The Prevalence of Musculoskeletal Disorders of Traditional Korean String Instrument Player

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ABSTRACT

Objective: The aim of this study is to investigate the prevalence of musculoskeletal disorders of traditional Korean string instrument player playing the Gayageum, Geomungo, Ajaeng and Haegeum. **Background**: Many instrument players have suffered from the musculoskeletal pain of various body parts. However, there is no research on the prevalence of musculoskeletal disorders of traditional Korean string instrument players. **Method**: A questionnaire was developed to investigate pain symptoms of musculoskeletal problems through focus group interview. The questionnaire consisted of four parts: demographic factors, performance factors, pain symptoms and experience of musculoskeletal disorders. For the survey, 86 expert players participated. The data from the survey were analyzed by correlation analysis and chi-square analysis. **Results**: The symptoms of musculoskeletal disorders and severe pain were observed at neck, shoulder, back and knee. These problems were statistically related to the factor of height in Gayageum and Geomungo. In addition, the pain symptoms in Geomungo were analyzed according to age and career. **Conclusion:** The symptoms of playing-related musculoskeletal disorders of traditional Korean musical players were prevalently observed at neck, shoulder, back and knee. In addition, these symptoms were related to the various demographic factors such as age, body height, BMI, career, sex, hobby and stretching. **Application**: The results of this study can be used as the preliminary data for preventing the musculoskeletal injuries of traditional Korean musical instrument players.

Keywords: Korean traditional string instrument, musculoskeletal disorder, pain symptoms, questionnaire.

1. Introduction

The issue of musician health problem was dealt with by international conference at Aspen in 1983. Since that time, many researchers have conducted researches on instrument players' health problems(Hoppmann, 2001). Although complaints of nerve and musculoskeletal pain related to playing musical instruments have been reported for many decades, searches for solving the problems were a relatively recent issue(Furuya et al., 2006). Recently, instrumental musicians are referred to as a special risk group for musculoskeletal pain(Hansen and Reek, 2006).

A large percentage of instrument players have suffered from the musculoskeletal pain of various body parts. The chief causes of musculoskeletal pain are the problems related to incorrect posture, irregular lifestyle, hard technique, insufficient rest and excessive string force when playing instruments resulting in musculoskeletal injuries(Hansen and Reek, 2006).

The musculoskeletal disorders of instrument players mostly occur in the upper extremities. Anderson(1988) observed string instrument players suffered from symptoms of muscle damage, sprain and tendinitis at upper arm, neck and shoulder. In addition, their symptoms begin with mild pain, tingling and can become motor paralysis. Cayea and Manchester(1998) reported that elite piano players also experienced high physical loads predispose to musculoskeletal disorders related to upper-extremity injuries.

Newmark and Hochberg(1987) observed that musicians such as keyboard players, string players and woodwind players did not feel the symptoms like musculoskeletal disorder in daily life. However, they experienced an involuntary action like a dystonia in fingers.

Many researchers have investigated the prevalence of playing-related musculoskeletal disorders. Pratt et al.(1992), Larsson et al.(1993), Roach et al.(1994) and Zara and Farewell(1997) reported prevalence of musculoskeletal disorders with instrument music related to practice from 39 to 87 % of musicians. Fry et al.(1988), Lockwood(1988), and Grieco et al.(1989) reported instrumental music with musculoskeletal disorders of students player related to prevalence from 34 to 62 % of musicians physical problems. Overuse syndrome was present in up to 50 % of professional symphony orchestra musicians(Fry, 1986). It accounted for 50 % to 80 % of consultations(Dawson, 1988). According to study on percussion and string instruments of orchestra in Korea, Sung et al.(2000) reported the symptom prevalence rate of musculoskeletal disorders according to the NIOSH surveillance criteria, the prevalence rate of viola players was higher than violin players, and the prevalence rate of the bass players was higher than the cello players. In additional, the shoulder was the most prevalent symptom complaint area by a string instrument player(Koh et al., 2006).

