies compared the effects of different types of treatments using frequency of sessions in some studies once a week[27,42,43,79], twice a week[44-47,80] and three times a week[28,48,81-85], but to our limited knowledge there is no study comparing the effects of frequency of sessions of the same exercise or the same modality of treatment on the patients' responses, and economic incomes.

Conclusions

Based on the current examination, we conclude that, both groups confirmed considerable development in pain severity, also the frequency of the exercise treatment done per week had no tremendous distinctions on affected person's pain response.

Limitation

We need more trials to assess the effect of exercise treatment frequency on patients' outcomes.

References

1. Vos T, Flaxman AD, Naghavi M, Lozano R, Michaud C, Ezzati M, et al. Years lived with disability (YLDs) for 1160 sequelae of 289 diseases and injuries 1990-2010: a symptomatic analysis for the Global Burden of Disease Study 2010. Lancet, 15(380): 2163-2196, 2012.
2. Aromaa A, Koskinen S. Health and functional capacity in Finland. Baseline results of the 2000 health examination survey. Helsinki: National Public Health Institute; 2002.
3. Picavet, H., & Schouten, J. Musculoskeletal pain in the Netherlands: prevalences, consequences and risk groups, the DMC 3-study. Pain, 102(1), 167-178, 2003.
4. Webb R, Brammah T, Lunt M, Urwin M, Allison T, Symmons D: Prevalence and predictors of intense, chronic, and disabling neck and back pain in UK general population. Spine 28: 1195-1397, 2003.
5. Spitzer WO, Skovron ML, Salmi LR, et al. Scientific monograph of the quebec task force on whiplash-associated disorders: redefining whiplash and its management. Spin.20, 1S-73S; 1995.
6. Falla D. Unravelling the complexity of muscle impairment in chronic neck pain. Man Ther 9(3):125–133, 2004.
7. Lee H, Nicholson LL, Adams RD. Neck muscle endurance, self-report, and range of motion data from subjects with treated and untreated neck pain. Journal of Manipulative and Physiological Therapeutics; 28:25-32, 2005.
8. Bogduk N. Neck pain. Aust Fam Physician, 13: 26-30, 1984.
9. Gordon SJ, Trott P, Grimmer KA: Waking cervical pain and stiffness, headache, scapular or arm pain: gender and age effects. Aust Physiotherapy, 48: 9-15, 2002.
10. McDonnell MK, Sharmann SA, Van Dillan L: A specific exercise program and modification of postural alignment for treatment of cervicogenic headache: A case report, J Orthop Sports Phys Ther; 35:3-15, 2005.
11. Silverman JL, Rodriquez AA, Agre JC. Quantitative cervical flexor strength in healthy subjects and in subjects with mechanical neck pain [see comments]. Arch Phys Med Rehabil, 72:679–68, 1991.
12. Treleaven J, Jull G, Atkinson L. Cervical musculoskeletal dysfunction in post-concussional headache. Cephalalgia; 14:273–282, 1994.
13. Barton PM, Hayes KC. Neck flexor muscle strength, efficiency, and relaxation times in normal subjects and subjects with unilateral neck pain and headache. Arch Phys Med Rehabil; 77: 680–687, 1996.
14. Placzek JD, Pagett BT, Roubal PJ, Jones BA, McMichael HG, Rozanski EA, Gianotto KL. The influence of the cervical spine on chronic headache in women: a pilot study. J Man Manipulative Ther; 7:33–9, 1999.
15. Cagnie B, Cools A, De Loose V, Cambier D, Danneels L. Differences in isometric neck muscle strength between healthy controls and women with chronic neck pain: the use of a reliable measurement. Archives of Physical Medicine and Rehabilitation; 88:1441-1445, 2007.
16. Falla D, Rainoldi A, Merletti R, Jull G. Myoelectric manifestations of sternocleidomastoid and anterior scalene muscle fatigue in chronic neck pain patients. Clin Neurophysiol; 114:488–95, 2003.
17. Falla A, Jull G, Hodges P, Vicenzino B. An endurance strength training regime is effective in reducing manifestations of cervical flexor muscle fatigue in females with chronic neck pain. Clinical Neurophysiology, 117:828-837, 2006.
18. Price DD, McGrath PA, Rafii A, Buckingham B. The validation of visual analogue scales as ratio scale measures for chronic and experimental pain. Pain, 17:45-56, 1983.
19. Wlodyka-Demaille S, Poiraudeau S, Catanzariti JF, Fermanian J, Rannou F, Ravel M. The ability to change of three questionnaires for neck pain. Spine, 71:317-343, 2004.
20. Ylinen J, Salo P, Nykanen M, Kautiainen H, Hakkinen A. Decreased isometric neck muscle strength in women with chronic neck pain and repeatability of neck strength measurements. Arch Phys Med Rehabil, 85:1303-1311, 2004.
21. Falla D, Farina D, Graven-Nielsen T. Experimental muscle pain results in reorganization of coordination among trapezius muscle subdivisions during repetitive shoulder flexion. Experimental Brain Research; 178:385-93, 2007.
22. Lluch E, Arguisulas MD, Quesada OC, Noguera EM, Puchades MP, Perez Rodriguez JA, Falla D. Immediate effects of active versus passive scapular correction on pain and pressure pain threshold in patients with chronic neck pain. J Manipulative Physiol Ther ,xx:1-7, 2014.
23. Hislop H, Montgomery J. Daniels and Worthinghams muscle testing: techniques of manual examination. 8th ed Philadelphia: W.B. Saunders, 2002.

