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TECHNICAL REPORT

Semidirect thrust technique for rotation disorder in the atlas with index finger contact

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ABSTRACT

Due to the large anatomical and functional differences, the study of the craniocervical region is separated from the rest of the cervical column. The craniocervical junction is considered as responsible for very different signs and symptoms to those we find in the inferior cervical spine, such as for example vertigo, headaches with different origins, etc.

The objective of the thrust technique for an atlas rotation disorder with index finger contact is to return mobility and functionality to the vertebra. It is important to master the basic principles of performing the technique to be able to apply the correct therapeutic procedure after having ruled out the possible risks of manipulation.

INTRODUCTION

The superior cervical column (C0-C1-C2) has the most extensive mobility of the entire vertebral column: it carries out more than 50% of the cervical rotation and a third of the cervical flexion-extension1. Trauma or painful procedures for the neck or adjacent structures can cause a reflex muscle spasm to protect the area, resulting in a loss of mobility [2].

Cervical pain affects the patient's quality of life and has significant social and financial consequences[3]. According to Rezai et al., it has a high morbidity rate, both at an occupational level and in daily activities [4]. We must carry out an intense anamnesis and diagnosis, using challenge tests and X-rays to prevent risks and contraindications such as, for example, accidents originating from an injury to the vertebral artery after a careless manoeuvre [5, 6].

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The artery can be damaged at those points where its mobility is less in relation to the neighbouring structures: C2 transverse foramen, C1 posterior arch channel and the intracranial dura mater [7, 8]. With the thrust techniques, we seek to return the muscle spindle to normal. Rapid stretching of the spindle's intrafusal fibres occurs, which causes a series of afferent impulses of such high frequency for the central nervous system that, as protection, it reduces the gamma hypersensitivity [9, 10].

OBJECTIVES

The technique's objective is to overcome the suboccipital muscle spasms that set the posterior vertebra and restore the articular mobility by opening the facet, dislocating it in the direction of the contralateral rotation. Two effects are produced:

-Mechanical effect: the joint is mobilised eliminating adherences and stretching the articular capsule and ligaments, causing a reflex inhibition of the muscle spindles and of the suboccipital muscles in spasm. The facets diverge.

-Neurological effect: the mechanical receptors of the transverse ligament, the main stabiliser of the odontoid processes on the atlas´s interior arch is stimulated[11] and of the alar ligaments that are essential in the control of the atlas rotation and those of the articular capsules that are not as significant as the above, but that also limit rotation and lateral inclination[12]. In this way the gamma hyperactivity is inhibited.

The technique is accompanied by an intra-articular cavitation[13]. We stimulate the sympathetic nervous system through the upper cervical ganglion, restoring the muscle spindles altered by the sympathetic hyperactivity to normal.

There is a local vascular reflex that enables the reduction of the inflammation in the intervertebral foramina.

APPLICATION PRINCIPLES

In a dysfunction of the atlas in rotation, we find the posterior vertebrae of the rotation side. The dysfunction is maintained by the suboccipital muscular spasm of the posterior side. The facet of the atlanto-axial joint on the rotation side is imbricated. The dysfunctions or pathologies at a high cervical level can trigger different types of symptoms, such as, for example, headaches[14,15,16] or pseudovertigo[17,18]. The limited movements are: contralateral rotation with the inferior cervical spine in flexion, homolateral tilt and anterior slipping on the posterior side, which limits a certain degree of the atlanto-axial extension. The technique consists of using direct contact through the distal inter-phalangeal joint of the physiotherapist's index finger on the transverse process of the atlas, regulating the capsular-ligament pressure, using the head as a lever, in a double chin position (neutral flexion-extension), slight anterior slipping, light homolateral lateral flexion (that involves contralateral slipping) and contralateral rotation to the posterior, up to the dysfunction level. Once the parameters are in place, a high speed and short-range thrust on the contralateral rotation are applied to open the imbricated facet and return mobility to the limited components.

