

The Effect of Selected Exercise Program on Musculoskeletal Pain of Neck and Shoulder in Violinist

Neda Alinia^a, Ali Asghar Norasteh^b, Ali Shamsi Majlan^b, Hamed Zarei^{b*}

^a Department of Corrective Exercises and Sports Injury, and Faculty of Physical Education and Sport Sciences, Karaj Branch, Karaj, Iran; ^b Department of Corrective Exercises and Sports Injury, and Faculty of Physical Education & sport sciences, University of Guilan, Rasht, Iran

*Corresponding Author: Hamed Zarei. Department of Corrective Exercises and Sports Injury, and Faculty of Physical Education & sport sciences, University of Guilan, Rasht, Iran. **Tel:** +98-9395995280; **E-mail:** zareei.h@yahoo.com

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Abstract

Introduction: Violinists spend considerable amount of time on daily exercises. Consistency of playing the instrument at a stationary position during daily exercises leads to skeletal disorders. This phenomenon is characterized by episodic pain and mal-alignment. Shoulder and neck pains have been seen as a common symptom among violinists. **Materials and Methods:** The methodology of the current research is based on pre-test and post-test methods. Statistical population of this research has been chosen randomly from female violinists in Guilan Province, Iran. Thirteen female violinists participated in this study (age: 24.76±4.79, weight: 63.38±16.47, height: 168.53±6.27, BMI: 23.61±3.1). Standardized Nordic questionnaires for the analysis of musculoskeletal symptoms and Visual Analogue Scale (VAS) to determine pain's severity were utilized respectively. To testify data normalization, Shapiro-wilk method was adopted. For evaluating the training effectiveness on shoulders and neck pain, T-test for normal data and Wilcoxon for abnormal data were employed respectively. **Results:** The result of the study showed a significant reduction of pain after 8 weeks of training (P= 0.001). **Conclusion:** In conclusion, performing the training program can lead to shoulder and neck pain reduction in violinists. Given the limitation of the current study, further study will be required to achieve more comprehensive final results.

Keyword: Selected Exercises; Violinist; Shoulder Pain; Neck Pain

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Introduction

Posture is defined as the relative disposition of body parts in relation to each other at a given moment (1). Postural abnormalities are adverse changes in the musculoskeletal structure and natural order of the stature caused by improper functioning of muscles or joints, environmental factors, and improper motor habits. These abnormalities can be resolved by removing the underlying factors (2).

Musculoskeletal abnormalities caused by intensive workouts or working conditions are very common in our time. This has attracted much scholarly interest which demands some preventive measures. Studies demonstrate that the majority of work-related musculoskeletal disorders are cervical pains (3), making it an imperative to care more for pains in this area. Further, musculoskeletal abnormalities from repetitive work, abnormal

working postures, intensive labor, and mismatch of tools with body size are factors that cause work-related disorders (4). Gender is also a key factor as women are more prone to musculoskeletal abnormalities (5).

Musicians suffer from a wide range of health problems as they are exposed to high physical and mental demands at work (6). Those who play wind instruments may suffer from the pressure exerted on teeth and pupils, while those who play stringed instruments are at risk of muscular pains and inflammation of skin (7). These, again, are more prevalent in women than in men (8). Zaza and Farewell reported that musculoskeletal abnormalities are really serious health problems among musicians (9). Similarly, Nyman *et al.* studied 235 musicians from a Sweden Orchestra. They divided them into four groups based on arm position and duration of performance. They reported that cervical pains are more common among those who play viola, violin, flute, and trumpet and

Table 1. Examples of selected exercises provided for subjects

Neck strengthening exercise
Exercise 1: the subject puts his hand on the forehead, and pushes the head forward while keeping that with the hand.
Exercise 2: the subject puts his hand at the back of the head and prevents head extension by isometric contraction of extensor muscles.
Exercise 3: the subject rests his head on the right hand and prevents bending head to the right by isometric contraction of lateral flexors of the neck.
Exercise 4: the subject rests his head on the left hand and prevents bending head to the left by isometric contraction of lateral flexors of the neck
Shoulder strengthening exercise
Exercise 1:
The subject stands erect and looks straight ahead, with both hands hanging at either sides. Then, he pulls up resistance bands.
Exercise 2:
The subject is seated on a chair and keeps his head in an anatomically neutral position. Then, he bends 20-30°. With his elbows bent at 5°, he puts his hands on the ground. The resistance band lied under the feet, while the subject holds that in both hands. He moves the hands up and down, parallel to the shoulder.
Neck positioning exercises (6 sets at 15 repetitions)
These postural exercises activate deep neck muscles.
Exercise 1: the subject lies on his back and puts a rolled towel under his head. He presses the head to the towel and gets back to the initial position. Then, the towel is unrolled to increase exercise intensity as the neck muscles become more active.
Exercise 2: the subject sits and keeps his head in a neutral position (straight spinal column). He presses the head with his hand and the head resists the rotational pressure.
Stretching exercises
Bending the head forward, bending the head backward, bending the head to the right, bending the head to the left

those who hold their arms in a higher position (10). Steinmentz *et al.* also examined the correlation between the severity of pain and risk factors such as type of musical instrument, age and fear among 720 musicians. They reported that 89.5% (408 musicians) had musculoskeletal pain, 62.7% had experienced it within last 3 months, and 8.6% had experienced it at the time of study (11). Thaele (2016) studied prevalence of musculoskeletal abnormalities among Western classical instrumentalists (72) in South African College of Music and found that 88.5% of participants had experienced it at some point in their lives (12).

