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The cervical therapeutic exercise programme

The therapeutic exercise techniques used in the randomised control trial (RCT) for cervicogenic headache aimed to address the changes in muscle function found to accompany cervical musculoskeletal disorders. In particular, the aim was to rehabilitate the muscles' supporting and postural functions. The programme specifically addressed impairments in the deep neck flexor and extensor muscles and changes in patterns of muscle use that have been documented in the cervicoscapular muscle system. In the presence of neck pain and headache, weakness has been identified in the deep neck flexor muscles, and patients show increased activity in their superficial flexors, presumably as a compensation strategy. [1 2] Atrophy has been shown in the suboccipital extensors,[3] and thus the deep muscle sleeve, important for active support of the cervical segments,[4] becomes impaired. Additionally, increased activity has been shown in muscles such as the upper trapezius in patients with neck pain during functional tasks,[5 6] which may cause unnecessary loading on cervical structures. Thus, the exercise approach is a motor relearning programme where the emphasis is on rehabilitating the impaired coordination of the cervical and scapular muscle synergies and on retraining the endurance capacities of the deep neck flexor and extensor muscles and shoulder girdle muscles at low levels of load as is required for their function of support and control of cervical joints and posture.

The prescription of specific exercises is based on the findings of the clinical examination. This includes the muscle test of craniocervical flexion (CCF) and the clinical analysis of muscle use in functional tasks such as assuming an upright sitting posture, the

pattern of muscle control during neck extension and flexion, and the pattern of scapular muscle control with arm function.

Elements of the exercise programme

Re-educating craniocervical spine flexor muscles

Re-education of CCF movement

The neck flexor muscle synergy is tested with the CCF test, which is performed in the supine lying position. The patient performs 5 incremental stages of CCF. Performance is guided by feedback from an air filled pressure sensor placed behind the neck to monitor the subtle flattening of the cervical lordosis, which occurs with contraction of longus colli. Patients attempt to target progressive 2 mm Hg pressure increments from a baseline of 20 mm Hg to the final target of 30 mm Hg. The clinician analyses the pattern of movement as well as the activity in the superficial flexors. There should be progressively increasing CCF with each stage of the test, but commonly patients use a substitute head and neck retraction action rather than the rotation action of CCF to reach the pressure targets to mask inadequate performance of the deep neck flexors. This is often associated with overuse of the sternocleidomastoid, hyoid, or scalene muscles. The first step in rehabilitation is to train correct performance of the CCF movement. This is done as a free exercise focusing on the perception and performance of the correct movement. The patient palpates the superficial flexors to avoid their inappropriate use. An emphasis on precision and control is essential. Most patients will achieve a correct movement with a few days of practice.

Training the low level endurance capacity of the deep neck flexors

Training the holding capacity of the deep neck flexors begins as soon as the patient can perform the CCF movement correctly. Pressure biofeedback is used to guide training. Without this feedback, it is difficult for the therapist or patient to know if the contraction is being maintained. Feedback is motivational for patient compliance and allows the therapist to gain some quantification of improvement to guide progression of the exercise. Training begins at the pressure level that the patient can achieve and hold steady with a good pattern, without dominant use or substitution by the superficial flexor muscles. This is often at the lowest levels of the test (22 or 24 mm Hg). The movement is facilitated with eye movement into the flexion direction, and emphasis is always on precision and control. Fast or jerky movements are discouraged as they often mask inadequacies in the deep neck flexors. Training should be short of fatigue, so that an incorrect pattern is not encouraged. The patient practises the formal exercise at least twice daily (eg, before arising in the morning and when retiring at night). For each pressure level, the holding time is built up to 10 seconds and 10 repetitions are performed, eventually to the desired level of 30 mm Hg.

Retraining the cervical flexors for antigravity function

Once the patient shows improvement in deep cervical flexor activation, training is progressed to the sitting position. The exercise is a controlled eccentric action of the flexors into cervical extension range followed by a concentric action of these muscles to return the head to the neutral upright position. The return to the upright position must be initiated by CCF, rather than a dominant action of sternocleidomastoid. The exercise is progressed by gradually increasing the range to which the head is moved into extension as control improves, and introducing isometric holds through range.

Extensors of the craniocervical spine

The patient practises eccentric control of the head into flexion followed by concentric control back to the neutral position in a 4 point kneeling position to train the coordination of the deep and superficial cervical extensors. These exercises are incorporated with re-education of the scapular muscles in these positions and are commenced early in the programme. Patients flex the head and neck slowly, controlling the speed against gravity and return to the neutral position. The exercise is progressed by performing alternating small ranges of craniocervical extension and flexion while maintaining the cervical spine in a neutral position. The aim is to encourage the deep cervical extensors to maintain a neutral cervical spine while the craniocervical extensors perform fine eccentric and concentric contractions as well as holding contractions.

