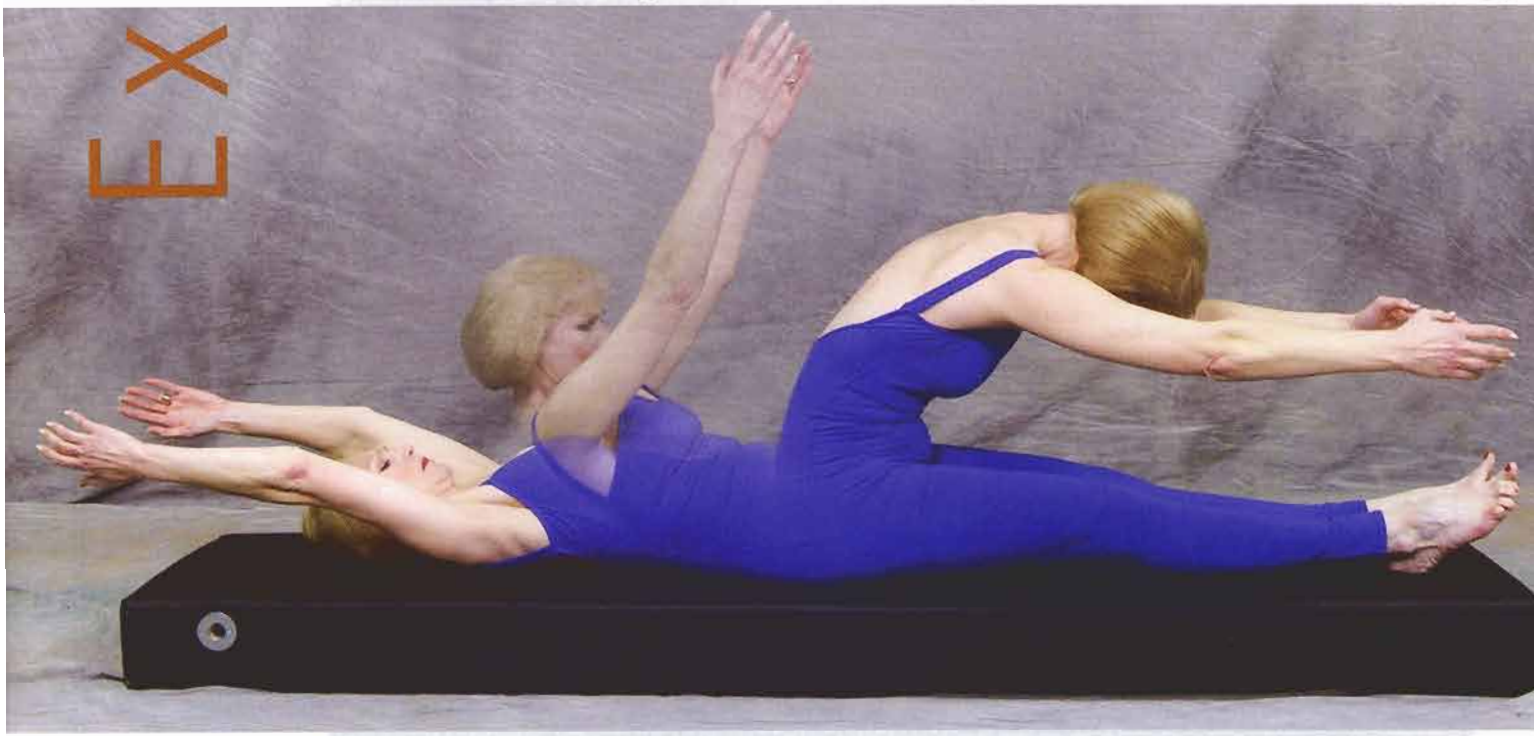
Evaluating the Sit-Up



Photography: David J. Savarino;
Models: Lynn Patterson and Christine Romani-Ruby

Methods that help create muscle balance and spinal stability.

BY CHRISTINE ROMANI-RUBY, MPT, ATC

Methods of strengthening the abdominal muscles have interested both the general public and the fitness industry for years. This interest stems from the desire to have a flat abdomen and from the abdominal muscles' assumed ability to protect and support the spine. Over the years, abdominal fitness has progressed from the sit-up to the crunch to the pelvic tilt and now to the straight-legged sit-up (roll-up). Unfortunately, many programs developed to strengthen abdominal muscles have contributed to abdominal muscle imbalances and pain syndromes (Sahrmann 2002). As a result, media information concerning the methods and effects of strengthening the abdominal region has been conflicting.

