BRICK PERFORMANCE
BIOMECHANICAL ASSESSMENT

NAME: Sarah Laws

Priority List:
1st) Address limitations at the hip in range of motion, then force.
2nd) Increase force production at the shoulders, focusing on your deltoids, rotator cuff complex and scapula.
3rd) Increase both knee flexion force and left knee extension force.
4th) Increase your ability to pressurise correctly through the foot.
5th) Reduce forward head posture and increase scapula control.
6th) Increase lower core function.

Range of Motion

When we consider range of motion, we are looking at asymmetries and deficiencies, but also how the length tension relationship affects the bone in the joint. Our gold standards are taken from various papers and research. We expect some varitation from gold standard (up to 15%) but the data suggests that the closer you are to the gold standards, the less stress on the joint.

ANKLE		LEFT	Gold Standard	RIGHT	ASYMMETRY	LEFT % OF GS	RIGHT % OF GS
Dorsiflexion	Range (degrees)	18	30	17	5.56%	60	57
Plantarflexion	Range (degrees)	166	165	163	1.81%	101	99

KNEE		LEFT	Gold Standard	RIGHT	ASYMMETRY	LEFT % OF GS	RIGHT % OF GS
Flexion	Range (degrees)	129	160	131	1.53%	81	82
Extension	Range (degrees)	175	170	175	0.00%	103	103

HIP		LEFT	Gold Standard	RIGHT	ASYMMETRY	LEFT % OF GS	RIGHT % OF GS
Flexion	Range (degrees)	115	90	115	0.00%	128	128
Extension	Range (degrees)	21	30	21	0.00%	70	70
Abduction	Range (degrees)	41	55	45	8.89%	75	82
Adduction	Range (degrees)	35	35	35	0.00%	100	100
External Rotation	Range (degrees)	53	45	51	3.77%	118	113
Internal Rotation	Range (degrees)	29	40	30	3.33%	73	75

Ribcage/Thoracic		LEFT	Gold Standard	RIGHT	ASYMMETRY	LEFT % OF GS	RIGHT % OF GS
Rotation	Range (degrees)	46	75	50	8.00%	61	67
Lateral Flexion	Range (degrees)	38	55	37	2.63%	69	67

Shoulder		LEFT	Gold Standard	RIGHT	ASYMMETRY	LEFT % OF GS	RIGHT % OF GS
External Rotation	Range (degrees)	100	90	106	5.66%	111	118
Internal Rotation	Range (degrees)	61	70	51	16.39%	87	73
Flexion	Range (degrees)	180	180	180	0.00%	100	100

Force

When we consider force, we are looking at asymmetries and deficiencies, but also how the length tension relationship affects the bone in the joint. Your percentiles are from your population group which factors in your age, gender and weight.

ANKLE		LEFT	RIGHT	ASYMMETRY	LEFT PERCENTILE	RIGHT PERCENTILE
Dorsiflexion	Force (N)	185	184	0.54%	66	66
Plantarflexion	Force (N)	1485	1652	10.11%	61	69

KNEE		LEFT	RIGHT	ASYMMETRY	LEFT PERCENTILE	RIGHT PERCENTILE
Flexion	Force (N)	161	166	3.01%	54	57
Extension	Force (N)	364	402	9.45%	76	84

HIP		LEFT	RIGHT	ASYMMETRY	LEFT PERCENTILE	RIGHT PERCENTILE
Flexion	Force (N)	160	170	5.88%	29	33
Extension	Force (N)	456	430	5.70%	89	85
Abduction	Force (N)	116	150	22.67%	46	73
Adduction	Force (N)	159	168	5.36%	81	85
External Rotation	Force (N)	112	69	38.39%	51	12
Internal Rotation	Force (N)	208	193	7.21%	79	71

