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ORIGINAL

Effects of Professional Body Massage on Forward Head Posture, Neck Pain, and Plantar Foot Pressure Balance in Men in their 20s

Soon-Seob Jang[1], Joong-Sook Lee[2], Jeong-Ok Yang[2], Bom-Jin Lee[2], Eui-Suk Kim[3], Kyung-Hee Woo[3], Se-Jin Oh[1]

[1]Department of Physical Education, Graduate School of Silla University, Busan, South Korea
[2]Department of Kinesiology, College of Health and Welfare, Silla University, Busan, South Korea
[3]Non-profit Corporation TheBodyLove

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Corresponding Author
Joong-Sook Lee
Department of Kinesiology, College of Health and Welfare, Silla University, 140, Baekyang-daero 700beon-gil, Sasang-gu, Busan, 46958, South Korea
Tel : +82-51-999-5064
Fax : +82-51-999-5164
Email : : jslee@silla.ac.kr

Objective: The purpose of this study was to investigate the effect of a 12-week professional body massage program (PMP) on forward head posture, neck pain, and plantar foot pressure balance in men in their 20s.

Method: A total of 20 men with musculoskeletal diseases were recruited for this study. The participants were asked to take part in a PMP twice a week for 12 weeks. The cranial vertical angle (CVA) for forward head posture and visual analogue scale (VSC) for neck pain and right/left foot plantar pressure balances were extracted to compare between pre- and post-program differences.

Results: CVAs before (56.86 ± 4.55°) and after (62.72 ± 4.57°) and VSCs before (6.95 ± 1.70) and after (1.70 ± 1.56) PMP revealed statistically significant differences. The right foot, after PMP, showed a significant increase in the plantar pressure balance from 46.17 ± 2.95 to 49.44 ± 1.29%, while the left foot decreased significantly from 53.83 ± 2.95% to 50.56 ± 1.29%. Therefore, based on these results, it may be said that the foot pressure balance abilities were improved after PMP because the ideal foot pressure ratio is 50%.

Conclusion: Consequently, it was suggested that a 12-week PMP could be utilized for improvement of forward head posture, neck pain, and foot plantar pressure balance in men in the 20s with musculoskeletal diseases.

Keywords: Probody massage program, Musculoskeletal diseases, Forward head posture, Neck pain, Foot plantar pressure balance

INTRODUCTION

Due to the development of IT devices, the number of people using smartphones in present days is continuously increasing. The usage rate of smartphones has increased from 27% in 2011 to 78.8% in 2015 (Korea Communications Commission, 2015), and the number of patients with "turtle neck syndrome" is increasing rapidly. According to the Health Insurance Review and Assessment Service (2015), the number of patients with cervical neck disease increased 16.6% from 2,270,000 in 2011 to 2,650,000 in 2015, among which the number of people diagnosed with turtle neck syndrome increased twofold in 4 years from 606 in 2011 to 1,134 in 2015.

Based on the result of the survey on the "utilization rate of smartphone by age," people in their 20s took the first place with 96.4% (Health Insurance Review and Assessment Service, 2012), and the average daily usage time of smartphone by Koreans was 3 h per person. People in their 20s had the longest average daily usage time of 4 h per day (Lim, 2016).

The turtle neck syndrome is a symptom in which the cervical bone is deformed into "1" or inverted letter "C" shape. Healthy cervical neck bones have the appearance of a well-curved C shape, which could be deformed if an individual's neck is bent forward for a long time (Jeon, 2016).

The turtle neck posture appears to be due to physical imbalance from maintaining a wrong posture for a long period (Hwang, 2012). Habits of maintaining wrong posture can cause deformity of the spine that causes pain and difficulty in having a healthy daily life (Im, 2003). In this way, our body parts such as the shoulder, waist, pelvis, and knee center around the vertebrate to maintain left and right symmetry of the whole body. Therefore, failure to maintain proper posture can lead to physical imbalance (Oh, 2016). Physical imbalance due to poor posture such as having the pelvis twisted to one side or the body tilted to one side can break the overall balance of the whole body and cause pain (Kim, 2013; Son, 2014; Woo, 2014; Park, 2015; Oh, 2016). A well-balanced posture affects the coordination of various joints such as upper and lower skeletal muscles and gait. Foot balance is important because it directly affects the ability to walk and increases body stability (Choi & No, 2011). This demonstrates that body balance and foot balance are

closely related to each other (Eric, 2005).

