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The effects of therapeutic exercise in improving forward head posture and functionality in patients with neck pain
A literature update

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Forward head posture (FHP) is a common pathological condition of the cervical spine. FHP is associated with neck pain, and reduced range of motion, strength and functionality. This biomechanical maladaptation is of multifactorial etiology, and muscle strain and articular sprain injuries, pathological adaptation of cervical soft tissues, arthropathy, intervertebral disc pathology and poor body posture may all play a role. Along with other therapeutic interventions, therapeutic exercises can lead to short-term improvement in terms of pain, strength and muscle elasticity, and postural improvement in patients with neck pain and FHP. Further research is needed, adopting a methodological research plan to evaluate the effectiveness of exercise treatment for overall correction of human body posture (cervical, thoracic and lumbar areas), both in the short- and long-term.

Η αποτελεσματικότητα της θεραπευτικής άσκησης στην πρόσθια μετατόπιση της κεφαλής και στη λειτουργικότητα σε ασθενείς με αυχενικό πόνο: Ενημέρωση βιβλιογραφίας

Περίληψη στο τέλος του άρθρου

Key words

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1. INTRODUCTION

Neck pain has a high epidemiological incidence, and in Europe and North America, at least one in three adults experience neck pain at some point during-any, and about 5–10% of those experience severe neck pain. The prevalence of neck pain is higher in women and increases with age.[1,2] In several studies, neck pain has been associated with a generally poor health state and psychological condition, and with previous neck injuries, and other factors, such as occupation and obesity.[3–5]

Cervical pain syndrome is of multifactorial etiology; muscle strain or articular-sprain injuries with maladaptation of the soft tissues of the cervical spine, arthropathy, spondylolisthesis, intervertebral disc pathology and poor posture have all been cited.[6] For all these factors, pathological biomechanical adaptation is strongly associated with painful syndromes of the cervical area. Epidemiological studies have shown that poor posture and inadequate cervical motor control may be present from as early as puberty, and forward head posture (FHP) and round shoulders are recorded as the most common orthostatic deviations of the neck and shoulder area.[7,8]

In addition, forward shoulder posture (round shoulders) can lead to muscular imbalance due to the shortening of the anterior shoulder muscles (minor and major pecto-

ralis) and elongation of the posterior shoulder muscles (trapezius, rhomboids). This imbalance can lead to the incorrect positioning and movement of the glenohumeral joint, thus increasing the risk of incorrect biomechanical adaptation, especially incorrect neck posture, connected with painful shoulders and upper crossed syndrome.[9–11] In relation to this, forward pelvic tilt can also cause incorrect biomechanical adaptation in posture, such as thoracical kyphosis and FHP.[12]

Therapeutic exercise, in the form of neuromuscular retraining and enhancement, is one of the most important therapeutic interventions for the treatment of neck pain. This type of treatment is indicated in the case of etiological factors that include hypermobility or reduced neuromuscular control and poor posture.[13] Specific therapeutic exercises can significantly benefit several systems of the body, including musculoskeletal, cardiovascular, lymphatic and brain function. Specifically, therapeutic exercises directed towards correcting pathological body adaptation have been documented to be capable of improving elasticity and mobility, increasing muscular strength and endurance along the cervical spine, increasing ligament tensile strength and averting tendon injuries.[14]

This review evaluates current research findings on the effects of therapeutic exercise in correcting FHP in patients with neck pain, given the high epidemiological frequency of neck syndrome, its consequences on functionality and the negative effects of incorrect biomechanical adaptations, such as FHP.

This overview is intended to outline the current understanding of FHP and its consequences, and the effects of therapeutic exercise in correcting FHP in patients with neck pain, in order to help clinical therapists to provide more accurate diagnosis and effective rehabilitation.

