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Teaching the Proper Push-up Position

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The push-up is a common fundamental exercise often used to both train and assess the muscular endurance of the entire body (Ebben et al., 2011; Gouvali & Boudolos, 2005; Mier, Amasay, Capehart, & Garner, 2014; Topalidou et al., 2012). Due to the emphasis on body control and ease of administration, this exercise has been performed regularly for decades by people of varying skill levels including physical education students, athletes, military personnel, and recreational fitness enthusiasts. Being able to maintain proper body positioning throughout the push-up activity is important in order to build strength and stamina, as well as to limit the potential for injury.

A great deal of research has been dedicated to investigating differences in hand placement, joint stresses and training approaches (Anderson, Gaetz, Holzmann, & Twist, 2013; Calatayud et al., 2014; Chou et al., 2011; Mok, Ho, Yung, & Chan, 2017). However, just as in sport, injuries and compensational strategies tend to occur later in the game or match when the players are tired. The same thing is likely true when performing the push-up continuously for a lengthy duration (e.g., 60 seconds or more), which is done during various assessments in physical education and sports. As the students begin to tire, they likely adopt body positions that allow them to continue the exercise, but in a slightly modified position.

In order to determine exactly what happens to body positioning when fatigue sets in, a comparison of the natural push-up body positioning from the beginning to the end of a continuous two-minute push-up test was completed. For the purpose of this comparison,

participants were observed (and video recorded) throughout the bout from the side in order to assess the overall ability to maintain a straight line from the head to the ankles, and to observe the hand placement in relation to the shoulders. Because the chest muscles (pectorals) are

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the largest muscle group being targeted by this exercise (compared to the shoulder and triceps muscles), the majority of work should be done by this muscle group. Ideally, the hands should be placed at chest level (not shoulder level) to maximize the activity in the chest

muscles (Borreani et al., 2015; Cogley et al., 2005; Gouvali & Boudolos, 2005; Herrington, Waterman, & Smith, 2015; Mok et al., 2017). Moving the hands higher results in less muscle activity in the chest and more activity in the shoulders and triceps.

Observations of the Push-up over 2 Minutes

At the beginning of the exercise participants began with their hands positioned much lower (i.e., more in line with the chest) in relation to the shoulder than at the end of the bout (see Figure 1). This initially indicates that the hands were moved to a higher position at some point during the exercise to lessen the strain and fatigue being experienced by the muscles (e.g., pectorals and

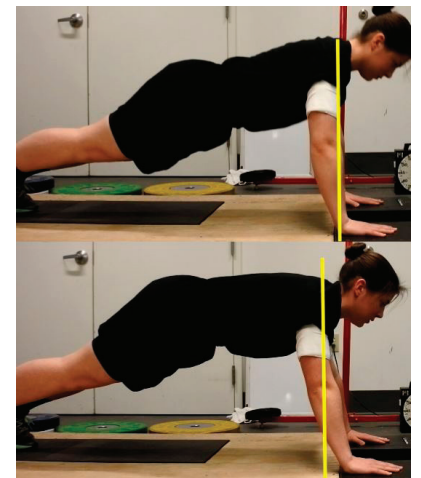


Figure 1.
Comparison of hand placement at the start (top image) and end (bottom image) of the 2-minute push-up activity

triceps; Borreani et al., 2015; Gouvali & Boudolos, 2005). However, when viewing video footage of the push-up bouts, participants' hands were actually not repositioning at all. Therefore, some other adjustment must have been made during the exercise.

Hip flexion was also observed to increase over the course of the activity (see Figure 2). As participants began to experience fatigue, they began to keep a slight bend in the hip, creating a somewhat “hinged” body position. This actually helps to take some of the body weight off of the hands as more weight is being supported by the legs (An, Korinek, Kilepa, & Edis, 1990; Ebben et al., 2011; Mier et al., 2014). This, combined with the hands moving closer to the shoulder at the end of the bout, indicates that as participants began to tire they did not fully return to the plank position. Instead, they gravitated toward a position that helped to gradually redistribute some of the weight from their upper body to their lower body.