DIAGNOSIS ASSESSMENT

The diagnosis for a dysfunction on rotation of the atlas is based on the following clinical tests:

1) *Radiology* [19]. Extensive osteopathic information can be obtained from the upper cervical spine X-rays.

-A transoral x-ray from the front shows the occipital condyles and the first two cervical vertebrae. Several lines are drawn:

a) One that joins the two mastoid notches

b) One that joins the junction points between the lateral and transverse mass of the atlas.

c) One that passes through the joint of the axis laminae and pedicles.

d) One vertical line that passes through the C2 spinous tubercles and the point of the odontoids.

The transverse line of the occiput is horizontal in the dysfunctions of the atlas rotation. Posterior rotation is identified because the homolateral lateral mass is apparently smaller. The atlas rotation is related to a lateral-flexion movement and to a homolateral lateral slipping. The vertebra is posterior-inferior. The anterior rotation shows a larger lateral mass. C1 is anterior-superior of the side contrary to the posterior one. The lateral space is measured through the distance between the internal border of the lateral masses and the odontoid processes; it must be equal, and a reduction indicates a lateral space on the opposing side.

-Profile radiography. This enables the study of congenital defects, bone spurs, C1 or C2 fractures. It enables the assessment of the defects at the occipital, atlas and axis level through:

a) An anterior-posterior line of the atlas joining the anterior and posterior tubercles.

b) A basioccipital line that joins an anterior point, determined by the joining of the flat part of the occipital and the posterior part of the condyle and one posterior placed in the join of the flat part, and also the start of the occipital squama.

The normal angle between these is 8º. Although dysfunction in rotation is normal in the atlas, dysfunctions can be added in flexion or extension. When the angle is less than 8º, we are looking at a dysfunction in flexion; when it is greater, we are looking at a dysfunction in extension. The rotation is characterised by a division of the posterior border of the lateral masses of the atlas.

-Radiology through the vertex. This is used to confirm a rotation of the atlas. A line is drawn from anterior to posterior that passes through the nasal septum, the basilar process, the middle of the odontoid processes and the rest of the cranium. Another line is drawn that passes in an anterior direction to the transverse processes of the atlas. Finally, a line is drawn perpendicular to the anterior-posterior line. Any difference between this line and the one which passes through the atlas indicates a rotation between the occipital bone and C1.

-Dynamic radiography. This is done in flexion-extension and is useful when we suspect atlas/axis instability.

2) *Neurological examination* [20]. Study of the dermatomes, myotomes, reflexes, etc.

3) *Palpation* [20].

4) *Orthopaedic tests:*

-Klein Test [21]. The cervical column is the region of the musculoskeletal system, where the majority of the reported complications in manual therapy treatment occur. The thrust techniques are used by a large number of physiotherapists during their daily practice [22]. An exhaustive examination, both objective and subjective of the patient must be performed that, along with our anatomical awareness and knowledge at the time of using thrust, increases the technique's safety and specificity [23]. Even though a traumatic injury to the vertebrobasilar arterial system is rare, it is catastrophic. The Klein Test is used as a provocative diagnostic manoeuvre of the artery's integrity. The test consists of extending the patient's head and neck off the bed with the patient in a supine position and initiating rotations to the right and left (figure 1), maintaining the head in each one of the rotations for between 30 seconds and 2 minutes, waiting for nystagmus to appear or adverse symptoms such as nausea, giddiness, loss of consciousness or any symptom that indicates partial or total occlusion of the artery. Appearance of any of these

symptoms is a total contraindication to vertebral manipulation[24]. Some authors state that the responsible manipulation parameters for an injury to the vertebral artery are the range and force of the thrust, whereas the speed can minimise risks [18]. Significant reduction in the vertebral systolic peak and final diastolic occurs in the artery flow on the contralateral side in the pre-manipulation position for the C1-C2 segment. Significant changes are also found in the rotation [25].

Figure 1. - Performing the Klein test.

5) ***Active mobility test***. Devices that measure the range of cervical mobility (RCMO) have been shown to be more reliable compared with other measuring methods in all its movement ranges [26-29]. Electromagnetic[30] or radiographic[31] equipment can also be used.

