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Programming Abdominal Training, Part I

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ABDOMINAL EXERCISES ARE AN important component of a strength and conditioning program. The same principles apply to these exercises that apply to any other type of exercise. Principles such as progressive overload, periodization of training, and specificity should all be observed with abdominal training.

In this article, I will discuss a number of aspects of abdominal training. First, I will review the anatomy of the abdominal region. Second, I will discuss the benefits to athletics of training abdominal muscles. Finally, I will review the principle of progressive overload and apply it to abdominal training.

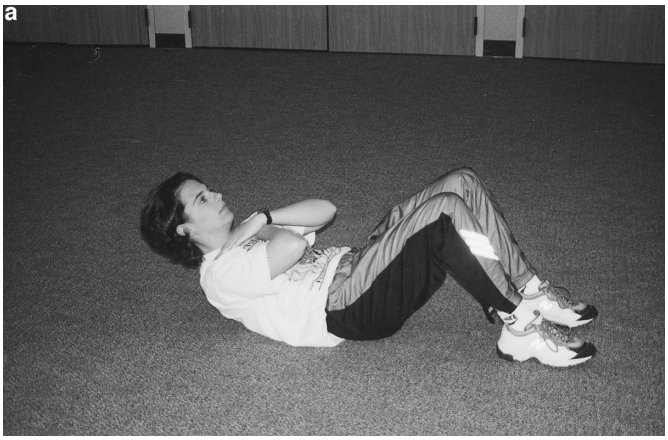
The abdominal muscles consist of the rectus abdominis, external obliques, internal obliques, and transversus abdominis (4). The rectus abdominis flexes the trunk (4, 7), and the external and internal obliques produce trunk rotation and lateral bending (4, 7). The transversus abdominis forms a third layer of muscle under the external and internal obliques (4). It is responsible for compressing the abdomen's content (4, 7). The upper fibers of the rectus abdominis and external and internal obliques act in unison to flex the trunk (7). The lower fibers function to posteriorly tilt the pelvis and to stabilize the pelvis (7). The internal obliques and transverse abdominis are also the major stabilizers of the spine because they pass from the anterior trunk to the lumbar spine (8).

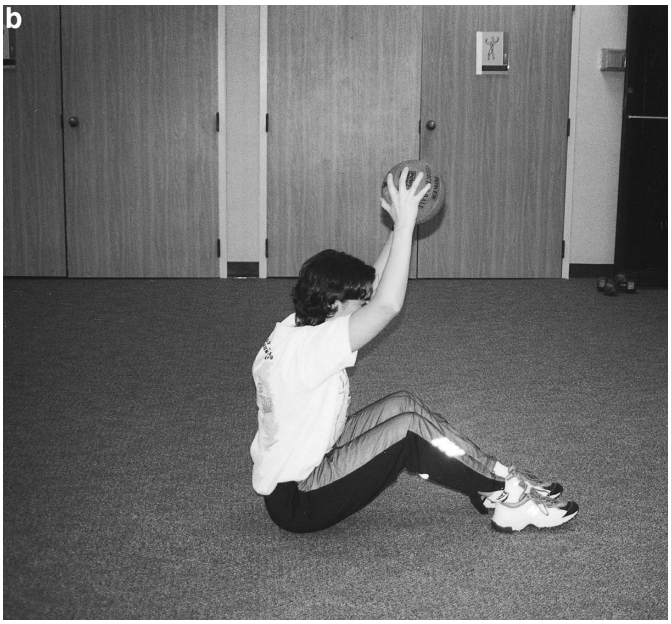
To focus on the abdominals in a conditioning program, it is important to have an understanding of the functions of these muscles. It is also important to understand what role they may play in athletics.

