

Situps Revisited 2004

By Fred Koch P-SCE, Robert K. Blom, R.P.T., Vidar Jacob, R.P.T.

Did you ever notice how all-abdominal training articles are the same. The only new element is the models and how good their abs look. You could probably pick the top 3 exercises and find them described in every article, in one variation or another. But, is this all there is? We are now going to share some startling information with you. Many abdominal exercises are just not working the abdominals the way you think they do, for two simple reasons. An effective abdominal exercise:

- 1) must bend the spine in it's full range of motion,
 - 2) while contracting the targeted abdominal muscles from full extension to full flexion.
- (see muscle drawings page 16)

Ask yourself this question. Why are you doing crunches for your abs? We will repeat the question. Why are you doing crunches for your abs? Do any of you really know why? We do squats for legs, bench presses for chest, and rowing movements for back. These are all compound exercises. But why are we doing crunches for our abs, when we know it is not a compound exercise. If a compound exercise done properly is so good for every other body part, then what is the problem with sit-ups for the abdominals? The reason is, 20 years ago some experts said that they were bad for your back. Did anyone ever stop and ask if that was true, or why?

Keep in mind that for year's people had criticized squats by saying they were dangerous for the back and knees. But there were no way athletes, bodybuilders and powerlifters were going to stop doing squats, because they knew the benefits far outweighed the risks. So what did they do? They went in, analyzed the movement and tried to get it right biomechanically. And they did. Unfortunately, seemingly simple "sit-ups" were not evaluated with the same open but critical eye. It was a lot easier to just let the critics tell us sit-ups were bad for the back and that we should do crunches.

When first asking questions about the crunch or sit-up, we should start with a clear and correct definition of what the abdominal muscles do. The abdominal muscles (talking about the abdominals that flex the spine) are attached to the rib cage and the pelvis. No news there. When they contract, working together, they bend the spine from full extension of the spine to full flexion of the spine. What was left out of this statement is exactly what "full extension" and "full flexion" means. Full extension of the abdominals is not achieved when the back is flat on the floor, but rather when the spine is arched back or extended 15-30°, a position that the flat floor does not allow. Full flexion of the abdominals occurs when the lower back comes off the floor. This is not possible with a crunch. (See Figures 1,1a, 2,2a)

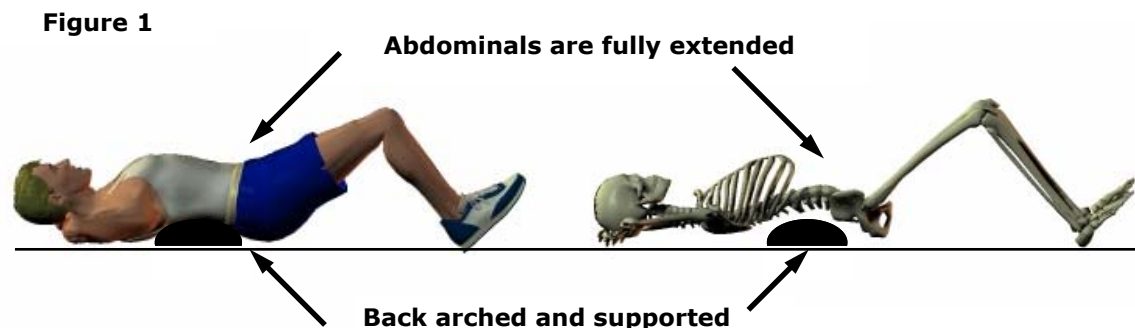
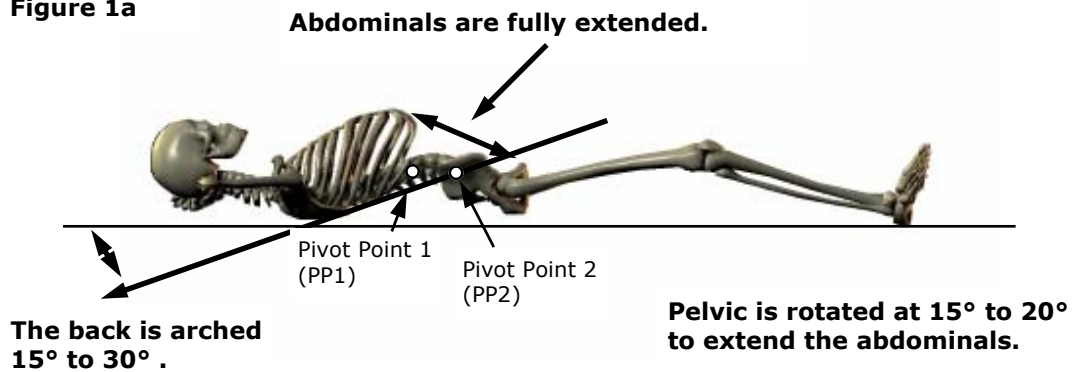


Figure 1a



Full contraction of the abdominals means the abdominal muscles shorten from maximal length to minimum length, bending the spine. What was not understood until now is that this includes the pivot points of the exercise moving down the spine and ending in the pelvis. (Fig. 1a) For full flexion to occur, the back must come off the floor as seen in the sit-up redefined. The redefined sit-up, like the bench press, or squat, is therefore a compound exercise using more than one joint.

If you look at *figures 2, 2a*, you can see this. Full contraction of the abdominals can only happen 1) when contraction begins with the spine fully extended and 2) when the pivot point slides downward toward the pelvis on the spine during the movement. Neither of these requirements is fulfilled during a crunch. So, you now have the two missing pieces of the abdominal mystery, full extension of the spine and a sliding fulcrum, or pivot point. For any

