Squat Pattern Fault and Correction: A Systematic Approach

Anthony Hugh Close D.C. B.Sc.

Wellington Allied Health Limited

Level 1, 64 Dixon Street

Wellington, New Zealand 6011

DDI: +64-4-499-3872

www.anthonyclose.com

All requests for reprints should be directed to:

dr.aclose@gmail.com

Abstract

The spine is notably unstable when hip muscle coordination and endurance are not optimal (McGill 2002). Awareness of this might well influence the way practitioners think in relation to mobility and functional outcome assessment for improvement when assessing the lumbar spine. Neutral spine consciousness is a functional concept that might usefully be applied to daily life to avoid unwanted flexion or extension that all too often damages passive structures of the spine. Neutral spine has been defined as a state of equilibrium between the trunk flexors and extensors where little resistance is offered by the passive spinal column (McGill 2001, Cholewicki et al. 1997, Panjabi 1992). However, poor spinal control or motion is often blamed on poor postural or movement habits (Adams 2004, Comerford et al. 2001, Lonn et al. 1999). This explanation may leave the patient and the practitioner little room for corrective communication. In clinical practice, the gluteal group is often found to be underperforming in relation to hip extension during daily actives (McGill 2006, James 2003). This may cause the patient to have reduced confidence concerning the hips during simple or complex loading tasks. Because of this the patient may lock their legs and flex their spine in order to complete specific tasks. This type of flexion and loading has been attributed to nuclear (discal) displacement (McGill 2003, Callaghan et al. 1996). This review describes an organized approach to assessing, diagnosing, and correcting closed chain squatting impairments.

Key Words: Squatting Pattern, Movement, Motor Control, Hip Extension, Squat Correction, Squat Assessment, Squatting Faults, Proper Squatting Techniques, Squat Techniques, Primary Movement.

Introduction

Improving hip power, speed, and coordination is important when addressing lumbar spine issues (McGill 2007). A reduced range of motion around the hip may also be a cause of lower back pain (Van Dillen et al. 2008, Van Dillen et al. 2007, McGill 2006, Esola 1996). In regards to pain, the lumbar spine seems to respond better to endurance type training rather than strength type training (Taimela 1999). Therefore, in training of the hip it may be beneficial to approach this early on from an endurance biased approach.

A primary goal when addressing mechanical lower back pain should be movement oriented. Meaning that, the practitioner should address and attempt to correct any common faults of the patient when assessing simple primary movements. Simple primary movements would be defined as squatting and lifting, pushing and pulling, twisting and torque, lunging, and gait.. Faults in these movements may be responsible for many diffuse musculoskeletal pain syndromes today. Balance, in particular, has been shown to be a leading predictor for future lumbar pain (Reeves et al. 2009, Brumagne 2008, Liebenson 1996).

Aside from traumatic insult, it has been shown that loading and unloading of the spine inappropriately over time may result in lumbar spinal pain (McGill 2004) McGill and colleagues found that cadaver spines being mechanically flexed for a period of ten to twenty thousand cycles became herniated (McGill 2004). In order to hold the spine into a neutral position during active motion, such as squatting, the body must have proper biomechanical function. The ability to do so may reduce the patient's symptoms. Moreover, due to individual variations, the squat technique is not a static procedure. In other words, conveying the squatting technique should vary per individual.

Gluteal Activation

It is suggested that patients should be assessed for major faults in the activation of the gluteal group prior to any type of movement pattern correction or exercise program being introduced. Failure to do so may result in suboptimal results or trauma to other bodily tissues (O'Sullivan 2005). The assessment may be done through simple corrective movements that encourage a neutral spine during active hip motion, this is termed "hip hinging" (Liebenson 2003). Gluteal firing can be assessed first by observation and then by palpation. If the gluteals are able to fire in an appropriate and isolated manner then correction may begin. If there is fault in patient's gluteal activation, then this is noted as the first fault and should be corrected before progressing into the flowchart sequence described in figure 1. Table 1.A shows a simple yet effective method at correcting gluteal activation fault.

Motion/Remedial	Sets	Reps	Notes
Kneeling Hip Hinge	1	12	Smooth symmetrical motion with no spinal motion permitted, light bracing throughout motion (Liebenson 2007, McGill 2006).
Clam Shells	1	12	No spinal motion permitted, keep a light brace.
Back Bridges w/ Elastic Band	1	12	Tie Elastic band around knees and keep pressure on band during pelvic raise, again no spinal motion is permitted (Hip Hinge).

Table 1.A (Needing Illustrations)

The patient should be observed during each movement to ensure that they are maintaining a neutral spine by not permitting motion in the lumbar joints. Having the patient feel the spine in a neutral position during the motions may allow for more efficient progress. After a few applications of the movements described in the table above, the patient's gluteal activation should be reassessed.