2. FORWARD HEAD POSTURE

Forward head posture is defined as anterior displacement of the head, accompanied by an overextension of the vertebral spine. This pathological adaptation is associated with a reduction in the length of the upper trapezius, the posterior part of the cervical extensor muscles (suboccipitals, semispinalis capitis, splenius capitis-cervicis), the sternocleidomastoid and the scapular elevator.[15] FHP was first reported through investigation of upper and lower extremity muscle imbalance syndromes.[16]

FHP is characterized by contraction of the extensor neck muscles. The diagnosis is made through the evaluation of the craniovertebral angle (CVA).[17,18] The CVA is defined as the angle between the line from the external auditory meatus to the horizontal line at the level of the seventh cervical vertebra. Most studies report 50° as a reference point for the diagnosis of FHP. When the angle formed by the two lines is <50°, this is a positive FHP indication; the smaller the angle, the greater the FHP relative to the cervical spine.

2.1. Definition, predisposing factors

An important predisposing factor for FHP is age, which is an irreversible factor, because over time the functionality of the neck decreases through the wearing down of the biological elements in the area.[19] Studies have indicated several other predisposing factors for FHP, related to contemporary lifestyles,[20] including incorrect work and rest patterns, lack of physical activity, weight gain, decreased kinesthesia and incorrect patterns of movement and position.[8,21,22] The first signs of incorrect posture patterns start in adolescence, with FHP and incorrect shoulder position being the most common deviations.[8]

2.2. Effects – symptoms

The most common symptoms of FHP are neck pain and headache.[23] In this pathological pattern, a decrease in the strength of the deep muscles of the cervical spine is initially observed, which gradually leads to a change of posture, and muscle imbalance. This imbalance causes instability in the thoracic spine, with consequent poor respiratory function and a general reduction of functionality in the thoracic area. All these changes create concomitant predisposing problems and lead to an increase in muscle pain.[24] In addition to the incorrect patterns of posture and movement in daily life, it is of note that the mental and emotional state of the individual contribute to overall body functioning, and general fatigue has a negative effect on the muscular system, and thus on posture and movement.[25]

2.3. Forward head posture evaluation

The evaluation of FHP is based on clinical observation and the use of specific equipment. Objective methods of evaluation include the assessment of the cervical spine position in the frontal and sagittal plane in either the standing or the sitting position. Imaging techniques include X-rays and magnetic resonance imaging (MRI). Goniometer and force platforms are used to determine the centre of gravity,[26] which provide data on the patient's balance, rather than the position of the head in relation to the body.[27]

2.4. The effect of therapeutic exercise on the improvement of forward head posture and function in patients with neck pain

Studies on improving incorrect biomechanical patterns and positions of the cervical spine through exercise have focused on strengthening the muscles that surround the shoulders and thorax, and the deep neck muscles. Applications include strengthening exercises, stretching exercises and myofascial release techniques targeting the suboccipital muscles.

Therapeutic exercise protocols aimed at the improvement of FHP vary in frequency, application techniques and the type of muscular contraction utilised. They include general exercises aimed at strengthening muscle groups, and specific exercises aimed at strengthening particular muscles. In targeting the neck muscles, strengthening of the deep flexors with a biofeedback stabiliser for exercises such as the neck curl with chin tucked has been suggested (fig. 1) and neck lateral flexion with the chin tucked in, in the supine or the lateral position. Exercises in the sitting position include the chin tuck and head pushing against the palm with chin tucked, in all directions (fig. 2).[21,28]

Strengthening of the shoulder and scapular muscles has been evaluated by many researchers for their contribution to the activation of the rotator cuff muscles (teres minor and subscapularis) and the stabilisation of the scapula (mainly the middle and lower trapezoids and the rhomboids muscles) alone or in combination with exercises for the deep neck flexors. Specific exercises, such as the latissimus dorsi pull down, shoulder external rotation exercise, horizontal shoulder abduction exercise (in prone position, fig. 3), shoulder abduction exercise, and shoulder flexion exercise and shoulder extension exercise, have been studied for their effects on improving FHP.[21] Other exercises include bringing the shoulder in abduction with a ball from position Ys to position Ws and from position Ls to position Ys.[1]