In general, foot pressure is used to determine the degree of gait and postural balance through the balance of the foot, and to measure the pressure applied to a specific part of the foot as well as the overall foot balance (Dowling, 2001).

In recent years, massage has been scientifically developed as a therapeutic tool for the entire body including the nervous, skeletal, vascular, circulatory, and muscular systems (Lim, No, & Kim, 2004). Until now, research on massage has focused on solving pain-affected areas and physical discomfort (Kim, 2013). Massage therapy uses the hands to stimulate the soft tissues of the body effectively to generate heat in the body using friction and muscular and nervous system output. This frictional heat dilates blood vessels and promotes blood and lymphatic circulation (Ok, 2008).

While studies on massage are being conducted in new directions, Park (1999) reported that massage improves maintenance of correct posture and muscle endurance, reduces pain, and helps restore body flexibility. Kim, Yang, and Lee (2015) reported that Probody massage is a highly effective rehabilitation massage to improve physiological response, large movements, and joint range of motion by inducing relaxation of rigid muscles and aligning the spine and joints of a patient with first-degree brain lesion. Additionally, Lee and Kim (2016) reported that Probody massage has a positive impact on improving body shape and balance in middle-aged women. Oh (2016) demonstrated that Probody massage improves body alignment and foot balance by affecting pelvic and knee postures in middle-aged men. Probody massage has already been proven to be effective in aligning the spine and joints and improving foot balance and body alignment. In this study, we investigated the effects of Probody massage on turtle neck posture, neck pain, and foot pressure balance in men in their 20s with chronic cervical pain due to wrong posture from high usage of computers and smartphones (Newdaily, 2016). We will use this information in a rehabilitation massage program to improve body balance by alleviating neck pain and correlating between the spine and plantar pressure.

METHODS

1. Selection of research subjects

In this study, subjects were selected from men aged 20~29 who resided in the "B" metropolitan city and have not participated in a previous Probody massage program (PMP) and with subjective visual analogue scale (VAS) of 5 or more. After thoroughly explaining the purpose and contents of the study, we selected 20 male subjects who expressed their willingness to participate in the study (Table 1).

Table 1. Physical characteristics of the subjects

Subjects	Age (years)	Height (cm)	Weight (kg)	BMI (kg/m^2)	VAS
N=20 (M ± SD)	24.75± 3.16	176.65± 5.40	74.58± 9.88	23.93± 3.33	6.95± 1.70

2. Measurements and methods

The purpose of this study was to investigate the effect of Probody massage on turtle neck posture, neck pain, and foot balance in male subjects in their 20s. Subjects participated in the PMP for 60 min per session, twice a week for 12 weeks (total 24 times). Prior to the PMP and planned measurements, all study subjects were required to wear plain cotton T-shirt and training pants. The cranial vertical angle (CVA), VAS, and plantar pressure were measured in a static standing posture before and after the PMP.

1) CVA measurement

In the subject's standing posture, the head maintains a natural head posture (NHP) through a self-balance posture (SBP), and the subject comfortably rests both arms on the side of the body. As shown in (Figure 1), the angle between the line connecting the 7th cervical vertebrae with the tragus of the ear and the line parallel to the floor (Chae, 2002) are used to measure the CVA.

