



Isometrics for the Mobility-Impaired

These exercises are the perfect option for individuals who have difficulty moving due to pain and/or weakness.

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THERE ARE A number of reasons someone receiving immune globulin (IG) treatments may, at least temporarily, not be motivated or able to move much. Fatigue, joint pain, muscle cramps and dizziness may be directly related to the treatment itself or to the patient's medical condition. Though taking it easy for a day or two following an infusion is certainly understandable, many conditions requiring IG therapy already include weakness and/or muscle atrophy as primary symptoms, and remaining inactive for too long can make the situation worse.

For patients who are unable to move, isometric exercises may be an option. Isometrics are a type of strength training that is performed "in place," without the angle of the joint or length of

the muscle changing during contraction. Resistance can be provided by structural items such as a wall, floor or furniture; holding an external weight in a fixed position; or using one's own body weight. Though not technically true isometrics, dynamic tension or self-resistance (i.e., pushing or pulling against one's own body for resistance) is a closely related strengthening technique.

Traditionally, isometric exercises have been used to help prevent disuse syndrome in a limb that is immobilized in a brace, sling or cast. However, they have also been shown to be beneficial for patients who are otherwise immobilized voluntarily or involuntarily. Depending on the method and purpose of the

routine, exertion with isometrics can vary in intensity. The force needed to hold a weight still, for example, is usually submaximal, or the weight would move. On the other hand, pushing/pulling against an immovable object or one's own body, such as with dynamic self-resistance, may be performed to elicit a maximal contraction.

Research and Parameters

There are a few published scientific studies on the effectiveness of isometric exercise. Some of the most widely referenced studies were supported by NASA to investigate the theoretical effectiveness of isometric exercise on astronaut muscle atrophy due to prolonged weightlessness in space. Though the experiments were performed on lab rats and not on astronauts, the studies' authors concluded that isometric exercises do promote muscle hypertrophy, but they also fail to prevent the wasting of contractile proteins in the muscle tissue at a molecular level. In other words, even though isometric exercises caused muscles to grow in their experiments, they didn't appear to increase strength.^{1,2}

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In contrast to the NASA research, several studies have found isometric exercises do indeed improve not only muscle size, but also strength, though they are most effective in preventing atrophy of slow-twitch (e.g., endurance and postural) versus fast-twitch (e.g., jumping and running) muscle fibers.³ The angle of the joint is also important to help determine an isometric activity's impact on strength. Training at only one joint angle does not increase the strength of the muscle as much as training through its entire range of motion. However, there is some cross-transference between joint angles, especially when the exercise is performed at an extended versus flexed joint angle.⁴

When the purpose of isometrics is to increase strength in the entire muscle, exercises should be repeated every 10 degrees to 30 degrees throughout the available range of motion. If there is only time to perform exercises in one position, the lengthened or

extended position should be chosen to have the greatest impact on strength in the entire muscle.^{5,6}

Research suggests both shorter isometric hold times with higher repetitions and longer hold times with fewer repetitions increase static strength.^{6,7} Because of the increased risk of muscle cramping with sustained contraction, I prescribe a hold of 10 seconds or less, with my preference for a three- to five-second hold, which corresponds well with the time required for someone to exhale slowly through pursed lips while performing the contraction. This is important because isometric exercises can raise blood pressure significantly during the duration of the exercise, which can be particularly dangerous if someone holds their breath while performing the contraction. Patients who have high blood pressure or any form of cardiovascular disease should first check with their doctor before performing any isometric exercises.

With regard to frequency and duration of isometric exercise, established optimal strengthening parameters should be used if possible: eight to 12 repetitions per set, two to three sets per session, at least three sessions per week. However, fewer repetitions and/or sets are certainly appropriate if a patient is not able to meet the optimal standards. In fact, if weakness or pain is a limiting issue, patients should *not* do more than they are able.

Examples of Isometric Exercises

One of the advantages of isometric exercises is they can be performed from just about any position. The following series of isometric and self-resistance activities can be performed without any special equipment, and have been selected because they emphasize the muscle groups that have a strong association with function and/or are the most vulnerable to atrophy with inactivity. Higher-level isometric exercises, which involve multiple muscle groups at the same time (e.g., some static-hold yoga positions) are not included in this article because if someone is able to perform them, their mobility likely isn't limited due to pain or weakness.