Single Leg vs. Double Leg Squatting

Although double leg squats have been shown with EMG to be superior for training the rectus femoris (McGill, 2007) it seems single leg squats (SLS) show multiple advantages to double leg squats when observing gluteal activation and functional outcomes. According to EMG studies (McGill, 2002) the single leg squat activates the entire gluteal group at much less of a squatting angle. In other words, when performing double leg squats the patient must squat at much lower levels to achieve similar gluteal activation. Moreover, single leg squats are highly proprioceptive due to the balance required to maintain the movement. During a single leg squat balance is of importance to regulate the upright stance and precision of movement by the patient. From a functional viewpoint, the patient will spend two-thirds of his gait cycle on one foot (Hammer 2007) therefore, precision of movement via balance is important. In addition to, single leg squats may limit the amount of flexion occurring in the patient's spine thus reducing the risk for lower back injury. The mechanism by which extra flexion may occur during a typical squat may be due to the limitation that a bilateral foot contact imposes on the hip during a double leg squat.

Functionally the single leg squat may also outperform the double leg squat when looking at sporting movements. For instance, a sprinter off the blocks will accelerate using a single leg push or consider the long jumper who will push off with a single leg. Functionality is an important consideration when assessing a patient participating in sport.

Squatting Observation

The squat pattern may be classified into three parts: the descending phase, the ascending phase, and a static phase. The static phase makes up the pause at the end ranges of the ascending and descending phases. During each phase the practitioner should observe the patient from the front (anterior), back (posterior) and sides (lateral). This should be done systematically to ensure patient to patient reliability. This section of the review describes what the practitioner should look for in regards to symmetry of squatting from a lateral perspective. The faults of the squat and their correction will be addressed later in the review.

During the entire motion it is suggested that the patient remain in a neutral spine so that minimal flexion occurs through the lumbar spine. The descending phase when observed laterally should appear as if the patient is dropping their hips at an angle of approximately 45 degrees (McGill 2006, Fry 2003). The author finds it helpful to position the patient in order to have their hips 45 degrees from the point where the wall meets the floor. In this position the practitioner may instruct the patient to "drop their hips towards the junction of the wall and floor." The practitioner may also begin by telling the patient to drop the hips, "down and back." The motion should appear symmetrical and there should be an equidistant angle between the patients shoulder, hips, and knees. Any shifting in the patient as they descend should be noted. The ascending phase when observed laterally should appear as a symmetrical extension of the patient's hips and knees. Again, any shifting or deviation in the patient during this motion should be noted.

