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PROPER STANCE FOR THE SQUAT EXERCISE (Part I)

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Proper technique while performing squatting exercises is essential to avoid the long-term effect of strain placed upon joints, muscles, tendons and ligaments. Good technique should start from the feet and progress upwards. It is the intent of this article to illustrate correct technique vs. improper technique of the squat exercise. The mechanical basis of structural alignment of the lower extremities during the squatting exercise is presented along with ramifications of improper stance position.

RULES OF SQUATTING

The squat position is utilized while performing bent knee dead lifts and when competing in power lifting events. This position develops several primary muscle groups. Included are the knee extensors encompassing all the quadriceps muscles (rectus femoris, vastus lateralis, vastus intermedius, vastus medialis). Also the hip extensors, all the hamstring muscles (biceps femoris, semitendinosus, semimembranosus) as well as the gluteus maximus and the hip adductors (inner thigh musculature). An added benefit is the strengthening of the extensors of the spine. It is the intention of this article to concentrate more on the correct stance position as opposed to muscular development.

CORRECT FOOT POSITION

Feet should be slightly wider apart than shoulder width (see Fig. 1). By having a nominal space between the feet, more stability is afforded to the

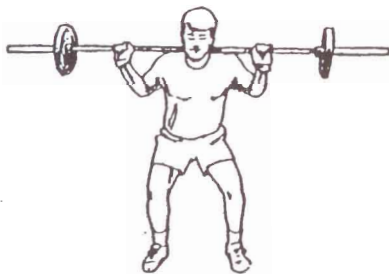


Fig. 1
Feet shoulder width apart

lifter which helps prevent the loss of balance. This forces the ground reactive pressures either directly up each leg or slightly inward of each leg. Besides keeping the lifter from falling sideways, this affords for mechanical advantage and transfers weight stress to the stronger pelvic area which is at the center of the body. Too wide a stance position may create strain on the medial aspect of the ankles, the deltoid ligaments, the inner aspect of the feet at the area of the medial collateral ligaments, and the tendons which cross the medial aspect of the knee joint. The adductor tendons and ligaments found at the inner aspect of the groin may also be strained.

Too narrow a stance may strain the lateral ankle ligaments and lateral knee joint ligament. The ligamentous structures of the outer hip, knee, or ankle may also be adversely affected.

CORRECT POSITION OF KNEES

This applies to the knee position during all phases of the squat exercise. Ideally the kneecaps should be straight ahead over the middle of each foot. This is facilitated by keeping the feet not more than 10 to 20 degrees toed outward. The more toed out the foot position the more reliance there is on the hip adductors and the less benefit there is to the hamstring musculature which one is trying to develop.

If the knees buckle or face inward then abnormal strain is being placed upon all soft tissue structures at the medial aspect of the knee (See Fig. 2). Simultaneously, there is increased compression of the lateral aspect of the knee predisposing to wear and tear of the lateral cartilage surfaces. The results of repetitive microtrauma is pain as one gets older. This can best be avoided by strengthening the hip adductors and by wearing supportive athletic shoes. Lifters with significant flat feet or collapsing arches should consider wearing a store-bought or custom in-shoe orthotic support avail-



Fig. 2
Knock Knees create abnormal strain at the knee

able from their sports podiatrist or physician.

FEET WELL BALANCED

During the squatting exercise there are increased weight forces being placed upon the feet. This perpetuates any abnormality of the arch. If one has a mildly collapsed arch, then the increased weight being lifted forces the foot to roll in and collapse (pronate). To counteract this, the lifter should attempt to hold up the arch position. Collapsing of the arch causes the leg bone to internally rotate which progresses up the leg and causes the kneecap to face inward. This is what is seen as knock knees. Should this be the case, the lifter should supplement his/her training routine with lower leg, ankle and arch strengthening exercises. If this does not work more supportive athletic shoes and/or arch supports should be instituted (see Fig. 3). Many lifters, especially those of heavier stature, also need more customized supportive orthotic devices as previously mentioned.



Fig. 3
Orthotic support device

Part II of this article will appear in our next issue

All drawings by Frank Cecala

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Knees Should be Proximal to Tips of Toes

During all phases of the squatting exercise, the kneecaps should not be too far forward. A plumb line attached at the center of the kneecap should touch on the top of the foot. (See Fig. 1) Correct knee position helps prevent

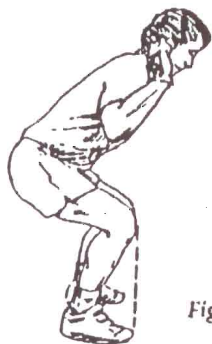


Fig. 1

excessive anterior strain to the patella tendon. If the plumb line falls past the tip of the toes this means that the knees are too far forward. (See Fig. 2) This proper knee position sets up for strain which may take weeks, months, or years to occur and may cause irreversible damage. To correct this the lifter should redirect the buttocks more posteriorly as if sitting in an imaginary chair.

The Squat Should be Limited to 90 Degrees of Knee Flexion

Bending of the knees as the lifter is squatting downward should be limited to forming a right angle between the lower legs and the thigh. Squatting down to this position creates sufficient tension (work) to strengthen the anterior thigh musculature by making use of the principles of eccentric (lengthening) contraction. The posterior muscles are also contracted in order to maintain balance. However, with knee flexion greater



Fig. 2

than the right angle (90 degrees) only the medial condyle of the femur (thigh bone) articulates with the corresponding medial surface of the patella, and increases pressure on this area (see Fig. 3). This increased pressure to the medial surface may predispose the knee joint to wear and tear. With the knees bent less, the medial and lateral



Fig. 3

aspects of the knee joint bear the pressure and weight forces are more evenly distributed.

Correct the Arch of the Back and Bend at the Waist

The lifter should maintain a mild arch of the lower back. This helps to pro-


vide increased stability by locking the back and making use of the stronger extensor musculature (See Fig. 4). However, this should not be excessive. Bending the waist a significant amount



Fig. 4

greater than 45 degrees causes the low back to arch further. This increases compressional forces at the posterior articulating surfaces of the vertebrae. As a result arthritic changes of the posterior aspects of the articulating joint may surface within the spine.

Conclusion

When the squatting exercise is performed adequately, it is then an exceptional exercise to strengthen the thigh and buttock musculature with resultant gains in stability of the knee joint. Correct balance is the key to performing this exercise and begins with proper foot stance. 

All drawings by Frank Cecala

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"The Weight Training Newsletter"

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