Figure 2

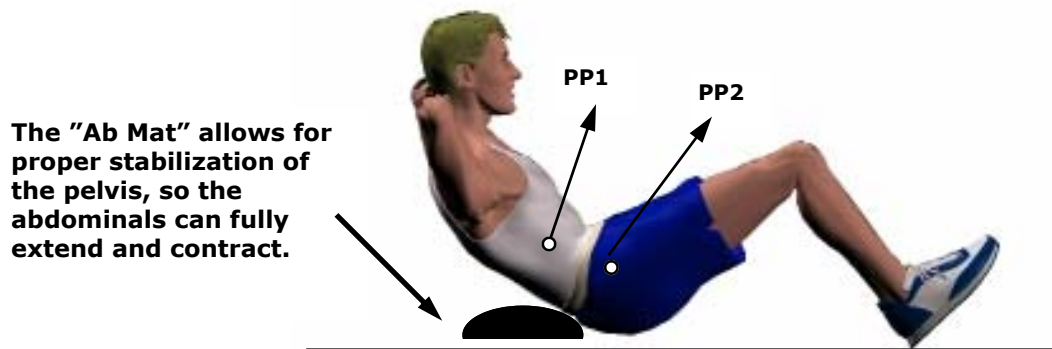
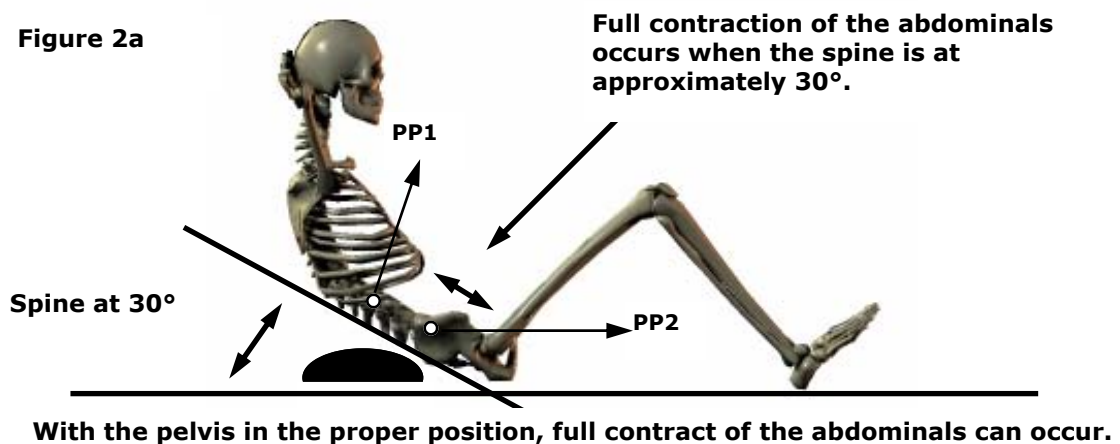


Figure 2a

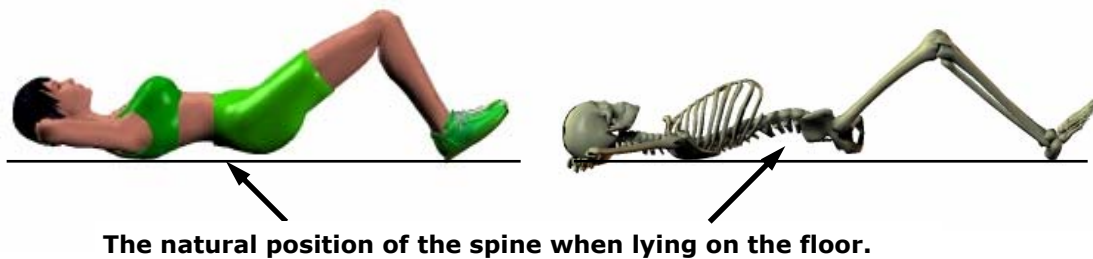


workout to completely work the abdominals these two ingredients must be present.

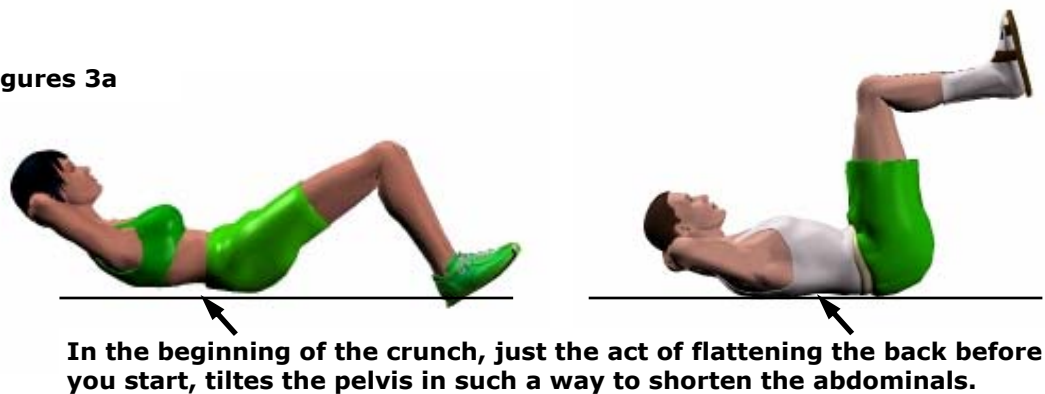
The Crunch

Let's first take a look at the crunch. To begin the exercise you must set your low back (spine) on the floor. This movement shortens the abdominals from their naturally stretched position before the movement even begins. If you look at *figure 3a*, you will see that the pelvis is tilted, by this movement. This starting position will never allow the abdominals to contract in a full range of motion.

Figures 3



Figures 3a



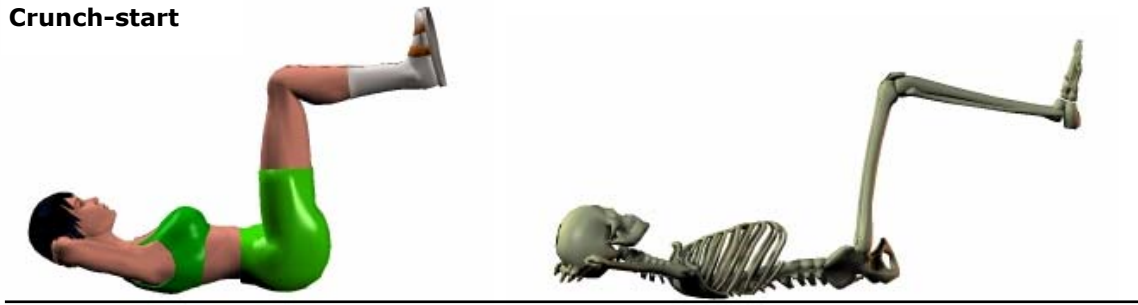
Figures 3b

Abdominals shortened



Figures 3c

Crunch-start



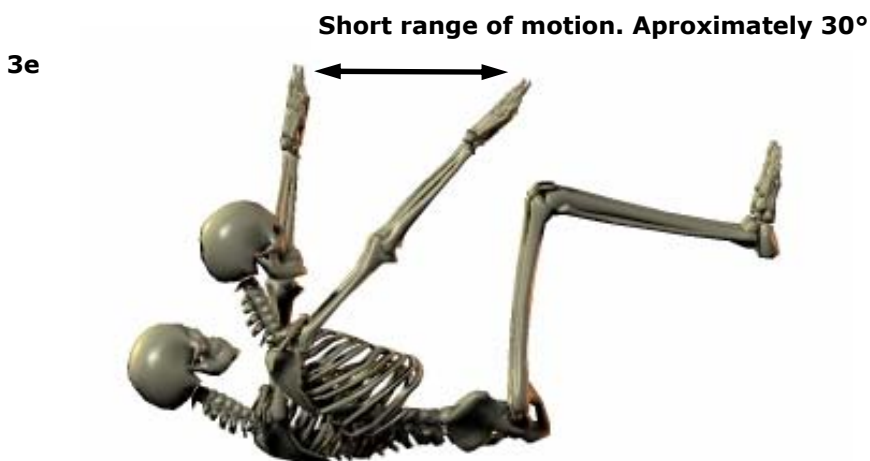
Figures 3d

Crunch-finish



So as you can see the movement becomes short with little actual abdominal range of motion.