The effects of exercise on reducing cervical pain have been extensively studied. Gram *et al.* randomly sampled 351 subjects and assigned them into three groups, applying exercise routines on two groups. Patient self-reports were the measure for pain. Exercises continued for 20 weeks and proved effective in reducing pain in the neck (10-20%) and head (30%) (13). Chan *et al.* studied the effects of a 10-week exercise program on playing-related musculoskeletal disorders among professional musicians. The participants reported that frequency and severity of pain diminished after this intervention program (14). Akbari *et al.* compared the effects of specific exercises for stabilizer muscles and dynamic exercises in correcting dysfunction and chronic pain in the neck. The participants had been randomly assigned into stabilizing or dynamic exercise groups of 13 samples. The intervention program involved twenty-four 45-minute sessions over 12 weeks. The results indicated that both programs increased

the strength of superficial and deep neck muscles as well as neck range of motion, and mitigated the neck pain and dysfunction. Meanwhile, stabilizing exercises were more effective (15). Soltani *et al.* compared the effects neuromuscular facilitation exercises and traditional exercises on pain and strength of smooth and flexible neck muscles in patients with chronic cervical pain. The samples were assigned into control and exercise groups, one receiving proprioceptive neuromuscular facilitation exercises of neck and upper extremities while the other receiving traditional strengthening-stretching exercises. The control group received a notebook containing proper posture for daily activities. The pain intensity and muscular strength of the neck were respectively measured by VAS and an isometric device. The results of the study indicated that neuromuscular facilitation exercises were more effective than traditional exercise protocols in reducing pain and recovering muscular strength (16).

Studies suggest that musicians usually face some abnormalities of any kind as they mostly use a single organ in performing and tend to bend their neck in one direction to hold the instrument. Thus, they are more likely to experience muscular pain and contraction, as well as cervical pain. However, no specific study has examined the effects of intervention protocols on cervical musculoskeletal pain in instrumentalists. It is, therefore, necessary to develop protocols to prevent or reduce possible abnormalities. The present study examines the effects of exercise programs on cervical musculoskeletal pain in violinists.

Table 2. Average and Standard Deviation ($\bar{X} \pm SD$) of Individual Characteristics of the Subjects

Variables	Average	Standard deviation
Age (year)	24.76	4.79
Weight (kg)	63.38	16.47
Height (cm)	168.53	6.27
Body mass index (kg/m ²)	23.61	3.1

Table 3. Wilcoxon test results for neck pain before and after the training

Statistics	Average	Standard deviation	Z	Sig
Before training	2.76	0.72	-3.250	*0.001
After training	1.30	0.48		

* Indicates a significant relationship at the level of $P \leq 0.05$

Table 4. T-test for correction of shoulder pain before and after the training

Statistics	Average	Standard deviation	Df	t	Sig
Before training	3.61	1.12	0.21	9.12	*0.001
After training	1.69	0.94			

* Indicates a significant relationship at the level of $P \leq 0.05$

Materials and Methods

Participants

This is a semi-experimental study. The population of the study consists of female violinists from Rasht, Iran, from whom 13 samples were non-randomly selected and assigned into an exercise protocol group.

The inclusion criteria were 3-10 years of performance, scores 3-5 in VAS questionnaire, female gender, willingness to participate in the study, ability to perform exercises, written consent, and no referral to doctor or use of medicine during the study. Exclusion criteria were history of cardiovascular problems, cervical spinal disorders, cervical surgery, pregnancy, and unwillingness to continue the study.

The participants filled in medical and sports questionnaire and signed the written consent form. They were informed about the objectives of the study and were ensured that the protocol would not harm them.

Data collection

Nordic Musculoskeletal Questionnaire (MSQ) includes items that measure pain in neck, shoulder, higher back, elbow, and wrist (17). It was used in the present study to explore cervical pain in the subjects.

The Visual Analogue Scale (VAS) is a measurement instrument to assess pain. It consists of a straight line of 10-cm with extremes of 0 'no pain at all' and 10 'pain as bad as it could be' (18). The conventional pretest-posttest self-report measurement design was applied on the subjects where the scale range of pain within 3-5 was used (19, 20).

Training program

The subjects performed an exercise protocol (static stretching exercises and strengthening exercises isotonic and isometric) of 8 weeks (3 times a week for 30 minutes) under the supervision of the researcher. The exercise routine included warmup (3-5 min), stretching activities (5-10 min), strengthening activities (10 min), and cooling down (3-5 min), followed by 10 seconds of rest time. The workout intensity was modulated by the principle of overload (19).

Stretching exercises program: Subjects performed 3 sets of 10-second stretching exercises for 5-10 minutes and rested for 5 seconds before starting the next set (21).

