Concurrent Validity of Equilibrium Tests in Boys With Learning Disabilities With and Without Vestibular Dysfunction

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Key Words: equilibrium • posture • sensory integration

Six equilibrium measures were administered to 50 boys with learning disabilities, 25 with and 25 without suspected vestibular system dysfunction. Pearson product moment correlations were computed between test scores for the total sample and for each subgroup to establish concurrent validity between tests. Four correlations for the total sample and three for each of the subgroups were statistically significant. However, only 3 of the 10 correlation coefficients mentioned were greater than \( r = 0.5 \). The relatively low magnitude of many of the correlations obtained demonstrates that different tests of equilibrium measure different balance-related competencies, and that competence in one area does not indicate competence in another. Therapists evaluating equilibrium should administer more than one test. The tilt test used in this investigation did not correlate significantly with any other test. This suggests that tilt tests should routinely be included in the evaluation of equilibrium.

The link between postural background movements, especially movements to maintain equilibrium, and skilled or learned movement has been established through the application of physical laws to human movements. As Broer (1966) stated, "whenever one body part moves away from the line of gravity in one direction (as occurs with skilled or learned movement), the center of gravity shifts in that direction. If this shift puts the center of gravity beyond the base of support, another body part must move in the opposite direction to bring the center of gravity back over the base or balance will be lost" (p. 43). These compensatory movements, which maintain or regain the center of gravity over the base of support for the purpose of maintaining equilibrium, should be finely tuned, automatic, and not consciously controlled. When equilibrium is impaired, the task of maintaining a position becomes a willed movement, executed at a great expense of energy, and more skilled and purposeful activity cannot be efficiently accomplished (Bobath, 1971).

The relative importance of equilibrium reactions to human function has encouraged therapists to find a means for evaluating them. However, no matter how theoretically accurate the above law or principle of human equilibrium, it offers little insight to therapists faced with the task of evaluating equilibrium reactions in children with central nervous system (CNS) damage or dysfunction. When this law is applied to the infinite number of potential combinations of human movements, the task becomes overwhelming. Therefore, most therapists resort to objective assessments of equilibrium based not on the above functional principle of equilibrium but on another physical prin-
Principle. This second principle states that the wider the base of support and the nearer the center of gravity to the center of the base, the more stable is the individual (Broer, 1966). Clinicians attempting to employ standardized measures of equilibrium that are valid, reliable, and also sensitive to development have turned primarily to tests of one-legged standing, beam walking, and tandem walking. The logic behind this choice appears to be that if disturbances in equilibrium exist, these disturbances will be most easily detected by drastically narrowing the base of support and objectively measuring the length of time an individual can maintain balance.

While based on an important physical law, such objective evaluations fail to consider the more functional but often qualitative or subjective aspects of an equilibrium response that provide the postural background for skilled activity. In everyday life, children rarely are required to stand on one leg, walk on a beam, or tandem walk, except in the context of a skilled activity (e.g., play, dressing). Yet commonly used objective evaluations require that the child consciously control equilibrium rather than use it automatically as part of a functional task. Therefore, therapists concerned with bridging the gap between postural responses and skilled activity often augment their objective evaluation of equilibrium with subjective observations of functional equilibrium.

Weisz (1983) has indicated that equilibrium reactions are elicited under the following three conditions: (a) through changes in the position of the body in space—as when a person is moving from place to place or position to position, (b) through changes in the body's supporting surface—as when a person is tilted, or (c) through changes in the position of the extremities in relation to the body—as when a person is reaching.

Therapists evaluating equilibrium by (a) placing the child on unstable surfaces, (b) gently displacing the child as he or she attempts to maintain a position, or (c) asking the child to obtain objects slightly beyond reach appear to be making the evaluation more functional in a manner supported by the literature. However, research has offered little help to the therapist in terms of how much tilt or active displacement a normal child of a given age should be able to withstand before losing balance. To make this kind of judgment, therapists must rely on their own clinical skill and knowledge of normal development.

