The Front Squat and Its Variations

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Summary
This article discusses the technical aspects of the front squat along with its variations that may be utilized by a strength and conditioning professional to increase lower extremity strength. It is the goal of the article to provide a basis on why to use the front squat or its variations in a strength program, which will hopefully lead to further research involving the front squat.

Introduction
When developing a strength program, one area touted as being vital to overall athletic improvement is leg strength. All weight-bearing athletic activities require individuals to overcome gravity by a production of force into the playing surface through their lower extremities. A well thought out strength training program typically will include some form of squatting (back squat, overhead squat, single leg or split squat, front squat) for enhancing a person's ability to create force in the lower extremities. This article will address the technique of the standard front squat, variations of the front squat, and reasons for these variations.

The front squat is used in the sport of weightlifting as a specific way to improve the lifter's ability to recover from a clean (1, 7). However, for general athletics it is an alternative exercise for the back squat, leg press, and other exercises typically used for developing leg strength.

The front squat has anecdotally been advocated to reduce the stress to the low back while increasing leg strength. However, the inclination of the back is what influences the chance of low back injury, regardless of whether the front squat or back squat is used (9). Even if a neutral spine is maintained during a back squat and front squat, there will be greater forward inclination during the back squat. So the correct technique performance of the front squat is what makes this exercise a viable alternative in a strength training program.

The squat exercise in general can be effective as a rehabilitative tool (3). Research has shown when comparing the front squat with the back squat or forward lunge that there is no significant difference in stress to an injured or repaired anterior or posterior cruciate ligament from posterior tibiofemoral shear force (10). There is also an increase in shear forces that are created posteriorly between the lunge, front squat, and back squat as the knee flexes (10). This is important to consider if applying the front squat to an athlete with an injured knee because shear force is the force that acts parallel to the contact surface. The purpose of this article is to address the movement techniques and variations of the front squats, and at no time do the authors take credit for these.

Standard Front Squat Technique
The first step is to establish a clean grip width by measuring thumb distance from the edge of the knurling on the bar, which should place the hands slightly wider than their shoulders (1, 2, 5–8). This grip may need to be adjusted, depending on wrist, elbow, and shoulder flexibility, to allow the bar to rest across the clavicles, upper chest, and anterior...
deltoids (1, 5–8). If an athlete uses a grip that is very wide on the bar, it has the potential to create wrist discomfort (1). The grip may need to be adjusted to a position that is the most comfortable for the athlete while maintaining a secure bar rack position.

The bar rack position should initially rest in the cradles of a squat stand at a height that the lifter has to slightly squat under the bar so it rests across the anterior deltoids, upper chest, and finger tips (Figure 1). Once the athlete stands up with the bar, it should rest across the anterior deltoids without pushing into the person’s throat. The burden of the weight should be placed on the anterior deltoids, upper chest, and torso, and the arms are used to balance the bar. The athlete should have a rigid torso at this time, upper arms parallel to the floor, chest elevated, and slight retraction of the scapulae prior to descending.

The athlete stands up with the bar, taking a step backward and placing the feet between hip and shoulder width, with foot placement comfortable for the athlete with no more than 30° of lateral rotation (6). Foot placement should allow for pain-free range of motion at the hip and knee. Modifications may be necessary if full range of motion at the ankle, knee, and hip is not possible or if the low back lacks flexibility to complete the movement. Athletes performing a front squat should be able to go to the position of hips parallel with knees, although greater depths can be used if necessary based on the objectives of the athlete. Parallel depth can also be determined when the top of thighs or back of the thighs is parallel to the ground (2, 5, 8). If range of motion is a problem for an athlete, these issues should be addressed through flexibility training prior to significantly loading the front squat or any other exercise.

Before the eccentric phase of the front squat, the athlete takes a deep inhalation, elevating the chest, and held during the descent (5). Initiate the descending or eccentric phase of the front squat with a posterior motion of the hips/pelvis with secondary hip flexion. Immediately as the hips move posteriorly, flex the knees moving forward while head position and back alignment (almost vertical) remain in a neutral spine alignment throughout the descent (Figure 2). Cervical hyperextension, or “looking up,” should be avoided during the front squat (6). This would cause unnecessary stress to the cervical spine and, contrary to antidotal belief, will not improve the amount of weight lifting in the movement. The knees should remain in line or behind the toes as back alignment is maintained, feet remain flat on the floor with the body weight over the arch of the foot, and at no time should the athlete’s heels raise from the floor (1, 2, 6, 8).