Co-contraction of the neck flexors and extensors

Co-contraction of the neck flexor and extensor muscles, in their action as a muscle sleeve, occurs during movements of the neck.[7] The co-contraction is facilitated with rotation, and the exercises are introduced once the patient can activate the deep muscles. The patient uses self resisted isometric rotation in a correct upright sitting posture. They look into the palm of the hand, providing the resistance to facilitate the muscles and perform the alternating rhythmic stabilisation exercises with an emphasis on slow onset and slow release holding contractions, using resistance to match about a 10–20% effort.

Retraining the strength of the superficial and deep flexor synergy

A final and late stage element of training addresses any strength deficits in the neck flexor synergy. Gravity and head load provide the resistance. Care must be taken that high load exercise is not introduced too early, as it may be provocative of symptoms. The head lift must

be preceded with CCF followed by cervical flexion to just lift the head from the bed. Strength training to higher levels may not be necessary for most patients. It must be noted that progression to strength training should not occur before problems in the interaction between the deep and superficial muscles have been addressed, as this may retrain and perpetuate incoordination between these muscle layers.

Retraining the scapular muscles

Retraining scapular orientation in posture

Regaining control of scapular orientation is begun from the outset. It can be a challenging clinical skill because of the small changes of scapular position that are often required. It is important initially that the patient has the feel for the correct motion. Initial retraining may need to exaggerate the movement required before fine tuning the desired contraction intensity. Emphasis should also be placed on relaxation of unwanted muscle co-activity.

One of the more commonly observed postural faults is the protracted and downwardly rotated position of the scapula. A correction strategy is to have the patient move the coracoid upward and the acromion backwards, which results in a slight retraction and external rotation of the scapula. The aim is to facilitate the coordinated action of all parts of trapezius and serratus anterior, allowing lower trapezius to slightly depress the medial border of the scapula, consequently lengthening (and relaxing) the levator scapulae. Emphasis is placed on the subtlety of the movement. Once the patient learns correct scapular orientation, he repeats the correction and maintains the position regularly throughout the day so that it becomes a habit.

Training the endurance capacity of the scapular stabilisers

Once the optimal scapular position, direction, and intensity of the scapular muscle contraction have been learnt, the patient progresses to train the endurance capacity of the synergistic muscle contraction. Repeated repetitions of 10 second holds of the corrected scapular position encourages early endurance retraining. Endurance of the middle and lower trapezius muscles is also trained by performing exercise in the prone lying position against the effects of gravity.

Retraining scapular control with arm movement and load

The control of scapular orientation in posture can be progressed with the addition of small range arm movements. This is important when activities such as computer or deskwork aggravate pain. The patient is encouraged to maintain their newly learnt scapular position while performing small range (≤60 degrees) arm movements, or during, for example, work at a computer. Scapular control in association with control of cervicothoracic postural position is also trained for functional activities such as lifting and carrying.

Re-education of posture

Re-education of control of posture begins from the first treatment. Frequent correction to an upright neutral postural position serves 2 functions. It ensures a regular reduction of adverse loads on the cervical joints induced by poor spinal, cervical, and scapular postures. Most importantly, it trains the deep and postural stabilising muscles in their functional postural supporting role. Although formal exercises for the deep neck flexors and scapular muscles in lying or 4 point kneeling positions are undertaken twice per day, the activation and holding ability of the muscles is trained as part of postural correction repeatedly throughout the day, with an emphasis on a change in postural habit. Postural position is trained in sitting and is corrected from the pelvis. The second aspect of re-education of postural position is correction

of scapular position. Maintenance of a correct scapular position with appropriate muscle coordination has the added benefit of inducing reciprocal relaxation in muscles such as levator scapulae, which reduces muscular pain in the area. A final element of the postural exercise is to ask the patient to add a gentle "occipital lift" (imagine lifting the occiput 1 mm off the atlas). This action of gentle lengthening activates the longus colli.[8]

Self management programme

Exercises are provided for the patient to incorporate into daily work practices. They are repeated frequently during the day. The clinician has a responsibility to educate, encourage, and gain patient compliance. This can be achieved if the patient understands and experiences the pain relief that can be obtained with correct muscle control and understands the consequences of poor muscle control and the adverse loads that are placed on cervical structures through inappropriate patterns of muscle use. A feature of the active stabilisation programme is that the self management component is not inordinately time consuming. Formal exercises for the re-education of the neck flexor and extensor synergies and scapular muscles are performed twice per day and take only about 10 minutes to perform. Other components of the programme are performed within normal work or daily activities and should become part of normal working routines. This is a time efficient self management exercise strategy.

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