The Split Squat

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The split squat is generally used as a supplementary exercise for the development of leg strength and hypertrophy. What maybe overlooked is the use of the split squat in the development of single leg strength. This is critical for most ground based sports, especially racket sports which requires a large degree of lunge based movements – a lunge being a progression once the split squat has been technically mastered.

This article aims to highlight the mechanics and technical issues associated with the split squat along with possible variations of the exercises

Mechanics

When designing an effective strength training programme Single leg strength cannot effectively be developed through the traditional double legged (bilateral) exercises. To develop this single leg strength, unilateral or partial unilateral exercises must be completed. As mentioned above, most ground based sporting movements require single leg strength. It is important to understand some of the mechanics of split squat and how they are applied to sports performance.

Both unilateral and bilateral movements require hip and knee extension. The split squat requires greater recruitment of the gluteus medius and Quadratus Lumborum to stabilise the pelvis in the frontal plane. During a back squat, the contra-lateral leg will provide most of this frontal plane pelvic stability. Ground based sporting movements which demonstrate a high degree of unilateral leg strength such as lunging and gait will display this same pelvic stability shown in a split squat.

The split squat has a small base of support when compared to the back squat. This small base of support makes any shift in the line of gravity very close to the edge of the base of support. This requires good ankle, knee and hip proprioception and stability.

The split squat places the trail leg hip flexor in a lengthened position. This lengthened position is mechanically similar to that of the stance leg while running. The front leg of the split squat will have the hip and knee extensors in a greater lengthened position. Not only will the split squat improve the development of single leg strength but also the mobility of the hip and flexibility of the surrounding hip musculature.

Below is a brief overview of the muscles and their major actions involved in the correct movement of a split squat:

	ACTION			
Muscle	Hip Extension	Knee Extension	Spinal & Trunk Stabilisation	Pelvic Stabilsation
Quadriceps		✔		
Hamstrings	✔			
Gluteus Maximus	✔			
Adductor Magnus	✔			✔
Abdominals			✔	✔
Spinal Erectors			✔	✔
Quadratus Lumborum			✔	✔
Gluteus Medius	✔			✔
Gluteus Minimus				✔

Technique

POSITION	DESCRIPTION	PROBLEMS	VARIATIONS/SOLUTIONS
Start position *(figure 1)*	Split position is a moderately large step forward	Split position too narrow - lead knee travels too far over toes	Allow athlete to vary split stance position to find appropriate position for correct execution of movement
		Split position too wide - restrict descent due to excessive starting hip extension of trail leg	
	Weight evenly distributed between both feet	Majority of weight on front foot	Ensure trunk is vertical
	Bar resting on upper trapezius and rear deltoids	Neck pain where bar is positioned	Ensure bar below C7 vertebrae
	Spine in full extension and trunk braced - the trunk remains vertical	Unable to hold extended position	Ensure athlete has no spinal pathology limiting thoracic or lumbar extension
			Ability to maintain extension unloaded
			Keep chest elevated
Descent *(figure 2)*	Inhale and brace the trunk		
	Knee and hip flexion of the lead leg - trail leg knee descends to floor	Excessive anterior movement of knee - travels past toes	Athlete to lower trail leg knee to floor
		Reduced range of movement of hip flexi	Trail leg hip flexor flexibility - static and dynamic flexibility of hip flexors (Rectus Femoris, Iliacus and Psoas complex)
	Trunk remains in the vertical position	Anterior forward trunk lean *(figure 4)*	Athlete to maintain extension in spine and keep trail leg hip extended. Keep chest elevated. Is the load to great? Trail leg hip flexor flexibility issue?
			Use of dumbbells to lower centre of gravity and reduce spinal compression - helps maintain spinal extension
		Lateral trunk lean *(figure 5)*	Athlete to widen stance of lead leg from midline of trunk
			Use of dumbbells to lower centre of gravity and increase stability
		Spinal flexion	Weakness in spinal erectors?
			Ensure chest elevated
	Ankle-knee-hip alignment of lead leg while flexing	Knee valgus *(figure 6)*	Athlete to control descent with weight on lateral border of foot - medial border still remains in contact with floor.
			Is the load too great?
			Possible hip abductor weakness?
Ascent *(figure 3)*	Drive lead foot into floor		
	Lead leg knee and hip extend		
	Ankle-knee-hip alignment of lead leg while extending	Knee valgus *(figure 6)*	Athlete to control ascent with weight on lateral border of foot - medial border still remains in contact with floor.
			Is the load too great?
			Possible hip abductor weakness?
	Trunk remains in the vertical position	Anterior forward trunk lean *(figure 4)*	Athlete to maintain extension in spine and keep trail leg hip extended. Is the load to great?
			Use of dumbbells to lower centre of gravity and reduce spinal compression - helps maintain spinal extension
		Lateral trunk lean *(figure 5)*	Athlete to widen stance of lead leg from midline of trunk
			Use of dumbbells to lower centre of gravity and increase stability
		Spinal flexion	Weakness in spinal erectors?
			Ensure chest elevated


