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# Extraocular Muscles – A Review

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**Abstract:**
The extraocular muscles (EOMs) are highly specialized and differ so significantly from other muscles in the body that they are considered a separate class of skeletal muscle, allotype. A thorough characterization of the molecular and cellular basis of the human EOM allotype has not been presented although it is expected to contribute to a better understanding of the functional properties of these muscles and the reasons why they are selectively spared in some neuromuscular disorder. The extraocular muscles are the six muscles that control movement of the eye (there are four in bovines) and one muscle that controls eyelid elevation (levator palpebrae). The actions of the six muscles responsible for eye movement depend on the position of the eye at the time of muscle contraction.Four of the extraocular muscles control the movement of the eye in the four cardinal directions: up, down, left and right. The remaining two muscles control the adjustments involved in counteracting head movement; for instance this can be observed by looking into one's own eyes in a mirror while moving one's head. Congenital fibrosis of the extraocular muscles is a disorder that affects the muscles that surround the eyes. These muscles control eye movement and the position of the eyes (for example, looking straight ahead). Congenital fibrosis of the extraocular muscles prevents the normal development and function of these muscles. As a result, affected individuals are unable to move their eyes normally. Most people with this condition have difficulty looking upward, and their side-to-side eye movement may also be limited.
**Key words:**extraocularmuscles,congenital fibrosis,extraocularmyositis,inervated fibers.

## INTRODUCTION:

Vision is by far the most important of our senses for communication with the world around us. The process of imaging is complex and includes the optics of the eye, the photoreceptors, the optical tract and the occipital cortex. In order to optimize perception and maintain stereo vision in every gaze position, it is necessary to perfectly control and co-ordinate the delicate movements of the eyeballs(1). The eyes are capable of highly specialized movements such as slow pursuit movements as well as rapid, instant change from one point of fixation to another (saccades). Eye movements are the result of the action of the extraocular muscles . Ocular myositis represents a subgroup within the idiopathic orbital inflammatory syndrome, formerly termed orbital pseudotumor. extraocular muscles are composed of three to four distinct populations of singly innervated fibres (SIF) and two distinct populations of multiply innervated fibres (MIF), which are distributed into discrete global (facing the eyeball) and orbital (facing the bony orbit) layerand histochemical properties along their length highlighting their unique characteristics(2). Ocular myositis Eye muscle myositis is an idiopathic inflammation of the extraocular muscles in the absence of thyroid disease, ocular myasthenia gravis.

## ANATOMY:

There are six EOMs the medial, lateral, superior and inferior recti, the superior and inferior oblique. The four recti originate from the tendinous ring around the optic canal, run forward in the orbit and insert into the eyeball at the medial, lateral, superior and inferior side respectively(3). The obliquus superior arises from the sphenoid bone just superior to the tendinous ring, runs forward to the trochlea, a fibrous pulley located at the superior and medial angle of the orbital anterior margin. Here it becomes tendinous and runs backwards and laterally, passing below the rectus superior to be inserted into the superior surface of the eyeball. The obliquus inferior originates from the orbital floor, just lateral to the lacrimal fossa, runs laterally and posteriorly, between the rectus inferior and the orbit floor and inserts into the inferior side of the eyeball(4) . The morphology and development of the extraocular muscles is inherently connected with the development of the head and its evolution in Vertebrata. The examinations proving that the extra-ocular muscles originate from the prechordal and paraxial mesoderm show their unique nature(5) . It is considered that the origin and development of the extraocular muscles as well as the propius lingual muscles may play a considerable role in tracing the evolution and the development of the head in Vertebrata.

## HISTOLOGY:

The fibers of the EOMs are organized into two separate layers. The thin orbital layer faces the orbital wall. The global layer consists of the central part of the muscle. This organization into layers is most clearly seen in the midbelly part of the muscles. In the oblique muscles the orbital layer may totally surround the global layer(6). A third layer – the marginal zone – covering parts of the outer surface has been described in human EOMs. The histologic structure of eye muscles, which perform the functions of both red and white muscles, differs in many respects from that of other striated muscles. Extraocular muscles contain fibers of varying diameters. In general they are the finest fibers found in any striated muscles. They vary in diameter from 9 _m to 17 _m, with fibers as fine as 3_ m having been seen,72 but these muscles also contain coarse fibers up to 50_ m in width. One can appreciate the fineness of fibers of extraocular muscles if their diameters are compared with those of fibers of the gluteus maximus (90 _m to 100 _m)(7).

