

THE ASSOCIATION BETWEEN ASYMMETRIC HIP MOBILITY AND NECK PAIN IN YOUNG ADULTS

Hsin-Yi Lee, PhD,^b Jung-Der Wang, MD, ScD,^c Hsiao-Lan Chang, BS,^d Yang-Chien He, BS,^e Mei-Mang Chu, BS,^f and Li-Fei Chen, MS^a

ABSTRACT

Objective: The objective of this cross-sectional observational study was to determine whether asymmetric hip mobility was associated with neck pain in young adults.

Methods: Three hundred twenty-seven freshmen students were recruited from an urban university and underwent the Patrick's flexion, abduction, external rotation, extension (FABERE) test for comparison of the functional mobility of bilateral hip joints during the health examination. A logistic regression model was constructed to determine whether the asymmetry measured by the Patrick's FABERE test was associated with neck pain after adjusting for factors of sex and exercise habits.

Results: The frequency of asymmetric results of the Patrick's FABERE test among the students who reported neck pain was significantly higher than that of those without neck pain (54.2% vs 26.5%; $P < .001$). After adjusting for the above confounders, the odds ratio of asymmetric results of a Patrick's FABERE test was 2.99 (95% confidence interval, 1.57-5.72; $P < .001$).

Conclusions: Imbalanced mobility of the hip joints might be associated with an increased incidence of neck pain. (J Manipulative Physiol Ther 2013;36:364-368)

Key Indexing Terms: Neck Pain; Hip

Nonspecific neck pain without pathoanatomic or radiologic abnormality is a common complaint in everyday clinical practice. However, the conven-

tional approaches, which exclusively focus on neck symptoms, seem to have inconsistent effectiveness¹⁻³ and high recurrence rates.^{4,5} The lack of identification of multidimensional mechanisms of neck pain might explain the inability to develop an effective treatment.

In the daily practice at our clinic, patients with neck pain often come with an abnormal posture, that is, forward head, round shoulder, aberrant curvature of the spine, and so forth. Undoubtedly, an optimal head position depends on a balanced trunk,^{6,7} in which the lumbar-pelvic-hip (LPH) complex is the center of the body. This complex consists of the fourth and fifth lumbar joints (4 apophyseal joints), the sacrum (2 synovial joints), the 2 hip joints, and the pubic symphysis.⁶ Therefore, asymmetry within the LPH complex may lead to a cascade of postural compensations throughout the axial spine.⁶⁻⁸ In fact, the idea of a relationship between spinal pain and dysfunction of the LPH complex is not new. Textbooks frequently mention that the evaluation of the LPH complex should be included in a comprehensive assessment of a patient with spinal pain.^{6,7,9} Although the real movement occurred in the sacroiliac joint was small by radiostereometric analysis,¹⁰ clinicians usually pay more attention to the importance of hip joints involved in the spinal function. It has been shown that

^a Physical Therapist, Department of Rehabilitation Medicine, Shin Kong Wu Ho-Su Memorial Hospital, Shih-Lin District, Taipei, Taiwan.

^b Physical Therapist, Institute of Occupational Medicine and Industrial Hygiene, College of Public Health, National Taiwan University, Taipei, Taiwan.

^c Professor, Department of Public Health, College of Medicine, National Cheng Kung University, Tainan, Taiwan.

^d Physical Therapist, Department of Rehabilitation Medicine, Shin Kong Wu Ho-Su Memorial Hospital, Taipei, Taiwan.

^e Physical Therapist, Department of Rehabilitation, Cathay General Hospital, Taipei, Taiwan.

^f Physical Therapist, Department of Physical Medicine and Rehabilitation, Tri-Service General Hospital, Taipei, Taiwan.

Submit request for reprints to: Li-Fei Chen, MS, PT, Department of Rehabilitation Medicine, Shin Kong Wu Ho-Su Memorial Hospital, No. 95, Wen Chang Road, Shih-Lin District, Taipei City, Taiwan (e-mail: 1000229@ms.skh.org.tw).