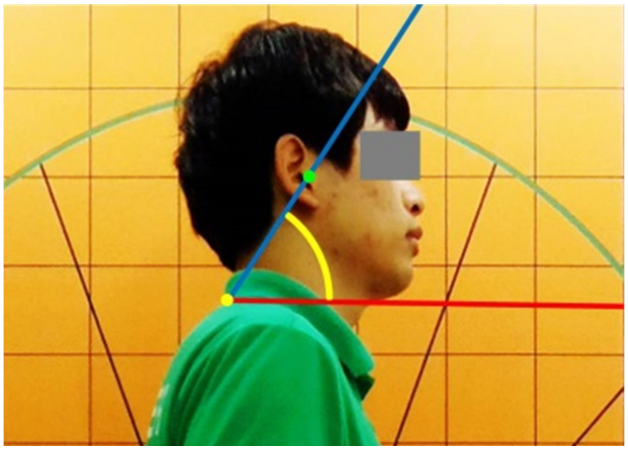

Figure 1. Cranial vertical angle

2) VAS measurement

Huskisson's VAS (Visual Analogue Scale, 1974) was revised to the Korean way of expression and used to measure the degree of pain (Wang & Kim, 1995). The ruler used to measure the VAS is a 10-cm-long ruler without mm scales and instead has a 1-cm interval indicating the degree of pain, with the most severe pain set at 10 points and no pain set at 0 (Figure 2). The severity of pain was measured by having the subjects mark their answer on the scale. The questionnaire was administered before and after the PMP.

3) Plantar pressure measurement

The plantar pressure was measured using a plantar pressure gauge (GHF-550, GHi Well, Korea). It is a tool that measures foot balance

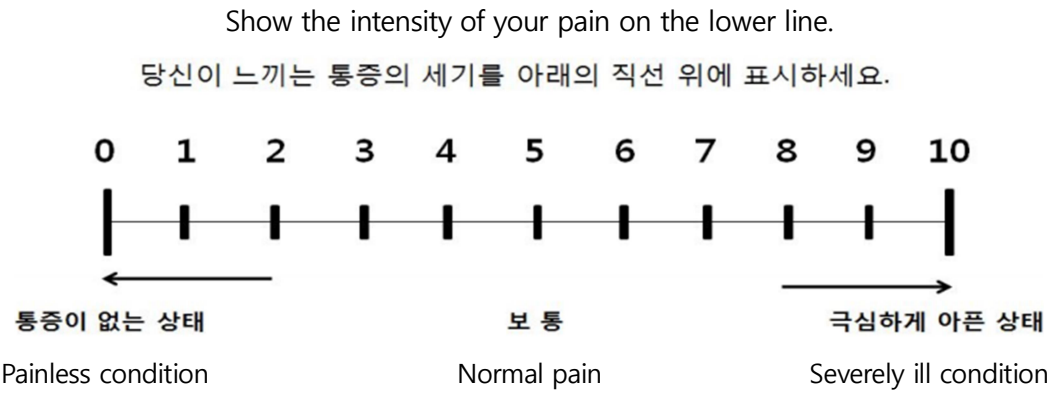

Figure 2. Visual analogue scale

(Figure 3), and the measurement is taken and analyzed by having subjects stand on the foot pressure sensor. The foot balance should be located in the center in order to have the standard measurement of 50:50. The measurement items and methods are shown in (Table 2) and (Figure 4).

Table 2. Plantar pressure

Subjects	Measurement
Plantar balance	Standing up over the whole foot pressure measurement sensors
Right foot pressure	Standing up over the right foot pressure measurement sensors
Left foot pressure	Standing up over the left foot pressure measurement sensors