Figure 3e

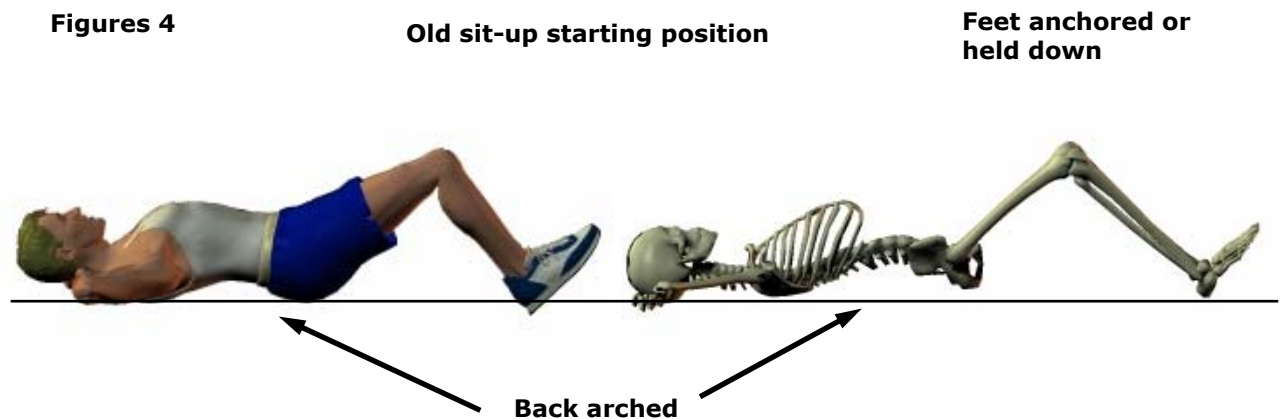


The abdominal muscles cannot work in a full range during the crunch.

The old Sit-up

Now we can go back to the old sit-up. The movement of the trunk area is so complex that it encourages numerous forms of "cheating." So it is important that we examine the sit-up movement with a more critical eye. (*Figures 4*)

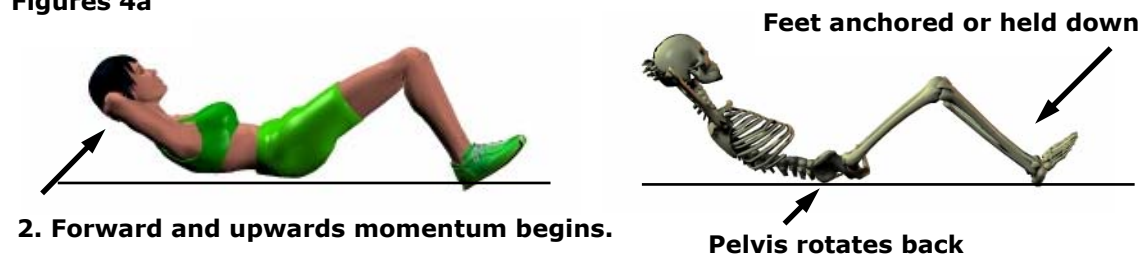
When this old exercise was performed it was usually done with the thought in your mind "how many reps can I do?" This quickly became "how many times can I get my head to my knees". Not, "I want to use a sit-up to maximally overload my abdominals in a full range of motion". The easiest way to do this is a dynamic head to knee movement with the feet anchored. Being efficient, the body instantly determines what muscles are going to be used in the movement, which ones are strong, which ones are weak. Thus how does the body make us do that sit-up?



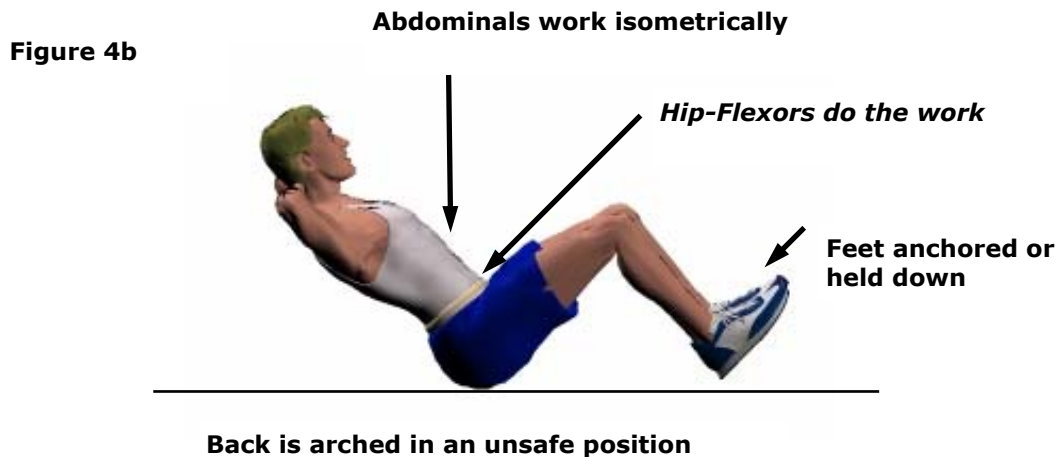
The first thing it does is create momentum by starting the head moving with a snap. This starts the upward and forward movement (*figures 4a, 4b*). Add to this the low back muscles contracting to set the spine down, straightening the spine.

1. In the old sit-up, just the initial movement of snapping the head up and setting the back flat on the floor, titles the pelvis back, shortening the abdominals, starting the movement with momentum, not muscle contraction.