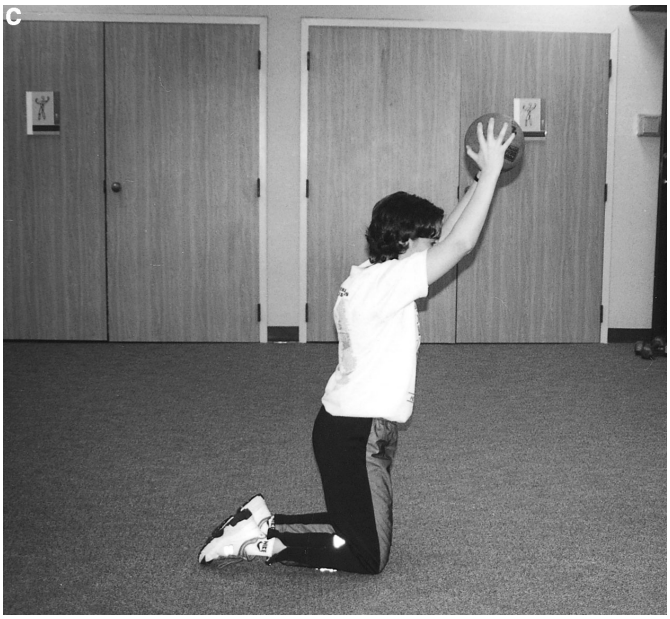
According to Hedrick (2), trunk strength is important because most athletic movements either originate in or are coupled through the trunk. This region allows one to transfer force in a kinetic chain from the lower body to the upper body (2). Hedrick (2) noted that failing to train the abdominal muscles can lead to poor posture. With proper training, the abdominal muscles can be made stronger and more explosive, and these effects can be transferred to sports. Sports such as track and field throwing events, baseball, and tennis would benefit from strong, powerful abdominal muscles.

Training the abdominal muscles may prevent injuries to the lumbar spine. Abdominal exercises will strengthen the muscles that act upon the spine and may also improve the coordination of those muscles. According to Tyson (8), this increased coordination is important for the prevention of lower back injuries because these muscles also function to stabilize the pelvis during activities (7, 8). Poor control of the pelvis can put excessive stress on the lumbar spine and can contribute to lumbar injuries (7). Trunk kinematics break down during fatigue, and this breakdown can contribute to lower back injury (5). These characteristics of the trunk musculature play a role in just about every sport.

Abdominal training is important for improving performance and for preventing injuries. Just like any other component of training, it should be approached with a number of principles in mind. Abdominal training needs to apply progressive overload, it needs to







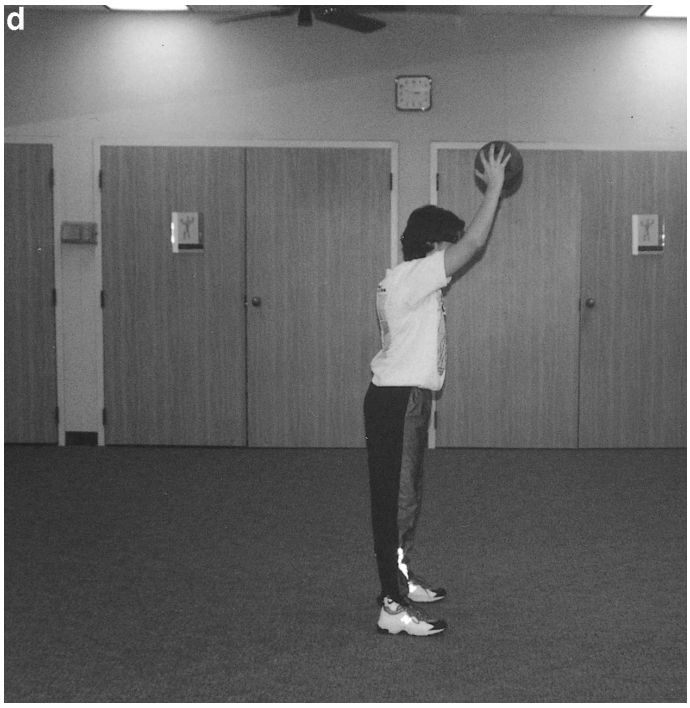


Figure 1. **Positional progression for the crunch exercise: (a) with flexed knees; (b) in sitting position with medicine ball throw; (c) in kneeling position with medicine ball throw; (d) in standing position with medicine ball throw; (e) standing on 1 leg with medicine ball throw.**

be applied in a systematic fashion, and it needs to be specific to the sport.

Abdominal training should be progressive in nature. The exercises should become more difficult as the athlete improves in fitness and skill (1, 3). There are a number of progressions one could use with abdominal training: position; resistance; speed of movement; and stability.