In response to this need, Fisher and Bundy (1982) developed four functional tests of equilibrium by selecting and modifying commonly used clinical assessments of equilibrium in accordance with Weisz's (1983) description of the conditions under which equilibrium reactions are elicited. The tests were designed to evaluate equilibrium reactions in both a quantitative and qualitative manner and included a tilt board test, two reaching tests (from a stable and an unstable base), and a test of manual displacement where the child was gently pushed while standing on a stable surface. In a pilot study, Fisher and Bundy found that certain tests and combinations of tests correlated with age and discriminated between normal boys and boys with sensory integrative (vestibular) dysfunction. Furthermore, the quantitative aspects of the tests (maximum angle of tilt or of displacement from vertical position during reaching, angle scores) could be reliably scored (inter- and intrarater reliabilities, \( r = .98 \)). However, Fisher and Bundy, like other researchers (Drowatzky & Zuccaro, 1967; Sanborn & Wyrick, 1969) found low correlations between equilibrium test scores; although each test was a measure of equilibrium, children who obtained high angle scores on one test did not necessarily obtain high angle scores on others. The result was poor correlations between test scores; Fisher and Bundy concluded that the tests measured different age-related aspects of equilibrium, and they therefore recommended that several types of assessments be used to adequately evaluate balance.

Two standardized evaluations of balance commonly used by therapists are drawn from the Southern California Sensory Integration Tests (SCSIT) (Ayres, 1980) and the Bruininks-Oseretsky Test of Motor Proficiency (Bruininks, 1978). The SCSIT includes two tests of balance, Standing Balance: Eyes Open (SBO) and Standing Balance: Eyes Closed (SBC); both are tests of one-legged standing. The Bruininks-Oseretsky Balance subtest (BOBS) includes eight items; seven of these are of one-legged standing on the floor or on a balance beam or of walking a line or beam. The final item is more functional and requires that the child walk across the beam while stepping over a stick placed at knee height.

BOBS, SBO, and SBC evaluate very different aspects of balance from those tests developed by Fisher and Bundy (Fisher & Bundy, 1983; Fisher 1984); yet all three groups of tests have face validity, and all three groups of tests have been shown to discriminate between normal children and children with CNS dysfunction (Ayres, 1976; Bruininks, 1978; Fisher & Bundy, 1982). Subsequent studies modified, standardized, and collected preliminary normative data on three of the four original tests on approximately 300 normal children 3 to 13 years old (Fisher, 1984; Izraelevitz, Fisher, & Bundy, 1985) The three tests include Tilt Board Tip (TBT), Flat Board Reach (FBR), and Tilt Board Reach (TBR). The fourth test, Flat Board Push, was discarded because it was difficult to administer in a reliable manner. The validity of the modified TBT, FBR, and TBR was demonstrated by the ability of the three angle scores to predict age (\( R^2 \)
all of these tests, although considered to be measures of equilibrium, appear to measure different aspects of equilibrium. If, however, as is hypothesized, the tests do not significantly correlate, those low correlations would support the need for the use of multiple valid tests for the thorough evaluation of equilibrium as part of a developmental or diagnostic evaluation. Low correlations would also be of theoretical interest since all of these tests, although considered to be measures of equilibrium, appear to measure different aspects of equilibrium.

Since equilibrium reactions are often depressed in children with learning disabilities (LD) and since equilibrium measures are frequently included in the evaluation of children with LD, the subjects for this investigation were all boys with documented LD. Furthermore, since equilibrium has been considered, at least in part, to be a vestibular function (Weisz, 1938), it would seem that the relationship between test scores might differ between LD children with no evidence of vestibular dysfunction and LD children with suspected vestibular dysfunction. Therefore, correlations were computed both for the total sample and for two subgroups of LD boys with and without suspected vestibular dysfunction.

Method

Subjects

The subjects were 50 boys who were enrolled in a private Midwestern school for children with LD. They ranged in age from 6 to 13 years (see Table 1). All were of at least average intelligence and all had known LD, which had been documented by psychological evaluation at the time of school placement. They were free from hearing loss, orthopedic disorder, and severe visual or neurological disorders.