Figures 4a



The abdominals are forced into an isometric contraction, never really dynamically contracting under a load. Now the momentum is immediately picked up by the hip flexors. They begin contraction with the spine already partially flexed. By the time the sit-up reaches the stage the abdominals and internal obliques should be most active at the end of the movement, so much momentum has been built up from this swinging that the workload is continued by the hip flexors. Momentum built up at the start of the movement eliminates the loading of the abdominals by forcing them to do an isometric contraction. Keep in mind the starting position was from a flat floor, so the movement began wrong. The abdominals were not working through a full range of motion and not allowing the spine to flex properly. (See figures 4a, 4b, 4c)

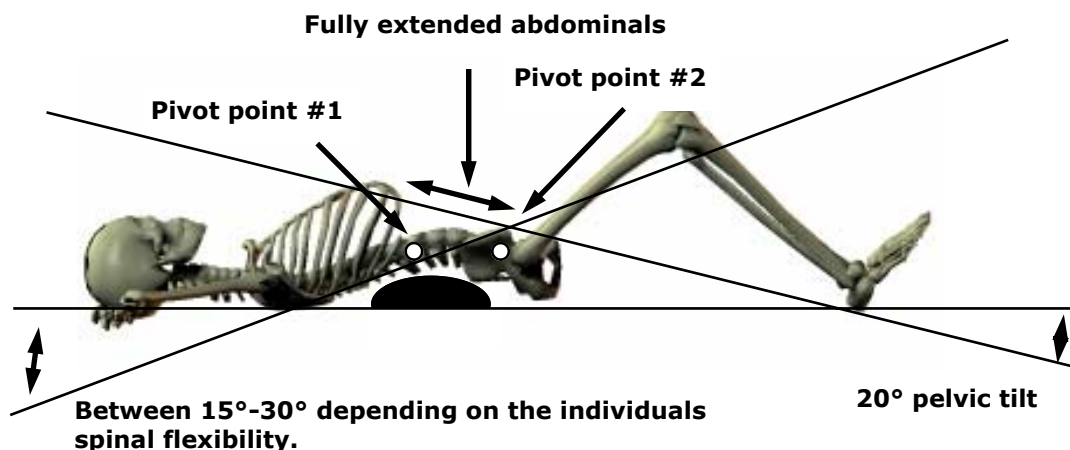


The following reps are even easier because the momentum from the downward movement increases the snap and momentum increases for the next rep (the so-called stretch reflex is brought into play). The body will, of course let the stronger muscles do the work. The hip flexors will continue to function as prime movers as long as the weaker abdominals can hold the isometric contraction. This whole fiasco usually ends when the abdominal muscles can no longer hold the isometric contraction. You feel a burn due to the isometric contraction of the abdominals trying to hold the spine stable while the hip flexors perform the movement. This improper form could have been the main reason so many people had back pain, due to the pulling on the spine by the hip flexor muscles.

Sit-up redefined:

Let us now examine the Sit-up redefined. To do the correct movement lay flat on your back with an Ab Mat or rolled up towel under your lower back. (An improper device will not give the proper support) Bend the knees about 45° with heels on the floor. The feet should not be held down or anchored and the knees are spread apart to further reduce the use of the hip flexors. (See figures 5,5a)

Figure 5



Figures 5a

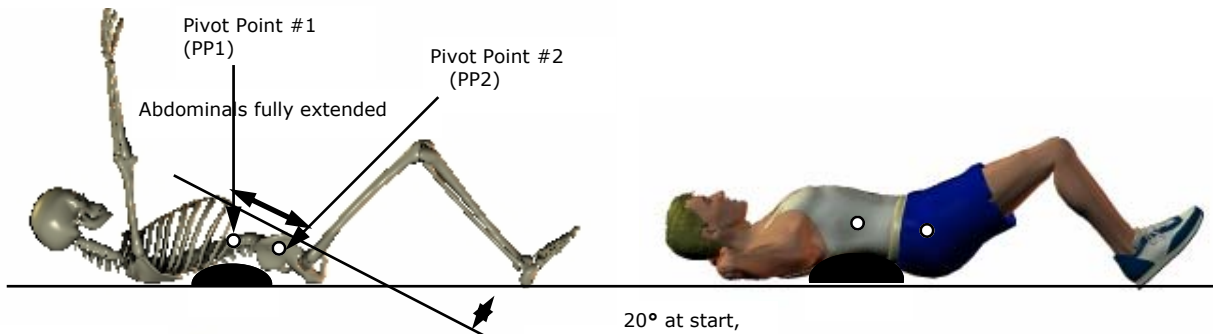


Practice with your hands between your legs until you learn the proper method to sit-up while bending the spine.

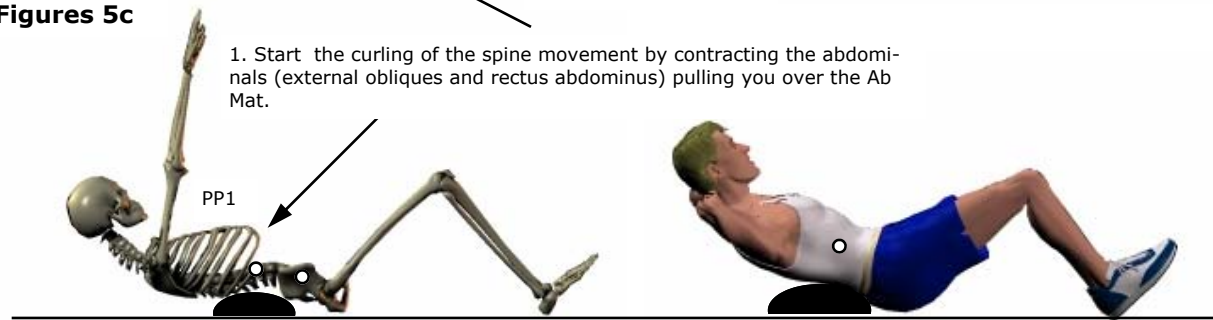
Put your hands between your legs. This will help you find the proper form from the beginning. Now, remember that the sole goal of the movement is to overload the abdominal muscles. Do not throw your head toward your knees. Concentrate on the origin of the abs at bottom of the rib cage.

1. Start this exercise by performing the transverse abdominus drawing in and up maneuver. This is done by drawing the navel in toward the spine and then up. Hold that position then-
2. Start the curling of the spine movement by contracting the abdominals (external obliques and rectus abdominus) pulling you over the Ab Mat. (Pivot Point 1)
3. The rectus now takes over the entire load as you reach the old crunch position and continue the curling movement. You will notice the focus of the exercise now changes to the pelvic area. (Pivot Point 2)
4. The lower internal obliques begin to help the abdominals to complete the final few degrees of spinal flexion. During this last part of the movement you will feel the Ab Mat supporting your lower back. We have found this support from the Ab Mat is "essential" in doing the movement correctly.
5. You reach the end of this exercise when the hip flexors take over the work from the abdominals. When you lay down just reverse the movement. You are now working through almost twice the range of motion of the old crunch and with more overload to your abdominals. (See figures 5, 5a, 5b, 5c, 5d, 5e, 5f.)