Position refers to the athlete's body position when he or she performs the exercise. Is it performed standing up or lying down? Changing the position of the exercise will do a number of things. First, it will change the level of difficulty of the exercise. Moving from lying to sitting, kneeling, or standing will require the involvement of different muscles and varying amounts of balance. Body position will also change the exercise from an "isolation" exercise (e.g., lying down) to more of a total body exercise (e.g., standing up) (2). Second, postional changes will change the specificity of the exercise. Very few athletic events are performed lying, sitting, or kneeling; most are performed standing up. For this reason, a good proportion of an advanced athlete's abdominal training should be performed standing up (2, 6). The following is a positional progression: (a) lying; (b) sitting; (c) kneeling; (d) standing (2 legs); and (e) standing (1 leg) (2).

Figure 1a–e demonstrates positional progressions for the crunch exercise. In Figure 1a, the athlete is lying down with her knees flexed. Her arms are crossed on her chest. She tightens her abdominal muscles and raises her shoulders off the ground. In Figure 1b, she is performing this exercise from a sitting position. She is holding a medicine ball over her head. She flexes her trunk and throws the medicine ball (she is using her abdominal muscles to help throw the ball). In Figure 1c, she is performing the same exercise from a kneeling position. She kneels, tightens her abdominal muscles, and then flexes her trunk and throws the medicine ball at the same time. In Figure 1d, she is performing the same type of exercise from a standing position. Once again, she flexes her trunk and throws the ball. In Figure 1e, she is performing the exercise while standing on 1 leg. This variation requires her to develop balance and proprioception in addition to developing her abdominal muscles. This exercise could also be performed in a slow, controlled manner using cables or could be performed explosively (as demonstrated) to increase the intensity.

The variations listed are not the only ones possible. One may also perform exercises with rotation to train the abdominal muscles in several planes of motion. Other exercises (e.g., leg-raises and sit-ups) may be performed hanging from a pull-up bar to change their difficulty level.

The position of the athlete's body is not the only type of progressive overload that may be applied to abdominal training. One may also modify the resistance that is used with the exercises. Abdominal exercises may be performed with no added resistance (i.e., body weight) or with added resistance (e.g., medicine balls, dumbbells, weight plates). There are several progressions for performing exercises with added resistance (appropriate progressions depend upon the exercise being performed): (a) no resistance; (b) resistance held on the chest; (c) resistance held over the head; and (d) resistance held over the head and between the feet.

These progressions are important because not only do the exercises become more difficult as an athlete moves through them, but they also can become more stressful to the lower back as they become more difficult. This means that an athlete needs to develop muscular strength before progressing to the next level of exercise.

Figure 2a–c shows how resistance can be modified to make the sit-up more difficult. In Figure 2a, the athlete is performing a sit-up with no added resistance. His hands are crossed over his chest, and he is flexing his trunk to sit up until his elbows touch his thighs. In Figure 2b, the athlete is performing the sit-up with a dumbbell held across his chest (this exercise could also be performed with a weight plate or medicine ball). Once again, he flexes his trunk until his elbows touch his thighs. In Figure 2c, he is performing the sit-up with a dumbbell held over his head, which further increases the lever arm of the applied resistance. His arms are straight, the weight is over his head, and he flexes his trunk until he is in the final position.

Figure 3a-c shows how resistance can be modified to make the v-up more difficult. In Figure 3a, the athlete is performing the v-up with no added resistance. She is trying to lift her lower and upper body off the ground simultaneously. In Figure 3b, she is performing the v-up with a medicine ball held over her head. In Figure 3c, she is performing the same exercise with a medicine ball held over her head and a dumbbell held between her feet.