Twenty-five of the boys demonstrated impaired vestibular system functioning as determined by (a) the prior results of the SCSIT, the Southern California Postrotary Nystagmus Test (SCPNT), clinical observations of neuromotor behavior administered by two occupational therapists certified in the administration and interpretation of the SCSIT and (b) the concurrent results of the SCPNT and clinical assessment of the ability to assume and maintain the prone extension posture.

More specifically, after completion of all testing, the subjects with suspected vestibular dysfunction were selected from the total sample by means of a two-stage screening process. In the first stage, boys who demonstrated depressed scores on concurrent prone extension and/or concurrent SCPNT were identified. Because means and standard deviations for SCPNT can vary significantly between experienced examiners, the subjects were only considered to have depressed concurrent SCPNT scores if their scores were more than one standard deviation lower than the mean established for approximately 150 normal boys tested by the principal investigators (Fisher, 1984).

In the second stage, the prior test results associated with vestibular dysfunction were reviewed. If, in the first stage of screening, the boys demonstrated depressed scores on both concurrent prone extension and the concurrent SCPNT, they were selected for inclusion in the group with suspected vestibular dysfunction if the second stage of the screening process revealed that they also demonstrated depressed scores on at least one prior score associated with impaired vestibular system function. The subjects were also selected for inclusion in the group with suspected vestibular dysfunction if, in the first stage of screening, they demonstrated depressed scores on either concurrent prone extension or the concurrent SCPNT and a review of their prior test results in the second stage revealed at least three prior depressed vestibular system-related scores. Prior scores associated with vestibular system dysfunction included the following: (a) SCPNT, SBO, and SBC scores more than 1.0 standard deviation below the mean for the normative sample as given in the respective test manuals (Ayres, 1975, 1980); (b) an SBC score at least 1.0 standard deviation lower than the SBO score; and (c) deficient responses on clinical observations of muscle

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean Age</th>
<th>SD</th>
<th>F_{1,46}</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>LD with vestibular dysfunction (n = 25)</td>
<td>121.3</td>
<td>25.0</td>
<td>5.656</td>
<td>.02</td>
</tr>
<tr>
<td>LD without vestibular dysfunction (n = 25)</td>
<td>137.7</td>
<td>22.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Sample (N = 50)</td>
<td>129.5</td>
<td>24.9</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: LD = learning disabled.*
tone, cocontraction, and gravitational security. The remaining 25 subjects did not demonstrate a meaningful cluster of scores and observations suggesting vestibular dysfunction.

Procedure

Testing was carried out in two phases. During the first phase, the BOBS was administered according to the standardized instructions by the same therapists who had administered the prior SCSIT, SCPNT, and clinical observations.

During the second phase, five tests of equilibrium were administered to each child. Three of these tests (TBT, FBR, and TBR) were based on those developed by Fisher and Bundy (1982). The remaining two equilibrium tests were based on the SBO and SBC tests (Ayres, 1986). In addition, all children had an assessment of the ability to assume and maintain the prone extension posture (Fisher, 1984), and the SCPNT (Ayres, 1975) was administered. The principal investigators administered all tests in the second phase. The results of Phase 1 testing were unknown to the Phase 2 examiners at the onset of Phase 2 testing. The two phases of testing were separated by approximately 3 months.

All Phase 2 testing was carried out in a large well-lighted, distraction-free room. The order of testing was systematically varied to control for the effects of order and fatigue. The SCPNT was always administered last, and Fisher and Bundy’s three tests were administered as a unit. Prone extension, SBO, and SBC were tested prior to or following Fisher and Bundy’s tests; the SBO always immediately preceded the SBC. Descriptions of the tests and precise administration procedures are described elsewhere (Fisher, 1984; Izraelevitz et al., 1985).