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induced static pelvic asymmetry was associated with functional asymmetry of the LPH complex, which can be revealed by measurements of hip mobility.¹¹ Some investigators have reported a relationship between lower limb function and low back pain (LBP).¹¹⁻¹⁴ An asymmetry in hip-rotation mobility has also been found among those with LBP and participated in rotation-related sports.^{12,15-17} However, to our best knowledge, no research has been conducted to examine its association with neck pain. We hypothesized that asymmetrical hip motion might alter the mechanical forces on the lumbopelvic region, and as a result, it may contribute to the occurrence of neck pain. This study was performed to determine whether there was an association between an asymmetric passive hip mobility and nonspecific neck pain in young adults.

METHODS

Before the commencement of this study, the protocol was approved by the Institutional Review Board at the Shin Kong Wu Ho-Su Memorial Hospital in Taipei, Taiwan.

Subjects

Three hundred twenty-seven subjects were recruited from the freshmen students during the new student health examination at the National Taiwan University in Taipei, Taiwan. Although the health examination usually lasted for 1 week, the study was conducted on 3 separate days to recruit the subjects from different departments. Consecutive subjects were asked to fill out a questionnaire that enquired about their demographic data and medical history, past and present. For the neck pain group ($n = 48$), the inclusion criterion was chronic pain, which was defined as pain duration greater than 3 months, within the area delimited by the following boundaries: the occipital crest superiorly, the acromion laterally, and the border of the lower trapezius muscle inferiorly. For the control group, there were no additional criteria ($n = 279$). Subjects (both groups) were excluded if they had previous surgery or fracture of the hip joint, systemic disease involving the joints of the trunk and extremities, systemic disease of neurologic origin, congenital deformity of the spine, neck surgery, trauma history of the neck, or inability to understand Chinese. Verbal consent was obtained for each subject after the explanation of the study.

Procedure

Because prone position required by the standard measurement of hip rotation seems to be more uncomfortable than supine for people with neck pain, the Patrick's flexion, abduction, external rotation, extension (FABERE) test was adopted instead as an alternative screening test to compare the general mobility between right and left hip. The examiner of the Patrick's FABERE test was an

experienced physical therapist, who currently works in a medical center. At the beginning, the therapist briefly explained the purpose of the Patrick's FABERE test to the subject and described it as a screening test that assesses the functional mobility of the hip joint without causing any harm to the body. The study hypothesis was not mentioned before the test so that the subject would not be biased.

The subject was then instructed to lie supine on the examining table, and the therapist stood at the bedside. The standard procedure of the Patrick's FABERE test was performed as follows:¹⁸ The therapist stabilized the anterior superior iliac spine of the contralateral side with one hand and used the other hand to place the ipsilateral leg into a figure-of-four position until the lateral malleolus was rested just above the extended knee of the contralateral leg. The therapist then slowly lowered the test leg into abduction toward the examining table until a limit was encountered. Then, the therapist walked to the other side of the table to evaluate the contralateral leg and thus determined whether there was difference in mobility measured by the end position of the Patrick's FABERE test between the 2 sides. A symmetric result was determined as having no visible difference between the 2 test legs. If there was a major visible difference of limitation between 2 joints, the test was considered asymmetric. If the difference was only minimal, it was categorized as uncertain. Thus, there were 3 possible results of the test: symmetric, uncertain, and asymmetric. The examiner was kept unaware of the neck pain pattern/history of the subject before performing the Patrick's FABERE test. Before this study, a pilot interrater reliability study was conducted on a sample of 27 subjects with or without neck pain. Two physical therapists independently performed Patrick test with 5 minutes apart and reported on a separate form. The interrater reliability was assessed by κ coefficient, which was 0.65.

