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Bilateral Asymmetry of Semispinalis Capitis Muscle Thickness and Neck Motion during Prone Neck Extension in Subjects with Unilateral Posterior Neck Pain

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Abstract. [Purpose] This study compared the bilateral thicknesses of the semispinalis capitis muscle and neck motions between subjects with and without unilateral posterior neck pain (UPNP). [Subjects] The study recruited 20 young subjects with UPNP at the end-range of neck extension and 20 age- and sex-matched subjects without neck pain as a control group. [Methods] The bilateral thicknesses of the semispinalis capitis in a relaxed prone position were measured bilaterally using ultrasonography. A three-dimensional motion-analysis system was used to measure the asymmetry of neck motions at 45° of prone neck extension. [Results] We found that the asymmetry of the semispinalis capitis muscle was greater in the UPNP group than in the controls. Neck rotation to the painful side and lateral bending to the non-painful side were greater in the UPNP group at 45° of prone neck extension than in the controls. [Conclusion] Asymmetric thickness of the semispinalis capitis muscles might be the cause of asymmetric neck motions in subjects with UPNP.
Key words: Asymmetry, Muscle thickness, Neck motion

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INTRODUCTION

The cervical paraspinal muscles play an important role in neck extension, maintaining the lordotic curve of the cervical spine[1)]. The cervical paraspinal muscles also contribute to proprioception of head and neck movements[2)], and postural balance while standing[3)]. To improve the performance of the cervical paraspinal muscles, neck extension exercises in the sitting or prone position are often advocated in the management of patients with mechanical neck pain[4)]. Neck extension exercises are effective at increasing the size of the cervical paraspinal muscles in patients with mechanical neck pain[5)].

The size of the cervical paraspinal muscles is measured when evaluating muscle function and provides a basis for therapeutic interventions in patients with chronic neck pain[6–8)]. Measuring the size of the cervical paraspinal muscles is considered an objective method of estimating indirect strength[9–11)]. Ultrasonography is commonly used to assess muscle size, including the atrophy and symmetry of the cervical paraspinal muscles[11, 12)]. A previous study suggested that an obscure outline of the fascial layer in ultrasound images was a diagnostic feature of muscle atrophy[8)]. However, the cervical muscle is smaller than the lumbar spine, and the lateral boundary of the deep posterior neck muscle is ambiguous. Therefore, ultrasonography is valid for measuring the thickness, but not the width or cross-sectional area, of the cervical multifidus and semispinalis capitis muscles[12, 13)]. Previous studies have demonstrated that bilateral symmetry is seen in ultrasound images of the posterior neck muscles of healthy subjects and patients with bilateral neck pain[7, 11)].

Asymmetry of the paraspinal muscles has been reported in unilateral spinal pain[14)]. In patients with unilateral back pain, a reduction in muscle cross-sectional area, *i.e.*, atrophy of the multifidus or psoas major, ipsilateral to the side of pain has been demonstrated[15–17)]. Unless the atrophic multifidus muscle is worked with specific exercises, the decreased muscle size will not recover in patients with unilateral back pain[18)]. In addition to the lumbar paraspinal muscles, asymmetry of the cervical paraspinal muscles has been demonstrated in patients with unilateral posterior neck pain (UPNP)[19)]. The semispinalis capitis muscle was smaller on the painful side than on the non-painful side in ultrasonographic images of patients with UPNP or migraine[13, 19, 20)].

Although a previous study found that semispinalis capitis thickness was asymmetrical in patients with UPNP[19)], no study has determined whether the asymmetric thickness of the semispinalis capitis influences neck motion during prone neck extension in subjects with UPNP. Therefore, we