Results

Because performance on equilibrium measures is known to change with age (Ayres, 1980; Bruininks, 1978; Fisher, 1984; Fisher & Bundy, 1982; Izraelevitz et al., 1985) and because the two groups of subjects differed significantly in age (see Table 1), z scores were computed for each of the equilibrium measures for each child. In addition, a z score for a composite total angle score (TOT) was also computed, which was derived from the sum of the raw angle scores for TBT, FBR, and TBR. The z scores for the BOBS were based on standardized information from the Bruininks (1978) test manual. All other z scores were based on the preliminary normative data obtained for normal boys 6 to 13 years of age (Fisher, 1984).

Means and standard deviations for the z scores for each test by the LD group and for the total LD sample are shown in Table 2. Overall, the means for both LD groups and for the total LD sample were lower than the means for the normal sample against which the LD groups were compared (Fisher, 1984), and the group with vestibular dysfunction demonstrated slightly lower mean scores than did the group with no suspected vestibular dysfunction. Only the BOBS differed significantly between the two groups (p < .05).

Pearson product moment correlation coefficients between test scores were computed for the total sample. Correlations between TOT and TBT, FBR and TBR were not computed since each of the latter contributed to TOT; therefore, significant correlations would be meaningless. The resulting correlation matrix is shown in Table 3.

Only 4 of the 18 correlations for the total sample reached statistical significance (p < .05). One of those four was a negative correlation, indicating that children who scored relatively lower on one test scored relatively lower on the other test and vice versa (see Table 3).

To determine whether the presence or absence of vestibular dysfunction resulted in a different pattern of significant correlations between test scores than was found for the total sample, Pearson product moment correlation coefficients were computed, by group, for each pair of tests. The results of these correlations are also shown in Table 3.

As can be seen in Table 3, different pairs of tests significantly correlated for the two LD groups. Because it frequently was noted that the direction of the correlations between the same tests differed between the groups, Fisher z transformations were used to compute statistical comparisons of the correlation coefficients for each test between groups to determine whether the correlations were significantly different. The results of the comparisons are shown in Table 4. Only two of the comparisons (FBR with SBC and TBR with FBR) reached statistical significance (p < .05).
Table 3
Correlations (r) Between Tests for Total Sample and by Group

<table>
<thead>
<tr>
<th></th>
<th>BOBS</th>
<th>SBO</th>
<th>SBC</th>
<th>TBT</th>
<th>FBR</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total sample</td>
<td>0.17</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vestibular</td>
<td>-0.11</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nonvestibular</td>
<td>0.34</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SBC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total sample</td>
<td>0.46**</td>
<td>0.31*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vestibular</td>
<td>0.38*</td>
<td>0.22</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nonvestibular</td>
<td>0.58**</td>
<td>0.40*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TBT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total sample</td>
<td>0.11</td>
<td>0.09</td>
<td>0.13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vestibular</td>
<td>-0.06</td>
<td>-0.01</td>
<td>0.03</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nonvestibular</td>
<td>0.28</td>
<td>0.39</td>
<td>0.24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FBR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total sample</td>
<td>0.13</td>
<td>-0.07</td>
<td>-0.11</td>
<td>-0.07</td>
<td></td>
</tr>
<tr>
<td>Vestibular</td>
<td>-0.05</td>
<td>-0.22</td>
<td>-0.35</td>
<td>-0.07</td>
<td></td>
</tr>
<tr>
<td>Nonvestibular</td>
<td>0.18</td>
<td>0.04</td>
<td>0.24</td>
<td>-0.07</td>
<td></td>
</tr>
<tr>
<td>TBR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total sample</td>
<td>0.16</td>
<td>-0.27*</td>
<td>-0.17</td>
<td>0.08</td>
<td>0.55**</td>
</tr>
<tr>
<td>Vestibular</td>
<td>0.28</td>
<td>-0.32</td>
<td>0.0008</td>
<td>0.20</td>
<td>0.69**</td>
</tr>
<tr>
<td>Nonvestibular</td>
<td>-0.08</td>
<td>-0.27</td>
<td>-0.43**</td>
<td>0.04</td>
<td>0.25</td>
</tr>
<tr>
<td>TOT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total sample</td>
<td>0.09</td>
<td>0.07</td>
<td>-0.21</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Vestibular</td>
<td>-0.19</td>
<td>0.07</td>
<td>-0.38</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Nonvestibular</td>
<td>0.30</td>
<td>0.04</td>
<td>0.05</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