Neck strengthening exercise program: Subjects maintained 15-30 second contraction at 3 sets for 45-90 seconds. Based on the principle of overload, the exercise routine started with 15-seconds and reached 30 at the end. The subjects performed stretching exercises at the end of each program to return to the initial position (19).

Shoulder strengthening exercise program: Subjects performed 2-4 sets of average (12-15) and high (15-20) repetitions based on the principle of overload. The average and high intensity programs were followed by 1 and 2 minutes of rest, respectively. Table 1 summarizes exercise routines for subjects.

Statistical analysis

All values are presented as mean $\pm$ standard deviation (SD). Pre- and post-values for the dependent variables were analyzed to determine if the distributions were normal using the Shapiro-Wilk Normality test. Pain intensity before and after the protocol was compared using independent t-test.

Abnormal data were analyzed by Wilcoxon Test. Data analysis was performed by SPSS 20.0 (Version 20, SPSS Inc., Chicago, IL) at a significance level of $P \leq 0.05$.

Results

The variables of this study were normal by the Kolmogorov-Smirnov test ($P > 0.05$). Table 1 details the demographic characteristics of the participants. The participant's characteristics include age, height, weight, and body mass index. Table 1 presents the mean and standard deviation of CV angle in the sitting and standing positions, pain intensity (VAS), the score of NDI, and the history of the neck pain.

The results of Pearson correlation test revealed a significant direct correlation between CV angles in two standing and sitting positions ($R = 0.626$, $P < 0.05$). Also, a significant reverse correlation was found between CV angle in sitting positions and the history of neck pain ($P < 0.05$) (Table 2).

Discussion

The present study examined the impact of training exercises on musculoskeletal pain in neck and shoulder of violinists. According to the results, the exercise protocol significantly decreased the pain severity ($P = 0.001$) in the participants.

Effects of training exercises (stretching, strengthening, proprioception, etc.) on pain status have been extensively studied and reported to have positive effects on mitigating pain severity. Our results are in agreement with findings of Ylinen *et al.* as well as Falla *et al.* (23, 24). Ylinen *et al.* reported that strengthening and resistance exercises decrease neck pain (23). Elsewhere, Falla *et al.* stated that people with neck pain have difficulty in maintaining head position. However, a period of therapeutic exercises significantly improves their resistance, strength, range of motion, proprioception, movability, and the ability to maintain head position (24). In chronic neck pain, the muscle is seized by pain and is weakened as it undergoes structural changes. This demands strengthening exercises to reverse the morphological changes in the neck muscle (25). Improved posture of the neck and head, through strengthening exercises, reduces pressure on the neck. Our results showed that combined strengthening and stretching training exercises reduced pain in violinists.

The results of our study also indicated that the training protocol had significant effects on decreasing shoulder pain.

This is in agreement with the findings of Ackermann *et al.*, Andersen *et al.*, and Lidegaard *et al.* (26-28). Ackermann *et al.* examined the effects of a training program on musculoskeletal abnormalities in musicians. They collected data through a questionnaire and measured muscle strength using a dynamometer, and reported that the protocol improved shoulder muscle strength. Also, the musicians were more eager to play the instruments (26).

Nevertheless, violinists complain mostly about neck and shoulder pains. This is because they have to maintain a static posture for a long time and bear continuous pressure on neck and shoulder while performing. This leads to a state of reduced blood supply to cervical and scapulohumeral muscles, particularly supraspinatus and infraspinatus. Further, trapezius muscle has more activity in patients with neck and shoulder pains. Studies suggest that strengthening exercises enhance blood flow and, consequently, decrease pain while increasing muscle strength (29). This is in agreement with our findings. Andersen *et al.* concluded in their study that progressive strengthening exercises could increase muscle strength and reduce pain severity plus frequency in neck and shoulder (27). Lidegaard *et al.* examined the effects of short-term daily strengthening exercises on muscular activity of neck and shoulder in employees with chronic neck pain (28). The authors realized that intensive strengthening exercises may promote muscular activity pattern, but their long-term effects enhance muscular rest time and mitigate pain. The literature is abundant with findings that reveal the positive impacts of strengthening, endurance, flexibility, and isometric exercises on decreasing neck and shoulder disorders (30, 31). The pain-alleviating mechanisms of training exercises include production of natural hormones that inhibit pain (such as endorphins and beta-endorphins) and raising pain threshold. Overall, physical activity and exercise programs are key healthcare measures in dealing with and reducing chronic musculoskeletal pains (31).

The present study suffers from certain limitations such as lack of control over mental condition and incentives of participants, willingness of participants for correct performance of the exercises, individual differences, working conditions, daily activities, nutrition, as well as social, economic, cultural, and health differences of participants. However, its strong point has been sampling the subjects in terms of gender, age, training schedule, and violin performance duration.

Conclusion

The results of our study revealed that strengthening and stretching exercises reduce pain in neck and shoulder. Therefore, violinists who do these exercises feel less pain in these areas and enjoy a higher muscular endurance time during their performance.

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All authors made substantial contributions to conception, design, acquisition, analysis and interpretation of data.

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