Some researchers found that several risk factors affected the musculoskeletal injury. Hansen and Reed3 indicated that the large number of hours musicians spend practicing, rehearsing and performing cause a predisposition to musculoskeletal injury. Robinson et al.(1995) reported the practice with musculoskeletal disorders consist of environment factors (temperature, limited place, equipment, the floor area, light and so on), physical factors (incorrect posture, excessive force, insufficient rest and so on) and personal factors (age, sex, physical suitability, nutrition and so on).

Therefore, the purpose of this study is to investigate the prevalence of musculoskeletal disorders traditional Korean instrument players using a variety of string instruments: Gayageum, Geomungo, Ajaeng and Haegeum.

2. Method

The flow chat of this study is shown in Figure 1. This study consists of focus group interview, questionnaire development and survey using questionnaire.

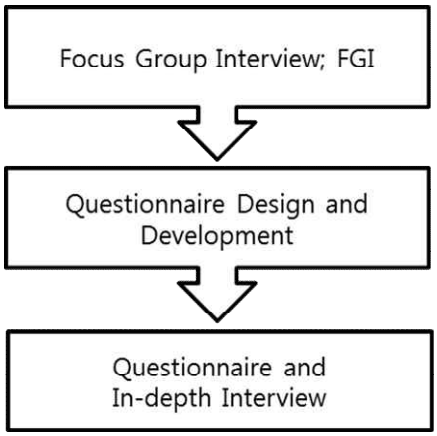

Figure 1. Chart flow for study procedure

2.1 Focus group interview

Focus group with expert player was selected to survey musculoskeletal disorders for Korean traditional instrument players. The focus group consisted of twelve persons who were senior expert members of Korean traditional instrument and an ergonomist. New type of musculoskeletal disorders questionnaire was developed from focus group interview with variant opinions and collection of questionnaire for musculoskeletal disorders risk factors using before.

2.2 Questionnaire development

The final questionnaire for symptom was developed with opinion of researcher and player of Korean traditional instrument. Questionnaire consisted of personal factors, performance factors, physical pain symptoms and experience of musculoskeletal disorders. Personal factors were investigated with age, sex, height, weight, exercise, hobby, drinking and smoking. Performance factors were investigated with length of career, level of performance practice, level of normal practice and stretching. Physical pain symptoms factors were investigated with pain areas,

pain level and pain measure of body. Physical pain symptoms were investigated with pain areas, pain level and pain measure of body. In a musculoskeletal disorders factor, data of disorder experience and treatment were collected.

2.3 Pain symptoms survey

This survey investigated playing members from the national classical music institutes of Seoul, Busan, Namwon and Jindo. 28 respondents for Gayageum, 20 respondents for Geomungo, 11 respondents for Ajaeng and 27 respondents for Haegeum replied for musculoskeletal disorders questionnaire. Korea traditional instrument investigated in questionnaire are depicted in Table 1.

Table 1. Explanation and Postures for each instrument

Instruments	Explanation	Postures	Number of Players
Gayageum	A long zither with 12 strings		28
Geomungo	A fretted bass zither with 6 strings. Plucked with a bamboo stick		20
Ajaeng	A vertical fiddle with two strings		27
Haegeum	A bowed zither		11
Total			86

3. Results

3.1 Demographic characteristics.

One hundred eighty-eight playing members in the national classical music institute were included in this study. The respondents were 17 % male and 83 % female, average age was 34.8±9.3 year, average height was 163.3±6.67cm, mean weight was 54.9±8.58 kg and average BMI of respondents was 17.8±7.26 kg/m^2. 56 % of the total respondents were in an exercise, the strength of exercise was 100 % of them were only in a level of moderate and low. Also, 42 % of the total had a hobby time and most of this group consisted of reading and watching movies. 52 % and 10 % enjoying drinking and smoking in each. 30 % of the respondents stretched before their normal practice (Table 2).