Subjective Evaluation of Neck Pain

Any subject who reported current neck pain was asked to complete 2 further questionnaires to assess their pain characteristics and functional disability. Pain characteristics included pain intensity evaluated by a visual analog scale (VAS), pain frequency, and pain duration. Functional disability due to neck pain was assessed by the Neck Disability Index (NDI).¹⁹ It consisted of 10 items addressing functional activities including personal care, lifting, reading, working, driving, sleeping, and recreational activities as well as pain intensity, concentration, and headaches. The questionnaire allowed for 6 potential responses for each item ranging from no disability (0) to total disability (5). A higher sum score indicates greater pain and disability.

Data Analysis

The χ^2 test was used to compare the frequency distribution of sex, exercise habits, and the results of the

Table 1. Baseline characteristics and results of the Patrick's FABERE test in the neck pain subjects and controls

Characteristics	Neck pain (n = 48)	Control (n = 279)	P
Age, y (SD)	18.5 (0.8)	18.6 (0.8)	.84
No. of females (%)	35 (72.9)	121 (43.4)	<.001
No. of persons with exercise habits (%)	2 (4.2)	46 (16.5)	.03
Patrick's FABERE test (%)			<.001
Symmetric	17 (35.4)	194 (69.5)	
Uncertain	5 (10.4)	11 (3.9)	
Asymmetric	26 (54.2)	74 (26.5)	
VAS of pain intensity (SD)	3.6 (1.9)		
NDI (SD)	15.4 (3.6)		
Neck pain frequency (%)			
≤2 times per week	41 (85.4)		
>2 times per week	7 (14.6)		
No. of recurrent cases of neck pain (%)	25 (52.1)		

FABERE, flexion, abduction, external rotation, extension; NDI, neck disability index; VAS, visual analog scale.

Patrick's FABERE test between the neck pain group and asymptomatic controls. Items measured in ratio scales, such as age, VAS score of pain intensity, and NDI, were tested by an independent-sample *t* test. A logistic regression model was used to investigate whether the results of the Patrick's FABERE test were associated with the existence of neck pain when adjusting for the sex and exercise habit (yes: exercise frequency ≥ 3 times per week; no: exercise frequency < 3 times per week). Because only a few subjects (n = 16) were classified as "uncertain" by the Patrick's FABERE test, they were grouped into the symmetric category for a more conservative inference. All statistical analyses were performed using SAS version 9.1 (SAS Institute, Inc, Cary, NC). *P* < .05 was considered statistically significant.

RESULTS

As summarized in Table 1, the age of the 2 groups was not significantly different (*P* = .81). However, the neck pain group consisted of more females (72.9%; *P* < .001) and less subjects with exercise habit (4.2%; *P* = .03) as well as a higher proportion of asymmetric result of the Patrick's FABERE test (54.2%; *P* < .001). Within the neck pain group, the mean values of pain intensity and disability score were 3.6 of 10 and 15.4 of 50. Most of them reported pain frequency less than 3 times per week (80.0%), and 52.1% were recurrent cases.

The result of logistic regression indicated that female sex (odds ratio [OR], 3.16; 95% confidence interval [CI], 1.58-6.33; *P* < .005) and an asymmetric result of the Patrick's FABERE test (OR, 2.99; 95% CI, 1.57-5.72; *P* < .001) were significant determinants of neck pain except exercise habits (OR, 0.23; 95% CI, 0.05-1.03; *P* = .05), indicating there is a 199% increase in the odds of neck pain with an

asymmetric Patrick's FABERE test after adjustment of other factors.

DISCUSSION

Although there is 1 prior study that reported an association between neck pain and LBP,²⁰ to the best of our knowledge, this study is the first one to investigate the possibility that compromised balance of bilateral passive hip mobility is associated with neck pain. We found that asymmetric passive hip mobility, which was evaluated by a Patrick's FABERE test, is associated with an increased risk of neck pain after an adjustment for sex and exercise habits. Although the Patrick's FABERE test is well accepted as a quick screening test for the evaluation of the general mobility of hip joints, the result was solely based on the subjective judgment of the therapist. This may have resulted in many false positives and negatives because the examiner was required to compare the range of motion of 2 legs subjectively. In this study, however, when the therapist was unable to differentiate the symmetric or asymmetric result of the Patrick's FABERE test on a subject clearly, she was asked to record it as "uncertain." In fact, such uncertain cases only happened in 16 (4.9%) of 327 subjects, and we deliberately grouped them with the cases of symmetric results in the analysis to obtain a more conservative estimate. Moreover, the results of a regression model also demonstrated that women reported more neck pain than men, which corroborated with previous studies.^{21,22} Because all our subjects were first-year young university students without any previous history of trauma or systemic chronic illnesses that may affect the LPH complex, we tentatively concluded that our findings cannot be explained by potential confounders including age, sex, or exercise habit, and therefore, we maintain that the association exists.