Note: BOBS = Bruininks-Oseretsky Balance subtest. SBO = Standing Balance: Eyes Open (part of the Southern California Sensory Integration Tests [SCSIT]). SBC = Standing Balance: Eyes Closed (part of SCSIT). TBT = Tilt Board Tip. FBR = Flat Board Reach. TOT = Total angle score. *p < .05. **p < .005.

Discussion
The primary purpose of this investigation was to examine concurrent validity between tests of equilibrium. Whether or not concurrent validity could be established, the attempt to do so was deemed important. If concurrent validity could be established, therapists could be assured that certain tests would provide equivalent measurements of equilibrium and that objective, quantitative standardized tests of one-legged standing beam or tandem walking would provide the same information as do clinical, qualitative observations of tilting reactions or functional equilibrium tests. If concurrent validity could not be established, therapists would receive objective support for the expenditure of additional time required to administer several tests, allowing for the careful evaluation of equilibrium.

Given previously reported evidence to suggest the presence of multiple aspects of equilibrium (Drowatzski & Zuccato, 1967; Fisher & Bundy, 1982; Sanborn & Wyrick, 1969), it was felt that observations of balance that resulted in a composite score, such as the BOBS or TOT, might reflect a broader picture of equilibrium than would any one test alone. Furthermore, the BOBS alone was found to discriminate between the two LD groups (unpublished observation), and the TOT was found to contribute significantly to the discrimination between normal and LD boys (Fisher, 1984). However, the correlations between the BOBS and the TOT were all very low (r = .09 for the total sample, \( r = -0.19 \) for the group with vestibular dysfunction, and \( r = 0.30 \) for the group without vestibular dysfunction), suggesting that even these two composite scores do not measure overlapping aspects of equilibrium.

While statistically significant correlations were found between pairs of tests for both the total sample and the individual groups, the question which seems most important is less one of statistical significance than one of clinical meaningfulness: Is the amount of shared variance between any of the pairs great enough so that it can be said that the two tests measure the same aspect(s) of equilibrium? Although no strict rules exist that determine practical or clinical significance, it would seem that tests having correlations of...
less than \( r = .50 \) (25% shared variance) are certainly
not measuring the same traits. Of the correlations
computed for the total sample, only the correlation
between the FBR and the TBR met this arbitrary
criterion. Correlations computed for each of the pairs
of tests by group revealed one correlation for the
group with vestibular dysfunction (TBR with FBR)
and one correlation for the group without vestibular
dysfunction (BOBS with SBC) that met this criterion
(see Table 3). These results support the previous
finding of Fisher and Bundy (1982) that multiple
measurements of equilibrium are necessary to ade­
quately evaluate balance abilities.

The results of this investigation suggest that boys
with impaired vestibular function tend to score
slightly, but not significantly, lower on equilibrium
tests than do boys with no suspected vestibular dys­
function. This investigation also suggests that LD boys
as a group may be impaired in their performance of
equilibrium tasks when compared with normal boys.
The pattern of significant correlations between tests
differed between the two groups, suggesting that the
equilibrium deficits of LD boys with vestibular dys­
function are to some way different from the equilib­
rium deficits of LD boys with no apparent vestibular
dysfunction. It should be noted that many of the boys
in the latter group demonstrated gross motor coordi­
nation deficits, including dyspraxia, which may ac­
count for their low mean balance scores.

The relatively low magnitude of many of the
correlations obtained in this investigation clearly
demonstrates that different tests of equilibrium mea­
sure different balance-related competencies, and that
competence in one area does not indicate compe­
tence in another. Therefore, multiple tests of equilib­
rium are required for a comprehensive evaluation.