Teaching Tips and Cues

When performed correctly, push-ups are a total-body exercise that builds the foundational strength required for more complex movements. Having proprioceptive awareness (or knowing

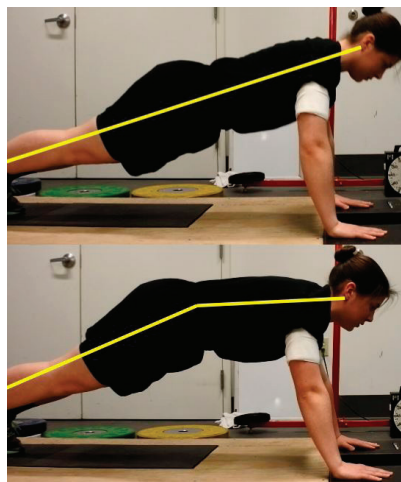


Figure 2.
Comparison of hip flexion at the start (top image) and end (bottom image) of the 2-minute push-up activity

where you are in space) is essential to moving efficiently, effectively and safely. Therefore, if instructors and coaches regularly allow students to use modified techniques when they become tired, the focus of that exercise now shifts to building strength in the modified (or improper) position. Rather than allowing students to use these compensational strategies, the instructor must be able to identify when the activity has reached its maximum duration, before form is compromised. At this point, instead of pushing students to the predetermined time (e.g., 2 minutes) regardless of the failing technique, stopping the activity

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early (e.g., 60 seconds) to allow for a recovery period (and possibly a second iteration of the exercise) would seem to be more beneficial. This will also allow students to gain an understanding of the importance of recovery and maintaining proper form throughout an activity.

As the instructor begins to notice modifications to technique, simple cues can be used to remind the students of their form and how to correct it for optimal performance. For example, when the hips begin to pike during the push-up exercise, cueing the students to “lower the hips” or “push the hips forward” can help to let students know

that their hips are not as low as they may think. Additional cues with reference to the hand position may include, “move your body right over your hands,” or having the students look down to see where their hands are. They should have to look down toward their feet slightly to see their hands if they are in the proper position.

Lesson Plan Progression

Gradual progression of the exercise is crucial, regardless of the level. Progressing through conditioning exercises that target total-body stamina and strength while emphasizing a body position that is optimal for the push-up is a great way to introduce the exercise. A three-level progression for learning proper form for the push-up is described below.

Level 1 (elbow planking): Assume the plank position on the elbows. The body should make a straight line from the head to the ankles. Encourage the students to keep their core muscles tight and breathe normally throughout. Begin holding this position for 10 seconds and gradually increase the duration of the holds by 10 seconds until one continuous minute is performed.

Level 2 (hand planking): Assume the plank position on the hands. Repeat the same procedures as Level 1.

Level 3 (dynamic planking): Assume the elbow planking position and hold for 20 seconds. Without dropping to the knees, move to the hand planking position, one hand at a time, and hold for 20 seconds. Return to the elbow planking position without dropping to the knees. Repeat the planking intervals until five repetitions in both positions are complete.

Conclusion

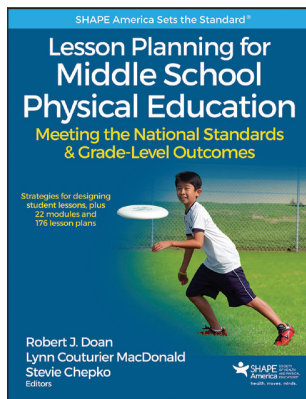
Students should be aware of their body positioning throughout any exercise. Over the course of an activity that is meant to challenge muscular endurance, it is reasonable to assume that compensational movement patterns (e.g., piking at the hips, hand placement higher than shoulder height) will likely be adopted once the primary muscles (i.e., pectorals and triceps, and core musculature) begin to fatigue in order to continue the exer-

cise. Correcting form with various verbal cues is advised as soon as the altered body positions are observed. In addition to verbal feedback, coaching tools such as mirrors and video cameras (e.g., cell phones, tablets) are recommended as a means of providing immediate visual feedback during training sessions to promote proper body alignment and spatial awareness. Once a student can no longer correct their body position, the exercise should be stopped to allow for adequate recovery before attempting the exercise again (if desired).

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