

Variations in upper limb and trunk muscles activation during isometric exercises with or without exertion of control

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Abstract

BACKGROUND:

External focus isometric exercises using a paper balloon can change trunk muscle activation in the chest squeeze; however, it is unknown whether this method affects muscle activities in conventional exercises.

OBJECTIVE:

To check variations of trunk muscle activity during front plank (static task) and shoulder press (dynamic task) both with and without instruction to avoid crushing an object.

METHODS:

Twenty-six healthy adult males aged 19–49 were recruited. Ten trunk muscle activities were measured using surface electromyography during a front plank and dynamic shoulder press exercises, both with and without external-focus instruction.

RESULTS:

Adding the external-focus using the paper balloon to the front plank significantly activated 8 out of the 10 muscles. In the downward shoulder press, 5 out of 10 muscles with 50% 1 RM, 2 out of 10 muscles with 100% 1 RM were significantly activated.

CONCLUSIONS:

Adding external-focus instruction using paper-balloon increases trunk muscles in front plank and shoulder press while possibly improving trunk stability. Novel exercises using paper balloon may efficiently activate specific muscles without external loading thus possibly reducing the stress on the involved joints during exercise.

紙風船 paper balloon vs 硬いプラスチック hard plastic

External focused instruction

Press hard as you can, but don't crush it!!

“潰さないように” 全力で押す！

No force on the hands



PBM
(Paper balloon method)

Fig.1a Soft paper balloon setting

Press hard as you can!!

全力で押す！

Maximum force on the hands



CIM
(Conventional isometric method)

Fig. 1b Hard plastic cylinder setting

筋活動に違いが！

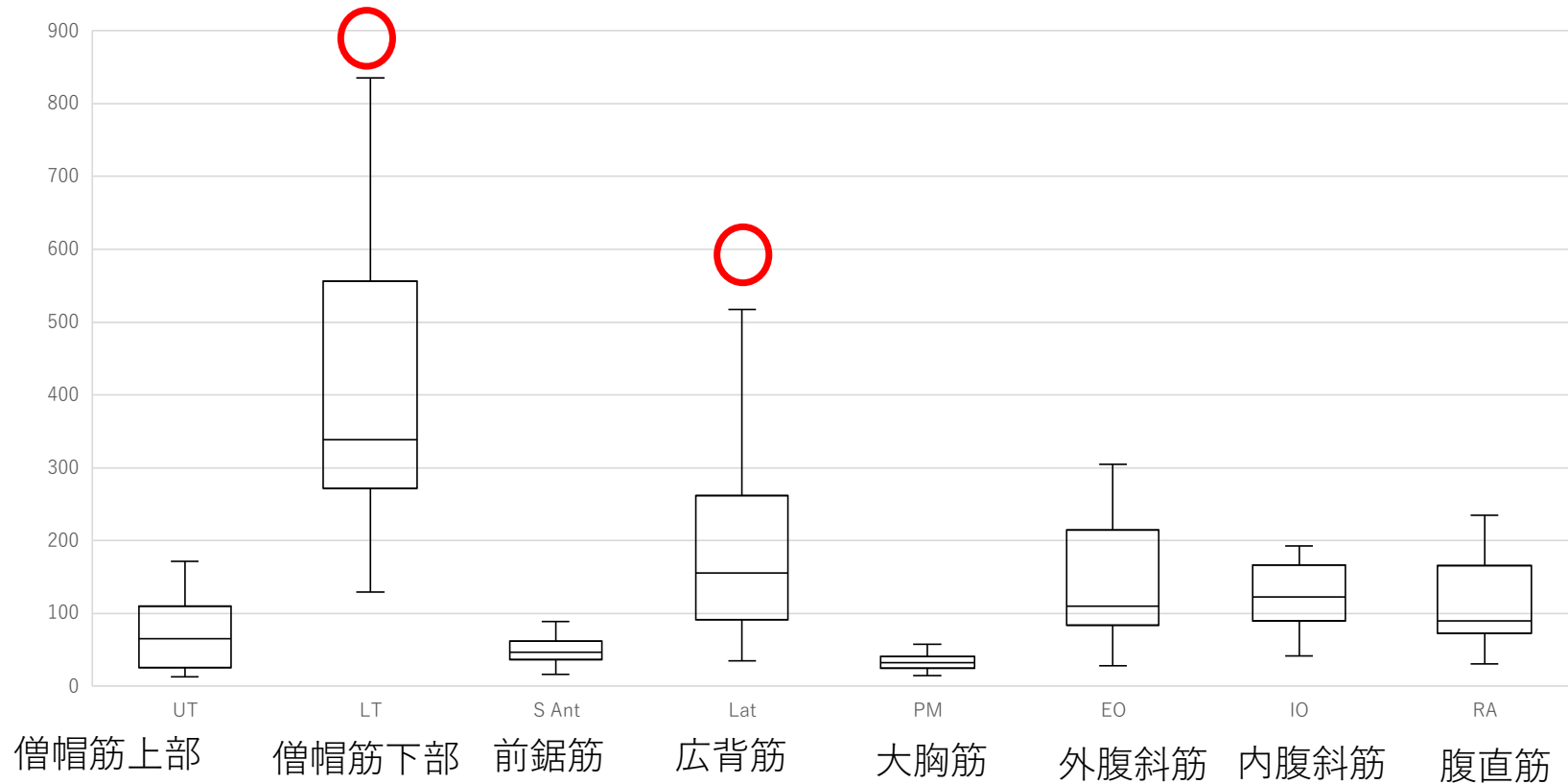
Table 4

Comparison of the muscle activity between the isometric squeeze exercises using the paper balloon and the hard plastic-cylinder