Poor equilibrium is both a diagnostic indicator
and a cause of functional impairment. The primary
purpose for evaluating equilibrium is to determine
treatment strategies for its improvement. Therefore,
therapists administering multiple tests of equilibrium
must attempt to determine the particular aspect(s) of
those tests that result in a relatively better or worse
performance for a specific child. While therapists
recognize the effects of eyes open versus eyes closed
on a child’s performance, the results of this investi­
gation suggest that the use of vision is only one aspect
of the requirements of various equilibrium tests
which should be considered. The following discus­
sion is not comprehensive; however, four additional
aspects of equilibrium tests which appear to affect
children’s performance are included.

Therapists should consider the placement of the
child’s non-weight-bearing extremities (e.g., arms
and raised leg in one-legged standing or reaching
tasks). Some tests dictate the position of these extrem­
ities and some allow the child to place them in the
position the child finds most comfortable (i.e., arm
position differs, but is fixed for both BOBS one­
legged standing tests and the SBO and SBC, whereas
the raised-leg position is fixed in the BOBS but “free”
in the SBO and SBC). The question that seems most
relevant for therapists to ask is this: Is the child
allowed to move the non-weight-bearing extremities
to assist in maintaining the center of gravity over the
base of support? The idea that extremity placement
may make a difference in equilibrium testing is sup­
ported by Fisher (1984) who found that the extent of
abduction (angle) of the uphill non-weight-bearing
limbs correlated significantly with the angle score on
the TBR and FBR.

Secondly, therapists should consider whether the
child has a visual target on which he or she must
fixate to successfully complete the task. Reaching
tasks, such as FBR and TBR, and some tilt type tests,
such as the TBT, require that the child fixate on a
target; many tests of one-legged standing do not spec­
fy a visual target. Visual fixation as a relevant aspect
of equilibrium has also been supported by Fisher
(1984), who found that very young normal children
and boys with vestibular dysfunction often preferred
to look down at the floor or their feet during TBT;
they appeared unable to fixate on a visual target
(camera), even with repeated instructions to do so.
Perhaps even fixation on a target is less relevant than
the fact that the child, given a choice, prefers a posture
of neck flexion.

A third aspect of equilibrium testing that thera­
pists should consider is the required work load of the
weight-bearing extremities. Reaching tasks, accom­
plished most effectively by abducting the uphill leg,
require that the child impose mobility on a very
stable, weight-bearing leg; tilt tests require relatively
less stability in the weight-bearing extremities.
Furthermore, even one-legged standing tests, which
would seem to place a reasonably large demand on
the weight-bearing extremity, can be accomplished
by the child’s fixating at the pelvis and “hanging” on
ligaments. Fisher (1984) found that very young chil­
dren and boys with vestibular dysfunction were often
reluctant to lift the uphill foot off the board during
FBR and TBR. Failure to lift the foot prevented their
attaining as great an angle score as was obtained by
older normal children.

A final consideration might be whether it is the
child or the therapist who is controlling the move­
ments required by the task. Reaching and one-legged
standing tests allow the child to determine when and
how much movement will occur; tilt tests require that
the therapist impose movement on the child. This
idea is supported by the low correlations between
the TBT and any of the other equilibrium measures. This
Finding is interesting since Fisher (1984) and Fisher and Bundy (1982) found that the TBT contributed significantly to a discriminant analysis between boys with vestibular dysfunction and normal boys. Traditionally, tilt tests have been used to identify vestibular dysfunction. Fisher has provided a comprehensive review of that research. The present investigation suggests that tilt tests should be routinely used in the evaluation of equilibrium and that these tests may evaluate an aspect of equilibrium that is very different from one-legged standing tests. Further research is indicated.

Summary

The evaluation and treatment of equilibrium deficits is of concern to occupational therapists treating children with learning disabilities. However, an individual's relative competence with regard to equilibrium is affected by the manner in which the reactions are elicited. Six equilibrium tests were administered to 50 LD boys. The resulting low correlations between test scores suggest that multiple measurements of equilibrium are essential for an adequate evaluation. Several relevant, but not always considered, aspects of commonly used equilibrium tests were discussed.

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References