The recovery or the concentric phase begins with a rise out of the bottom squat position by pushing through the center of the feet and keeping the elbows pointing straight forward with the upper arms parallel to the floor (1, 5, 6). The upward bar path should be a relatively straight vertical line while maintaining a neutral spine. Ascending from the full squat position should be stopped if thoracic kyphosis increases dramatically or a significant drop in the elevation of the rib cage occurs, which may cause the athlete to drop the bar (1, 6). Exhalation should take place as the athlete passes the sticking point of the front squat as-
The authors have observed that an exhalation that is too forceful or takes place too early during the ascending portion has caused a kyphotic posture of the thoracic spine to occur, increasing the risk of injury.

This recovery phase stops once the knees and hips have reached full extension and the body is completely vertical. Throughout the front squat, neutral spine should be maintained with a good rack and arm position, strong back musculature, and efficient leg movements. Strengthening the back muscles and increasing the flexibility of hip flexors, along with having range of motion in the upper extremities, will assist the athlete in holding a neutral spine. There is a checklist the strength and conditioning professional can utilize to ensure the athlete is completing all tasks/movements during the front squat (6).

Safety Considerations

There are a few safety considerations that should be evaluated and practiced prior to performing the front squat and will be detailed in the following paragraphs. The athlete needs to learn how to safely escape from a missed attempt without causing injury prior to performing the exercise. Missing a front squat is taught in the same means as missing a clean. If the athlete starts to lose torso stability or the rack position, he or she should extend the knees and hips while simultaneously pushing the barbell from the rack position controlling the drop of the barbell. This will reduce the chance of the athlete’s body being in the path of the falling barbell.

Bumper weights should always be used when performing a squat outside of a power rack in the event a missed lift occurs to ensure safety of those around the platform and longevity of equipment. If a facility does not have access to bumper plates, then front squats should be performed within a power rack or with use of a spotter on either side of the barbell to assist if necessary. When performing front squats in a power rack, the catch bars should be set as close as possible to the bar in the bottom position (Figure 3) (4). This will allow an athlete to safely eccentrically lower the bar to the catch bars. It is not recommended dumping a loaded barbell from the shoulders falling to the catch bars because the direction of a rebounding weight can be unpredictable (4).

Utilizing one spotter on each side of the barbell is recommended to assist the athlete’s removal and return of the bar to
the rack safely (2, 6). Spotting the athlete by standing behind him or her may put the spotter in a potentially hazardous position if the bar is dropped forward and the athlete falls backward or if both the bar and athlete fall back. Each spotter stands to the side of the bar with hands cupped a few inches below the ends of the bar. The spotters will descend and ascend with the athlete during the front squat to assist if the athlete is unable to safely complete the repetition. Communication between the spotters and athlete should be constant and encouraging. The athlete should say "got it" as they step back from the rack ready to front squat. Spotters will tell each other to "grab it," "it" being the bar, if the athlete should begin to compromise his or her form. It is also acceptable for the spotters to assist the athlete in removing the bar from the racks, which should be discussed prior to the execution of the exercise. Spotters should be used if bumper plates are not used or performed outside of a power rack. These safety and spotting techniques may also be applied to the variations that are discussed next.

Variations
This section will discuss the variations and adjustments that can be made to the standard front squat that will assist to remove errors or alleviate stress to the joint. Wrist flexibility, which is critical for completion of a clean, is also necessary for completing the standard front squat. A limitation of wrist extension will hinder the athlete's ability to tolerate or even execute the front squat properly. The variations to follow primarily address upper extremity considerations, and with that in mind, the lower extremity movements will remain unchanged from the standard front squat technique.

Front Squats with Straps
Tying power straps or 1-in. thick ropes to the bar where hand spacing should be can allow the athlete to maintain elbow and shoulder flexion during the front squat (Figure 4). The athlete will rack the bar across the chest in the standard form with the exception of grasping the straps/rope tightly with the edge of the hand pressed against the bar, although it maybe a necessity to move the hands further up the straps to allow for restrictive arm range of motions. The advantage of using this method is that it maintains the catch position of the clean, ingraining a good squat recovery and leg strength.