Shoulder		LEFT	RIGHT	ASYMMETRY	LEFT PERCENTILE	RIGHT PERCENTILE
Shoulder "I" ISO	Force (N)	132	141	6.38%	84	89
Shoulder "Y" ISO	Force (N)	96	92	4.17%	60	55
Shoulder "T" ISO	Force (N)	73	92	20.65%	29	65

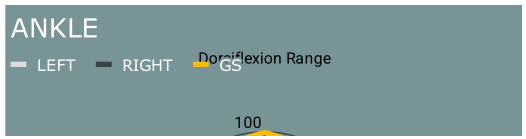
LENGTH TENSION (POSTURAL) ASSESSMENT:

From the postural assessment we found some positive results as well as some areas we could concentrate on for improvement. Your forward head posture was measured at 2.7cm (normal is deemed 0-3cm). Your thoracic (upper back) curvature was above our gold standard range, you measured 37 degrees, normal is considered 30-35. We saw a reduced curvature in your lumbar spine, you measured 27 degrees with normal being considered 30-35. These normative figures are ranges where we would expect the least amount of pressure on the paraspinal muscles and intervertebral discs. These readings indicate you have a forward head posture. So where your forward head posture is slightly increased we could expect increased levels of force and tension being applied to the discs and muscles of your cervical and thoracic spine (neck and upper back). A reduced curve in your lumbar spine (lower back) this can be associated with worse force absorption and transference and therefore increased loading through the joints of the spine. You were able to rotate your spine 46 degrees to the left and 50 degrees to the right, and could laterally flex (side bend) 38 degrees to the left and 37 degrees to the right.

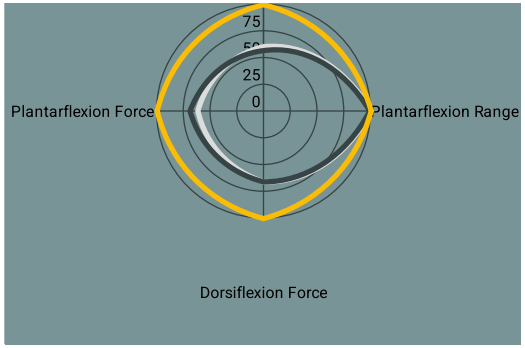
The angle of pelvic tilt in quiet standing describes the orientation of the pelvis in the sagittal plane. It is determined by the muscular and ligamentous forces that act between the pelvis and adjacent segments. You were 6 (left) and 6 (right), normal is 7-10 degrees for females. The lumbar spine directly articulates with the sacrum and its joints with the pelvis.

ASSESSMENT OF THE CORE FUNCTION:

The core function assessments mainly look at TVA strength and coordination as well as some multifidus activation. The test highlighted a some dominance of your QL's and remaining lower back musculature to want to 'take over', as they were a little active throughout the lower abdominal tests. You have a reduced curvature in your lumbar spine which is likely contributing to the reduced lower abdominal strength. To note; co-ordination tested were a fail. When we tested your upper core function, you could brace more efficiently than your lower limbs. We would like to teach you to use your deep lying core muscles, build their strength and work on their co-ordination with a larger emphasis on your lower abdominals.



ASSESSMENT OF THE FOOT AND ANKLE COMPLEX:

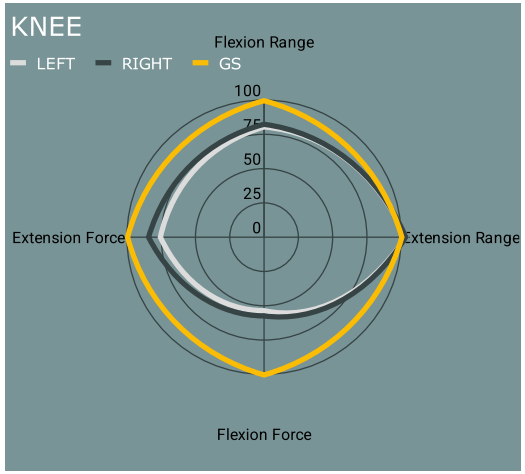


ASSESSMENT OF THE FOOT AND ANKLE COMPLEX:

The Left foot: Your left rear foot had a centre of mass over the 2nd metatarsal which demonstrates you naturally stand in a neutral position. With your ankle in a state of dorsiflexion (knees over toes) you could pronate the leg but there was little to no movement at the mid foot to promote this. You were not able to supinate very effectively as there was little translation of this through your medial arch. Your left ankle had poor range in dorsiflexion and was 10% weaker in plantar flexion. You also need to start building some more control and awareness.

The Right foot: Your right foot was very similar to the left but could pronate slightly better. The right foot had similarly poor range of motion in dorsiflexion.

Foot and Ankle summary: Your symmetry was pleasing but there was a notable deficit in dorsiflexion range and global ankle force. What was most notable was your inability to effectively articulate the bones of the mid-foot. There is a lack of movement and control through the fascia on the sole of the foot. Subconscious movement (not controlled gym based movement but more dynamic gait cycle movements) should be introduced along with motion to promote lengthening of the tissues in your foot. In order to generate force or contract, we must first lengthen the tissue through articulation.

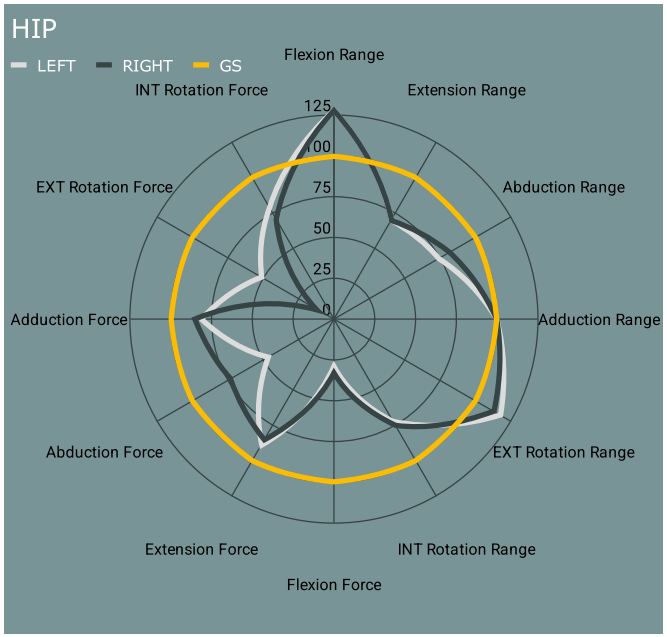


ASSESSMENT OF THE KNEE:

The Left knee achieved good range in extension, 3% above our gold standard but was over 30 degrees (19%) below our gold standard in flexion. Your left knee was surprisingly weak in flexion (distal hamstring) and your hamstring to quadriceps ratio poor. It is important to note that your left knee extension was 9% weaker than the right.

The Right knee had near identical range to the left. While the right knee flexion was stronger, your right knee extension was considerably stronger so your hamstring to quadriceps ratio was worse on the right.

Knee summary: There is some good range available at the knee in extension but there needs to be a large focus on flexion. We would like to improve the flexion peak force in order to increase your hamstring to quadriceps ratio as well as building some tolerance in left knee extension.



ASSESSMENT OF THE HIP:

The Left hip showed a large lack of range with three movements scoring below our gold standard. There was a significant lack of force at the left hip in flexion and abduction, with abduction being 23% weaker than the right.

The Right hip showed a very similar range and force compared to the left in all movements other than hip abduction force which was 23% stronger than the left and external rotation force which was 28% weaker than the left.

Hip summary: When we consider range of motion there was a significant reduction in hip extension range of motion. Hip extension helps to stabilise the pelvis and when range of motion and/or strength is poor this can influence proper alignment of the lower limb. Hip extension strength is essential for providing propulsion preventing excessive back extension, which can lead to inefficient movement patterns and increased risk of injury. In addition, hip extension contributes to propulsion forward and exerting force into the ground.

