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Kinetic Ergocise based on Movement Analysis

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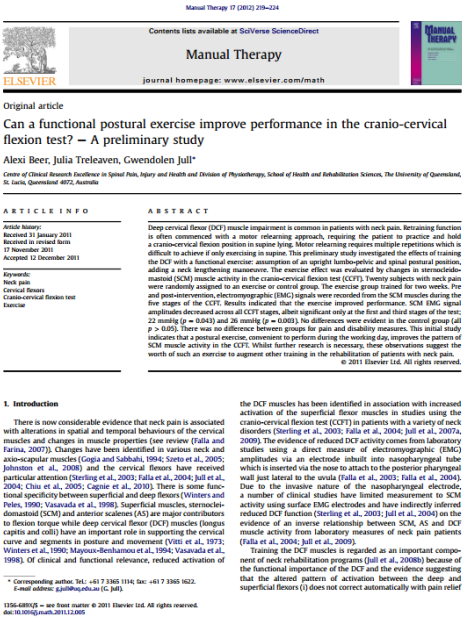

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Original article

Can a functional postural exercise improve performance in the cranio-cervical flexion test? – A preliminary study

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ABSTRACT

Deep cervical flexor (DCF) muscle impairment is common in patients with neck pain. Retraining function is often commenced with a motor relearning approach, requiring the patient to practice and hold a cranio-cervical flexion position in supine lying. Motor relearning requires multiple repetitions which is difficult to achieve if only exercising in supine. This preliminary study investigated the effects of training the DCF with a functional exercise: assumption of an upright lumbo-pelvic and spinal postural position, adding a neck lengthening manoeuvre. The exercise effect was evaluated by changes in sternocleido-mastoid (SCM) muscle activity in the cranio-cervical flexion test (CCFT). Twenty subjects with neck pain were randomly assigned to an exercise or control group. The exercise group trained for two weeks. Pre and post-intervention, electromyographic (EMG) signals were recorded from the SCM muscles during the five stages of the CCFT. Results indicated that the exercise improved performance. SCM EMG signal amplitudes decreased across all CCFT stages, albeit significant only at the first and third stages of the test; 22 mmHg ($p = 0.043$) and 26 mmHg ($p = 0.003$). No differences were evident in the control group (all $p > 0.05$). There was no difference between groups for pain and disability measures. This initial study indicates that a postural exercise, convenient to perform during the working day, improves the pattern of SCM muscle activity in the CCFT. Whilst further research is necessary, these observations suggest the worth of such an exercise to augment other training in the rehabilitation of patients with neck pain.

1. Introduction

There is now considerable evidence that neck pain is associated with alterations in spatial and temporal behaviours of the cervical muscles and changes in muscle properties (see review (Falla and Farina, 2007)). Changes have been identified in various neck and axio-scapular muscles (Gogia and Sabbahi, 1994; Szeto et al., 2005; Johnston et al., 2008) and the cervical flexors have received particular attention (Sterling et al., 2003; Falla et al., 2004; Jull et al., 2004; Chiu et al., 2005; Cagnie et al., 2010). There is some functional specificity between superficial and deep flexors (Winters and Peles, 1990; Vasavada et al., 1998). Superficial muscles, sternocleidomastoid (SCM) and anterior scalenes (AS) are major contributors to flexion torque while deep cervical flexor (DCF) muscles (longus capitis and colli) have an important role in supporting the cervical curve and segments in posture and movement (Vitti et al., 1973; Winters et al., 1990; Mayoux-Benhamou et al., 1994; Vasavada et al., 1998). Of clinical and functional relevance, reduced activation of the DCF muscles has been identified in association with increased activation of the superficial flexor muscles in studies using the cranio-cervical flexion test (CCFT) in patients with a variety of neck disorders (Sterling et al., 2003; Falla et al., 2004; Jull et al., 2007a, 2009). The evidence of reduced DCF activity comes from laboratory studies using a direct measure of electromyographic (EMG) amplitudes via an electrode inbuilt into nasopharyngeal tube which is inserted via the nose to attach to the posterior pharyngeal wall just lateral to the uvula (Falla et al., 2003; Falla et al., 2004). Due to the invasive nature of the nasopharyngeal electrode, a number of clinical studies have limited measurement to SCM activity using surface EMG electrodes and have indirectly inferred reduced DCF function (Sterling et al., 2003; Jull et al., 2004) on the evidence of an inverse relationship between SCM, AS and DCF muscle activity from laboratory measures of neck pain patients (Falla et al., 2004; Jull et al., 2009).

