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ART. XI.—ON THE PHYSIOLOGY OF THE MUSCLES OF THE EYE, WITH SOME NEW VIEWS OF THEIR FUNCTIONS.

BY HENRY HOWARD, M.D.,

Surgeon to the Montreal Eye and Ear Institution, Craig Street.

RECTI MUSCLES.

Speaking of the four recti muscles of one eye, without considering those of the other, they may be said to be all voluntary, and their action, either separately or collectively, completely under the influence of the will; that is to say, they do not act without the will, still they cannot at all times obey it, in opposition to any of the involuntary muscles of the eye in action, as, for example, when the inferior oblique is acting.

This can be understood by a very common illustration. If a foreign body gets into the eye, which gives pain, the cornea becomes turned upwards, through the action of the inferior oblique (which is an involuntary muscle), in opposition to the strongest efforts of the will that can be made upon the inferior rectus muscle to bring the cornea down, and keep it in that position.

The use of the four recti muscles, acting collectively, is to fix the eye when looking at any object: in this action they are perfectly voluntary, and obedient to the will. They likewise prevent the eyeball being protruded during the action of either of the obliques. The separate actions of those muscles are as follows:—The superior rectus turns the eye upwards, the inferior downwards, the external outwards, and the internal inwards; and when talking of one eye only, *all* these separate actions are voluntary, being in obedience to the will. The internal rectus acts involuntarily, or as is now more correctly said, automatically, whenever the external rectus of the other eye acts in any degree, thus turning the one eye inwards without the exertion of the will to follow the voluntary outward motion of the other. In opposition to the opinion of other physiologists, I maintain that this muscle (the internal rectus), is the *only* automatic muscle of the eye. The two oblique muscles of the eye, supposed by Carpenter and others to act sometimes automatically, or to be partly voluntary and partly involuntary, act *always involuntarily*; and are, as I shall presently show, absolutely dependent for their action upon the movements of the orbicularis, or levator palpebræ.

The superior recti always act consentaneously to turn the eyes up, the inferior recti consentaneously down, the internal recti acting together voluntarily, as well seen when we examine a very minute object, turn the cornea towards the nose. The external recti never act consentaneously; the voluntary action of one external rectus being accompanied by the automatic action of the internal rectus of the other eye, as already stated. The obvious harmony of this arrangement, in preserving the axis of vision perfect, is abundantly evident. It must be remarked, that any intermediate movements of the eyeballs, when the eyes are open, such as turning the eye upward and outward, upward and inward, &c., are due to the combined action of two recti muscles, and *in no such case* to the action of either of the *obliques*.

The rapid consecutive contractions of these four muscles, give that appearance to the eyes which is called rolling, and is perceived in persons when in a passion, drunk, or insane. But the appearance is deceptive; there is no such motion in the eyes as rolling.

Physiologists have assigned another use to the recti muscles, viz., to retract the eyeball into the orbit when the eyelids are closed; but they have no such power, nor is there any occasion for such an action, for the eyeball is no more protruded when the eyelids are open, than when they are shut. The cause of this deceptive appearance will be explained by and by.

SUPERIOR AND INFERIOR OBLIQUE MUSCLES.

The two oblique muscles are purely involuntary or reflective, and are always antagonists to one another. The action of the inferior oblique is to turn the cornea upwards and inwards; the action of the superior being to turn the cornea downwards and *inwards*. It will be now necessary to prove that these muscles are involuntary in their action. If there be the slightest irritation produced on the lower part of the eyeball, the cornea is at once seen to turn up by the action of the inferior oblique, and to be retained in that position, in opposition to the will, as long as the irritation is kept up. That it is the action of the inferior oblique which thus elevates the cornea, is proved by the fact that it is turned up nearly altogether out of view—a power which the superior rectus has not; for if a person wills to look up, he can do so, but cannot turn the cornea out of view. If