24. McArdle W, Katch F, Katch V. Exercise physiology. Baltimore, MD: Williams and wilkins, 1996.
25. Gogoi P. Effect of the cervical endurance training program in mechanical neck pain. Int J physiother. 2(5):724-730; 2015.
26. Chiu TT, Lam TH, Hedley AJ. A randomized controlled trial on the efficacy of exercise for patients with chronic neck pain. Spine, 30:1-7, 2005.
27. Takala EP, Viikari Juntura E, Tynkkynen EM: Dose group gymnastics at the work place help in neck pain? A controlled study. Scandinavian Journal of Rehabilitation Medicine, 26: (1), 17-20, 1994.
28. Viljanen M, Malmivaara A, Uitti J, Rinne M, Palmroos P, Laippala P. Effectiveness of dynamic muscle training, relaxation training, or ordinary activity for chronic neck pain: randomized controlled trial. BMJ, 327-475, 2003.
29. Jull G, Falla D, Vicenzino B, Hodges PW. The effect of therapeutic exercise on activation of the deep cervical flexor muscles in people with chronic neck pain. Manual Therapy, 14(6): 696-701; 2009.
30. Borisut, S., Vongsirinavarat, M., Vachalathiti, R., & Sakulsriprasert, P. Effects of strength and endurance training of superficial and deep neck muscles on muscle activities and pain levels of females with chronic neck pain. Journal of physical therapy science, 25(9), 1157-1162, 2013.
31. Ylinen J, Takala EP, Nykanen M, Hakkinen A, Malkia E, Pohjolainen T, Karppi SL, Kautiainen H, Airaksinen O. Active neck muscle training in the treatment of chronic neck pain in women: a randomized controlled trial. JAMA; 289: 2509–2516, 2003.
32. Gross AR, Hoving JL, Haines TA, et al. Cochrane review of manipulation and mobilization for mechanical neck disorders. Spine, 29:1541-1548, 2004.
33. Borghouts JA, Koes BW, Vondeling H, Bouter LM. Cost-of illness of neck pain in the Netherlands in 1996. Pain, 80: 629- 665, 1999.
34. Slcargreen FJ, Carlsson PG, ObergBF. One year followup comparison of the cost and effectiveness of chiropractic and physiotherapy as primary management for back pain. Spine, 17: 1875-1881; 1998.
35. Korthals-de Bos BC, Hoving JL, Van Tulder MW, et al. Cost effectiveness of physiotherapy, and general practitioner care for neck pain: economic evaluation alongside a randomized controlled trial. BMJ, 326:911; 2003.
36. Bronfort G, Evans R, Nelson B, Aker PD, Goldsmith CH, Vernon H. A randomized clinical trial of exercise and spinal manipulation for patients with chronic neck pain. Spine; 26:788–797, 2001.
37. Jull G, Trott P, Potter H, Zito G, Niere KR, Shirley D, et al. A randomized controlled trial of exercise and manipulative therapy for cervicogenic headache. Spine, 27: 1835-1878; 2002.
38. Gross AR, Goldsmith C, Hoving JL, et al., Conservative management of mechanical disorders: A Systematic review. J Rhumatol 34:1083-1185, 2007.
39. Carroll LJ, Hogg-Johnson S, van der Velde G, Haldeman S, Holm LW, Carragee EJ, Hurwitz EL, Cote P, Nordin M, Peloso PM, Guzman J, Cassidy JD. Course and prognostic factors for neck pain in the general population: results of the bone and joint decade 2000–2010 Task force on neck pain and its associated disorders. Spine (Phila Pa 1976) 33(4):S75–S82, 2008.
40. Helew A, Goldsmith CH, Smythe HA, Lee P, Obright K, Stitt L. Effect of therapeutic exercise and sleeping neck support on patients with chronic neck pain: a randomized clinical trial. Journal of Rheumatology. 34(1): 151-158; 2007.