Training the DCF muscles is regarded as an important component of neck rehabilitation programs (Jull et al., 2008b) because of the functional importance of the DCF and the evidence suggesting that the altered pattern of activation between the deep and superficial flexors (↓) does not correct automatically with pain relief

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Build a better neck project

자세 유지하는 것 만으로도 운동이 되나요?

Can a functional postural exercise improve performance in the cranio-cervical flexion test? A preliminary study

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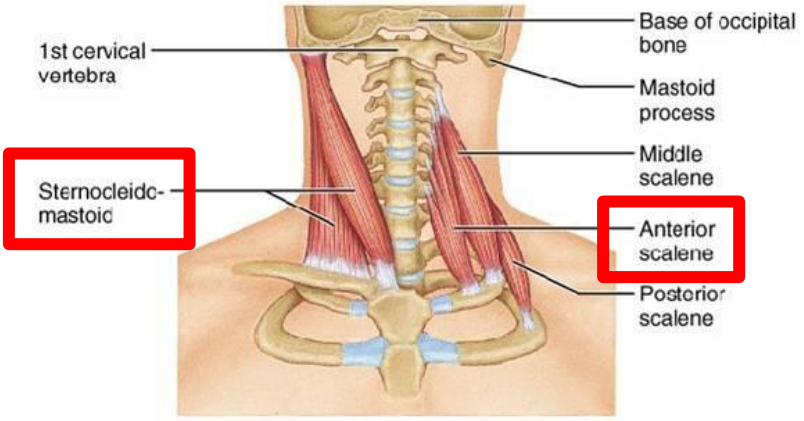
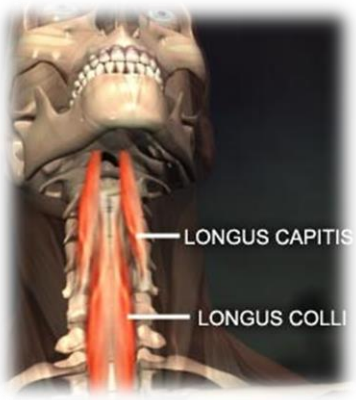
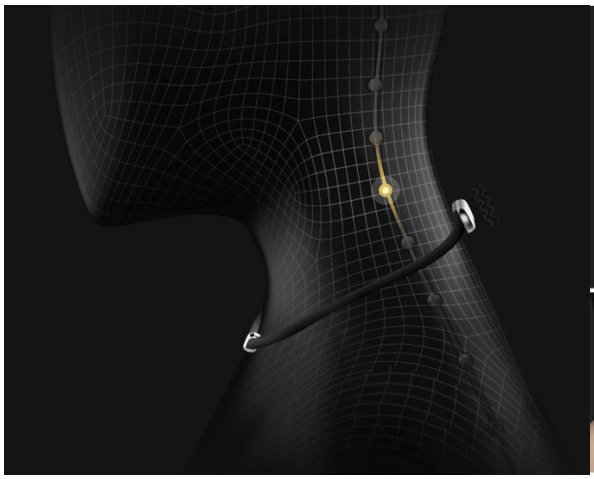