To change the difficulty of abdominal exercises, one may change the position of the athlete's body, the resistance used, the speed at

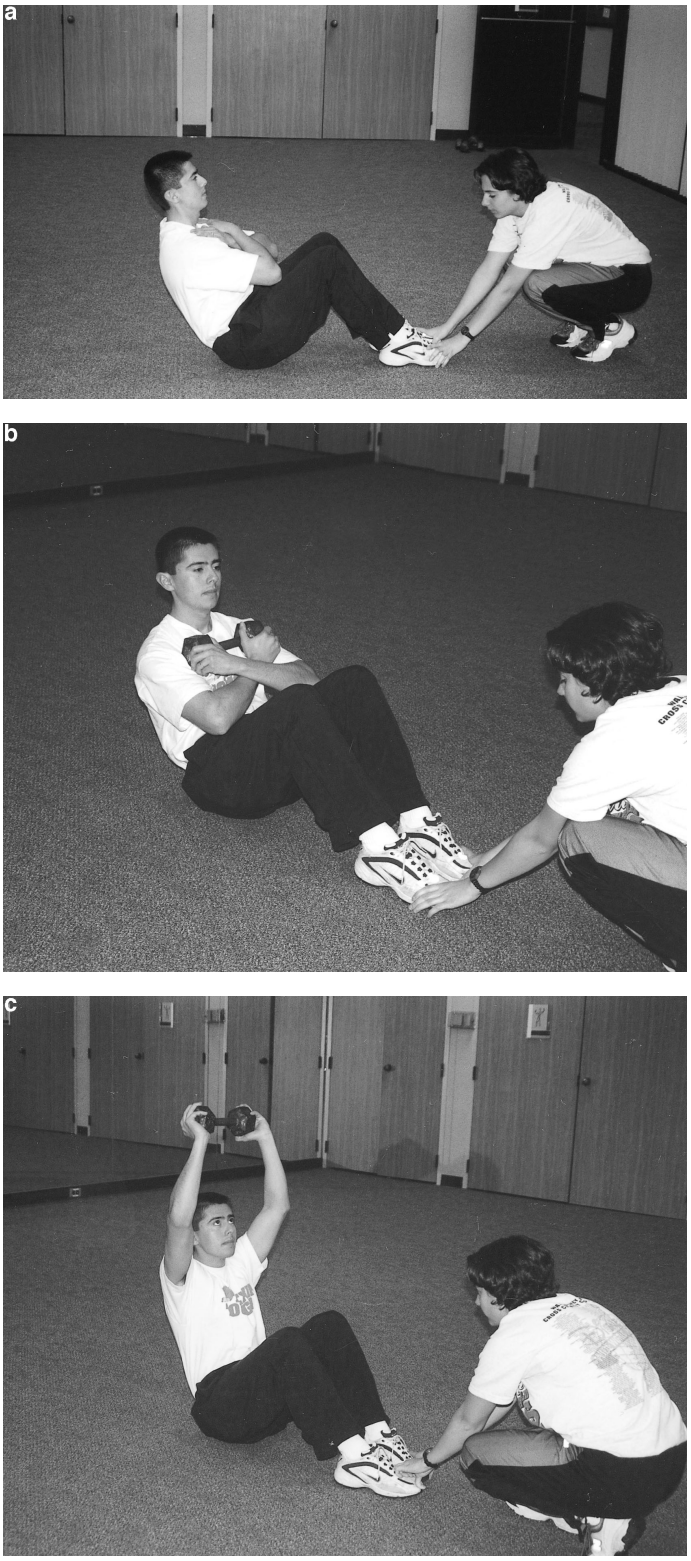


Figure 2. Modifying resistance for the sit-up: (a) no added resistance; (b) with dumbbell held across the chest; (c) with dumbbell held over the head.