41. Kay TM, Gross A, Goldsmith CH, Rutherford S, Vos S, Hoving JL, Bronfort Gert, Santaguida PL. Exercise for mechanical neck disorder (review). Coharance database of systematic review, (8):1-160; 2012.
42. Hemmila HM. Bone setting for prolonged neck pain: a randomized clinical trial. Journal of Manipulative and Physiological Theraputic 28:508-525, 2005.
43. Skillgate E, Vingard E, Alfredssone L. Naparpathic manual therapy evidence based care for back and neck pain: A randomized, controlled trial. Clinical Journal of Pain 23:431-439, 2007.
44. Jordan A, Bendix T, Nielsen H, Hansen FR, Host D, Winkel A: Intensive training, physiotherapy, or manipulation for patients with chronic neck pain. A prospective, single –blinded, randomized clinical trial. Spine 23: (3), 311-317, 1998.
45. Taimela S, Takala EP, Asklof T, Seppala K, Parviainen S: Active treatment of chronic neck pain: A prospective randomized intervention. Spine, 25: (8), 1021- 1027, 2000.
46. Kjellman G, Oberg B. A randomized clinical trial comparing general exercise, Mckenzie treatment and a control group in patients with neck pain. Journal of Rehabilitation Medicine. 34:183-190, 2002.
47. Hoving JL, de Vet HCW, Koes BW, van Mameren H, Deville WLJ, van der Windt DA et al. Manual therapy, physical therapy, or continued care by a general practitioner for patients with neck pain. Long term results from a pragmatic randomized clinical trial. Clinical Journal of Pain, 22: 370-377, 2006.
48. Vasseljen O Jr, Johansen BM, Westgaard RH: The effect of pain reduction on perceived tension and EMG-recorded trapezius muscle activity in workers with shoulder and pain. Scandinavian Journal of Rehabilitation Medicine, 27: (4), 243-252, 1995.
49. Bagheri-Nesami M, Esmaeili R, Tajari M. INTRAVENOUS MEDICATION ADMINISTRATION ERRORS AND THEIR CAUSES IN CARDIAC CRITICAL CARE UNITS IN IRAN. Mater Sociomed. 2015 Dec;27(6):442-6. doi: 10.5455/msm.2015.27.442-446.
50. Miladinia M, Zarea K, Baraz S, Nouri EM, Pishgooie AH, Gholamzadeh Baeis M. Pediatric nurses' medication error: The self-reporting of frequency, types and causes. International Journal of Pediatrics. Volume 4, Issue 3, 2016, Pages 1439-1444.
51. Raei B, Ghadi A, Bozorgian AR. Heat integration of heat exchangers network using pinch technology. (2010) 19th International Congress of Chemical and Process Engineering, CHISA 2010 and 7th European Congress of Chemical Engineering, ECCE-7
52. Saei Ghare Naz M, Kariman N, Ebadi A, Ozgoli G, Ghasemi V, Rashidi Fakari F. Educational interventions for cervical cancer screening behavior of women: A systematic review . Asian Pac J Cancer Prev. 2018 Apr 25;19(4):875-884.
53. Niaki EA, Arab S, Shamshiri A, Imani MM. The effect of the buccal corridor and tooth display on smile attractivenessAustralian orthodontic journal. Volume 31, Issue 2, 1 November 2015, Pages 195-200.
54. Imani MM, Jalali A, Dinmohammadi M, Nouri P. The effect of orthodontic intervention on mental health and body image. The effect of orthodontic intervention on mental health and body image. Volume 6, Issue 6, June 2018, Pages 1132-1137.
55. Alimoradi Z, Kariman N, Ahmadi F, Simbar M. Preparation for sexual and reproductive self-care in Iranian adolescent