Figure 3. Foot checker

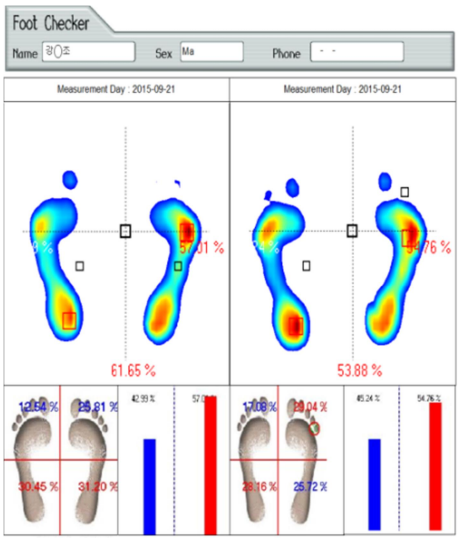

Figure 4. Plantar pressure

3. Professional body massage program

The PMP used in this study is a rehabilitation massage program (Kim, 2015) developed by applying the good body posture exercise program (Kim, 2013). It is an effective massage program that normalizes the curvature of the spine and aligns the body. Only professional body massage therapists were qualified to participate in this study as instructors. One instructor performed Probody massage per one study subject. Subjects were asked to receive Probody massage while wearing cotton training clothes. According to the method reported by Jeong (2009), the massage strength of 1~5 (mild) was used for weeks 1~4, the strength of 5~7 (moderate) for weeks 5~8, the strength of 7~9 (vigorous) for weeks 9~12. Before each session, each subject's VAS and condition were checked, and the intensity of massage was adjusted according to the severity of pain. Subjective pain index was measured as VAS with a range of score 0 (no pain) to 10 (severe pain) using the category called "How severe is your pain?" which is the number 1 item out of 15 items listed in the pain assessment questionnaire by Wang

Table 3. Probody Massage Program (1~4 weeks, 5~8 weeks, 9~12 weeks)

Subject position	Massage contents	Massage frequency	Massage strength	Time
1~4 weeks program, 5~8 weeks program, 9~12 weeks program				
Supine Position	Cervical portion massage 1	3 points, 3 times, 1 set/2sets	1~4 weeks Pain stimulation strength 1~5 (mild)	60 min
	Laryngeal muscle massage	2 points, 3 times, 1 set/2set		
	Trapezius muscle massage 1	3 points, 3 times, 1 set		
	Hip joint massage 1	3 points, 3 times, 1 set		
	Quadriceps muscle of thigh	4 points, 3 times, 1 set		
	Knee joint massage	3 points, 3 times, 1 set		
	Hip joint massage 2	3 points, 3 times, 1 set		
	Front crural muscle massage 1	3 points, 3 times, 1 set	5~8 weeks Pain stimulation strength 5~7 (moderate)	
	Front crural muscle massage 2	2 points, 3 times, 1 set		
Prone Position	Back massage 1	3 points, 3 times, 1 set		
	Back massage 2	3 points, 3 times, 1 set		
	Scapula massage	3 points, 3 times, 1 set		
	Back massage 1	3 points, 3 times, 1 set		
	Back massage 2	3 points, 3 times, 1 set	9~12 weeks Pain stimulation strength 7~9 (vigorous)	
	Hip massage	1 point, 3 times, 1 set		
	Biceps muscle of thigh	3 points, 3 times, 1 set		
	Back crural muscle massage	3 points, 3 times, 1 set		
	Ankle massage 1	1 point, 3 times, 1 set		
	Ankle massage 2	3 points, 3 times, 1 set		
	Ankle massage 3	1 point, 3 times, 1 set		
Supine Position	Chest massage	1 point, 3 times, 1 set		
	Cervical portion massage 2	1 point, 3 times, 1 set/2 sets		
	Cervical portion massage 1	3 points, 3 times, 1 set/2 sets		
	Laryngeal muscle massage	2 points, 3 times, 1 set		
	Arms massage	3 points, 3 times, 1 set		
Sitting Position	Spine muscle 1	3 points, 3 times, 1 set/2 sets		
	Spine muscle 2	3 points, 3 times, 1 set/2 sets		
	Shoulder joint massage	1 point, 3 times, 1 set		
	Trapezius muscle massage 2	3 points, 3 times, 1 set		

and Kim (1995). In the present study, the measurement of massage intensity was performed by applying the massage stimulus intensity index developed by Jeong (2009). The massage program, experiment scene, and VAS index are shown in (Table 3), (Figure 5), and (Figure 6).

