Poor head and trunk control interfere with the quality of life for the person with neuromuscular disabilities. The ability to sit independently, orient the head upright in space, and use the hands functionally are integral to the performance of daily activities. All of these abilities are affected by the control of head, neck, and trunk musculature. In the pediatric population, developmental assessments, for example, the Peabody Developmental Motor Scale (Folio & Fewell, 1983) and the Revised Gesell Developmental Schedule (Knobloch, Stevens, & Malone, 1980), assess sitting as a functional skill from a quantitative perspective. However, the use of these standardized assessments to measure trunk control and posture is limited, in that quality changes are rarely reflected (Hacker & Porter, 1987). In the teen and adult populations, various classifications of seating balance have been developed within sports programs for persons with disabilities. At our clinic, we use the Ontario Wheelchair Sports Balance Classification.

The Slump Test was designed at our clinic to measure and quantify changes in trunk control that ultimately affect function. The term slump test is borrowed from an engineering term that describes the readiness of concrete for pouring. A test batch of concrete is poured into a specially designed bucket and inverted. The critical question is how long it takes for the concrete to slump, or drop down. Slumping at too short or too long an interval is considered abnormal. Similarly, for many persons with poor trunk control, the degree of slump is measured to most accurately describe their posture in a functional sitting position.

The Slump Test uses the shadow image created by a light source to provide a picture representation of how a person sits. As trunk control changes, the shadow changes. A standard form of administration and scoring allows comparison between tests and a quantitative measurement of qualitative changes.

Test Preparation and Administration

A 150-watt floodlight is placed 15 ft from a wall, on which is mounted white paper (also referred to as "slump" paper). The paper extends from the support surface up to the top of the shadow image and is at least 24-in. wide (see Figure 1). The paper is aligned along a piece of tape placed at right angles, as determined by a plumb line. The client sits on a 3-ft by 5-ft plinth that is 6 in. from the wall. Standard shadows are cast onto the paper by the client as he or she is positioned with his or her right side parallel to the wall. Each time the assessment is administered, a different colored marker is used to draw the shadow.

1Distributed by the Canadian Wheelchair Sports Association, 1600 James Naismith Drive, Suite 212, Gloucester, Ontario, Canada K1B 5N4.
Figure 1. Equipment and physical set-up for the Slump Test.

An effort is made to help the client feel comfortable in order to establish an accurate representation of sitting abilities. A caregiver or an interesting picture positioned in front of the person may provide visual cues to encourage head lift and an upright trunk. This technique can be used for a variety of sitting positions (see Figures 2 and 3). Cross-legged, long-legged, ring, or even reverse-W sitting can be used, depending on the person’s capabilities. Two positions may be recorded to examine the difference in trunk stability based on the size of the base of support or the effect of muscle and tendon tightness or shortening on sitting position. The cross-legged, reverse-W, or ring sitting posture compared with long-legged sitting captures this difference.

Once the client is comfortable in sitting on the plinth or on the floor, the therapist traces the shadow of the trunk, neck, and head (including the nose), which has been cast onto the paper. In long-legged sitting, the angle of the flexed knees may be traced. The procedure is repeated for different positions, if applicable. The shadow is labeled according to the sitting position used (see Figures 2 and 3).

Scoring and Recording

Figure 4 illustrates the measurements to be recorded. With the use of an 18-in. ruler, a line is drawn between the neck (A) and the point of contact between the bottom of the trunk and the seating surface (B). At the midpoint (C) of line AB, a perpendicular line is drawn to the trunk (D). The distance of lines AB and CD is recorded on the slump paper. The seating angle (angle θ), the angle between the horizontal support surface and line AB, is measured with a protractor or goniometer (see Figure 4).
Measurements taken for the Slump Test. Angle $\theta$, the sitting angle, is the angle produced by the horizontal line of the seating platform and line $AB$. Angle $\beta$ shows the degree of pelvic tilt. In this case, angle $\beta$ is in a posterior tilt. It is measured as $x$ number of degrees from the vertical of $90^\circ$. Line $CD$ shows the displacement of the back from the midpoint of line $AB$.

Other information can be recorded as well. The distance of line $CD$ measures the displacement between the head and the midpoint of the trunk. With more rounding of the trunk, there will be a greater displacement, as measured by line $CD$.