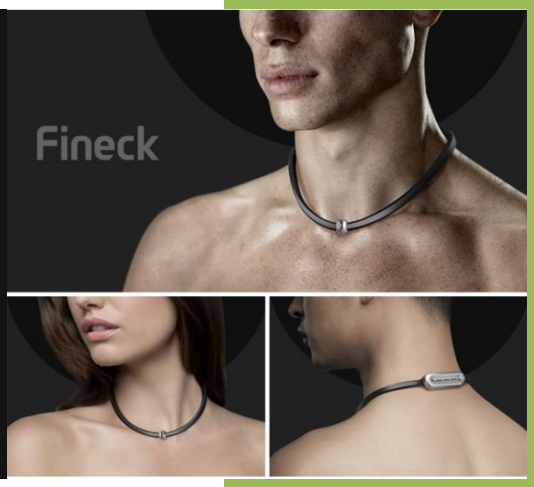


Superficial cervical flexor muscles (sternocleidomastoid, anterior scalene)는 flexion torque를 만드는 주요 근육입니다. 반면 deep cervical flexor muscles (longus capitis and colli)는 목의 커브 자세와 움직임에서 segments를 유지하는 중요한 역할을 합니다. 이전 연구들에 따르면 목에 관련된 질환을 가지고 있는 환자들은 cranio-cervical flexion test시에 deep cervical flexor muscles 의 활성도가 줄어들고 superficial cervical flexor muscles의 활성도가 증가하였다고 보고하고 있습니다. 이런 활성 패턴의 변화 때문에 현재 목 재활 프로그램에서는 deep cervical flexor muscles의 훈련에 초점이 맞춰지고 있습니다.

이제까지 연구들에서 deep cervical flexor muscles 근육 훈련을 할 때, 보통 supine자세에서 시행하는 것이 보통 이였습니다. 이 자세에서 시행하는 방법은 cranio-cervical flexion 동작을 교육하고, 지구력 훈련을 하는 데에 효과적 입니다. 하지만 이는 일상생활 안에서, 반복하여 시행하기에는 한계가 있습니다.

그렇기 때문에 일상생활에서 쉽게 수행 할 수 있는 postural correction exercise의 중요성이 부각되고 있습니다. 이에 따라 upright posture자세가 longus capitis / colli를 activation시킨다는 연구 결과가 발표 되었으며, 이런 일상생활의 neck postural의 중요성을 느낀 중국의 Veari라는 디자인 팀은 Fineck이라는 neck posture monitoring 하는 wearable device를 개발하여 kickstator를 통해 기금을 모으기도 하였습니다.





그렇다면 postural correction exercise는 정말 deep cervical flexor muscles의 performance를 향상 시켜줄 수 있을까요? 위 논문을 바탕으로 내용을 확인해 보겠습니다.

연구 방법

지속적인 목 통증을 가지고 있고, Cranio Cervical Flexion (CCF) test에서 2단계 이상 수행하지 못하는 20명의 대상자들(여자 10명, 남자 10명)을 선별 후 실험을 진행하였습니다.

전 → functional posture exercise → 후

functional posture exercise 를 2주 동안 실시한 뒤, 전과 후에 목빗근(sternal head of the sternocleidomastoid)과 전사각근(anterior scalene)의 표면 근전도(surface EMG)를 비교하였습니다.

◀ **Functional posture exercise**

neutral lumbo-pelvic position을 맞춘 upright posture를 취한 뒤, 목의 윗부분으로 부터 두개골의 끝을 끌어올리 듯이 경추를 바르게 정렬하는 자세.