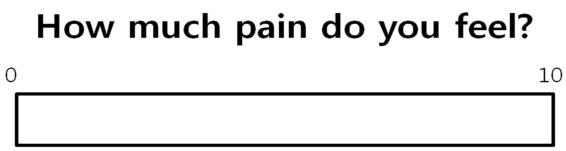

Figure 5. Massage intensities of stimulation (Jeong, 2009)

4. Data processing

In the present study, general characteristics of subjects and data collected for analysis were averaged and standardized using the Windows SPSS 23.0 program. In order to compare the effectiveness of variables before and after the PMP, the paired *t*-test was used. The significance level of all the items was set to $\alpha = .05$.

RESULTS

1. Change of turtle neck posture before and after the PMP

The changes in turtle neck posture before and after the 12-week PMP are shown in (Table 4).

The mean CVA was 56.86 ± 4.55° before and 62.72 ± 4.57° after the Probody massage, which was an increase of 5.86° that was statistically significant ($p<.001$).

2. Changes in subjective neck pain before and after the PMP

The changes in subjective neck pain before and after the 12-week PMP are shown in (Table 5).

The subjective pain index measured was 6.95 ± 1.70 before and 1.70

Figure 6. Probody massage (cervical portion massage 1)

Table 4. Change of the forward head posture (unit, degree)

Subjects	Before (M ± SD)	After (M ± SD)	*t*	*p*
N=20	56.86±4.55	62.72±4.57	-8.23	.001

Table 5. Change of neck pain

Subjects	Before (M ± SD)	After (M ± SD)	*t*	*p*
N=20	6.95±1.70	1.70±1.56	13.46	.001

± 1.56 after Probody massage, which was a statistically significant reduction by 5.25 ($p<.001$).

3. Changes in plantar pressure balance before and after the PMP

The changes in plantar pressure balance before and after the 12-week PMP are shown in (Table 6).

The left foot's plantar pressure balance was 46.17 ± 2.95% before and 49.44 ± 1.29% after the Probody massage, which was a statistically significant increase ($p<.001$). The right foot's plantar pressure balance was 53.83 ± 2.95% before and 50.56 ± 1.29% after the Probody massage, which was a statistically significant decrease ($p<.001$).

Table 6. Change of the plantar pressure balance (unit, %)

Subjects	Before (M ± SD)	After (M ± SD)	*t*	*p*
Left foot	46.17±2.95	49.44±1.29	-4.55	.001
Right foot	53.83±2.95	50.56±1.29	4.55	.001
Difference	9.59±1.37	2.74±0.72	17.32	.001

DISCUSSION

As a result of the popularization of smartphones and tablet computers, turtle neck syndrome is becoming more frequent in many workers (Korea Sports Economy, 2016). Especially in the case of men in their 20s who use smartphones the most, their poor posture and drastic reduction in physical activity expose them to musculoskeletal problem such as the turtle neck syndrome (Harrison, Barry-Greb, & Wojtowicz 1996). The turtle neck posture causes not only muscle stiffness but also chronic neck pain (Ferrari & Russell, 2003) due to persistent stress applied on the neck (Slingle, 1972). If the stress persists, then it causes a round shoulder posture, vertebral deformity), pelvic imbalance, and lower limb deformity and ultimately brings in gait instability (Kim, 2013; Son, 2014; Woo, 2014; Park, 2015).

Plantar pressure is one of the index markers that measures and reflects the balance and gait of the human body (Dowling & Steele, 2001). Body imbalance affects the plantar pressure balance (Korea Integrated Medical Research Institute, 2013), and plantar pressure imbalance leads to poor posture and gait. This sequence of events leads to stress and fatigue on the muscles and joints and repeated delivery of abnormal shock to the spine causing direct spinal disease (Go, Hong, Lee, & An, 2013). The turtle neck syndrome can be improved and prevented with therapeutic massage (Yoo, 2006), and it is very important to maintain good posture and gait (Kwon, 2013).

In this study, changes in the turtle neck posture, subjective neck pain index, and plantar pressure balance of men in their 20s through the PMP were analyzed and found to be statistically significant. This is similar to the study results of Park (2010) that showed a significant difference in the cervical curve after a 4-week manipulative therapy in subjects with elderly syndrome and the study results of Kim (2006) that showed a significant improvement in the cervical vertebral angle after 4 months of chiropractic therapy.

