Endurance of deep neck flexor muscles and neck pain in patients with temporomandibular disorders

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Temporomandibular joint and the cervical spine are connected biomechanically and neurophysiologically. This study was designed to investigate the variability in endurance of deep neck flexor muscles in temporomandibular disorders (TMD) patients, with and without neck pain. Sixty female patients, age ranged from 20-40 years, were included in this study. All were diagnosed with TMD for at least three months. They were equally divided into two groups based on presence of neck pain. Group I included patients with TMD who complained from neck pain while group II included patients with TMD without neck pain. All patients underwent craniocervical flexion test using a pressure biofeedback unit to measure endurance of deep neck flexor (DNF) muscles. The mean endurance of DNF significantly decreased in Gr. I compared to the Gr. II (p-value <0.001). Endurance of DNF decreases in relation to presence of neck pain in patients with TMJ disorders, so examination and training of DNF is important in patients with TMD complaining from neck pain.

Keywords: Temporomandibular, neck pain, deep neck flexor.

INTRODUCTION

Temporomandibular disorder (TMD) is a collective term for all problems related to temporomandibular joint and its musculoskeletal masticatory structures (Grossi and Chaves, 2004). Temporomandibular joint and the cervical spine are connected biomechanically and neurophysiologically (Pedroni and Oliveira, 2005). The trigeminal brainstem sensory nuclear complex, located within the suboccipital spine, represents the main neurophysiological connection, where sensory informations from the first 3 cervical spinal nerves converge with trigeminal afferents (La Touche et al., 2011).

Patients with TMD have cervical pain more frequently than subjects without this disorder (Visscher et al., 2001; Weber et al., 2012) in addition to limitation in upper cervical mobility (Grondin et al., 2015).

Patients with TMD, especially those with mixed TMD, have increased activity in the superficial cervical muscles and reduced isometric endurance of the cervical flexor and extensor muscles (Armijo-Olivo et al., 2012).

The cervical flexors, primarily the deep neck flexors (DNF) (longus capitis, longus colli, rectus capitis anterior and lateralis), are postulated to assist in stabilizing the cervical spine during gross neck movements (Harris et al., 2005). They work in synergy with superficial muscles to stabilize the cervical segments, especially in functional mid-ranges of the cervical spine (Fallal et al., 2004a,
Deep neck flexors weakness and endurance deficits are related to inability to sustain craniocervical flexion in inner-range position. This control deficit is associated with increased cervical spine lordosis and serves as a contributor to the pathogenesis of head and/or neck pain. (Domenech et al., 2011)

Patients with neck pain show a delay in DNF activation (Falla et al., 2004a) and display deficits in the postural endurance of these muscles. Evidence suggests that people with neck pain have more forward head position when distracted (Szeto et al., 2005).

Controversy exists regarding head and cervical posture in patients with TMD, yet forward head posture is the most common one. However, this hasn’t been confirmed by systematic and well designed methodologically studies (Olivo et al., 2006). Postural alteration could be related to cervical spine disorder more than TMD (Weber et al., 2012).

This study was designed to investigate the variability in endurance of deep neck flexor muscles in TMD patients, with and without neck pain.

Jull and colleagues (2008) developed the craniocervical flexion test (CCFT) to objectively measure strength and endurance of deep neck flexors. This test has high intra-tester reliability of 0.91 (Hudswell et al., 2005; Arumugam et al., 2011).

MATERIALS AND METHODS

This study was conducted at the faculty of Oral and Dental Medicine, Cairo University, Egypt. Sixty female patients, age ranged from 20-40 years and body mass index (BMI) less than 30 were included in this study. All were diagnosed with TMD for at least three months. They were equally divided into two groups based on presence of neck pain. Group I included patients with TMD who complained from neck pain while group II included patients with TMD without neck pain.

Patients were excluded if they had a history of head and neck trauma, undergone orthodontic treatment, apparent spinal deformity, back pain, dysfunction and surgery, migraine, ear problems, systemic arthritis, neuromuscular skeletal disorders, and upper respiratory dysfunction such as mouth breathing. The study was approved by the ethical committee of the Faculty of Physical Therapy, Cairo University, approval number; P.T.REC/012/001069.

All patients underwent craniocervical flexion test using a pressure biofeedback unit to measure endurance of deep cervical flexor muscles (Arumugam et al., 2011). The device is made of a manometer and a balloon connected with a pressure cell and an analog ranged from 0 to 200 mmHg and a pressure accuracy of + / - 3 mmHg.

The test measures the pressure at which the subject is able to maintain the correct craniocervical flexion action. During the test, the subject was positioned in a crook lying position with pressure biofeedback unit under the back of the head. Each subject performed the head nod action to first target pressure (the lowest level; 22 mm Hg) and was instructed to hold that position for 10 seconds. If the subject could perform 3 repetitions of 10-second hold without substitution, the test was progressed to the next pressure target (Jull et al., 2008).
Statistical analysis
The statistical analysis was conducted by using statistical SPSS Package program version 20 for Windows (SPSS, Inc., Chicago, IL). Unpaired (independent) t-test was used to compare the demographic data and endurance of deep cervical flexor muscles between Gr. I and Gr. II. All statistical analyses were significant at 0.05 level of probability (P ≤ 0.05).