Many people who have difficulty with long-legged sitting have a posteriorly tilted pelvis. This may be related to poor trunk control, lower limb spasticity, or both. The degree of pelvic tilt can be recorded by the angle between a vertical line (i.e., a $90^\circ$ angle) through point $B$ and the tracing of the back shadow (angle $\beta$). This may change as trunk control, leg spasticity, or both are altered through treatment.

The data obtained from the above calculations are recorded in the client's chart. The therapist must accurately record each sitting position and the client's behavioral state during the assessment for test-retest reliability.

Redadministration of the test is recommended twice annually. The results are compared with previous tests to document change in seated trunk control over time.

The Slump of a Nondisabled Population

Ten women were used as a small normative sample for the Slump Test. We found that the seating angle in long-legged sitting for the subjects' best (i.e., straight sitting position) and relaxed (i.e., sitting position) positions varied from $80^\circ$ to $95^\circ$. The degree of pelvic tilt varied from a neutral position ($90^\circ$) to $20^\circ$ posterior to neutral. The average best long-legged seating angle was $85.7^\circ$, with a pelvis posterior to neutral $7.2^\circ$. In comparison, the relaxed long-legged seating angle average was $82.7^\circ$, with the pelvis $10^\circ$ posterior to neutral. It is recognized that this small, exclusively female adult group cannot be used for normative data per se. However, it did reflect, as suspected, that the seating angle approaches the vertical and the pelvis is displaced minimally from the vertical in the nondisabled population.

Test Evaluation

The Slump Test was administered as outlined in conjunction with the Peabody Developmental Motor Scale to determine the baseline functional level of a child aged 5 years 8 months with moderate spastic diplegia prior to the onset of physical therapy and occupational therapy with new therapists. The child was cooperative during the test, which was administered with the child in a cross-legged sitting posture. At the 6- and 12-month evaluations, long-legged and cross-legged sitting were measured, due to improved sitting abilities.

In cross-legged sitting at baseline, the seating angle was $45^\circ$ (angle $\theta$) and both hands were free. Long-legged sitting could not be maintained without support. The score on the balance section of the Peabody Developmental Motor Scale was 15 (total raw score), with the mean for age being 62. Percentage of normal for this raw score was calculated at 23%.

Six months later, the cross-legged sitting angle was $75^\circ$ (angle $\theta$), and the long-legged sitting angle, $75^\circ$, with the pelvis tilted $15^\circ$ posterior to neutral and the arms propped on the mat for support. The Peabody Developmental Motor Scale balance raw score was 20 and the mean for age was 64. Percentage of normal was 30%. Qualitative changes at the 6-month evaluation included increased thoracic extension balanced by flexion; improved ambulation with a strider walker and ankle-foot orthoses; less adduction and internal rotation of the legs, which allows for a more normal muscle sequence for gait; ability to sit in a long-legged position; and an attempt to stand independently.

The 12-month evaluation revealed a seating angle of $75^\circ$ (angle $\theta$) with a neutral pelvis in cross-legged sitting. Long-legged sitting was done without hand propping. In this position, the seating angle was $75^\circ$, with $20^\circ$ posterior orientation of the pelvis. The Peabody Developmental Motor Scale was unchanged from the 6-month evaluation. Qualitative changes included independent transition from floor to walker and reverse, ability to release grasp of walker, ability to stand independently for up to 2 sec, and introduction of canes as a mobility device.
The Slump Test was sensitive to the qualitative changes in trunk control between the 6- and 12-month assessments, which may correlate directly to the functional changes documented above. In comparison, there was no change in the Peabody Developmental Motor Scale score to quantify these functional changes. A change in balance score would only have been reflected by independent standing for up to 3 sec or other more complex balance skills, such as bending down to secure a toy or taking an independent step. The Slump Test data were useful to reinforce that, although the Peabody Developmental Motor Scale score did not change from 6 to 12 months, the Slump Test measurements did reflect improved trunk control through the changes in seating angle over this time period.

Summary

The Slump Test is an inexpensive, easily administered assessment tool that can help record qualitative changes in sitting in an objective manner. Objective data are useful to document treatment efficacy over time.

Over the past 2 years, the Slump Test has been administered at our clinic to a varied population with respect to age, neuromuscular condition, and functional abilities. At the time of this writing, more than 200 children have had the Slump Test administered as part of their assessment protocol. Most of these children have been between the ages of 3 and 8 years; have cerebral palsy, decreased trunk control, and limb spasticity; and are dependent on a wheelchair or aide for ambulation.

In conclusion, the picture representation and objective data obtained from the Slump Test along with a qualitative description of sitting have provided us with a useful means of assessing change over time.

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