

# Intrinsic Foot Muscle Activation During Specific Exercises: A T2 Time Magnetic Resonance Imaging Study

Thomas M. Gooding, MEd, ATC; Mark A. Feger, PhD, ATC; Joseph M. Hart, PhD, ATC, FNATA; Jay Hertel, PhD, ATC, FNATA, FACSM

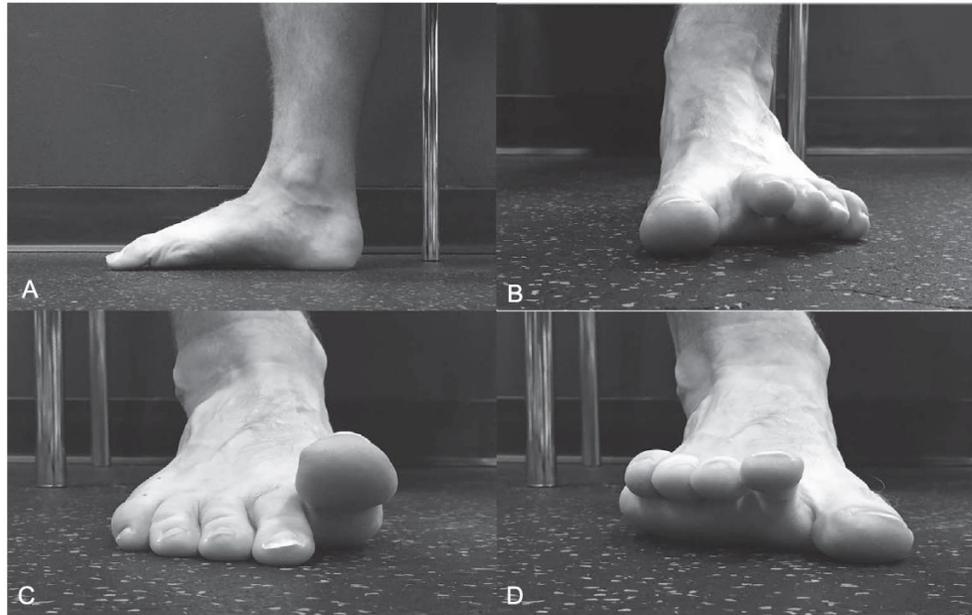
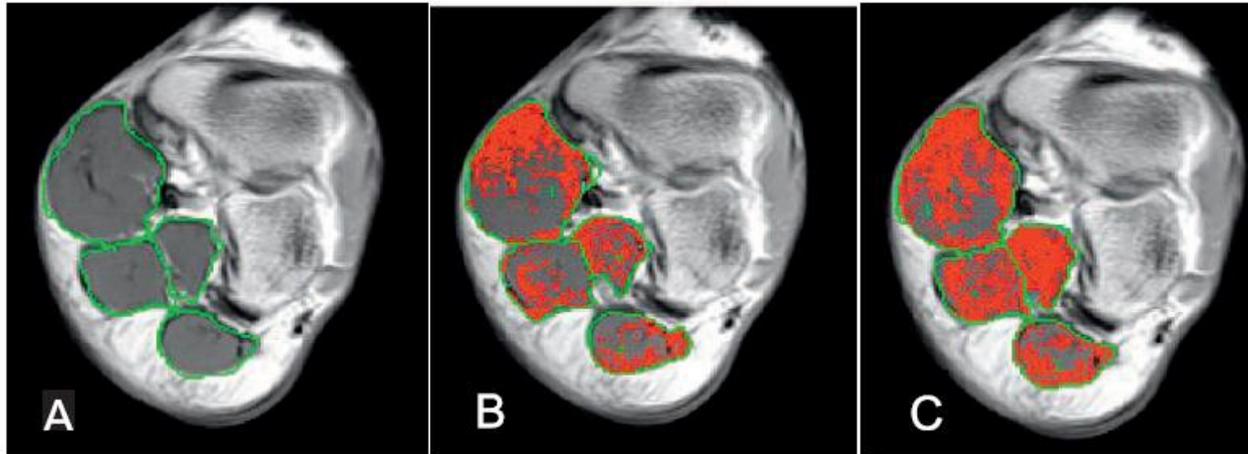


Figure 1. Intrinsic foot muscle exercises: A, short-foot exercise; B, toes-spread-out exercise, C, first-toe extension; and D, second- to fifth-toe extension.



**Figure 2. Representative example illustrating A, muscle heads; B, pre-exercise levels of activation, and C, postexercise levels of activation used in the analysis of muscle activation after intrinsic foot-muscle exercises.**

$$\frac{\text{Active Pixels}}{(\text{Total Pixels} - \text{Inactive Pixels})} \times 100 = \% \text{ Active Muscle}$$

$$\begin{aligned} & \% \text{ Active Muscle Postexercise} \\ & - \% \text{ Active Muscle Pre-exercise} \\ & = \% \text{ Increase in Activation} \end{aligned}$$

**Table. Increase in Intrinsic Foot-Muscle Activation With 4 Intrinsic Foot Muscle Exercises, Mean % (95% Confidence Interval)**