Review Current Research

An understanding of each abdominal muscle's role both in the sit-up or crunch and in healthy posture is vital to the evaluation of abdominal muscle performance. A study by Juker and colleagues indicates that during sit-ups, a greater percentage of the activity is performed by the rectus abdominis (68%) than by the external obliques (19%) or the internal obliques (14%) (Juker et al. 1998). The problem with this is that the rectus abdominis is not the preferred muscle to strengthen, as it is not effective at preventing rotation (needed to protect the lumbar spine). Moreover, shortening of the rectus abdominis actually contributes to a thoracic kyphosis (Kendall 1993). ➤

Revisit the Move

When examining a sit-up, legs bent or extended, there are two component motions to identify: the trunk curl and the sit-up itself (hip flexion). In the trunk curl, the internal obliques and rectus abdominis are the most active muscles. As the trunk curls and is pulled toward the pelvis, there is a simultaneous posterior tilt of the pelvis. At this point, the hip flexors are activated and serve as the prime movers through the movement's completion. With this in mind, it is not surprising that the most common imbalance encountered in an individual who has performed abdominal exercises is overdeveloped internal oblique and rectus abdominis muscles (Sahrmann 2002).

The greatest injury risk during the sit-up arises if hip flexion occurs without the trunk curl. This may happen because of lack of abdominal strength, hip flexor dominance or an inability to flex the lumbar spine (stiff spine). Hip flexor contraction without trunk curl (lumbar flexion) causes dangerous anterior shear forces from hyperextension of the lumbar spine (Kendall 1993). Because the hip flexors are attached to the front of the lumbar spine, the sit-up phase will cause the torso to lift, pulling on the unstable extended spine.

Recognize the Benefits

For years, fitness professionals have advocated the trunk curl with hips and knees flexed so as to minimize hip flexor action, the theory being that the hip flexors are slack in this position. In reality, the benefit of flexing the hips and knees is that a posterior pelvic tilt is then produced rather easily. This reduces the risk of anterior shear to the lumbar spine. For this reason, the bent-knee crunch is recommended for class settings where one-on-one training is not available.

Realize Custom Options

In the one-on-one setting, the sit-up is a better choice for those who can perform it safely. This is because the internal obliques are not required to perform at their maximum when the exercise is limited to the bent-knee crunch (Sahrmann 2002). The greatest demands are put on the abdominal muscles as the hip flexors contract for the sit-up phase. In a full trunk-curl sit-up, the abdominal muscles must maintain not only the trunk curl but also the posterior pelvic tilt. The eight-point assessment described on page 27 is a good guide to use when working with clients in small groups or one-on-one.

Yoga and Pilates have reintroduced the straight-legged sit-up, or roll-up, to the fitness environment. With the roll-up, you are able to place greater demands on the abdominal muscles, thereby enhancing performance, but unfortunate risks exist

Eight-Point Abdominal Strength Assessment

When a client is performing a trunk-curl sit-up (legs bent or extended), check the following criteria:

1. **Know the Client's Passive Spinal Flexibility.** The client may have limited lumbar mobility (a stiff spine), and this will limit her ability to perform the trunk curl to a point where the sit-up portion is safe. To measure lumbar mobility, passively raise the client into a trunk curl and assess trunk flexion.
2. **Look for Tight Hip Flexors.** If the client has hip flexor tightness, she will be unable to hold her pelvis in a posterior tilt, which is needed to perform the sit-up phase safely. The client should be able to flatten the lumbar spine onto the floor in the supine position with the legs extended. If she cannot perform this maneuver, place a roll under her knees to reduce hip flexor pull.
3. **Watch for a Posterior Pelvic Tilt.** When the client initiates the trunk curl, the pelvis should tilt posteriorly. If the client is using the hip flexors for the motion, the pelvis will tilt anteriorly.
4. **Observe the Neck Position.** The chin should be brought to the Adam's apple, *not* the chest. The neck should not extend either; neck extension occurs when the client's face is to the ceiling.
5. **Check for Thoracic Kyphosis.** If the client has this condition, the trunk-curl sit-up will contribute to the problem (Kendall 1993).
6. **Test Whether the Client Can Curl to the Limit of Her Spinal Flexibility.** This should be attainable with the shortest lever of the exercise (arms reaching in front). If the degree of difficulty is increased with lever (arms on chest or behind head), does the client still perform the same amount of lumbar flexion (trunk curl)? If the trunk curl diminishes, the client is not ready to progress to the more challenging exercise.
7. **Test Whether the Client Can Maintain the Lumbar Curl at the Initiation of the Sit-Up Phase.** If not, the abdominals are too weak, and there is anterior shear stress on the lumbar spine.
8. **During the Trunk-Curl Phase, Make Sure the Heels Stay in Contact With the Floor (Kendall 1993).** If the feet come up, it is safe to hold them down *if attention is focused on maintaining the trunk curl.* (Holding the feet down before the sit-up phase will cause the hip flexors to contract, prompting the trunk to rise.) For best results, hold the feet only during the sit-up phase. It is especially dangerous to hold the feet while your client is performing a high number of repetitions. The onset of abdominal fatigue in this instance would allow the less fatigable hip flexors to dominate the movement.

in the group setting. The most common error made when giving general instructions for the trunk curl is not matching the client's strength level with the appropriate level of demand (Sahrmann 2002). This should be a reminder that disciplines like yoga and Pilates require personalized instruction and attention to detail. The roll-up is most successful when taught in small groups or one-on-one.