Table 2. Demographic characteristics

Variable	Statistic
Gender	
Male	15 (17 %)
Female	71 (83 %)
Age	34.8±9.3
Physical Index	
Height (cm)	163.3 ±6.67
Weight (kg)	54.9 ±8.58
BMI (kg/m2)	17.8 ±7.26
Exercise	45 (56 %)
Strength	
High level	0 (0 %)
Moderate level	32 (71 %)
Low level	13 (29 %)
Hobby	36 (42 %)
Drinking	45 (52 %)
Smoking	9 (10 %)
Stretching/Warming up	26 (30 %)

3.3 Prevalence of pain symptoms

Due to the playing posture, prevalence of body area appeared differently. Gayageum players complained about their neck (78.6 %), back (75 %), shoulder (71.4 %), and

knee (71.4 %). Geomungo players complained about their shoulder (95 %), neck (80 %), wrist (65 %), and knee (65 %). All the Ajaeng players complained about their neck sore (100 %), shoulder (90.9 %), and back (72.7 %). Haegeum players complained their shoulder (81.5 %), fingers (74.1 %), and neck (70.4 %) All kind of string instrument players were suffering for neck and shoulder (Table 3).

3.4 The analysis of relationship between demographic variables and factors and prevalence of symptoms

Chi-square analysis for nominal data and correlation analysis for numeric data was used to investigate the connection between demographic variables and pain symptoms.

For the string instruments, the significantly related factors with symptoms of musculoskeletal disorder were different for each string instrument. Gayageum and Geomungo were significantly related with height factors, that is, taller players tended to have more musculoskeletal disorder symptoms. In addition, there was a significant relation in age and career factors for Geomungo instrument, and the result showed that older or more career players had less symptoms. Ajaeng and Hageum instruments were significantly related with hobby factor. The surveyed list of hobbies was fitness, yoga, bicycling and swimming (Table 4, 5).

4. Discussion

In this study of Korea traditional string instrument players, we surveyed the personal characteristics, revealed musculoskeletal disorder area and experience then, collected the data of pain symptoms. Thus later, by arranging the fundamental data prevent the musculoskeletal disorders.

Although there has been some similarity with regards to pain symptom areas between Korea traditional instrument players and western instrument players in the literature, this study indicated greater variability in the type of areas in Korean players. For Western players, the upper limbs were the area with mostly experiencing the musculoskeletal disorders(Dawson, 1998). For the Korean players, the knee, neck, shoulder and back were revealed to be vulnerable body parts. These differences were caused by different performance type. Western players usually perform on their feet or on a chair but Korean players mostly sit on the floor with cross legged. Because of this difference, more pain symptoms were found also in lower limbs including back compared with western players. Particularly for the string instrument players, pain symptoms were found in forearm, wrist, fingers, neck, shoulder, back, knee and other body areas. Therefore, various prevention strategy and management are needed for Korean instrument players.

In this study, increasing age and career factors were found to be related significantly to decrease musculoskeletal disorders in Geomungo instrument. This result indicated that aging was not a factor in this case. Instead, this could be explained by mentioning work hardening. Virokannas et al.(1999) analyzed the correlation between work career and musculoskeletal disorder of 55 year old workers. They showed that advanced work career people had less pain

Table 3. Prevalence and degree of pain symptoms in body parts

Prevalence of pain symptoms														
Instruments	Neck	Shoulder	Upper arm	Elbow	Forearm	Wrist	Palm	Finger	Back	Hip	Thigh	Knee	Calf	Ankle/foot
Gayageum	**78.6**	**71.4**	35.7	25.0	35.7	42.9	25.0	39.3	**75.0**	46.4	28.6	**71.4**	32.1	35.7
Geomungo	**80.0**	**95.0**	35.0	10.0	**55.0**	**65.0**	25.0	**60.0**	**60.0**	40.0	25.0	**65.0**	20.0	45.0
Ajaeng	**100.0**	**90.9**	**54.5**	27.3	**54.5**	**54.5**	0.0	45.5	**72.7**	27.3	9.1	**54.5**	9.1	9.1
Haegeum	**70.4**	**81.5**	25.9	22.2	29.6	48.1	18.5	**74.1**	**63.0**	48.1	25.9	**63.0**	40.7	44.4
Degree of pain symptoms														
Gayageum	3.4	3.7	2.0	2.6	2.3	3.3	1.6	2.9	3.9	3.4	3.6	2.8	2.6	2.5
Geomungo	3.8	3.8	1.9	2.0	1.8	2.7	1.2	3.1	**4.0**	2.6	2.6	3.3	2.5	1.8
Ajaeng	3.5	**4.2**	3.2	2.0	2.2	3.0	0.0	3.0	**4.3**	4.3	2.0	3.0	1.0	3.0
Haegeum	**4.0**	**4.0**	3.0	2.3	3.0	3.4	2.0	**4.5**	**4.0**	3.6	2.0	3.0	2.5	3.4