Front Squats with Crossed Arms
The front squat, with a crossed-arm rack position, is used if there is limited flexibility of the wrist, elbow, or shoulder joints (Figure 5). Anecdotally, the athlete may have more confidence performing the front squat with this method because of the eased pressure of the upper extremity joints. Although this position may have an increased sense of upper body stability, there can be a reduction in the athlete's ability to miss the lift if he or she loses technique, so spotting or use of a power rack is recommended. The crossed-arm technique involves the flexion of the elbows and shoulders, where the forearms cross over each other with the hands open placed on top of the bar (2). The overall movement of the crossed-arm technique is the same as the clean-grip technique.
Front Squats with Straight Arms
The straight-arm front squat technique may be a valuable alteration to correct an athlete's tendency of increasing thoracic kyphosis during the movement. The athlete will step under the bar, placing the bar across the upper chest and anterior deltooids. However, at this point the arms will maintain shoulder flexion and elbow extension (Figure 6). Athletes who allow thoracic trunk flexion to occur will be directed to keep the arms parallel to the floor and a rigid back to prevent the bar from falling to the platform. This method is for teaching technique and not necessarily for maximal attempts. Once the athlete has demonstrated the ability to maintain a rigid back, he or she may return or progress to the standard or with straps front squat styles.

Front Squats with Ball and Wall
Using a small stability ball or basketball placed in the middle of the back against a wall can provide a physical cue if the athlete has difficulty initiating front squats with posterior hip motion or demonstrates an inability to maintain a neutral spine. The ball used should be fully inflated to allow for posterior hip movement and support the athlete's body weight (Figure 7). An empty bar will be used to emphasize technique and as a warm-up activity. Athletes new to lifting exercises in general may benefit from using this variation for a few weeks to instill good front squating mechanics, gradually increasing the volume of traditional fronts squats.

Using straps on the bar, ball against a wall, and crossed-arm style can be kept permanently in a strength program to develop leg strength or may be used as a step toward the standard front squat. Progression to the standard technique is preferable if the athlete will be performing cleans in the weekly regimen. The standard front squat can assist in the recovery portion of a clean along with the development of leg strength. As the athlete improves with these variation styles, it is appropriate to test his or her ability to perform the standard front squat. The athlete can also change foot or hand placement and add flexibility drills to aid in progressing to a traditional front squat. Table 1 lists some of the technical errors that may be prevalent or limit success with the standard front squat and potential corrective exercises and methods.

Conclusion
As a strength and conditioning program is developed, there should be some form of leg strengthening exercise. The front squat when properly instructed and performed with efficient mechanics is a beneficial addition to a strength program. There is still a lack of specific research-based evidence on whether the front squat can have a positive impact on athletic ability, but secondary to the similarities of the back squat, it should have a positive crossover to other movements requiring strength, speed, or power production. It would be prudent for further research to be performed on the front squat as it relates to programming and comparing like motions and the physiological adaptations from...
<table>
<thead>
<tr>
<th>Technical Error</th>
<th>Corrective Action</th>
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<tbody>
<tr>
<td>Rounding of the upper back or inability to maintain</td>
<td>• Rest bar across anterior deltoids with shoulders flexed to 90° and elbows</td>
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<tr>
<td>neutral spine</td>
<td>extended (straight-arm technique)</td>
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<tr>
<td></td>
<td>• Use small ball (e.g., basketball) against wall to guide back alignments</td>
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<td></td>
<td>• Exercises to strengthen upper back musculature</td>
</tr>
<tr>
<td>Pain to wrists in rack position or tight wrist</td>
<td>• Widen hand grip width</td>
</tr>
<tr>
<td>flexors</td>
<td>• Use power straps or 1-in.-thick ropes attached to the bar</td>
</tr>
<tr>
<td></td>
<td>• Crossing the forearms in the racked position</td>
</tr>
<tr>
<td></td>
<td>• Stretch wrist flexors</td>
</tr>
<tr>
<td>Unable to achieve 90° shoulder flexion in racked</td>
<td>• Stretch shoulder internal rotators and upper back musculature</td>
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<tr>
<td>position</td>
<td>• Use power straps or 1-in.-thick ropes attached to the bar may help</td>
</tr>
<tr>
<td></td>
<td>• Crossing the forearms in the racked position</td>
</tr>
<tr>
<td>Anterior shift of bodyweight onto toes during</td>
<td>• Use small stability ball against wall to guide posterior hip shift</td>
</tr>
<tr>
<td>descending portion of front squat</td>
<td>• Stretch hip flexors, back extensors, and ankle plantar flexors</td>
</tr>
<tr>
<td></td>
<td>• Slightly widen foot placement and externally rotate feet</td>
</tr>
<tr>
<td></td>
<td>• Stretch ankle, knee, hip, and low back musculatures</td>
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<tr>
<td>Knees move medially “knock knee”</td>
<td>• Focus on laterally moving knees during ascension of squat</td>
</tr>
<tr>
<td></td>
<td>• Place light band around knees as a guide for a few weeks</td>
</tr>
<tr>
<td></td>
<td>• Strengthen hip abductors</td>
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using the front squat alone or in conjunction with others.

References

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