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10.1152/japplphysiol.00311.2004.

HIGHLIGHTED TOPIC | *Neural Control of Movement*

The dynamics of force generation has been well studied in limb muscles, but far less is known about such dynamics in orofacial muscles. In a featured article entitled "Fast force-generation dynamics of human articulatory muscles," Dr. T. Ito and colleagues (1) explored the force-generation dynamics of the human articulatory muscles of the upper and lower lips and tongue, using arm muscles to obtain comparative measurements in limb muscle. Twitch force responses were induced by electrical stimulations in these muscles. The dynamic responses were modeled as a second order of dynamics, with model parameters identified using a nonlinear least squares method. The measured force responses fit the estimated model parameters, which suggested that lip and tongue muscles generate forces significantly faster than arm muscles. Faster dynamics of force generation enable the articulatory muscles to respond to motor commands for generating fast speech movements. This finding is important for investigating the mechanisms of speech motor control and for building a computational model of speech articulation. Another notable aspect of this study is the methodological advantage of using electrical stimulation to activate muscle fibers. The dynamics of human muscle have traditionally been studied with the use of muscle force responses generated by tasks involving voluntary contraction. However, as this study demonstrates, voluntary tasks are not appropriate for identifying the upper limit of the dynamics of force generation, possibly because fast-twitch muscle fibers are not activated during voluntary tasks. In addition to providing essential information for studies of speech motor control and speech articulation, the findings of this study highlight the advantage of using electrical stimulation for estimating the upper limit of the dynamics of force generation in human muscle.

REFERENCES

1. **Ito T, Murano EZ, and Gomi H.** Fast force-generation dynamics of human articulatory muscles. *J Appl Physiol* 96: 2318–2324, 2004.

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