Table 1 presents the studies that have utilised therapeutic exercises as a basic intervention to improve FHP. Stretching has been used with both shoulder and thoracic muscles as a therapeutic intervention[8,15,27,29–34] incorporated into a Pilates program[35] or as a warm-up treating different muscle groups.[21] Increase in the elasticity of the scalene muscles and levator scapulae has also been evaluated and proposed as a suitable intervention.[31,33] Finally, general dynamic and isometric exercises for muscle strengthening with elastic straps and balls have been used to improve posture and increase elasticity.[8]

All of the therapeutic exercise programs that have been carried out to date led to short-term improvement of the variables that were examined, in terms of muscle strength and elasticity, posture and FHP.[8,14,28–30,33,35–37] The studies that included evaluation of the effects of the treatment after a more extended period (follow-up), however, concluded that the improvement of the parameters was not maintained with the passage of time. The duration of the follow-up measurements was from one month to four months after the end of the interventions.[15,21]

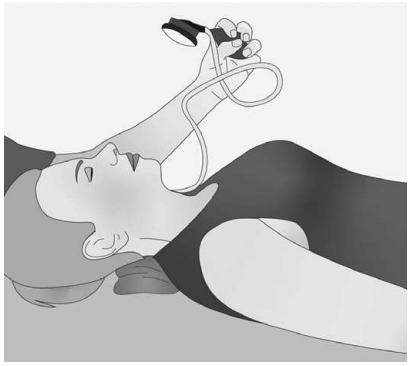

Figure 1. Exercises to improve forward head posture: Neck curl with chin tucked in.

Figure 2. Exercises to improve forward head posture: Lateral flexion with chin tucked in.

Figure 3. Exercises to improve forward head posture: Horizontal shoulder abduction.

Table 1. Exercise therapy protocols for improving forward head posture.

Study	Duration – patients	Purpose	Strength exercises	Stretching exercises	Results
Roddey et al[34]	14 days; n=38	Effects of a stretching program and FHP		Pectoral muscles	Improvement in moderate FHP
Harman et al[32]	10 weeks	Exploring progressive exercises at home	Deep neck flexors, shoulder muscles	Pectoralis minor, neck extensors	Improved ROM, posture and FHP
Falla et al[14]	6 weeks; n=58	Change posture of the head/ thorax during work; compare exercises	Neck flexors, endurance deep flexors strengthening	–	Reduction in cervical angle
Andersen et al[29]	8–10 weeks; n=12	Determine level of muscle activation with EMG	Shoulder and scapula exercises	–	Pain reduction
Lynch et al[33]	8 weeks swimmers	Correct posture; increase strength; reduce pain, malfunction	Scapular adduction; exercises on ball	Thorax muscles; chin tucked	FHP and strength improvement; Pain reduced
Gupta et al[28]	4 weeks; n=30	Effect of deep flexor training	(a): deep flexors ex; (b): isometric exercises	–	A: FHP improvement; A and B: pain reduction
Kang[21]	6 weeks; n=20	Effect of deep flexor training	Neck curl, lateral bending chin tucked etc.	Neck, shoulders, scapula	Improvement ROM and endurance
Bae et al[30]	4 weeks; n=30	Effects on the upper crossed syndrome	Medium trapezoid-lower trapezoid	Rhomboid/upper trapezoids	Improvement of the crossed syndrome
Lee et al[35]	10 week; n=20	Effect of Pilates and a classic exercise program on the craniovertebral angle ROM, pain, fatigue	Pilates and classic strengthening exercises	Pilates and classic exercises	ROM improvement with all exercises
Kim et al[36]	1 time; n=8	Effects of myofascial release – alignment	Scalenes; splenius capitis; suboccipital	–	Combining methods is more beneficial
Kim et al[37]	1 time; n=12	Effect of training with elastic bands	Lat pull down; shoulder external rotation; horizontal abduction etc.		Posture improvement
Schwanke et al[8]	4 months; n=61	Effects of a general exercise program	Isometric exercises using elastic straps, balls, etc.	General exercises	Posture and elasticity improvement
Ruivo et al[15]	32 weeks; n=130	Effect of exercises on: FHP; rounded shoulders	Rotator cuff muscles, scapula stabilization and deep flexors of the neck	Pectoralis minor, sternocleidomastoid	Increase in FHP and rounded shoulders

