UNDERSTANDING AND MEASURING PUSH & PULL FORCES

Moving an object requires force. Pushing and pulling forces are often misunderstood by employers, physicians, and even therapists. There are many types of force, including frictional force, tensional force, air resistance, gravitational force and applied forces.

Push/Pull force is complicated. Here are a few examples of how force is misunderstood. None of the following statements is true:

- If a job requires 50# of push force you can determine whether applicants meet the job demand by putting 50# in a crate and having them push the box across a countertop.
- If you push a 300# patient in a wheelchair it requires 300# of push force.
- The patient has a 20# restriction, so he cannot push a utility cart with more than 20# on it.

UNDERSTANDING THE FORCES FOR PUSH/PULL

It's not as easy as you may think! In doing a functional job analysis or a prework screen, there are many factors that must be considered. The amount of force required to push or pull an object must be measured by a force gauge. Factors that influence the amount of force required to move an object include:

- Size / shape of the object.
- Weight of the object.
- Location of the object.
- Is the object on wheels? Larger diameter wheels make the push/pull easier than smaller diameter wheels.
- Are the wheels/bearings properly maintained, or are they all gummed up and sticking?
- Is the object being pushed on tile, carpet, or outside on rough terrain?
- Are you pushing on level surfaces, up a ramp or incline or down a ramp or on a declined terrain?
- Are there transition points that the object must be pushed / pulled over?
- Are there easy places to grip the object for pushing or pulling?

Technically, if you push or pull exactly level to the ground in the exact same circumstances the force will be the same for pushing as it is for pulling. However, in real life, since people tend to vary in the way they push and pull, there will sometimes be a difference in force results. When pulling, there is a tendency to lift on the object, whereas the tendency is to push downward when pushing. The human body can typically generate more pulling force than pushing force. The main problem with pulling objects is the need to turn the body to see where we are going. As therapists, we recommend in back safety programs that it is preferable to push rather than pull. When you push you tend to use the strength of your legs to move the object and it is easier to maintain the lumbar lordosis and protect the low back.

MEASURING PUSH/PULL FORCES

When measuring push or pull force, you must use a force gauge. The technique requires positioning the gauge (force) parallel to the ground and applying a steady push or pull. Push or pull slowly -- you do not want to

UNDERSTANDING AND MEASURING PUSH & PULL FORCES

record the force applied by momentum, but the actual force required to get the object moving - to overcome inertia. Here are some examples of push / pull forces required to move an object. NOTE: These are examples only and should not be substituted for actual measurements under actual work conditions.

Example #1: A utility cart with 4" wheels in good condition and holding 141 lbs. of weight required between 7 to 10 pounds of force to get the cart moving. Once it was moving, only 5 pounds of force was required to keep the cart in motion.

Example #2: A manual pallet jack was loaded with various weights and the push/pull force to initiate movement of the pallet jack was as follows, based on the weight load:

- 240# required 10# of force
- 640# required 26# of force
- 960# required 33# of force
- 1280# required 54# of force
- 1600# required 71# of force
- 2000# required 100# of force

Example #3: Pushing a wire basket holding 50 pounds of weight across a smooth countertop required 10 lbs. of force. Pushing the same wire basket weight load over a hard surface floor required 13 lbs. of force.

Each job must be evaluated based on the conditions, the equipment, and the objects being pushed or pulled in that specific job. Because there are so many factors that influence the measurement of force, a push/pull gauge is the only means to accurately measure. This force is then used as the critical demand when doing a job match in an FCE or in PWS testing.

If a job description indicates the need to push 300# a distance of 20 feet, job matching cannot be completed with this limited information. Doing a job specific push activity at the end of your FCE will provide additional information, but qualify any conclusions with the specifics of how you simulated the activity and what equipment was used. The variables in your clinic may not reflect what is encountered at the work site. Document the client's push/pull abilities, explain any job simulation testing that was done and make the case that the job description does not include the measured force required to move 300#. Information should be confirmed / validated by the employer before a final recommendation can be made related to return to work.