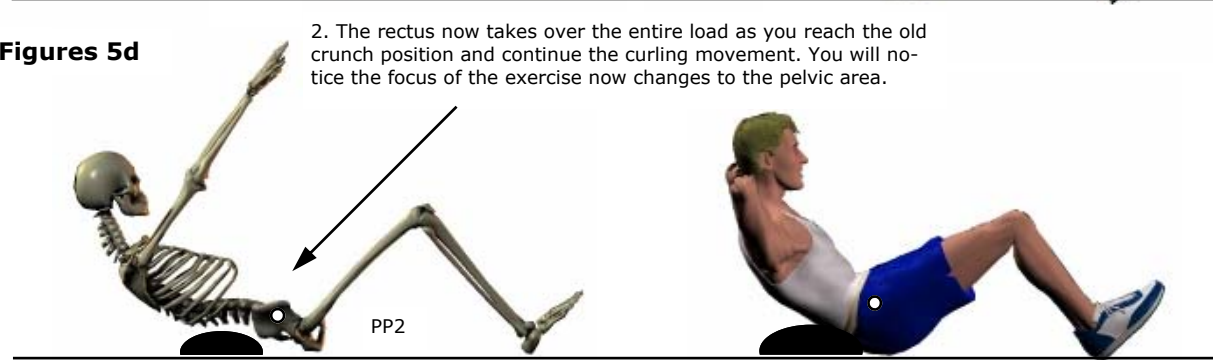
Figures 5b



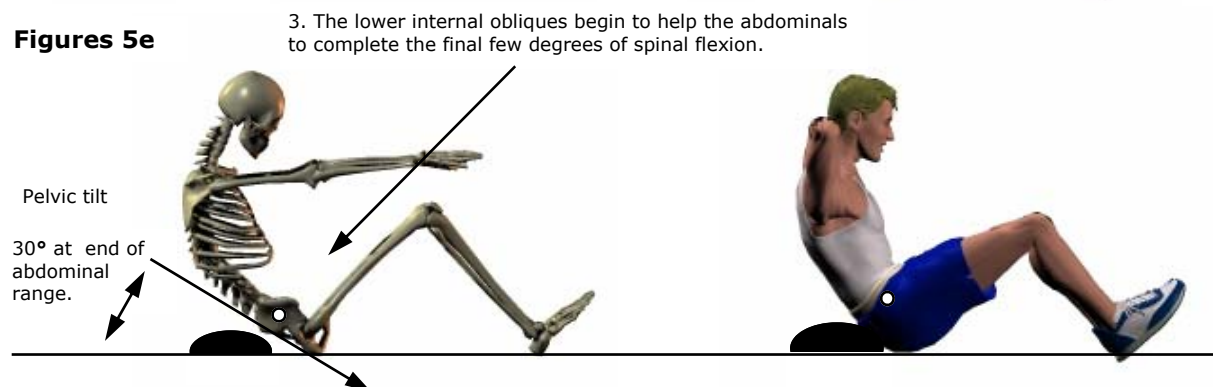
Figures 5c



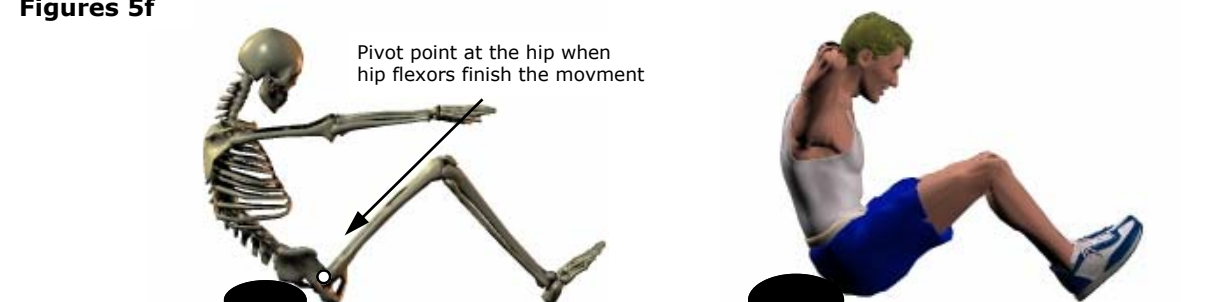
Figures 5d



Figures 5e

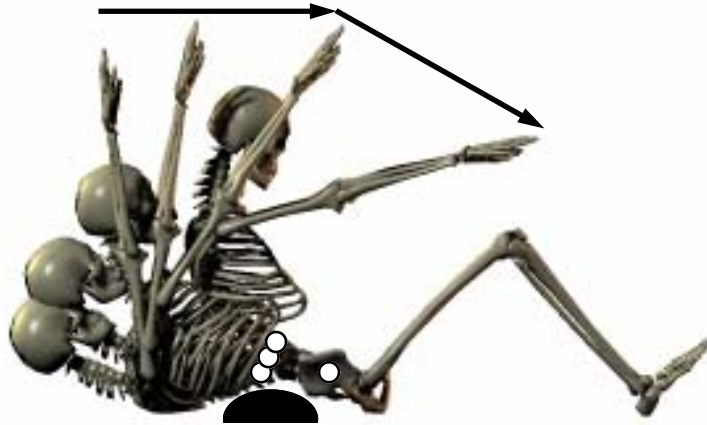


Figures 5f



Abdominal range of motion with the Ab Mat is approximately 85 degrees

Figure 6



Abdominal range of motion with the crunch is approximately 30°

Figure 6a



When you use the Ab Mat for this exercise you notice how the back is extended in the beginning. This is a position you cannot take on a flat floor. In this position the abdominal muscles are fully stretched and ready for full contraction. You will now be able to work the abdominal muscles through a full range of motion more than doubling what could be achieved in a crunch. You will immediately feel the extra load place on the abdominals when worked by the redefined sit-up.

Advanced Training: Adding Load

Advanced Abdominal Training: Adding load

Why train abdominal muscles any different than other body parts? Adding a load is part of training muscles. With the Sit-up redefined we can now take the next step and train the muscles the same as any others. Pick your repetition range and try the following loading methods. (More about loads and testing in part 2.)