RESULTS
In Gr. I the mean age was 31.0833 (±5.614) years, weight was 70.3667 (±8.475) kg, height was 1.6537(±0.836) m, and body mass index (BMI) was 25.649(±1.58) kg/m². In Gr. II the mean age was 30.0167 (± 5.745) years, weight was 71.1 (±6.138) kg, height was 1.679 (±0.567) m, and BMI 25.2(±1.208) kg/m². Comparison between Gr. I and Gr. II revealed no significance difference in demographic data between both groups (table 1 and fig. 2).

The mean value of endurance of DNF in Gr. I was 22.8 (±1.349) while in Gr. II it was 24.8 (±1.9369). The mean endurance of DNF significantly decreased in Gr. I compared to the Gr. II (p-value <0.001) (table 2 and fig. 3).

Table (1). Comparison of demographic data between Gr. I and Gr. II.

<table>
<thead>
<tr>
<th></th>
<th>Group I (TMD and neck pain)</th>
<th>Group II (TMD and no neck pain)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>31.0833 (±5.614)</td>
<td>30.0167 (± 5.745)</td>
<td>0.470</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>70.3667 (±8.475)</td>
<td>71.1 (±6.138)</td>
<td>0.703</td>
</tr>
<tr>
<td>Height (m)</td>
<td>1.6537 (±0.836)</td>
<td>1.679 (±0.567)</td>
<td>0.175</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>25.649 (±1.58)</td>
<td>25.2 (±1.208)</td>
<td>0.222</td>
</tr>
</tbody>
</table>

Figure (2). Mean values of demographic data.

Table (2). Comparison of the DNF endurance mean between Gr. I and Gr. II.

<table>
<thead>
<tr>
<th></th>
<th>Group I (TMD and neck pain)</th>
<th>Group II (TMD and no neck pain)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>DNF endurance</td>
<td>22.8 (±1.349)</td>
<td>24.8 (±1.9369)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
Cervical spine function is affected directly by cervical flexor endurance. Any affection of cervical spine flexor endurance activity leads to cervical dysfunction, tissue overload, trauma, and pain (Harris et al., 2005).

Muscular dysfunction in the cervical spine refers to changes in structure and function. Moreover, deficiencies such as reductions in maximal strength, accuracy of head position during dynamic movements and repositioning, efficiency of muscle contraction and endurance have been observed in people affected by NP (O’Leary et al., 2009; Arazza et al., 2014).

Results of the current study showed that patients with TMD and neck pain had less deep neck flexors endurance than patients with TMD and no neck pain. So, interpretation of these results leads to the assumption of neck pain in the patients with TMD could be related to muscular dysfunction of the cervical spine. The results of the current study agrees with previous studies which found that neck pain is related to reduced deep neck flexor activity and endurance.

In a study comparing patients with neck pain to normal control participants, it was found that patients have an altered neuro-motor control strategy during craniocervical flexion. This alteration was in the form of reduced activity of DCF muscles and an increased activity in the superficial flexor muscles. This is also accompanied by altered movement strategies as delayed onset of activation of cervical flexors. This change in motor control with neck pain potentially compromises the cervical spine’s control which may leave it vulnerable to further strain (Jull et al., 2008).

In another study, individuals with neck pain showed an altered muscular synergy were the sternocleidomastoid and anterior scalene (superficial flexors) became more active than the deep flexors. Furthermore, decreased deep flexor endurance has been associated with increased cervical lordosis and cervical pain (Olson et al., 2006).

Falla et al., (2004b) reported delayed neck muscle activation, particularly of DCF, in patients with chronic neck pain during rapid, unilateral arm movements compared to normal control participants. These findings were attributed to a deficit in the motor control of the cervical spine (Falla et al., 2004b). Decreased endurance of the craniocervical flexor muscles has been observed in patients with neck pain at 20% of their maximal voluntary contraction (O’Leary et al., 2009).

On the other hand, Grimmer and Trott, (1998) failed to show an association between endurance of deep neck flexor and neck pain in their population-based study.

Moreover, it was found that training of deep neck flexors helps in decreasing neck pain. Falla (2007) reported that patients with chronic neck pain demonstrate a reduced ability to maintain an upright posture when distracted. After training of craniocervical flexor muscles, there was improved ability to maintain a neutral cervical posture during prolonged sitting.

Deep flexor training in patients with cervicogenic headache (CEH) has been shown to decrease pain and the frequency of headaches.
CONCLUSION
Endurance of DNF decreases in relation to presence of neck pain in patients with TMJ disorders, so examination and training of DNF is important in patients with TMD complaining from neck pain.

CONFLICT OF INTEREST
The authors declared that present study was performed in absence of any conflict of interest.

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AUTHOR CONTRIBUTIONS
All authors contributed in all parts of this study.

REFERENCES


