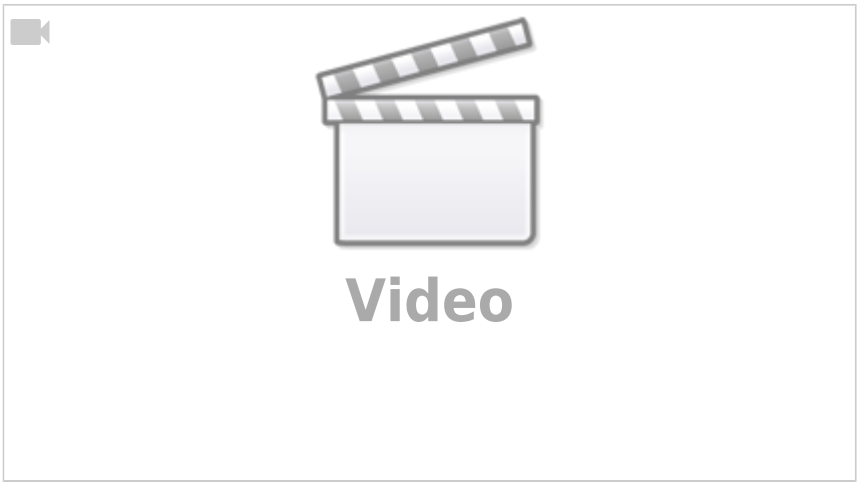
Trochlear Nerve

Andrew T. Austin has hypothesised that it may be the trochlear nerve that provides the organic mechanism for the changes brought about the utilisation of eye movements within the Integral Eye Movement Therapy (IEMT) model.

The trochlear nerve, also known as cranial nerve IV, is responsible for supplying one of the extraocular muscles of the eye: the superior oblique muscle. Additionally, the trochlear nerve is a somatic efferent or motor nerve, and alongside the oculomotor and abducens nuclei, it is responsible for eye movement.

Muscles



The superior oblique, the only muscle that the trochlear nerve innervates, is the longest and thinnest muscle amongst the extraocular muscles. It works to help the eye to move out and down. To create this type of movement, the muscles need to pass through a pulley-like structure known as the trochlea of the superior oblique, which is the Latin origin for pulley and where the nerve gets its name.

This pulley-like system afforded by the trochlea makes the superior oblique unique among the extraocular muscles. It allows for its muscular functions of depression, abduction, and intrusion of the eye. Because of the muscle's specific placement at the posterior portion of the eye, the muscle elevates the posterior of the eye and causes the front of it to grow depressed.

The muscle also creates abduction of the eye, moving the pupil away from the nose, and intrusion, rotating the eye such that the top of the eye moves toward the nose.

The superior oblique muscle is the only extraocular muscle that can lower the pupil with the eye adducted. Thus, to isolate the function of the superior oblique muscle from the other additional extraocular muscles, the muscle can be tested by requesting the patient to adduct the eye and then ask to depress the eye. Failure to depress the eye during adduction indicates a problem with the superior oblique muscle or the trochlear nerve. In addition, a general rule of thumb is that “obliques go opposite”; the left superior oblique is tested by having the patient look right, while the right superior oblique is tested with the patient looking left.

Origin

The trochlear nerve originates in a small nucleus in the midbrain. The nerve fibers cross over to the other side of the brainstem before leaving it near the junction of the midbrain and pons. The trochlear nerve is the single cranial nerve that leaves the brainstem from the back of the brainstem's posterior surface. Additionally, it's also the only cranial nerve to entirely originate from a nucleus contralateral to the structure it supplies.

The trochlear nerve is also a very delicate nerve that can get damaged relatively easily. Damage can be congenital, the most common cause, or occurs due to other causes such as trauma. However, the symptoms of trochlear nerve palsy aren't typically as noticeable as those that result from the damage done to the oculomotor or abducens nerve.

Because the superior oblique helps move the eye down, the eye tends to deviate upwards when the nerve gets damaged since there isn't an opposing force coming from the superior oblique. This can result in double vision, or what's known as diplopia. Some patients will adopt a head tilt to compensate for aligning their eyes better and reducing diplopia. This characteristic head tilt is also commonly towards the unaffected side.

If the palsy doesn't resolve on its own, or through less invasive treatments, patients can undergo surgery to weaken an opposing muscle, typically the inferior oblique) to minimize the deviation. Interestingly enough, there's enough evidence that suggests that congenital superior oblique palsy is more commonly found in young males.

Fragility

Because of the natural fragility and extensive intracranial course, the trochlear nerve is especially vulnerable to trauma compared to most other cranial nerves. As a result, the most common cause of an acquired defect of the trochlear nerve is trauma.

Traumatic trochlear nerve palsies are associated with car accidents and boxing because they involve a rapid deceleration of the head. And because of the fragility of the trochlear nerve, this can also occur in minor head injuries that don't involve a loss of consciousness or skull fracture. Shearing forces can disrupt, particularly at the superior orbital fissure, where the trochlear nerve enters the orbit.

Another condition involving the trochlear nerve is superior oblique myokymia, which causes spasms of the superior oblique muscle. Symptoms include transient vertical diplopia. The etiology is not well known but may be related to other similar conditions that produce microtremors. This can rarely cause superior oblique muscle weakness.

Lesions of the trochlear nerve can involve either the nerve or the nucleus, but both have comparable symptoms. The only difference is that a single trochlear nuclear lesion impairs the contralateral nerve and superior oblique muscle, while a vesicular lesion affects the ipsilateral nerve and muscle.

Most trochlear nerve palsies are unilateral, but because the decussation of the trochlear nerve pain occurs when the nerve pair is near one another, a single lesion at the dorsal midbrain can produce bilateral trochlear nerve palsy. But suppose the other ocular motor nerves are experienced by a patient. In that case, a lesion in the cavernous sinus or midbrain is more likely, as these nerves are moderately near one other in this place and share a vascular supply.

The clinical presentation of an acquired fourth nerve palsy is similar to congenital palsy. Patients most commonly present with diplopia but can also experience blurry vision or other minor vision problems when looking down, such as going down the stairs or reading a book.

The diplopia in trochlear nerve palsy can be vertical or diagonal and worse with a downward gaze. Compensation for nerve palsy usually includes a head tilt to the opposite side and a tucking of the chin, so the affected eye's pupil can move up and out, instead of downwards and in. The eyes will display hypertropia during clinical examination, with the affected eye being slightly elevated relative to the other normal eye. Undercover, the affected eye will show an upward drift relative to the other eye.