Muscle	Exercise			
	Short Foot	Toes Spread Out	First-Toe Extension	Second- to Fifth-Toe Extension
Abductor hallucis	29.7 (16.8, 42.6)	18.9 (7.4, 30.5)	16.9 (8.3, 25.5)	16.5 (5.8, 27.2)
Flexor digitorum brevis	24.8 (11.8, 37.9)	27.0 (18.3, 35.7)	18.1 (9.5, 26.7)	15.1 (5.4, 24.7)
Abductor digiti minimi	34.9 (26.7, 43.0)	35.2 (23.6, 46.9)	14.1 (3.9, 24.2)	22.5 (10.0, 35.1)
Quadratus plantae	19.0 (12.0, 26.0)	25.4 (12.6, 38.2)	13.9 (5.8, 21.9)	17.0 (4.7, 29.3)
Flexor digiti minimi	23.4 (4.0, 42.9)	30.2 (9.7, 50.6)	16.3 (6.5, 26.1)	10.3 (4.9, 15.7)
Adductor hallucis oblique	22.4 (4.5, 40.3)	31.5 (17.2, 45.8)	15.9 (5.9, 26.0)	17.6 (7.4, 27.8)
Flexor hallucis brevis	20.8 (7.6, 33.9)	29.5 (20.8, 38.3)	13.1 (4.3, 22.0)	20.2 (9.6, 30.7)
Interossei and lumbricals	16.7 (4.5, 28.8)	17.3 (6.5, 28.0)	15.0 (9.3, 20.7)	8.9 (3.9, 13.9)

Abductor hallucis : 母趾外転筋、 flexor digitorum brevis : 右趾屈筋、 abductor digiti minimi : 小趾外転筋、 quadratus plantae : 足底方底筋、 flexor digiti minimi : 短小趾屈筋、 adductor hallucis oblique : 母趾内転筋、 flexor hallucis brevis : 短母趾屈筋、 interossei and lumbricals : 骨間筋と虫様筋

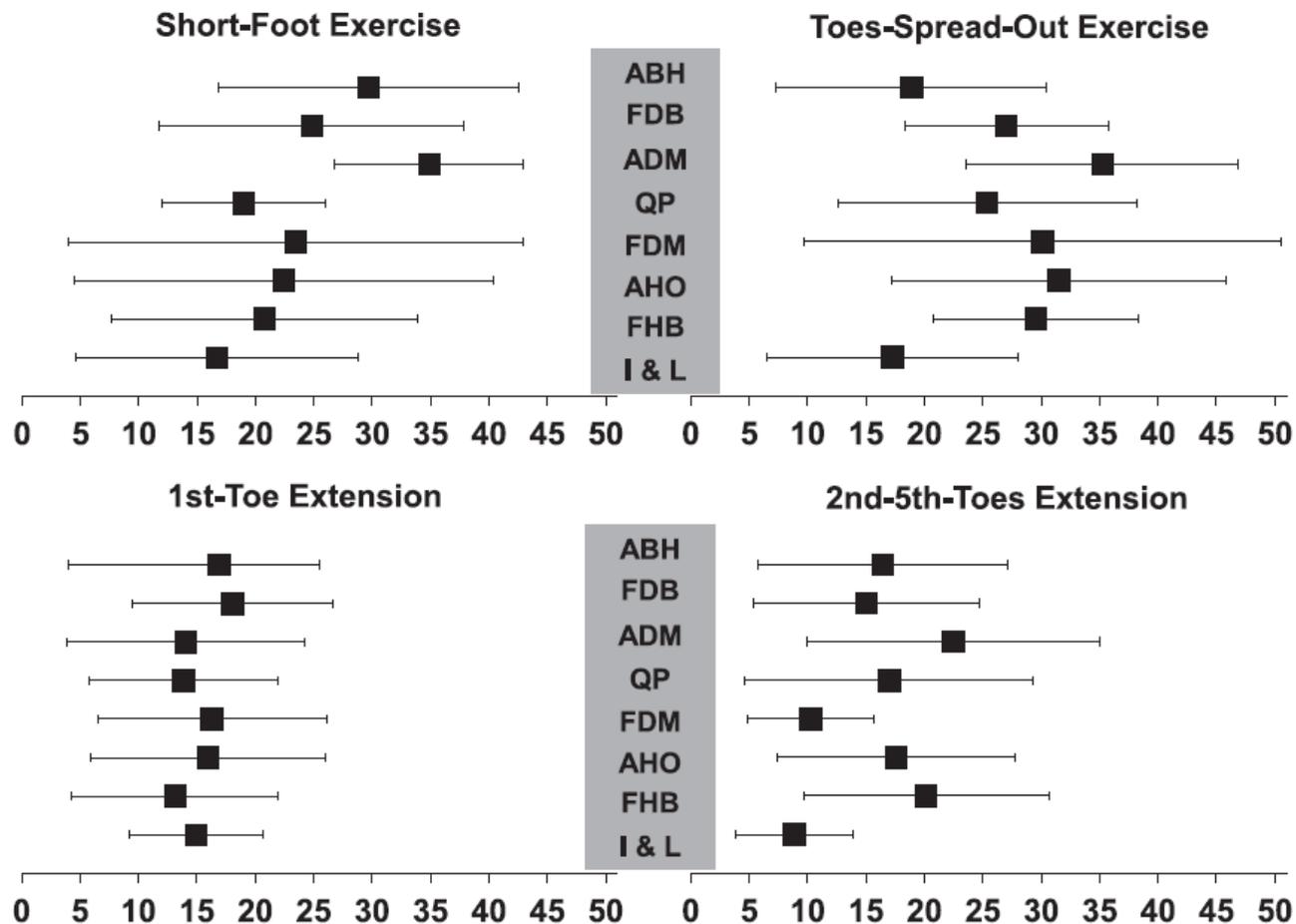


Figure 5. Muscle-activation increases (%), group means, and associated 95% confidence intervals for each exercise. Abbreviations: ABH, abductor hallucis; ADM, abductor digiti minimi; AHO, adductor hallucis oblique; FDB, flexor digitorum brevis; FDM, flexor digiti minimi; FHB, flexor hallucis brevis; I&L, interossei and lumbricals; QP, quadratus plantae.

どの運動がどの筋を活性化するかということについては十分に提案することができなかった