Stage 1

1. Hands between the legs is the easiest from the flat floor. It teaches the trainee to bend the spine correctly as well as moving the weight of the arms forward. (Figure 7)
2. Arms across the chest adds the weight of the arms to the upper body. (Figure 7a)
3. Arms behind the head brings more weight up. (Figure 7b)

Stage 2

4. Now you can add extra weight on your chest. Note: At this time it is ok to counter-balance the weight on the chest with holding down the feet. (Figure 7d,)
5. Using an incline board to increase resistance is another method. (Figure 7e)
6. Using an incline board with weight. (Figure 7g)
7. Using a decline board to decrease resistance, for example if you are doing a muscle endurance phase or a beginner cannot lift the weight of their upper body from a flat floor. (Figure 7f)

Figure 7 Hands between the legs



Figure 7a Arms across the chest



Figure 7c Arms behind the head



Figure 7d



Figure 7e Incline board

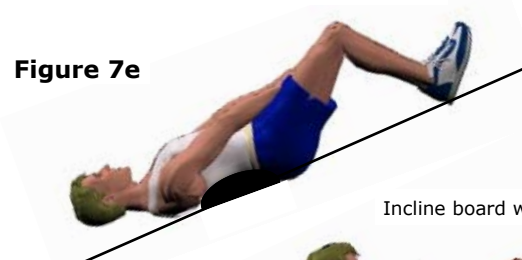


Figure 7f

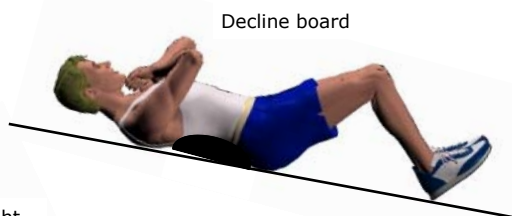
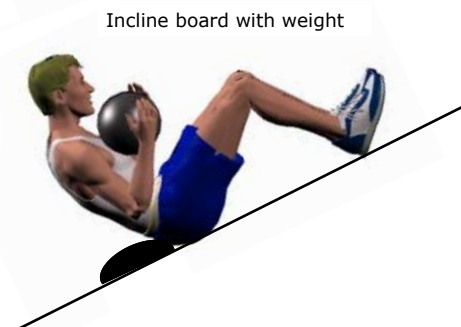


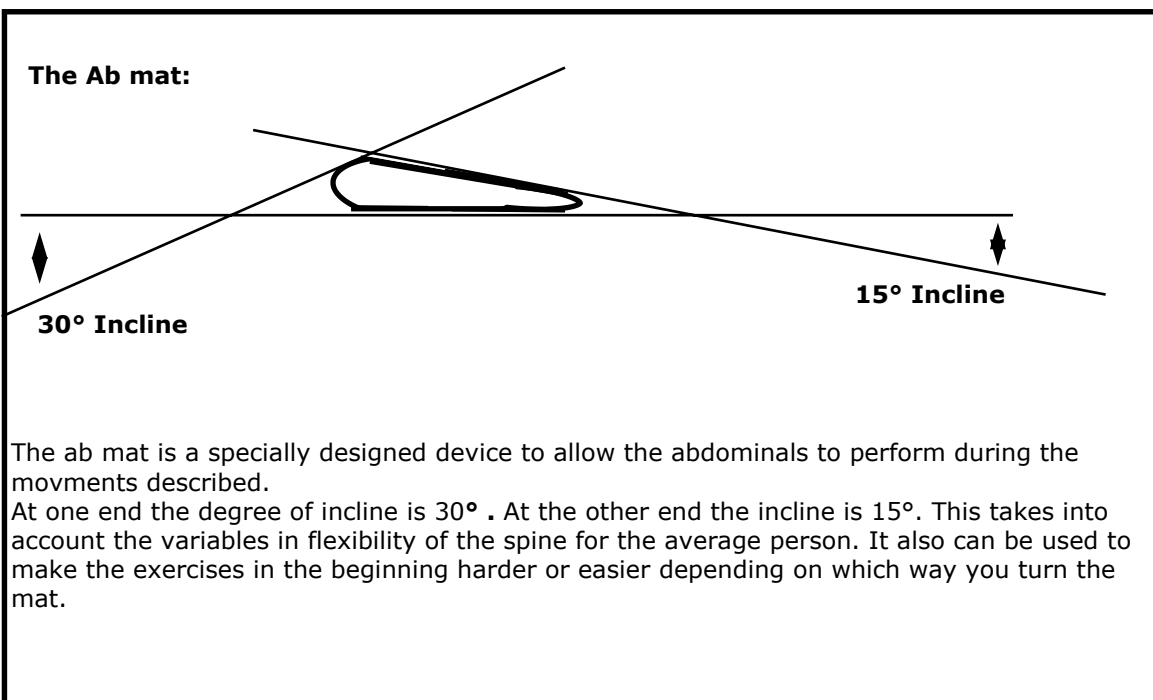
Figure 7g



Decline Sit-ups: Note

When you first begin to use the Ab Mat keep in mind your body has never been subject to a full range sit-up before. You will have developed strong and weak points through the range of motion. The strong point will be in the range you usually did crunches in and the weak points will be at the beginning and end of the sit-up. Rather than cheat through these points, we suggest you try the *Decline Sit-up*. The Ab Mat exercises are like any other resistance exercises, unfortunately the starting point, which is body weight sometimes is too heavy. Using a decline board can help that. You will find using the *Decline Sit-up* is also good for do high repetitions also.

Note: : If you find yourself sliding down the board, just position yourself near the bottom of the board and put your feet on the ground next to the board.



Variations of Abdominal Movements

Figure 8



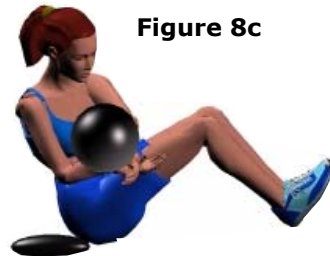
Figure 8a



Figures 8b



Figure 8c



Sit-ups Twist:

The focus of this exercise will be on the External Obliques (of course the rest of the abdominals work as well). The External Obliques, when stretched over the Ab Mat, assist the Rectus Abdominus when doing the basic sit-up. To focus more directly on the External Obliques you simply allow them to pull in a straight line. The effect of the EO pulling in a straight line will twist the body. *Figures 8a, 8b, 8c* demonstrate this.

If you simply want an exercise to isolate the upper External just complete the first 25% of the movement and then lie back down to the starting position.

Figure 9



Figure 9a



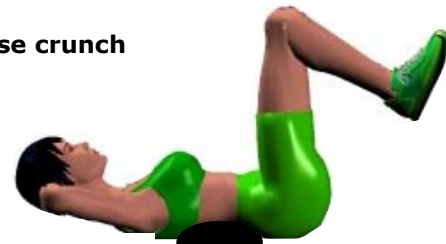
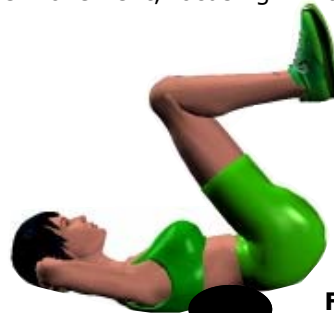
Side Crunch:

When performing the **Side Crunch** use the arm on the ground to support and assist as you learn to perform the exercise

Reverse Crunch:

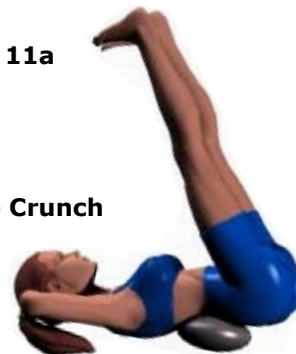
This movement places more emphasis on the lower area of the abdominals. Place hands behind your head or at your sides if that feels more comfortable. The exercise is performed by rolling your hips back over the Ab Mat. Do not use your legs to throw you back over the mat. Keep in mind you are lifting the entire weight of your legs and hips with the lower section of your abdominals. This may be difficult at first. You may want to start with the *Decline Reverse Crunch*.