Boldfaced numbers indicate the ratio of equal to 50 % and above for prevalence of pain symptoms

Boldfaced numbers indicate the score of equal to 4 point and above for degree of pain symptoms

symptoms. Salik and Ozcan(2004) analyzed the correlation between work career and musculoskeletal disorder of physical therapist. The result showed that short work career workers had more musculoskeletal disorder because of low skill and technique. The current result also showed similar trend such that musculoskeletal disorder was found to be related to performance skill of career.

In the case of Gayageum and Geomungo instruments, increasing height factor had significantly caused more experience of musculoskeletal disorders. In contrast, there was no significant difference between height and disorders in Ajaeng with a similar instrument shape. Through this, posture of performing string instruments causing the disorders. Gayameum and Geomungo players perform in a cross legged with asymmetric posture, controlling tension with bended left hand and picking strings with bended right hand. On the other hand, Ajaeng players perform with bow in their right hand and sit in the middle of the instrument with symmetric posture. Therefore, height factor only affects to the Gayageum and Geomungo instrument.

In this study, Korean traditional string instrument players suffered various kinds of musculoskeletal disorder through whole body with high pain unlike western players. Musical players who are unable to play due to musculoskeletal disorder cause financial loss as other types of employees. Therefore, for rapid recovery, before the stage of absent, work hardening programs should be developed. With a work hardening program, practical and effective work treatment programs were developed by training the symptom area (Noe et al., 1992). Such programs can be developed into a prevention program through training and stretching. Finally, it is expected that such programs would be effective for Asian traditional musical instrument players with similar performing posture.

5. Conclusion

This study investigated Korean traditional musical instrument player's symptom area. The symptoms of playing-related musculoskeletal disorders of traditional Korean musical players were prevalently observed at neck, shoulder, back and knee. The areas differ from western problems so different recovery programs are required. In addition, these symptoms were related to various demographic factors such as age, height, career and hobby. A prevention and treatment program should be proposed

Table 4. Correlation analysis between experience of musculoskeletal disorder and demographic variables

Instruments	Age		height		Weight		BMI		Career	
	R	p-value	r	p-value	r	p-value	r	p-value	r	p-value
Gayageum	0.10	0.629	0.18	0.054*	0.03	0.903	-0.21	0.307	0.09	0.661
Geomungo	-0.46	0.050*	0.43	0.062*	0.15	0.571	0.13	0.628	-0.47	0.038*
Ajaeng	0.41	0.208	0.23	0.531	0.30	0.398	0.22	0.601	0.50	0.115
Haegeum	0.08	0.693	-0.09	0.657	-0.16	0.425	-0.18	0.374	-0.20	0.325

r: coefficient of correlation, *: $p<0.1$

Table 5. Chi-square analysis between experience of musculoskeletal disorder and demographic variables

Instruments	Gender		Exercise		Hobby		Smoking		Drinking		Stretching /Warming up	
	X^2	p-value	X^2	p-value	X^2	p-value	X^2	p-value	X^2	p-value	X^2	p-value
Gayageum	0.24	0.611	0.18	0.611	1.34	0.212	3.64	0.359	0.56	0.562	0.00	0.946
Geomungo	0.27	0.628	0.95	0.355	1.82	0.196	0.03	0.876	1.83	0.196	0.27	0.628
Ajaeng	0.08	0.808	0.02	0.910	3.23	0.085*	0.41	0.568	0.92	0.389	2.93	0.104
Haegeum	0.59	0.463	0.30	0.603	6.75	0.008*	0.55	0.478	0.31	0.597	1.92	0.179

*: $p<0.1$

considering the characteristics of instrument and performer oneself for currently examined pain causing factors. This result is expected to improve health and welfare of Asian traditional instrument players.

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