FHP: Forward head posture, ROM: Range of motion, EMG: Electromyography, PBU: Pressure biofeedback unit

Based on the above findings, it was reported that the implementation of stretching and strengthening with resistance exercises led to an initial increase in the craniovertebral angle from 45.0±3.5 degrees to 46.9±4.0 degrees (p=0.004),[15] but the improvement was not maintained, and the angle had returned to the same levels as before the intervention 16 weeks later (p=0.236).[33] In support of these findings, a targeted exercise program at home that included exercises to strengthen the deep neck flexors, stabilise the scapular muscles, and stretch the thorax muscles, and neck extensions, improved FHP and range of motion.[32]

3. CONCLUSIONS

FHP is part of the dysfunctions caused by poor biomechanical functioning of the body. Changes in the length of the muscles in the area, proprioception disorders, and older musculoskeletal problems, such as round shoulders, kyphotic patterns in the thoracic cage, pathology in the scapula, and anterior pelvic tilt, can all cause dysfunction and misalignment in the cervical region, most commonly resulting in FHP. This review highlighted the overall positive impact of some of the therapeutic exercises programs that have been conducted, which have led to short-term improvement in patients with neck pain, in terms of pain reduction, increase in strength and muscle elasticity, and improvement in posture and FHP. Further research is needed based on a methodological evaluation plan for the overall correction of human body posture (cervical, thoracic, and lumbar), both in the short- and long-term.

ΠΕΡΙΛΗΨΗ

Η αποτελεσματικότητα της θεραπευτικής άσκησης στην πρόσθια μετατόπιση της κεφαλής και στη λειτουργικότητα σε ασθενείς με αυχενικό πόνο: Ενημέρωση βιβλιογραφίας

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Η πρόσθια μετατόπιση της κεφαλής (ΠΜΚ) είναι μια κοινή παθολογική κατάσταση της αυχενικής μοίρας της σπονδυλικής στήλης που σχετίζεται με πόνο στον αυχένα, μειωμένο εύρος κίνησης, μειωμένη δύναμη και λειτουργικότητα. Αυτή η παθολογική εμβιομηχανική προσαρμογή έχει πολυπαραγοντική αιτιολογία, που περιλαμβάνει μυϊκές και συνδεσμικές κακώσεις, παθολογικές προσαρμογές μαλακών ιστών του αυχένα, αρθροπάθειες, παθολογίες μεσοσπονδύλιου δίσκου και τη λανθασμένη στάση του σώματος. Μεταξύ άλλων θεραπευτικών παρεμβάσεων, οι θεραπευτικές ασκήσεις μπορεί να οδηγήσουν σε βραχυπρόθεσμη βελτίωση όσον αφορά στον πόνο, στη δύναμη και στην ελαστικότητα των μυών, καθώς και σε βελτίωση της στάσης σε ασθενείς με πόνο στον αυχένα και ΠΜΚ. Απαιτείται περισσότερη έρευνα που θα πρέπει να υιοθετήσει έναν μεθοδολογικό ερευνητικό σχεδιασμό για την αξιολόγηση τόσο της βραχυπρόθεσμης όσο και της μακροπρόθεσμης αποτελεσματικότητας της θεραπευτικής άσκησης για τη συνολική διόρθωση της στάσης του ανθρώπινου σώματος (αυχενική, θωρακική και οσφυϊκή μοίρα).

Λέξεις ευρετηρίου: Άσκηση, Αυχενικός πόνος, Πρόσθια μετατόπιση κεφαλής

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