*This movement can be performed by fully contracting the abdominal muscles and rolling all the way up, or by simply doing the lower section of the movement, focusing on the lower Internal Obliques 2-4 inch movement

Reverse crunch**Figure 10****Figure 10a****Reverse crunch twist****Figure 10b**

Reverse Crunch Twist: (figure 10b) is a good way to focus on the lower Internal Obliques. You will be following their direction of pull during this exercise. Place hands behind your head or at your sides if that feels more comfortable. Twisting as you begin rolling your hips back over the Ab Mat performs the exercise. Do not use your legs to throw you back over the mat. Keep in mind you are lifting the entire weight of your legs and hips with the lower section of your abdominals. This may be difficult at first. You may want to start with the **Decline Reverse Crunch Twist**.

*This movement can be performed by fully contracting the abdominal muscles and rolling all the way up, or by simply doing the lower section of the movement, focusing on the lower Internal Obliques 2-4 inch movement.

Figure 11**Figure 11a****Legs Up Reverse Crunch**

The Legs Up Reverse Crunch is a variation of the **Reverse Crunch**. This can be performed either flat or on a decline. By raising the legs you move their weight back, thus decreasing the load on the lower abdominal area for beginners.

Decline Reverse Crunch:

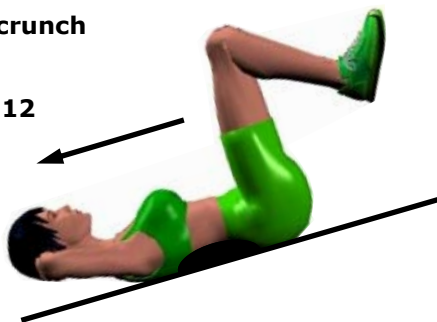
The challenge with doing **Reverse Crunches** is that you must lift the entire weight of your legs and hips with the little used lower section of the abdominals. The **Decline Reverse Crunch** is a good way to start. Here we let the angle of the incline board help with overcoming the weight of the hips and legs. This exercise is also used to do high repetitions.

Start with your head facing down the decline and the Ab Mat under your low back. Hold on to the sides of the board and roll your hips toward the chest.

*This movement can be performed by fully contracting the abdominal muscles and rolling all the way up, or by simply doing the lower section of the movement, focusing on the lower 2-4 inch movement.

Decline reverse crunch

Figure 12



Decline Reverse Crunch Twist:

The focus of the **Decline Reverse Crunch Twist** (figure 13) is the lower section of the Internal Obliques. Take another look at the direction of pull of these muscles. (page 16) The problem with doing **Reverse Crunches Twist** is that you must lift the entire weight of your legs and hips with the little used lower section of the abdominals, while focusing on twisting. The

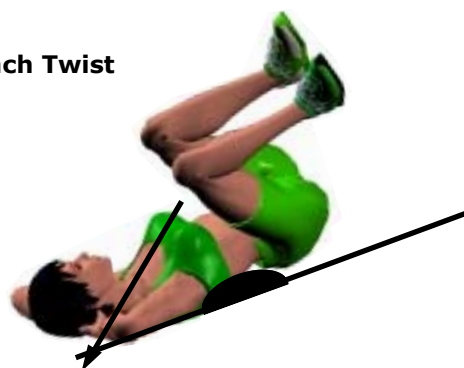
Decline Reverse Crunch Twist is perfect for this. Here we let the angle of the incline board help with overcoming the weight of the hips and legs. This exercise is also used to do high repetitions.

Start with your head facing down the decline and the Ab Mat under your low back. Hold on to the sides of the board and contract your abdominals rolling and twisting your hips as you focus on the line of pull of the muscles. Continue the twisting motion through the full range of the movement.

*This movement can be performed by fully contracting the abdominal muscles and rolling all the way up, or by simply doing the lower section of the movement, focusing on the lower 2-4 inch movement.

Decline Reverse Crunch Twist

Figure 13



Variable Resistant Sit-up:

It is possible to add variable resistance to your situps by using the arms. At the beginning of the movement the upper body is on the ground. As you move through the movement not only is more of the body off the ground, adding more resistance, but the leverage of more of the upper body being off the ground also adds more resistance. To combat this, the movement is started with the arms behind the head. As the movement progresses the arms are slowly moved up lightening the load. When returning to the starting position slowly move the arms back behind the head.

Variable Resistance Sit-up**Figure VR-1**

Arms behind the head.

Figure VR-2

Arms slowly moved forward as the movement progresses

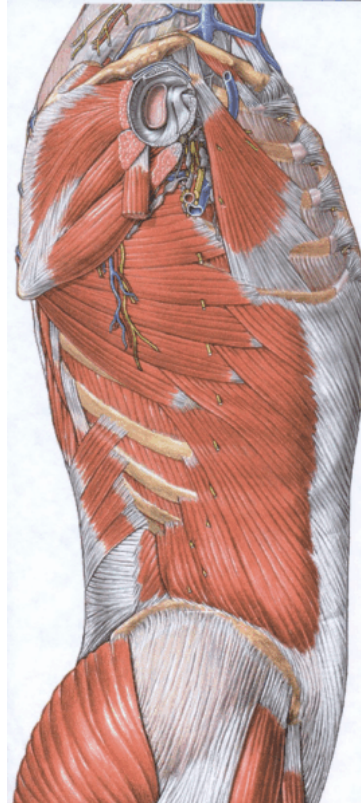
Figure VR-3

Arms fully out by the end.

Abdominal Drawings: What to look for.