Figure 1. Start Position

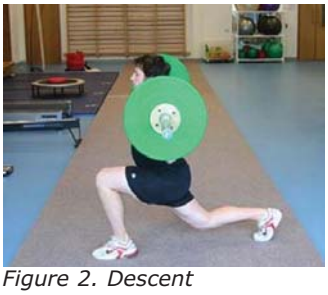
Figure 2. Descent

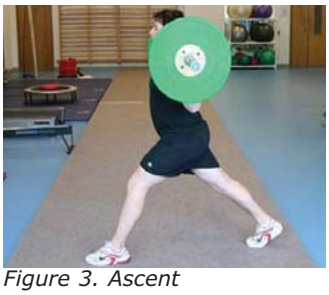
Figure 3. Ascent

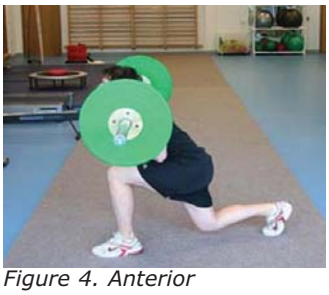
Figure 4. Anterior


Figure 5. Lateral Trunk Lean

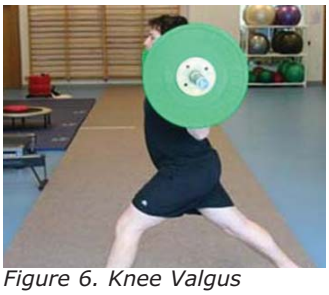
Figure 6. Knee Valgus

Application

Limited flexibility of the hip flexors of the trail leg (including the knee extensor Rectus Femoris) will lead to an anterior forward trunk lean. Limited flexibility in the hip and knee extensors will restrict the range of movement of the hip and knee through the descent of the split squat. With this in mind, using a body weight unloaded split squat as a dynamic or static flexibility exercise can improve the flexibility of the hip musculature as this can be incorporated as part of a warm up. Mobility of the hip joint is not limited to the flexibility of the musculature around the hips, but also by the mechanical structure of the joint (For further details, refer to Sahrmann's Diagnosis and Treatment of Movement Impairment Syndromes). Increasing the multi-planar mobility of the hip is essential for its health and the ability to safely complete compound movements without excessive lumbar mobility. A split squat can be an affective tool to help with this important hip mobility along with the flexibility of the hip musculature.

The split squat has a variety of progressions and regressions (some described above in the technique solutions) for the strength coach to implement within an athletes training programme. Completing the split squat holding dumbbells to the side rather than a barbell across the shoulders will lower the athlete's centre of gravity. This can help improve balance and stability of the movement by bringing the mass closer to the line of centre of gravity.

A natural progression of the split squat is to develop the movement into a lunge. The lunge will have a large eccentric loading of the hip and knee extensors while also decelerating the lead leg. This action is similar to that seen in lunges in racket sports such as tennis and badminton. Again, the use of dumbbells can be used to improve stability and balance.

A further progression is the bench split squat where the trail leg is raised on a bench. This will increase the loading of the lead leg while reducing the loading of the trail leg. The base of support is further reduced making ankle, knee and hip stability even more significant when completing the exercise.

Hopefully, you will now have a greater understanding of the mechanics and technique of the split squat. Having this understanding will assist the correct implementation of the split squat within a training programme and also encourage you to question the inclusion of other exercises within a training programme.

Acknowledgements

Thank you to Richard Chessor, the photographer for this article.

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