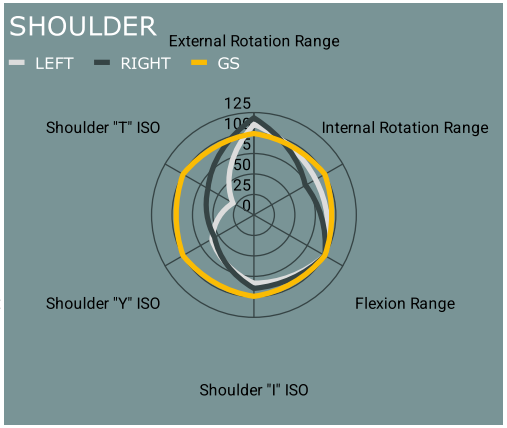
When we consider force there was a large deficit in external rotation and flexion. When we consider external rotation in a closed & open-chain its play an important role in squatting, deadlifting etc. Having range and strength here is vital for maintaining hip joint integrity and stability. More importantly, the flexor mechanism also plays a role in projecting from the hip muscles to the lower limb and ultimately to the ground. Optimising external rotation mechanics will allow for more efficient energy transfer during both closed and open-chain movements. It's necessary we reduce the current asymmetry present at the hip.

ASSESSMENT OF THE SHOULDER:

The Left Shoulder had a notable reduction in internal rotation range compared to our gold standard while still having more than the right. The left shoulder had a huge deficit in force during your "T" iso on our force plates, highlighting a deficit in strength of the deltoids, rotator cuff muscles (supraspinatus, infraspinatus, teres minor, subscapularis), and scapular stabilizers (trapezius and rhomboids)

The Right Shoulder had greater external rotation but less internal rotation when compared to the left. The right shoulder was notably stronger than the left.

Shoulder Summary: From how your transverse plane range is biased towards external rotation (mirroring the hip), it is clear the humerus is sitting in the joint more externally rotated (more so on the right). Which also matches your ribcage mechanics. We should work through both shoulder mobilisation drills but equally scapula mobility and strength while increasing sagittal plane mechanics. Your left shoulder needs a lot of work to catch up to the right but really both shoulders need to prioritise force development through the rotator cuff and deltoids.



CONCLUSION

Our results indicate you have a forward head posture. This is characterised by thoracic kyphosis which creates a depression of the rib cage since the thorax is tipped forward. From a standing position this gives the appearance of the shoulders rounding forward and thus sitting in an externally rotated position. At the pelvis there is often a loss of internal rotation and a magnification of external rotation. Your results would suggest this and you would benefit from some correctives to help address this posture and rib cage dynamics. This position also has consequences during gait.

There are some obvious compensations occurring at the hip; with different strategies are being utilised to generate forward propulsion during gait/running and when pushing through the ground in closed-chain movements common when transferring force. Internal rotation is also closely paired with achieving hip extension, both movements had limitations in your case. When both are reduced this would indicate the spine is being overused to generate a downward force. Alongside working on your downforce, we need to build some awareness of the mid foot and pressurising through the floor.

Our method would be to increase range of motion at the hip and integrate lots of work around the foot to help you load into tissues in the most efficient pattern. This will ensure key areas are not being overloaded. Increasing range will allow for better articulation of the joint, this will in turn improve muscle contraction quality and we can begin the address the force discrepancies at the knee and the hip.

In order to move your shoulder girdle more efficiently, we need to address your ribcage and scapula mechanics. We believe you would adapt to this faster through a high level of resistance (heavy isometrics and eccentrics) after fascial release work. A large emphasis should be on your deltoids and rotator cuff complex as well as the scapula.

Please book in a call so we can talk through your findings and get you back to pain free performance.

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