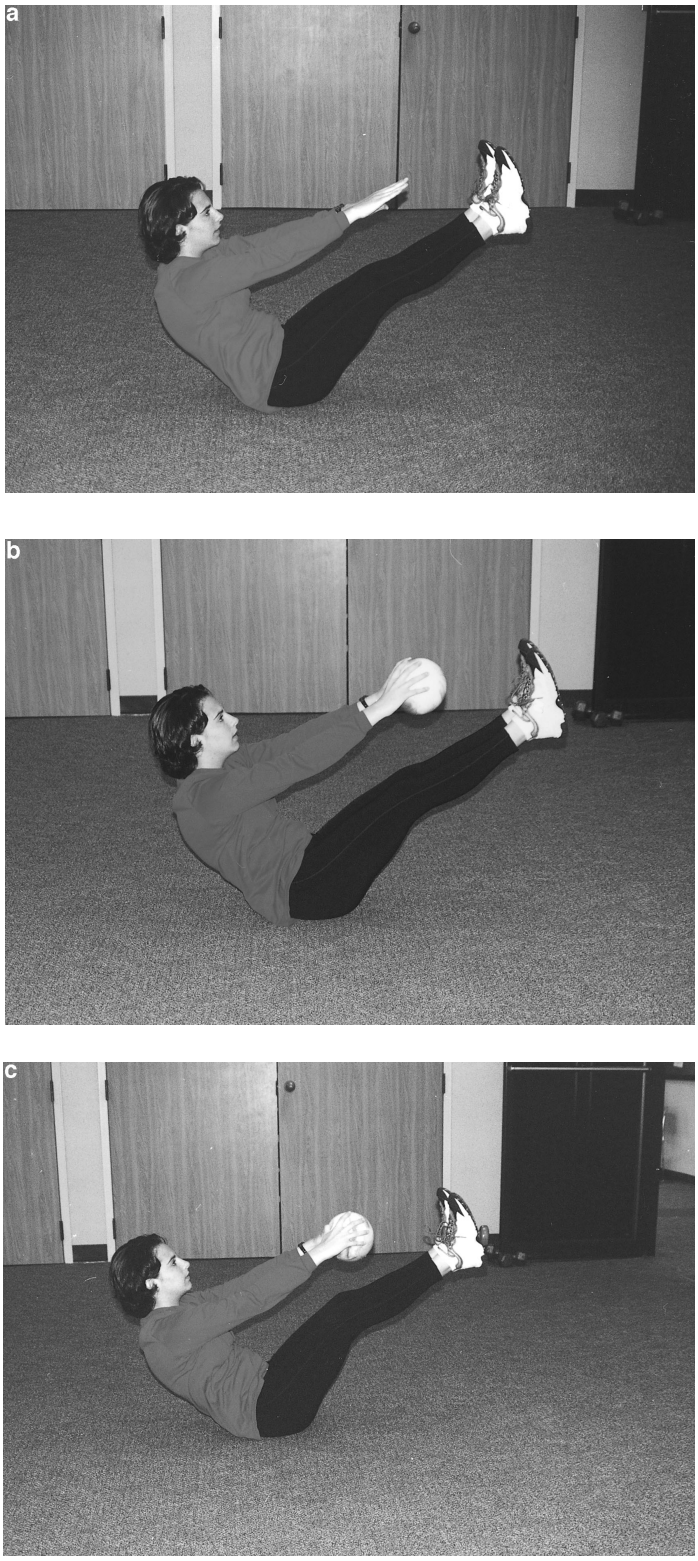


Figure 3. Modifying resistance for the v-up: (a) no added resistance; (b) with medicine ball held over the head; (c) with medicine ball held over the head and dumbbell held between the feet.

Figure 4. **Sit-up with medicine ball toss.**

which the exercise is performed, or any combination of the three.

Many traditional abdominal exercises are performed in a slow, controlled manner. This approach is fine for general fitness; however, athletics are not performed this way. Some of the abdominal work should be performed explosively to help transfer to the playing field (2, 6). The following is a speed-of-movement progression (again, appropriate progressions depend upon the exercise being performed): (a) slow; (b) explosive; and (c) explosive with resistance.

Figures 2a, 4, and 5a–c show examples of this progression. In Figure 2a, the athlete is performing a sit-up slowly. The second step in this progression (not pictured) would be to perform the sit-up by lowering himself slowly (over 10 seconds) and then exploding back up. The final step (Figure 4) involves performing the sit-up with a medicine ball toss. The moment he catches the medicine ball, he should lie back quickly and then explode up, releasing the ball at the top of the sit-up.

In Figure 5a, the athlete is performing a slow, controlled leg-raise. In Figure 5b, she is performing leg-throws with a partner's assistance. Her partner will throw her legs to the ground. Her goal is to slow her legs down so that they do not contact the ground and then to bring them back up quickly. In Figure 5c, she is performing the leg-raise using a medicine ball throw. Her goal is to catch the ball between her feet, lower it quickly, and then (using her legs) throw it back to her partner. Note that she is maintaining posterior pelvic tilt throughout these exercises.