girls: a qualitative study. Int J Adolesc Med Health. 2017 May 17;30(1). pii: /j/ijamh.2018.30.issue-1/ijamh-2016-0094/ijamh-2016-0094.xml. doi: 10.1515/ijamh-2016-0094.

56. Mirnia K, Samad Soltani T, Rezaei M, Heidarzadeh M, Piri Z. Design and evaluation of electronic briefs of neonatal intensive care unit in Taleghani hospital, Tabriz, Iran. (2014) Global journal of health science, 6 (5), pp. 125-131.
57. Issazadeh K, Ali Abadi MA, Kazemi Darsanaki R, Alikhani F, Dadras H, Tajehmiri A. Isolation, identification and analysis of probiotic properties of Lactobacillus spp from traditional yoghurts in North of Iran. (2013) Journal of Pure and Applied Microbiology, 7 (4), pp. 2965-2971.
58. Ramazani A, Hamidnezhad R, Foroumadi A, Mirzaei SA, Maddahi S, Hassanzadeh SM. In vitro antiplasmodial activity and cytotoxic effect of (Z)-2- benzylidene-4, 6-dimethoxybenzofuran-3(2H)-one derivatives. (2016) Iranian Journal of Parasitology, 11 (3), pp. 371-376.
59. Ravaji B, MashadizadeS, Hashemi A. Introducing optimized validated meshing system for wellbore stability analysis using 3D finite element method. Journal of Natural Gas Science and Engineering. Volume 53, May 2018, Pages 74-82.
60. Tavan H, Sayehmiri K, Taghinejad H, Mousavi Moghadam SR. Factor Analysis of Spiritual Health on the Islam Viewpoint. Iran J Public Health. 2015 Nov;44(11):1572-3.
61. Mousavimughaddam SR. Healthy man and its role in the spiritual health and mental health from the viewpoints of rene descartes and allamah tabatabaei based on the interpretative attitude of almizan. 2014, Journal of Zanjan University of Medical Sciences and Health Services. 22(90), pp. 33-44
62. Hosseini SA, Ashrafi MR, Heidari M. Diagnosis of an abnormality in brain MRI. Iranian Journal of Pediatrics,2014. 24(6), pp. 779-780.
63. Samadian M, Nazparvar B, Haddadian K, Rezaei O, Khormaee F. The anatomical relation between the superior sagittal sinus and the sagittal suture with surgical considerations. Clin Neurol Neurosurg. 2011 Feb;113(2):89-91. doi: 10.1016/j.clineuro.2010.09.006. Epub 2010 Oct 16.
64. Sharifi G, Bakhtevari MH, Samadian M, Alavi E, Rezaei O. Endoscopic Surgery in Nonhydrocephalous Third Ventricular Colloid Cysts: A Feasibility Study. World Neurosurg. 2015 Aug;84(2):398-404. doi: 10.1016/j.wneu.2015.03.033. Epub 2015 Mar 28.
65. Samadian M, Bakhtevari MH, Nosari MA, Babadi AJ, Razaei O. Trigeminal Neuralgia Caused by Venous Angioma: A Case Report and Review of the Literature. World Neurosurg. 2015 Sep;84(3):860-4. doi: 10.1016/j.wneu.2015.04.063. Epub 2015 May 9.
66. Bakhtevari MH, Sharifi G, Jabbari R, Shafizad M, Rezaei M, Samadian M, Rezaei O. Giant leaking colloid cyst presenting with aseptic meningitis: Review of the literature and report of a case. World Neurosurg. 2015 Dec;84(6):1997-2001. doi: 10.1016/j.wneu.2015.06.064. Epub 2015 Jul 2.
67. Shushizadeh MR. Persian gulf bioactive natural drugs. 2014. Jundishapur Journal of Natural Pharmaceutical Products. 9(2).
68. Shushizadeh MR, Azizyan S. Solvent-free preparation of novel 2-[phenyl (pyridine-2-ylamino) methyl] phenols as pseudo-Betti processor for natural products. 2014. Jundishapur Journal of Natural Pharmaceutical Products. 9(4).
69. Sohrabi N, Akhi MT, Farajnia S, Nahaei MR, Rezaei MA. PER-1-type extended-spectrum ß-lactamase producing Acinetobacter baumannii. Pakistan Journal of Medical Sciences.2010. 26(4), pp. 769-772
70. Badri R, Shushizadeh MR A new method for the oxybromination of aromatic compounds with copper(II)bromide and potassium dichromate. 2005. Phosphorus, Sulfur and Silicon and the Related Elements. 180(2), pp. 533-536.
