FACT SHEET
Strength Testing in Pediatric Physical Therapy

Assessment of muscle force production (strength) is almost always an essential element to a complete and thorough physical therapy examination. If one of our priorities as physical therapists is to improve movement and positioning, knowledge about the strength of muscles that enable ideal alignment and movement is imperative.

Testing the muscle strength of children can present unique challenges for many reasons. In choosing a method to assess muscle strength, the physical therapist needs to consider the age and cognitive status of the child, his or her emotional/behavioral state at the time of the examination, and how the information will be used to develop the treatment plan. Additional factors that will influence this decision include the pediatric experience of the physical therapist, the amount of time and resources available, and the family's goals and priorities.

There are several methods for testing muscle strength in children, including:

Observation of Functional Skills:

• **What it is**: The PT observes a child performing typical movement activities and makes deductions about muscle strength based on these observations.

• **Skills**: The PT must have excellent observation and movement analysis skills.

• **Advantages**: No special equipment is required. PTs can use skilled observation with patients who have difficulty following directions. This method focuses on functional movement analysis.

• **Disadvantages**: This is not a specific muscle strength measure. Observation allows PTs to make inferences as to which muscles/muscle groups are weak. This is a subjective measure by definition and different PTs might come to different conclusions. Use of an objective scale for rating functional muscle strength can improve the reliability of the measurement. Examples of this type of scale can be found in Daniels and Worthingham's Muscle Testing: Techniques of Manual Examination.1

• **Suggested patient populations**: Very young children and infants who cannot follow directions and older children with cognitive or behavioral impairments that limit their ability to follow directions.

• **Examples**:

  • "Kitty" is a 2-year-old who has been walking for several months and is unable to squat and return to stand without the use of her upper extremities. The PT suspects hip extensor, knee extensor, and/or ankle plantar and dorsiflexor weakness.

  • "Henry" is an infant with left torticollis and no known neurological disorder. He does not demonstrate head righting when tilted to the left in vertical suspension. The PT deduces a weakness of the right lateral flexors of the cervical spine.

• **Use skilled observation to guide treatment**:

  • "Kitty" The PT tries activities that include squatting through partial range, squatting, and/or stair climbing with partial body-weight support, stepping up and down with good alignment on increasingly higher steps, heel raises, etc.

  • "Henry" After checking available range of motion, the PT has him play in left-side sitting or side lying, or teach his parents to carry him in a slightly left tilted position to strengthen right lateral flexors of the cervical spine.

• **Additional notes**: The Active Movement Scale2 is a standardized, observational scale, developed for children with brachial plexus injury that provides data related to upper-extremity movement against gravity.

Manual Muscle Testing:

• **What it is**: Isometric muscle strength is tested in specific positions, usually with the muscle at an optimal working length. Using a "break" test, the PT overpowers the muscle being tested to determine the muscle grade.

• **Skills**: Positioning, hand placement, and reliability of scoring is learned through practice.

• **Advantages**: This method does not require special equipment. The PT can be very specific with regards to muscle tested. Test–retest reliability is generally very good for lower muscle grades.3,4

• **Disadvantages**: This method does not provide information about strength throughout the range of movement and is not very specific at higher muscle grades.4

• Suggested patient populations: Manual muscle testing may be used reliably in children as young as 3, depending on their ability to follow direction. Also, following orthopedic injury or surgery, manual muscle testing can be used to gauge progress. It is useful with patients whose conditions indicate yearly strength measures.

• **Examples**:

  • "Jonah" is a 12-year-old boy who sprained his ankle 4 weeks ago and is still limping. The PT measures the strength of gastrocnemius, soleus, tibialis anterior/posterior, and peroneal muscularture.

  • "Anna" is an 8-year-old girl with Down syndrome who wants to join the community track and field team and is having trouble jumping and running well. Before beginning a strengthening program, her PT measures gluteus medius/maximus, hamstring, quadricep, and gastrocnemius strength.

• **Use data to monitor progress and adapt exercise programs**:

  • Following 3 weeks of physical therapy, “Jonah’s” ankle strength is symmetrical.

  • “Anna’s” strength is re-measured every month to help with decisions about the strengthening program.

Handheld Dynamometry:

• **What it is**: Isometric muscle strength is tested in specific positions using a handheld dynamometer. The PT may use a “break” or “make” test. In a make test, the patient exerts maximal effort against resistance for a given period of time. Make tests have better inter- and intrarater reliability than break tests.3-6 Much of the available literature recommends performing 3 tests and averaging the results of the second 2 for improved reliability.6

• **Skills**: PTs must learn and practice positioning of the patient, themselves, and the dynamometer. Standardized procedures are necessary to ensure interrater reliability. Examples of standardized procedures can be found in an article by Eek, Kroksmark, and Beckung.7

• **Advantages**: Objective measure of even small gains or losses of strength can be measured. The use of a handheld dynamometer can be used reliably on children as young as 28 months.8,9 In addition, normative data is available on the use of handheld dynamometry with children to assist PTs in interpreting dynamometry information.7,10

• **Disadvantages**: Without standardized procedures, the measurements can be unreliable, particularly between testers.7 Testers have to be careful not to create readings related to their own pressure on the dynamometer as they resist the child’s muscle activation.

• **Suggested patient populations**: This measurement tool can be used for any child who is able to follow the directions. It can be especially helpful following orthopedic injury or surgery to gauge progress and with patients whose conditions indicate yearly strength measures.

• **Examples**:

  • “Billy” is a 12-year-old boy with mid-lumbar level myelomeningocele. His neurosurgeon requires an annual strength check to monitor early signs of tethering or other issues.

  • “Victoria” is a 15-year-old girl with cerebral palsy who has completed a 2-week inpatient rehabilitation stay following single-event, multiple level surgery. Her PT assesses her strength with a handheld dynamometer at admission and discharge.

• **Use data to monitor progress and adapt exercise programs**:

  • “Billy’s” manual muscle test scores are unchanged, but his right hip flexor score on the handheld dynamometer is 25 pounds lower than at his last exam. The neurosurgeon is notified, and additional imaging is ordered.

  • “Victoria’s” strength is measured at her annual follow-up. She has made gains in all muscles tested except plantarflexors. The PT recommends she spend time without her ankle foot orthosis each day.

• **Additional notes**: Handheld dynamometers are approximately $1,000. There may be an additional cost if an interface with the internet is desired. They often require re-calibration. Annotated bibliography available on request.

Isokinetic Dynamometry:

• **What it is**: The child is positioned in the isokinetic machine, with lever arms that mirror the lever arm of the muscle(s) being tested. The dynamometer controls or measures the velocity of the movement, while the child attempts to move as quickly as possible. Concentric, eccentric, isotonic/isometric measures can be obtained. The full arc of motion can be assessed, and power can be measured.

• **Skills**: The PT must be trained on the equipment for efficient and effective use.

• **Advantages**: This tool allows muscle strength to be measured through the full arc of motion. Objective measures of eccentric or concentric strength are obtainable.

• **Disadvantages**: The equipment is expensive and has a large footprint. Measurement of the strength of smaller muscle groups, especially in smaller patients, can present difficulties. The equipment requires expertise and time to adjust between patients.

• **Suggested patient populations**: May be most beneficial in a research setting or a gait lab.

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Recommended References:
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There are numerous Web sites and publications available on this subject; this list is not meant to be all inclusive. Many of the listed sites have links to additional resources.

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