

# Effect of different trunk postures on scapular muscle activities and kinematics during shoulder external rotation

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## 研究の概要

投球動作などのオーバーヘッドスポーツにおいて、肩関節が外旋するときに肩や肘に大きな負荷がかかり、その時の肩甲骨の運動は重要とされている。投球動作などは様々な体幹姿勢で行われる。本研究は、体幹姿勢が肩関節を90度外転した状態で肩関節を外旋した時の肩甲骨の運動へどのような影響を与えるかを明らかにした。

結果は、体幹をまっすぐにしたときに比べて、最大屈曲時は肩甲骨の後傾角度が減少、内旋角度が増加した。最大伸展では、上方回旋角度が増加した。最大対側回旋では、後傾角度が減少、内旋角度は増加した。最大同側回旋は角度に変化はなかった。同側側屈では後傾角度の減少、対側側屈では、後傾角度の減少、内旋角度が増加した。

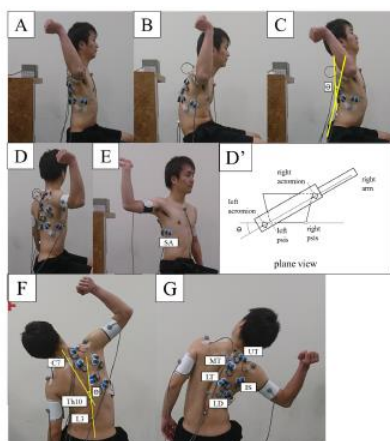


Figure 1 different trunk postures during 2nd ER.

Participants performed shoulder external rotation at shoulder 90° abduction with different trunk postures. Electromyography electrodes were placed on UT (upper trapezius muscle), MT (middle trapezius muscle), LT (Lower trapezius muscle), SA (serratus anterior), IS (infraspinatus muscle), and LD (latissimus dorsi). Three optical markers were attached to the 7th cervical spinous process (C7), 10th thoracic spinous process (Th10), and 3rd lumbar spinous process (L3). θ means contralateral lateral bending angle. A: upright posture. B: Flexion posture. C: Extension posture. D: Contralateral rotation. E: Ipsilateral rotation. F: Contralateral lateral bending. G: Ipsilateral lateral bending. D' shows trunk rotation angle defined by the line linking the bilateral acromion and the line linking the bilateral posterior anterior iliac spine (psis).

Table I. Kinematics data

	Posture	GH (°)		Scapula (°)		
		External rotation	Posterior tilt	Upward rotation	Internal rotation	
Control	Upright	89±14	13±6	10±10	12±7	
Flexion and Extension	Flex <sub>max</sub>	83±16 [.534]	7±8* [.000]	12±11 [.078]	19±6* [.001]	
	Flex20	84±12 [.607]	10±7 [.103]	9±10 [.650]	14±5 [.722]	
	(Ext20)	(88±10)	(12±9)	(13±11)	(13±10)	
	Ext <sub>max</sub>	97±11 [.259]	12±6 [.591]	12±12* [.027]	10±6 [.347]	
	Main effect	F=3.26, p=.029	F=8.66, p<.001	F=3.46, p=.026	F=9.79, p<.001	
Rotation	CR <sub>max</sub>	79±11* [.001]	8±7* [.000]	10±11	17±6* [.001]	
	CR30	82±10* [.020]	11±6 [.059]	11±10	14±5 [.102]	
	CR15	87±12 [.836]	11±6 [.122]	10±10	15±5* [.046]	
	IR15	91±10 [1.000]	14±6 [.615]	11±10	13±6 [.659]	
	IR30	90±12 [.980]	14±6 [.287]	11±11	14±6 [.447]	
	IR <sub>max</sub>	88±17 [.991]	13±6 [1.000]	11±12	12±7 [1.000]	
	Main effect	F=6.57, p<.001	F=14.74, p<.001	F=1.36, p=.241	F=3.75, p=.002	
Lateral bending	ILB30	90±10	9±6* [.015]	11±10 [.979]	15±6 [.170]	
	ILB15	85±11	11±6 [.456]	11±11 [.925]	14±6 [.407]	
	CLB15	86±13	9±7* [.018]	11±10 [.879]	18±7* [.001]	
	CLB30	90±11	7±7* [.001]	10±9 [.996]	16±5* [.018]	
		Main effect	F=1.86, p=.132	F=4.62, p=.003	F=0.36, p=.838	F=4.68, p=.003

Flexion, Flex; Extension, Ext; Contralateral Rotation, CR; Ipsilateral Rotation, IR; Contralateral Lateral Bending, CLB; Ipsilateral Lateral Bending, ILB. The Ext20 values were not included in analysis because only 5 subjects achieved Ext20. The values were shown as the reference values. \*p<0.05: the value has a significant difference with that in upright posture. The P-value is shown in [] with each value.