Changing body position, resistance, and speed of movement are all leading up to the final way to change the difficulty and complexity of the exercises, by changing the stability of the surface that the exercise is performed on.

Performing the exercise on an unstable surface will require the athlete to develop his or her proprioception to master the exercise. Proprioception will aid him or her in increasing the coordination of those muscles that stabilize the pelvis, which can aid in injury prevention. When performing an abdominal exercise on an unstable surface, several events occur simultaneously.

- The athlete must use his or her abdominal muscles to perform the exercise in question.
- The athlete must use his or her abdominal, hip, and lower back muscles to stabilize the surface so that the exercises may be performed.
- The athlete must stay on the surface while performing the exercises.

All of these events make abdominal exercises on an unstable surface challenging. The following is a stability progression: (a) stable surface; (b) unstable surface; (c) unstable surface with resistance; and (d) unstable surface, exercise performed explosively.

Figures 1a, 6a, and 6b show how to change the stability to perform the crunch. In Figure 1a, the crunch is performed on the ground. The athlete tightens his abdominal muscles and attempts to raise his shoulder blades off the ground. Figure 6a illustrates the crunch performed on an unstable surface. In this exercise he bridges across the stability ball and attempts to perform a crunch while keeping the ball still. In Figure 6b, he is performing the crunch with a dumbbell held on his chest (the dumbbell may also be held over the head for maximum difficulty).

One of the keys to making an abdominal program effective is to make it progressive. This means that over time the exercises become more difficult. This approach will lead to an increase in the athlete's fitness, develop his or her motor skills, and protect him or her from injury. It is also important to apply abdominal training in a systematic fashion. Just as in