Shoulder abduction. Position yourself with the right arm bent at the elbow and held across the chest. Now, grasp the right elbow with your left hand and pull both arms outward. Switch sides by bending the left elbow and grasping it with the right hand. This can also be performed by standing or sitting with a bent elbow held at the side of your body, and pushing into the wall.

Shoulder flexion. Lie face down with both arms held at the sides of your body and push into the surface of the bed or floor with your open palms. The exercise can also be performed while standing face forward and pushing into a stable wall or door frame, or from any position via self-resistance by attempting to

lift one of your arms in front of your body while pushing down on the targeted upper arm with the opposite hand.

Shoulder extension. Flip the position used for shoulder flexion by lying on your back or standing faced away from the wall or door frame and pushing into the surface with open palms.

Horizontal abduction (pecs). Firmly grasp your hands with curled fingers in front of your body, and pull apart without breaking the grasp.

Horizontal adduction (pecs). Push the palms of your hands together in front of the body.

Elbow flexion. Place both hands under either side of a chair, with bent elbows, and pull upward. If elbows are extended, the activity becomes isometric shoulder elevation instead of elbow flexion.

Elbow extension. Place both hands on top of a seat surface, with bent elbows, and push downward without lifting yourself up out of the chair. If elbows are extended, the activity becomes isometric shoulder depression instead of elbow extension.

Abdominals. Contract to pull the abdominal muscles inward as you slowly exhale through pursed lips. This can take some practice because the natural tendency is to push outward during exhalation. Squeeze tightly as you come toward the end of your breath, relax, inhale and repeat.

Knee extension. Keep your right leg straight and tighten the quadriceps (thigh muscles) by pushing your knee backward into extension. If performed while lying on your back in bed or on the floor, your knee would be pushed downward toward the supportive surface. Repeat the activity for the left leg.

Squats. These also target the quadriceps. They are performed by standing with your back against a stable wall and lowering the body toward the floor as if you were going to sit in a chair. Begin by lowering yourself to a point where you just can't see the tips of your toes. If abdominal obesity is a factor, using the toes as a reference may not work, and because of the extra weight on the knees, it is probably not the best activity to perform. Regardless, don't go past a position that you are able to stand back up from, and don't perform this activity if you have a history of knee surgery or pain.

Hip extension. Gluteal sets are performed by simply squeezing the buttocks together and holding for a designated time. If you have a hard time initiating the contraction, as some people do, try imagining you are holding a quarter or cracking a walnut between the cheeks of your derriere. These can also be performed by standing with your heel against a wall and pushing backward into the baseboard, or by lying on your back and pushing down through your heel into the surface. Both of these positions can actually contract both the hip and knee extensors at the same time.

Hip abduction. The gluteus medius, one of the primary muscles responsible for hip abduction and side-to-side balance, is a smaller structure that is very prone to atrophy with prolonged inactivity or bed rest. To perform hip abduction exercises, sit or lie with hands placed on the outside of bent knees and attempt to spread the legs further outward while resisting the motion by pushing inward with the hands. A wall or sofa (back or arm) can be used instead of the hands to resist hip abduction, but only one leg at a time can be targeted in this manner. To perform the exercise while standing, place yourself so that the targeted leg is positioned parallel to a wall, and push the side of your foot into the baseboard while keeping the leg straight.

Plantar flexion (calves). Stand on your toes while holding onto a countertop or sturdy chair. If the activity is too easy, try standing on one foot at a time, then repeating on the other side. You can also perform the exercise while seated with your feet on the floor and pushing up onto your toes, or while lying on your back and pushing your toes first downward, and then pulling them back upward toward your body.

These exercises are just a few of the many isometric and self-resisted exercise options that exist. Though not mentioned here, there are also isometric exercises for the head/neck, back, hip flexors, knee flexors, hands/fingers and more. Just about any dynamic exercise can also be adapted to have an isometric component by holding the repetition statically at some point in the range of motion and contracting.

Do What You Can

If dynamic exercises are not currently an option, don't distress. The important thing is to do what you can and increase activity as you are able. There can be hope and progress even in being still. ■

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