6) *Osteopathic tests.*

-Flexion-rotation test. This test has been validated by Hall et al. in different studies [32,33], even using live magnetic imaging[34]. Sensitivity and specificity of the test was 90% and 88% respectively with a kappa index of 0.85. The test is done prior to the procedure to determine the side of the dysfunction, and to check afterwards its correction and the relevant increase in mobility. The test is done with the patient in a supine position. The assessor makes contact using the radial border of the index fingers of two hands at the level of the atlas controlling the transverse processes. The thumbs rest on the side of the head. The test consists of putting the mid cervical spine in flexion, to achieve pressure on the posterior soft cervical tissue which blocks all the cervical levels except the atlas that remains free to perform the rotation movements. Maintaining the head in a double chin position at the level of the upper cervical spine the patient's head is turned in rotation on both sides, comparing the range of motion to the left and then to the right; likewise the quality of the restriction is analysed. One rotation restriction to the right becomes one dysfunction in the posterior of the left side [20].

INDICATIONS / BENEFITS

The previously mentioned is indicated for cases of cervicalgia, cervicobrachial neuralgia, Arnold's neuralgia; headache and migraines, cervical disc hernias, position vertigo; and also, related visceral problems [6,9,20] (heart, throat, eyes, nose etc.).

CONTRAINDICATIONS / RISKS

Due to the existence of related risks[6,9,20] this technique is not recommended in the following cases: recent trauma (fractures, grade III sprains, dislocations), vascular alteration (aneurysms, vertebrobasilar insufficiency); metabolic illnesses (significant osteoporosis); congenital defects (Downs´ syndrome, due to the absence of the transverse ligament); basilar impression (Arnold-Chiari, syringomyelia); occipitalisation of the atlas; pontus unticus; psychological changes (rejecting the manipulation or hysteria; peripheral or central paralysis; hyperalgesic syndromes related to neurological pathology; Barré-Lieou syndrome; bone tumours; inflammatory rheumatism (rheumatoid arthritis, ankylosing pelvic spondylitis, etc.); infections (spondylodiscitis).

Likewise, we consider the following relative contraindications[35]: incomplete diagnosis, not having the patient's consent, pain during the performance of

the technique on looking for the pressure, postpartum situations, etc.

TECHNIQUE DESCRIPTION

Position of the party. The patient is in a supine position, with the physiotherapist standing, bended forward of the patient's head, on the side of the atlas posterior, with the centre of gravity above the dysfunction.

Position of the hands. The left hand takes the cranial pressure. The right hand, because of its position "square" to the C1 transverse process between the ramus of the mandible and the mastoid processes, cannot apply a classic contact with the index finger and therefore, it is done with the tip of the third phalange of the index finger strengthened by the big finger, on the posterior part of the transverse process of the atlas. The forearm is placed in the reduction axis.

Carrying out the technique.

1st stage. Set the double chin right position until noticing the pressure in the right index finger.

2nd stage. Light anterior slipping, light homolateral lateral flexion (that leads to contralateral slipping), contralateral rotation, contralateral, after circumductions to perfect the pressure.

3rd stage. Rotational thrust in the direction of the patient's eye, accompanied by a rotation of the physiotherapist's wrist (figure 2).

After performing the manipulation, we find an analgesic effect due to the release of endorphins [36] and a placebo effect thanks to the articular cavitation [37].

Figure 2.- Thrust technique for a dysfunction on the right rotation of the atlas with an index finger contact.

PRECAUTIONS

The idea is to assist the release of tissue in the expiratory phase and to reduce the pressure within the correction parameter; the rotation. When performing the technique, elbows are kept touching the body in order to control the thrust´s force and range. The technique is suspended if pain occurs when putting on pressure.

CONCLUSIONS

The technique's objective is to focus a brief and quick, short-range thrust, using fine contact and a construction of parameters using levers to release the joint without any risk for the patient, overcoming the single-articular homolateral muscle spasms that set the dysfunction.

CONFLICT OF INTEREST

The authors declare that they do not have any conflict of interest.

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