Living in a gravitational field, the balance of the neck is inextricably tied to balance of the whole body. The asymmetric imbalance of the LPH complex might result in excessive stress on the joints and/or the soft tissues of the spine. A recent electromyographic study demonstrated that cervical postural muscles (deep neck flexors) were more difficult to recruit in nonneutral spinal lumbopelvic alignment than in a neutral posture.²³ Shum et al²⁴⁻²⁷ have also demonstrated that spinal and hip movements are closely coordinated in many functional and daily activities, but such a relationship was noted to be altered in LBP subjects. The subjects with a history of LBP were found to display earlier and/or greater lumbopelvic rotation and deviation during limb movement tests.^{12,28-30} Moreover, a right-left difference in flexibility and/or movement pattern of the hip was also observed in subjects with LBP.^{12,16,17} Thus, we suspected that an asymmetric hip mobility might attribute to imbalanced lumbopelvic region in the long run, which might exert tissue stress to the spine and induce potential neck pain. Alternatively, a downstream effect was

also demonstrated among patients with complex regional pain syndrome, in which myofascial release in the temporomandibular joint immediately increased the hip motion.³¹ Therefore, it is also possible that a pain on the neck might induce compensated movement pattern of the spine and LPH complex, which might also produce an asymmetric results of the Patrick's FABERE test.

The findings of this study may have some implications for the clinical treatment of neck pain. First, as the Patrick's FABERE test has been frequently used in the clinical practice and the rate of being unable to differentiate the symmetric or asymmetric result was low, it could be considered as a quick screening tool in the clinic to identify a potential group whose neck pain is associated with asymmetric hip mobility. Second, when designing a treatment program for patients with neck pain and asymmetric hip mobility, additional attention should be given to the restoration of the balance of the LPH complex.

Limitations

There are several potential limitations of the current study. First, we did not formally quantify the hip mobility when evaluating the degree of asymmetry between right and left hip joints. Future studies may consider placing a gravity-dependent inclinometer/goniometer over medial aspect of the thigh and take readouts or measuring the standardized range of motion of hip rotation. Quantification of passive hip joint motion would provide more informative data to explore more detailed mechanisms relating to pain intensity, pain duration, NDI, and others. Second, because the study design is cross-sectional, we cannot differentiate whether asymmetric hip mobility is a cause or a result of neck pain. As neck pain can be influenced by muscle atrophy, proprioception, coordination between local and global muscle systems, postural habits, and structural and functional asymmetry, we are not sure if the connection is strictly neural or whether additional components are involved. Besides, the movement of external rotation and abduction of the hip also test the sacroiliac joint, in which the movement pattern is influenced by sex and limb dominance.^{32,33} So one is unable to distinguish whether the hip, the sacroiliac, or both contribute to this asymmetry. Finally, we used a small and homogeneously young group of subjects. They do not seem likely to suffer from a long-lasting neck pain over years. In general, it would probably take a significant period to develop neck pain having only asymmetric Patrick test as its background. Future studies are indicated to stratify patients on recent, recurrent, or a persistent long history of neck pain.

CONCLUSIONS

Asymmetric passive hip mobility seems to be a determinant of neck pain after controlling for potential confounding

effects by sex and exercise habits. These results suggest an association between neck pain and the imbalanced mobility of bilateral hip joints.

FUNDING SOURCES AND POTENTIAL CONFLICTS OF INTEREST

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