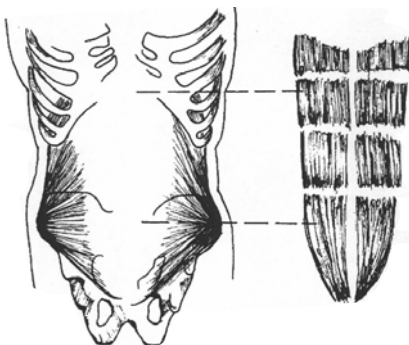
You have seen many pictures of what the various abdominal muscles look like so we will not go in depth with it again. Keep in mind as you read this material,

1. Muscles work in a straight line through approximately 1/2 their length.
2. See the length of the abdominal muscles, what direction they are pulling in.
3. What effect that pull will have on the joints involved (spinal vertebrae)

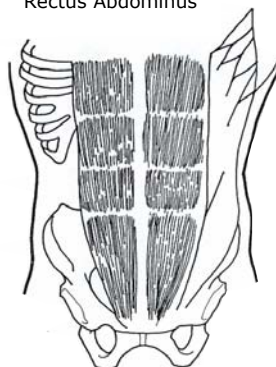


Muscles work in straight lines and through half there length.

Internal Obliques-Rectus Abdominus



Rectus Abdominus

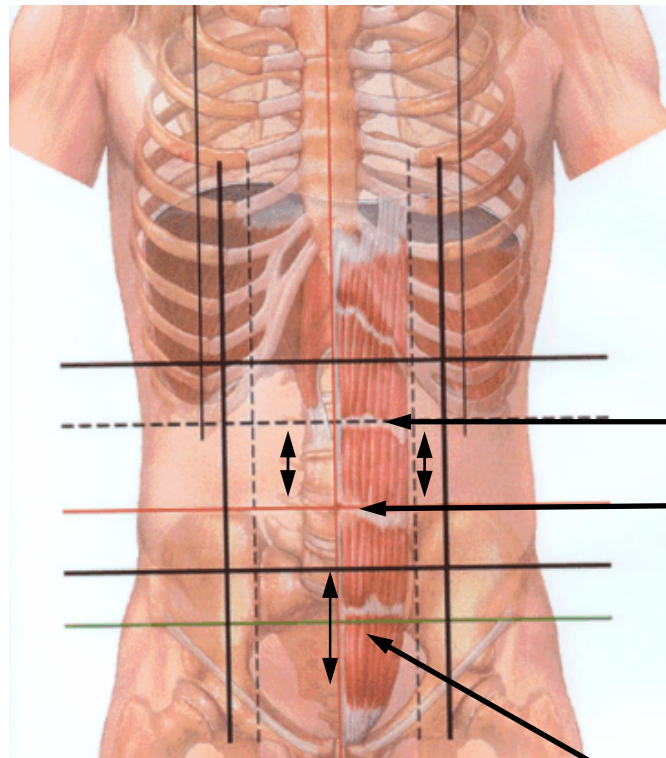


External Obliques



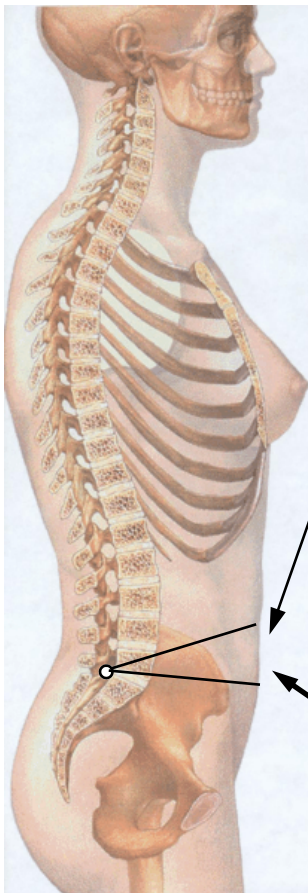
Note:

Some interesting comments have come out of the work that has been done so far with the information presented. It is "Food for thought" as we would say.



What is the relationship between the abdominal segment lengths with the distance between the vertebrae?

Since the discovery of the changing pivot points, which allows for more work with the lower section of the abdominals. What effect does this have on the lower section of a womens abdominal area. It almost seems to have exact relationship. From pivot area to those 2 inches of lower abdominal problems.



Pivot Point 2 radiates the work are out to this 2 inches of problem area.

Lower Back Exercises

Whenever we talk about abdominal training it is important to not forget that 1/2 of the mid-section is lower back. Thus we include low back training as a part of all our abdominal training.

Norwegian Back Extension

Figure 14



Figure 14a



Figure 15

Lying Back Extension



Figure 15a



Figure 16

One Leg Back Kick



Figure 16a



Figure 17

Reverse Back Kick



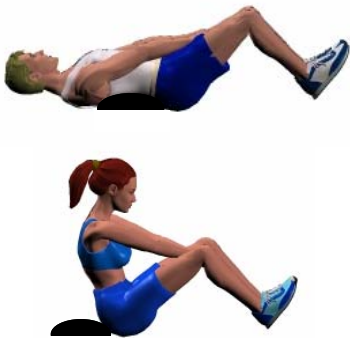
Figure 17a



Abdominal and Low Back Training "Begin"

By Fred Koch

1. Sit-Up



2. Norwegian Back Extension



3. Sit-Up with a Twist



4. Reverse Extension



5. Reverse Crunch ** turn mat



6. Lying Back Extension

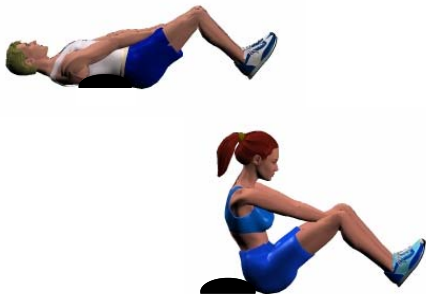


Follow the order above doing 5-10 reps with each exercise

Abdominal and Low Back Training "Program #2"

By Fred Koch

1. Sit-Up



2. Norwegian Back Extension



3. Sit-Up with a Twist



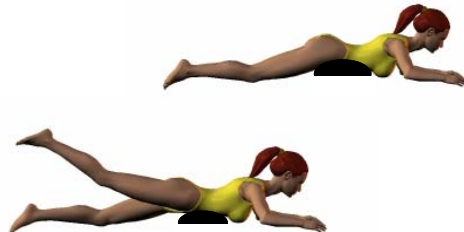
4. Lying Back Extension



5. Reverse Crunch ** turn mat



6. One Leg Back Kick



7. Side Bend ** turn mat



8. Reverse Back Kick



Follow the order above doing 5-10 reps with each exercise

Abdominal and Low Back Training "Program #3"

By Fred Koch

1. Sit-Up



****Hold weight or Ball on the chest**

2. Norwegian Back Extension



3. Sit-Up with a Twist



4. Lying Back Extension



6. One Leg Back Kick



5. Reverse Crunch **** turn mat**



7. Side Bend **** turn mat**



8. Reverse Back Kick



Follow the order above doing 5-10 reps with each exercise