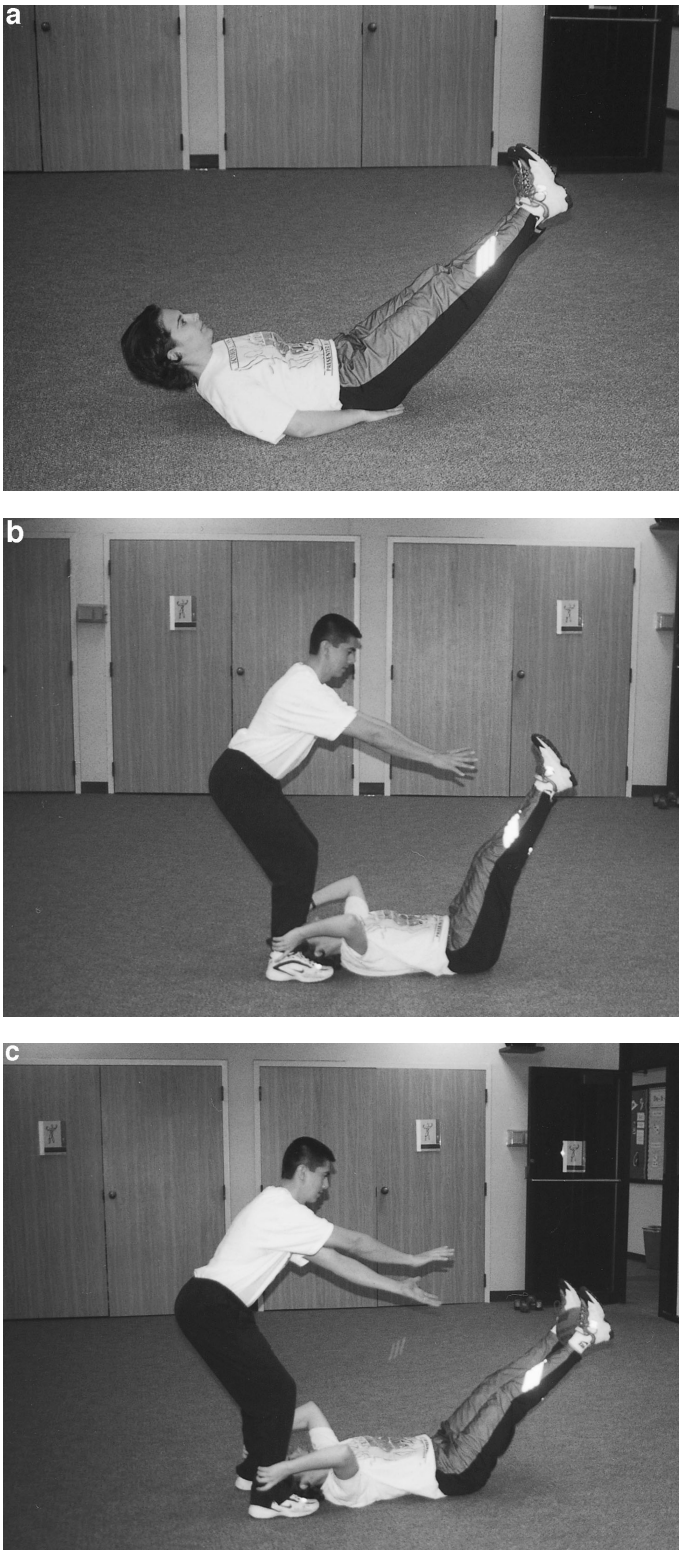


Figure 5. Speed of movement progressions for the leg-raise: (a) a slow, controlled leg-raise; (b) leg-throws with partner's assistance; (c) leg-raise with medicine ball throw.

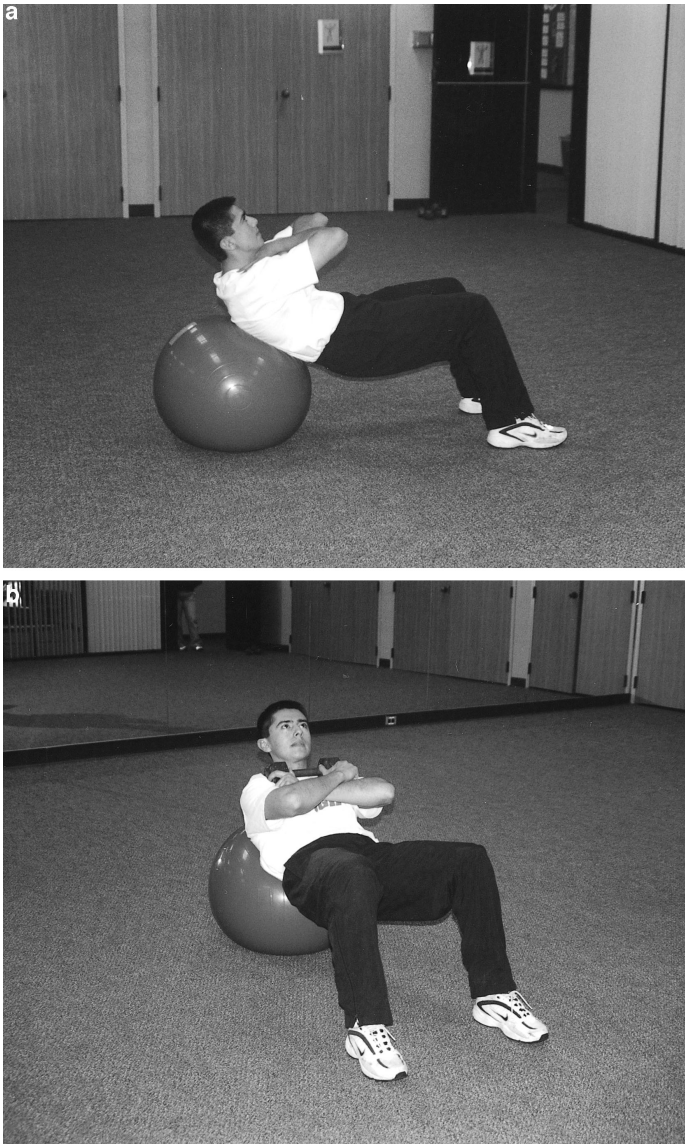


Figure 6. Changing the stability of the crunch: (a) crunch performed on stability ball; (b) crunch performed on stability ball with dumbbell.

any other aspect of a strength and conditioning program, abdominal exercises should be periodized. In the second part of this article, I will discuss periodization of abdominal training and application of specificity to training the abdominal muscles. ▲

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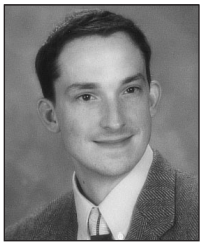

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