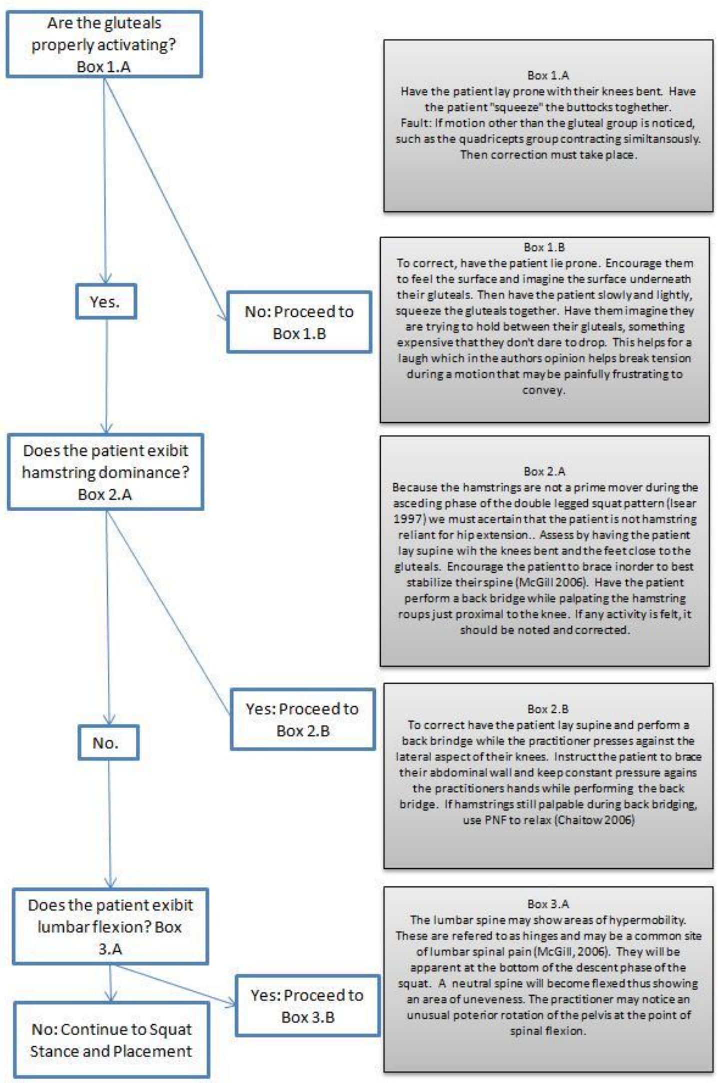
Muscle Assessment

When preparing the patient for any type of squatting activities the muscles of the patient much be assessed to determine areas of over-activity or inhibition. Phasic muscles comprise muscles that are primarily active with dynamic movement or locomotion, whereas, postural muscles are primarily to hold the individual in a static upright position against the earth's gravitational force (Chaitow 2006, Janda 1983). It will be found that often a patient's phasic muscles are not as active (as described above) while the postural muscles are over-active thus causing a perceived tightness. This may cause errors in the squat mechanism and should be addressed before commencing a squat routine of any type.

Assessment of the anterior muscles includes the quadratus group, the hip flexor group, tibialis anterior, and anterior abdominals (transverse abdominis and rectus abdominis). Assessment of the posterior and lateral muscles includes the hamstrings, piriformis, gluteals, gastrocnemius, soleus, tensor fasciae latae, and adductors. Muscle testing should be done to assess muscle shortness or weakness. Correction should then take place in order to correct any muscular faults found. An example would be using a muscle energy technique (MET) to relax any overactive muscle while using facilitation to stimulate an underactive muscle (Chaitow 2006). Such activities are outside the scope of this paper.

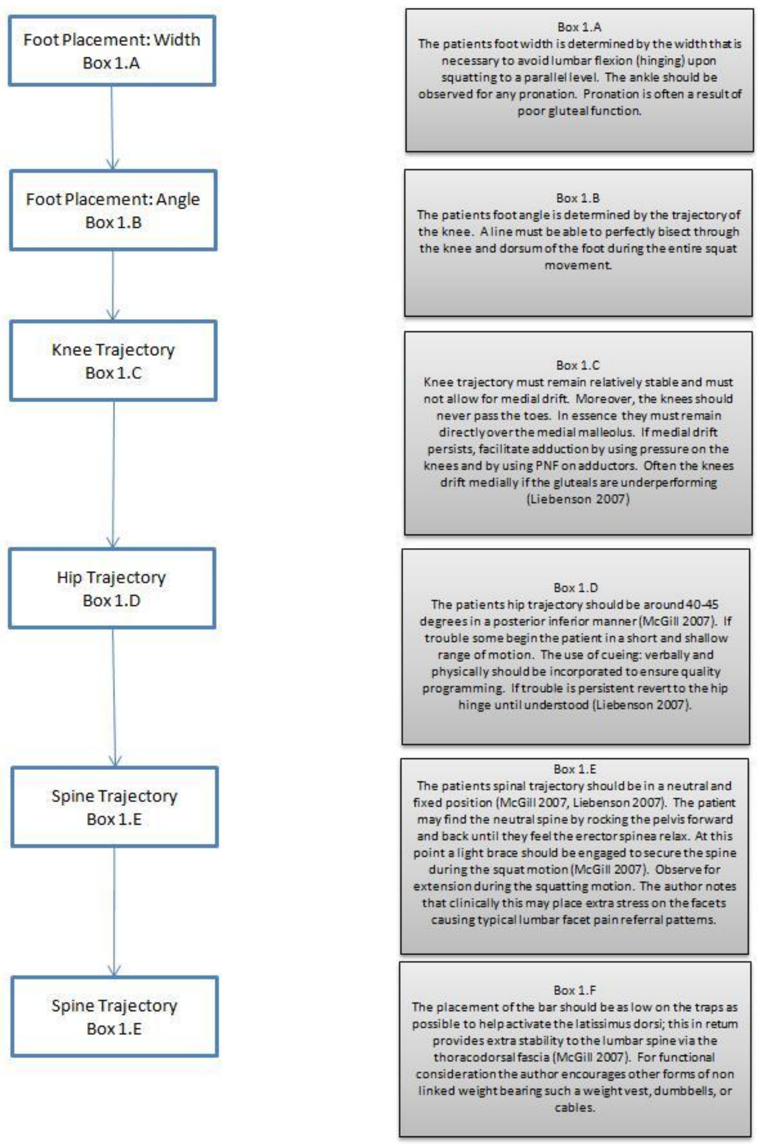
Squat Motor Control Assessment and Correction: Flow Chart

The following flow chart provides an organized pathway by which the practitioner can approach correcting and re-training an aberrant squatting pattern. This flowchart is to be attempted only after the prior corrections have been made. Failure to do so may result is sub-optimal results or injury to the patient.



Squat Placement and Trajectories Assessment and Correction: Flow Chart

The following flow chart provides an organized pathway by which the practitioner can diagnostically correct and place the client during a squatting procedure. This flowchart is to be attempted only after the prior corrections have been made. Failure to do so may result is sub-optimal results or injury to the patient.



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