Remember Other Methods

In summary, one should remember that the sit-up, with legs either extended or bent, demands considerable hip flexor recruitment. The main abdominal muscle strengthened is the rectus abdominis, and strengthening this muscle can cause more harm than good to the spine. It is therefore important to incorporate other methods of abdominal strengthening to create muscle balance and spinal stability. Emphasis should be placed on strengthening the external oblique and transverse abdominis muscles.

When teaching any abdominal exercise, it is important to screen clients very carefully for appropriate abdominal strength and balance, spine and hip flexor flexibility, and strict form. Screening for these factors will prevent excessive stress and compensatory motions of the pelvis during movements of the extremities (Sahrmann 2002). Clients should be able to stabilize their spines appropriately, maintain optimal alignment and understand movement relationships between the pelvis and the spine. ◆

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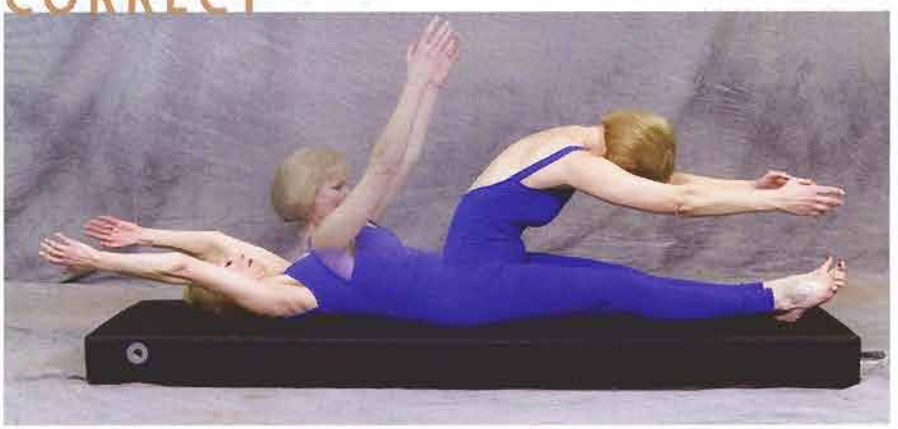
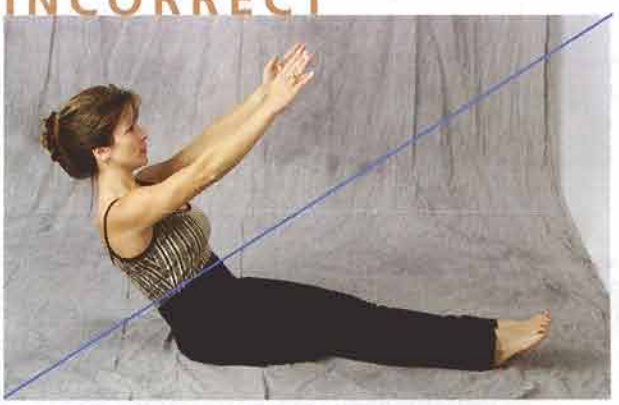
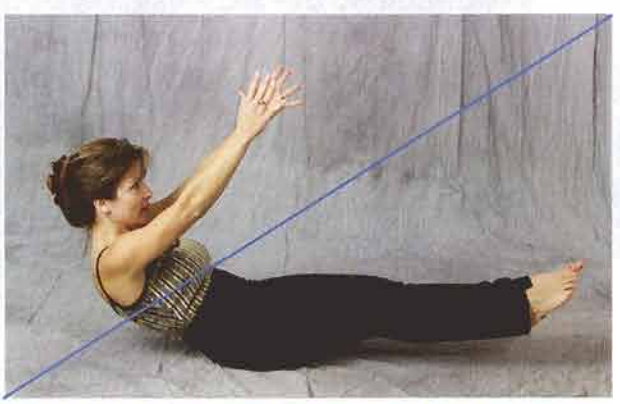
CORRECT



When the roll-up is performed correctly, the client's chin is brought to the Adam's apple area, not the chest. During the trunk-curl phase, the heels stay in contact with the floor. The client is able to maintain the lumbar curl at the initiation of the sit-up phase.

INCORRECT





When the roll-up is performed improperly, hip flexor contraction occurs without trunk curl and the sit-up phase causes the torso to lift, pulling on the unstable spine.

REFERENCES

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