## CONTRACTILE PROPERTIES:

Extraocular muscles contract much more quickly than other voluntary muscles. The great speed of contraction of extraocular muscles is inkeeping with the requirements of saccadic eye movements and with what is known of the

structure and innervation of extraocular muscles(8). Customarily, one thinks of voluntary striated muscles as being characterized by fibers that respond to a single stimulus applied to their nerve with an ungraded fast twitch, followed by speedy relaxation, and accompanied by propagated electrical activity. Repetitive stimuli of relatively high frequency are required to maintain a tetanic contraction of these fibers. In contrast, smooth and other slowly contractile muscle systems do not react to a single stimulus applied to their nerve, but they do respond with a slow, maintained graded contraction to a few repetitive stimuli, unaccompanied by electrical activity(9). There are also pharmacologic differences between these two systems, which, in general, are present in spatially unrelated muscle groups. Irrespective of peripheral mechanisms, the most important source of tonus of extraocular muscles is reflex in origin. A certain tonus within the central nervous system is kept up by stimuli from sensory sources. Light itself is a powerful source of tonus. In adult humans, reflex tonus from neck muscles appears to be of minor importance. All the more important are reflexes resulting from vestibular stimulations. These stimulations to a large degree control the position of the eyes in space. They are active when the head is erect, and they also regulate the position of the eyes with every movement of the head.

## CONGENITAL FIBROSIS:

CFEOM is a rare, congenital, and non progressive disorder with multiple extra ocular muscle restrictions. Its diagnosis and classification is defined by clinical characteristics and genetics. Based on clinical features and genetics, CFEOM can be classified into three types . Bilateral cases of CFEOM might be very asymmetrical. CFEOM is not easy to treat. Any refractive error and amblyopia should be corrected. Due to the extreme chin up posture adopted by some of the patients with CFEOM, eccentric viewing through the corrective lenses is commonly encountered, contributing to a sub optimal refractive correction. The surgical correction of strabismus and ptosis in CFEOM is challenging. Strabismus surgery is always attempted before ptosis correction. The expectations of strabismus surgery should be realistic and parents and patient should be well informed about these expectations. Very large recessions (12mm) of the affected muscles may be indicated(10). In CCDDs, resections of extraocular muscles are usually avoided from fear of worsening the enophthalmos. A forced duction test should be done pre-operatively and during the strabismus surgery. With respect to ptosis surgery, due to the absence of Bell's phenomenon and the risk of exposure keratopathy, it is advisable that ptosis is under-corrected. The aim of ptosis correction should be to provide a clear visual axis, partly eliminate the head posture, and prevent deprivation amblyopia.

## EXTRAOCULAR MYOSITIS:

Ocular myositis represents a subgroup within the idiopathic orbital inflammatory syndrome, formerly termed orbital pseudotumor. Ocular myositis describes a rare inflammatory disorder of single or multiple extraocular eye muscles. Unilateral or sequential bilateral subacute painful diplopia is the leading symptom of eye muscle myositis. There are at least two major forms, a limited oligosymptomatic ocular myositis (LOOM) with additional conjunctival injections only, and a severe exophthalmic ocular myositis (SEOM) with additional ptosis, chemosis, and proptosis(12). Eye muscle myositis is an idiopathic inflammation of the extraocular muscles in the absence of thyroid disease, ocular myasthenia gravis, and other systemic, particularly autoimmune mediated diseases, resembling $CD4^+$ T cell-mediated dermatomyositis. Contrast-enhanced orbital magnetic resonance imaging most sensitively discloses swelling, signal hyperintensity, and enhancement of isolated eye muscles. High-resolution orbital computed tomography is not as sensitive as MRI. When available, contrast-enhanced MRI with multiple coronal views and fat saturation(13) . Eye muscle biopsy or limb muscle biopsy is usually not indicated, and response to therapy frequently confirms the diagnosis. Other additional blood analyses are recommended regarding to optional differential diagnoses. oral corticosteroid treatment results in prompt improvement and remission within days to weeks in most patients. Beyond corticosteroids, other immunosuppressives are helpful in tapering corticosteroid doses in selected patients. Antimetabolites, such as azathioprine, methotrexat, mycophenolate mofetil are frequently used immunosuppressives in this condition, but T-cell inhibitors (eg, cyclosporine, tacrolimus).

## CONCLUSION:

The six tiny muscles that surround the eye and control its movements are known as the extraocular muscles (EOMs). The primary function of the four rectus muscles is to control the eye's movements from left to right and up and down. The two oblique muscles move the eye rotate the eyes inward and outward. All six muscles work in unison to move the eye. As one contracts, the opposing muscle relaxes, creating smooth movements. In addition to the muscles of one eye working together in a coordinated effort, the muscles of both eyes work in so that the eyes are always aligned.

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