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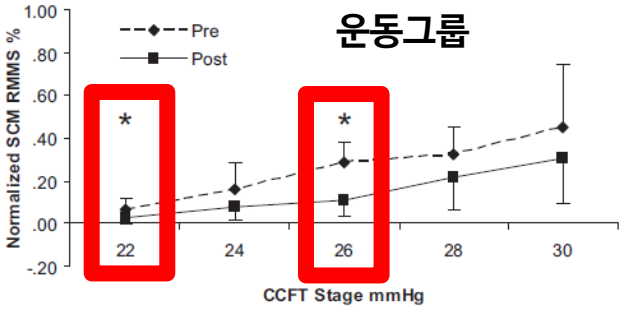
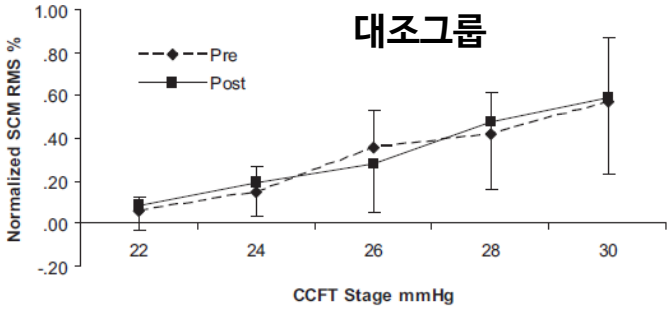
연구 결과

	운동그룹	대조그룹	*p* value
Neck pain intensity (VAS/10)	3.0 ± 2.8	2.9 ± 1.2	0.92
Neck disability index (/100)	17.8 ± 11.9	21.8 ± 11.8	0.46
PSFS (/10)	5.9 ± 2.5	6.5 ± 1.7	0.87
Stage of CCFT[a]			
22 mmHg	2.8 ± 3.4	8.3 ± 10.9	0.15
24 mmHg	7.5 ± 6.3	19.4 ± 16.1	0.04
26 mmHg	11.1 ± 7.9	27.7 ± 22.3	0.04
28 mmHg	21.5 ± 14.8	47.3 ± 31.0	0.03
30 mmHg	30.6 ± 21.2	59.2 ± 36.1	0.04

[a] values expressed as SCM normalised RMS values.

위 표 에서는 functional posture exercise 를 시행한 후 데이터를 나타냅니다. 여기에서는 운동 그룹이 대조 그룹보다 SCM의 EMG 활성도가 유의하게 낮다는 것을 알 수 있고, 22mmHg 단계를 제외하고 모두 통계학적으로 유의하게 차이가 난다는 것을 확인 할 수 있습니다.





위의 그래프로 좀 더 자세히 살펴보면, 운동을 시행했던 그룹이 22mmHg, 26mmHg 단계에서 전, 후 비교 시 SCM의 EMG 활성도가 유의하게 차이가 났음을 볼 수 있습니다.

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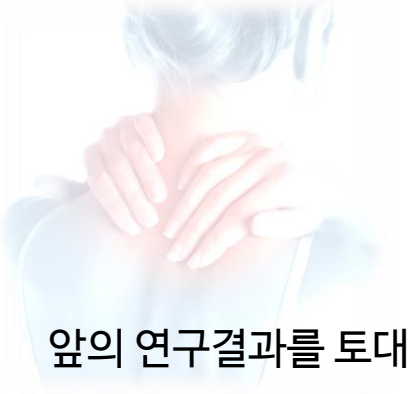

앞의 연구결과를 토대로 위 저자는

neutral lumbo-pelvic과 neck을 lengthening 시키는 spinal posture로 구성된 posutral exercise 훈련이 CCF test를 시행 할 때에 cervical flexor muscles의 pattern 향상을 가지고 온다고 말하고 있습니다.

따라서 "자세를 유지하는 것 만으로도 운동이 되나요?"에 대한 질문에 근골격계 전문가인 우리의 답변은

"neutral lumbo-pelvic sitting과 neck을 lengthening 시키는 sitting postural exercise는 deep neck flexor의 사용을 촉진 시키기 때문에 바른 앉는 자세 유지는 좋은 운동입니다."

라고 이 논문을 근거로 이야기 할 수 있을 것입니다.

-KEMA 책임 연구원 정성훈-

-문의사항은 KEMA 홈페이지 Q&A 란 에 남겨주세요-

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