Moreover, the present study's result is similar to the study results of Ferreira, Ferreira, Maher, Herbert, and Refshauge (2006) that reported the efficacy of stabilization exercise in reducing chronic neck pain and enhancing the optimal neck posture and function, and the results of Kim's (2011) study that demonstrated the efficacy of neck massage on the cervical vertebrae and gravitational center by relaxing muscles. Similar results were reported by Son's (2016) study, which showed that 8 weeks of Probody massage has a positive effect on plantar pressure balance in middle-aged women with musculoskeletal diseases, and Yoo's (2014) study, which showed that foot reflexology and intravenous relaxation therapy were effective on plantar pressure balance and psychological stability in elderly women.

The result of the study shows that the turtle neck posture increased from 56.86 ± 4.55° before the 12-week PMP to 62.72 ± 4.57° after completion of the program, and the result was statistically significant. This demonstrates that the neck angle became closer to a healthy C angle. Similar results were reported by Cheon's (2011) study, which showed that myofascial massage therapy has a positive change in the cervical vertebrae angle of women aged 30~60 and that the PMP has a positive effect on the turtle neck posture in men in their 20s. The improvement in the cervical vertebrae angle appears to have been positively influenced by the improvement in posture and spinal angle. The improvement of the cervical vertebrae angle seems to have impacted the improvement of the turtle neck syndrome as well.

Analyzing the changes in subjective neck pain index reveals that the VAS score has significantly decreased from 6.95 ± 1.70 before the PMP to 1.70 ± 1.56 after completing the program (p<.001). Similar results are reported in a study by Chae and Kim (2000), which showed that the PMP has a positive effect on the improvement of subjective neck pain index in men in their 20s. Improvement in the turtle neck syndrome is thought to have resulted from relaxation of stiff neck muscles and subsequent reduction of neck pain.

Changes in plantar pressure balance measured in the present study revealed that left foot's plantar pressure increased significantly from 46.17 ± 2.95% before the PMP to 49.44 ± 1.29% after the program (p<.001) and right foot's plantar pressure decreased significantly from 53.83 ± 2.95% before to 50.56 ± 1.29% after the program (p<.001). The left and right foot pressure difference decreased significantly from 9.59 ± 1.37% before the PMP to 2.74 ± 0.72% after program (p<.001). This result demonstrates that massage has a positive effect on plantar pressure balance, similar to the results of the study by Oh (2016). The results of this study suggest that the PMP improves imbalance of the upper and lower body posture in men in their 20s with turtle neck syndrome and that such improvement in both body balance and gait influences plantar pressure balance. In addition, changes in the cervical vertebrae angle have a positive effect on the curvature of the spine, which is closer to the center of the body, and improvement in plantar pressure balance.

Combining all results suggests that Probody massage had a positive effect on the change in cervical vertebrae angle, neck pain, and plantar pressure balance due to the close relationship between cervical vertebrae angle and neck health. The stabilization of the cervical vertebrae not only reduces neck pain but also stabilizes the whole spine and positively influences the overall postural balance, which subsequently improves plantar pressure balance as well. In the future, Probody massage can be provided to various subjects with body imbalance from plantar pressure imbalance in order to improve plantar pressure balance and body balance.

CONCLUSION

The purpose of this study was to investigate the effects of professional body massage on turtle neck posture, neck pain, and plantar pressure balance in men in their 20s. The following results were obtained from 20 men aged 20~29 after receiving Probody massage 60 min per session, twice a week for 12 weeks.

First, Probody massage has a positive effect on turtle neck posture and neck pain in men in their 20s. More studies are needed to assess the efficacy of Probody massage in improving cervical vertebrae angle among subjects with different ages and sex. Through these studies, a healthy physical state can be promoted by eliminating neck pain and improving postural alignment.

Second, Probody massage influences plantar pressure balance in men in their 20s. More studies are required to examine the impact of Probody massage on the improvement of body posture and plantar pressure imbalance among subjects with different ages and sex. Through these continuous studies, it is expected that gait stability and improvement in plantar pressure balance can be promoted.

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