71. Badri R, Shushizadeh MR. An efficient tandem oxidative-protection reaction of benzylic alcohols to corresponding arylhydrazones and oximes. 2007. Phosphorus, Sulfur and Silicon and the Related Elements. 182(3), pp. 601-605
72. Gholami S, Tabatabaei M, Sohrabi N. Comparison of biofilm formation and antibiotic resistance pattern of Pseudomonas aeruginosa in human and environmental isolates. Microbial Pathogenesis. 2017. 109, pp. 94-98
73. Ghaderi N, Taymoori P, Yousefi F, Nouri B. The prevalence of Cigarette Smoking among adolescents in Marivan City- Iran: Based on health belief model (HBM). International Journal of Pediatrics. 2016. 4(9), pp. 3405-3414
74. Mohammadi S , Ghajari H , Valizade R , Ghaderi N , Yousefi F , Taymoori P , Nouri B. Predictors of smoking among the secondary high school boy students based on the health belief model. International Journal of PreventiveMedicine.2018.8.
75. Mahmoodzadeh H, Nasimfar A, Sadeghi E, Macooie A, Gazavi A, Rasouli J., …, Nikibakhsh A. Study of Vitamin D level in children with Non-specific Musculoskeletal Pain. International Journal of Pediatrics. 2017. 5(3), pp. 4533-4540
76. Moradian M, Fard MZ, Mozaffari K. Atrial rhabdomyoma: A case report. Iranian Heart Journal. . 2014 15(2), pp. 39-42.
77. Moradian M. Fetal circulation. Comprehensive Approach to Adult Congenital Heart Disease. 2014.pp. 13-17.
78. Nazer MR, Ghanadi K, Goodarzi G, Sajedi Y, PourniaY, Darvishi M. Prevalence of Chlamydia pneumoniae by Real time PCR in referred patients with respiratory syndrome to clinic center of infectious diseases. Life Science Journal. Volume 11, Issue 1 SPECL. ISSUE, 2014, Article number 15, Pages 87-92.
79. Nazer MR, Ghanadi K, Goodarzi G, Sajedi Y, PourniaY, Darvishi M. Prevalence of Chlamydia pneumoniae by Real time PCR in referred patients with respiratory syndrome to clinic center of infectious diseases. Life Science Journal. Volume 11, Issue 1 SPECL. ISSUE, 2014, Article number 15, Pages 87-92.
80. Makhdoomi Arzati M, Mohammadzadeh Honarvar N, Saedisomeolia A, Anvari S, Effatpanah M, Makhdoomi Arzati R, Yekaninejad MS, Hashemi R, Djalali M. The Effects of Ginger on Fasting Blood Sugar, Hemoglobin A1c, and Lipid Profiles in Patients with Type 2 Diabetes. Int J Endocrinol Metab. 2017 Aug 27;15(4):e57927. doi: 10.5812/ijem.57927. eCollection 2017 Oct.
81. Samadian M, Alavi E, Sharifi G, Rezaee O, Faramarzi F. Extension of Echinococcal spinal infestation extra- and intradurally after a decade of extinction. Journal of Neurosurgical Sciences. . 2010 54(4), pp. 143-148.
82. Badri R, Shushizadeh MR. Silica sulfuric acid as an efficient reagent for bamberger rearrangement of phenyl hydroxylamine derivatives in solvent-free conditions. Asian Journal of Chemistry. . 2007 19(6), pp. 4661-4664.
83. Lubin AS, Snydman DR, Ruthazer R, Bide P, Golan Y. Predicting high vancomycin minimum inhibitory concentration in methicillin-resistant Staphylococcus aureus bloodstream infections. Clin Infect Dis. 2011 Apr 15;52(8):997-1002. doi: 10.1093/cid/cir118.
84. Nejad DB, Azandeh S, Gholami MR, Gharravi AM, Zhaleh M. Superficial palmar arch with Persistent median artery. Journal of the Anatomical Society of India.2016. 65(2), pp. 175-176
85. Varaa N, Azandeh S, Khorsandi L, Bijan Nejad D, Bayati V, Bahreini A. Ameliorating effect of encapsulated hepatocyte-like cells derived from umbilical cord in high mannuronic alginate scaffolds on acute liver failure in rats. Iranian Journal of Basic Medical Sciences. 2018. 21(9), pp. 928-935