| Muscle | Paper balloon (μ V) | Hard plastic cylinder (μ V) | <i>p</i> -value |
|-------------------|--|--|------------------------|
| Upper trapezius | 102.9 (105.5) | <u>172.3 (185.1)</u> | 0.016 |
| Lower trapezius | <u>167.3 (125.5)</u> | 40.3 (18.0) | < 0.010 |
| Serratus anterior | 179.8 (119.5) | 371.5 (179.8) | < 0.010 |
| Latissimus dorsi | <u>108.8 (64.6)</u> | 82.5 (39.3) | 0.030 |
| Pectoralis major | 96.7 (46.7) | <u>333.5 (194.1)</u> | < 0.010 |
| External oblique | 118.8 (180.5) | 99.4 (99.2) | 0.496 |
| Internal oblique | 87.0 (143.8) | 77.9 (92.9) | 0.293 |
| Rectus abdominal | 22.1 (25.8) | 20.9 (26.7) | 0.592 |

Values are medians (interquartile ranges).

体幹部を支える筋群の活動が活発に



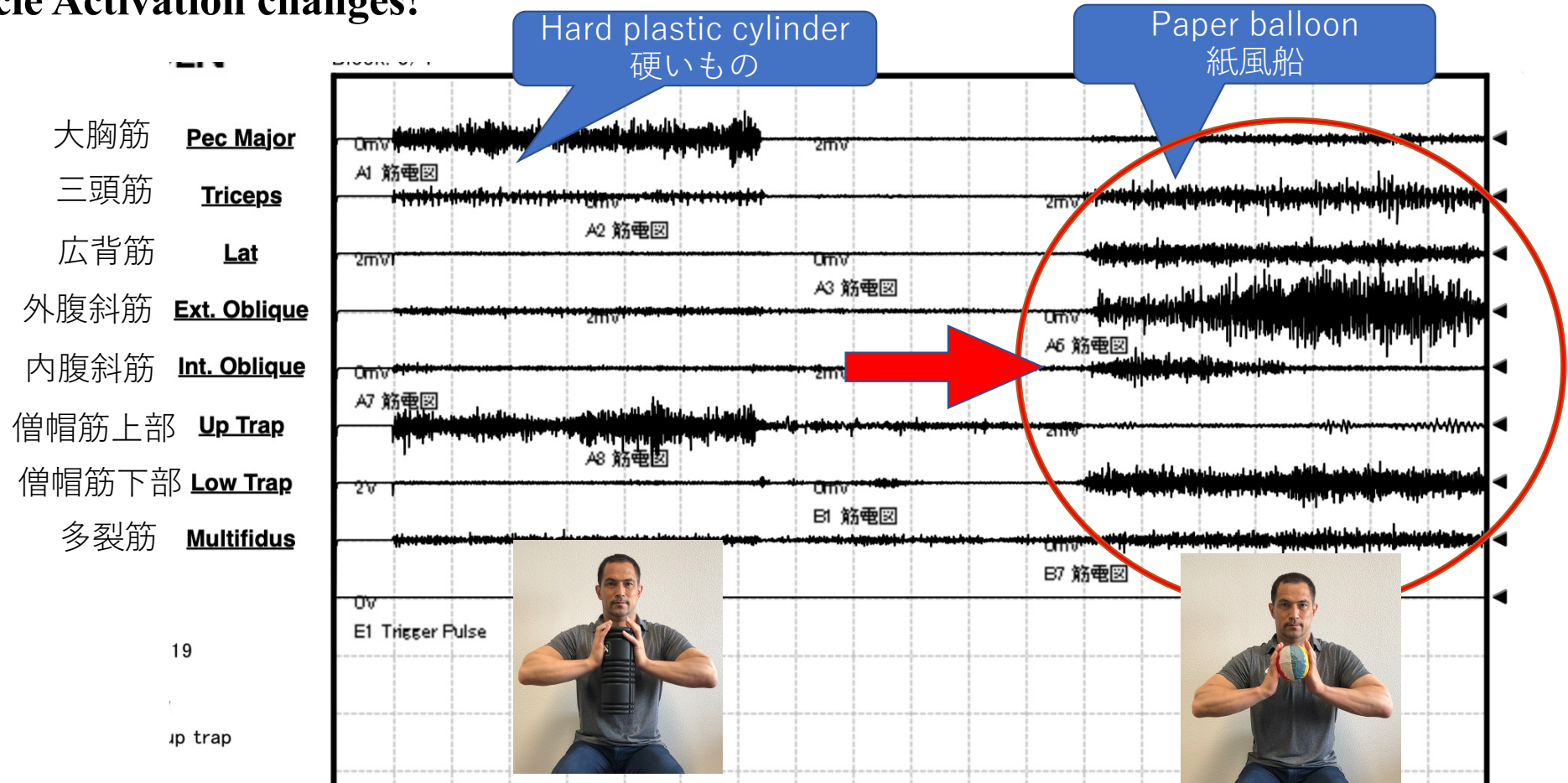
The PBM/ CIM ratio in each muscle (graph).PBM, paper balloon method; CIM, conventional isometric method using hard plastic; UT, upper trapezius; LT, lower trapezius; S Ant, serratus anterior; Lat, latissimus dorsi; PM,clavicular part of the pectoralis major; EO, external oblique; IO, internal oblique; RA, rectus abdominal.

Chest squeeze

Muscle Activation changes!

私自身が行ったTest case

意識せずとも筋肉の活動する場所が変化する！



体幹部の筋群の活動が高まり、大胸筋や、僧帽筋の上部の筋群が静まる