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Author Contributions: Drs Ament and Pineda had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

Financial Disclosure: The authors do not have any commercial or proprietary interest in the Boston KPro, nor do they have any financial interest or receive payment as a consultant, reviewer, or evaluator. Dr Ament is a clinical research fellow under Claes Dohlman, MD, PhD, creator of the Boston KPro. Dr Dohlman has no financial interest in the Boston KPro. He makes no profit from its sales. All proceeds support continuing research and medical missions to Africa and other nonindustrialized nations.

Role of the Sponsor: Dr Dohlman was not involved in the design and conduct of the study; the collection, management, analysis, and interpretation of the data; or the preparation, review, or approval of the manuscript.

Additional Contributions: Through a research and development fund, Dr Dohlman donated the KPro devices and provided support for the medical trips. Khalil Lakho, MD, an administrator in Sudan, provided logistical support, clinic time, operating room time, and coordination of efforts with ophthalmology staff and residents. Tania Marie Ament, BS, modified and conducted activities of daily living, instrumental activities of daily living, and quality-of-life surveys.


Proprioceptive Transient Elevation of Ptotic Eyelid and Lacrimation in Congenital Third Nerve Palsy: The Monosynaptic Stretch or Hoffmann Reflex Gone Awry?

Although proprioceptive structures seen in antigravity muscles like jaw-closing muscles are lacking in levator palpebrae superioris muscle (LPSM), another antigravity muscle, Müller muscle (MM), may act like one for LPSM.1 We report stretch-induced ephemeral eyelid elevation of the completely ptotic eyelid followed by copious lacrimation in a girl with congenital third nerve palsy, speculate about the neuronal pathways, and educe its diagnostic and therapeutic implications.

Comment. Proprioceptive structures, muscle spindles, and palisade endings exist in the global but not orbital layer of human extracocular muscles. Distal myotendinous junctions, the areas traumatized in most strabismus procedures, are most richly endowed. The information they relay, however, remains controversial.2

Figure 1. External photograph of the patient with complete ptosis of the left eye.

Figure 2. Complete third nerve palsy with pupillary involvement in the left eye.

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The palpebrae superioris muscle lacks a global layer as well as proprioceptive structures. Its orbital layer has 2 types of muscle fibers. Most (80%) are fast-twitch, singly innervated, fatigue-resistant fibers and the rest (20%) are slow-twitch, multiply innervated, fatigable fibers. The latter likely have an MM-mediated proprioceptive role, reflexively contracting in response to voluntary contraction of the former. Intraoperative stretching of MM is known to induce ipsilateral or bilateral involuntary contraction of LPSM. Thick (proprioceptive) and thin (sympathetic) nerve fibers on proximal and distal MM are shown to pass through the palpebral lobe of the lacrimal gland to join the lacrimal nerve. Electrical stimulation of thick but not thin fibers consistently results in involuntary retraction of the upper eyelid (Hoffmann reflex). Electromyographically verified the presence of monosynaptic trigemino-oculomotor reflex ossibly mediated via mesencephalic and central caudal nuclei of the fifth and third cranial nerves and speculated that it may account for inexplicable ptosis following trauma, surgery, or tumor removal in the aponeurotic area of LPSM. The horseradish peroxidase technique has shown that fibers from the oculomotor nerve entering the trigeminal (ophthalmic) nerve are afferent in nature. A hyperactive monosynaptic trigemino-oculomotor reflex resulting from stretch by multiply innervated slow-twitch fibers as elaborated earlier likely gave rise to sustained, fatigable eyelid elevation here.

As the proprioceptive fibers run through the lacrimal gland and nerve, the lacrimation that follows could be due to cross talk between proprioceptive or sympathetic fibers with secretomotor fibers from superior salivatory nucleus. Sparing of other extraocular muscles supplied by the third cranial nerve further buttresses proprioceptive underpinnings. Such a monosynaptic reflex, conterminous with a jaw-jerk reflex, is quite distinct from motor miswiring resulting in a jaw-winking phenomenon in congenital ptosis.

Proprioceptive ephemeral eyelid elevation and lacrimation induced by stretching of the eyelid (MM) has not been reported to our knowledge. The phenomena, harnessed and modulated pharmacologically, may have tremendous diagnostic and therapeutic potential in entities like dry eye, thyroid eye disease, ocular myasthenia, pathological eyelid retraction, acquired ptosis, eyelid trauma, surgery involving the LPSM aponeurosis, and numerous neuromuscular disorders. Alleviation of eyelid retraction in thyroid eye disease by triamcinolone acetonide injections in MM is a case in point.

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**Financial Disclosure:** None reported.

**Online-Only Material:** A video is available at http://www.archophthalmol.com.