A normative comparison was carried out on the Southern California Postrotary Nystagmus Test. Two hundred and twenty two (222) children, ages five to nine, from Syracuse, New York, were compared with the original Los Angeles sample of 226. In analyzing the Syracuse data, no significant differences were found in duration of postrotary nystagmus by age, sex, or sex/age interaction. Comparison of the Syracuse with the Los Angeles data revealed significantly different means and standard deviations, with the effect that the cut-off point for diagnosing prolonged nystagmus shifted upward. It was concluded that postrotary nystagmus is a consistent measure unaffected by age or sex in normal five- to nine-year-olds, but that in view of the differences between the Syracuse and Los Angeles data, care should be taken in diagnosing prolonged postrotary nystagmus.

The Southern California Postrotary Nystagmus Test (SCPNT) measures the normalcy of horizontal postrotary nystagmus from which inferences may be drawn about some of the brain’s integrative processes (2). Nystagmus is a reflexive rapid oscillating movement of the eyeballs that results from stimulation of the semicircular canals of the vestibular system by rotational or calor-  ics means, from some types of visual input (optokinetic), or sometimes from CNS pathology. According to Ayres:

The Southern California Postrotary Nystagmus Test (SCPNT) provides a standard procedure for measuring and comparing against normal expectations one of the more common types of nonpathological nystagmus. When the head of a neurologically intact individual is rotated so that the axis from the top of the head to the neck is 30° forward from the vertical, the horizontal semicircular canal is approximately horizontal to the earth’s surface and in optimal position for stimulation through rotation. The normal reflex response to accelerated motion or to cessation of motion is horizontal postrotary nystagmus. (2, p 1)

When given the SCPNT, the subject sits cross-legged on a “lazy susan” type board placed on the
floor. The subject's head is positioned in 30° forward flexion. With eyes open, the subject is rotated evenly in a full circle 10 times in 20 seconds, then stopped abruptly. After the abrupt stop, the eyes are observed for duration and excursion of nystagmus (eye movement) while the subject looks toward a blank wall. This technique was designed to discourage focusing which would depress the nystagmic response. Rotation is done first to the subject's left and then to the right, resulting in left, right, and total (combined) scores.

There are other methods for investigating nystagmus. Caloric testing involves irrigating the ear with fluid several degrees above or below body temperature. Surface electrodes that can be placed at the outer canthus of each eye and forehead (ground), or above and below one eye (for vertical measurement), record nystagmus electronically. This electronystagmographical (ENG) pickup and recording mechanism may be used to record a postrotary response with the stimulus provided by a revolving chair or board. The mechanism of the SCPNT as described previously requires direct observation and subjective timing. ENG provides a written record, is more reliable in discerning eye movement often missed by direct observation, can distinguish between true nystagmus and orienting responses, and can provide additional information besides excursion and duration of nystagmus. However, use of ENG with caloric or rotational stimulation requires extensive training and is relatively expensive.

Keating (4) correlated the duration of postrotary nystagmus as measured by the SCPNT and ENG and found, in a sample of 20 normal female adults aged 25 to 30, a correlation of .90. The SCPNT then is as accurate as ENG testing. The noninvasiveness of the technique, the lack of need for expensive equipment, and the short time required for testing, makes the SCPNT appropriate for use by therapists with a variety of patient populations. Therapists, however, need to be aware of the necessity for proper administration.

Functioning of the vestibular system as measured by SCPNT is not known to be affected by age. Ottenbacher (5) did not directly investigate the relationship of SCPNT and age, but did find that the SCPNT score was the single best predictor of ability to assume the prone extension posture and that the prone extension posture was the variable least affected by age. Ayres (2) found a slight sex difference; females evidence slightly shorter duration of nystagmus.

In 1976, Ayres (3) documented the importance of deficits in vestibular functioning in minimal brain dysfunction children. In the study, 50 percent of the sample of learning-disabled children showed depressed vestibular functioning as measured by the SCPNT. Those with depressed SCPNT scores improved significantly over matched controls on post-test measures of academic achievement when they were given individual sensory integration ther-

Table I
Means and Standard Deviations—Syracuse Norms. Postrotary Nystagmus Text

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apy to ameliorate their vestibular-balance dysfunction. Vestibular system dysfunction has been shown to lead to form and space perception problems because of the strong basis the vestibular system gives right hemisphere functions (1,6). Vestibular system dysfunction, or tactile system dysfunction, or both, can also lead to difficulties in motor planning (dyspraxia) (1,3).

deQuiros has also documented the importance of vestibular deficits in learning-disabled children. Beginning in 1957, he tested over 1300 babies in Buenos Aires and has found that those who showed vestibular areflexia to caloric stimulation at birth later developed learning problems (7, 8).

In standardizing the SCPNT, Ayres found the test-retest reliability between two tests given, at least one week apart, to 42 normal children to be .834. Kimball (6), involving 63 normal children and a 2.5-year interval between tests, found a test-retest reliability of .80. Mean age at first testing was 72.2 months; mean age at second testing was 103.2 months (6). In spite of these two rather good test-retest reliabilities with normal children, some concern about reliability continues. This concern comes mainly from therapists working with dysfunctional populations and may reflect the variability of impaired nervous systems or, in some cases, inexperience in testing. Although the test is brief, extensive practice is required in order to give it accurately, and a therapist using the test should be certified in SCPNT administration.

Of concern also is the small number of children involved in Ayres' normative sample. Ayres tested 226 children, ages 5 through 9, from greater Los Angeles. Because a larger, more diversified normative sample is needed, particularly since the establishment of the importance of the SCPNT in sensory integrative diagnostics, this normative comparison study was undertaken.

Method

Subjects. Two hundred and twenty (222) children, kindergarten through fourth grade, aged five through nine years, all from a suburban Syracuse, New York elementary school, were given the SCPNT during December 1978 and January 1979. The school was chosen because its ongoing program of coordination screening eliminated the need to obtain individual permission slips from the parents of each child in the study. There were several children of oriental descent, but no Black children in this middle class sample (consistent with Ayres' sample). Children with specific physical problems such as cerebral palsy, spina bifida, hearing loss, myringotomies, or seizure disorder were not included. Although this exclusion may appear to bias the sample, children with these conditions were eliminated from the study to make the sample as much like Ayres' sample as possible. There were 105 females and 117 males in the sample. The females had a mean age in months of 89.94, SD 17.44, the males 97.34, SD 17.50. Total mean age was 91.20, SD 17.47.

Procedure. The SCPNT was administered in the standardized fashion in a dimly lighted room with 20 seconds between rotations. All the children sat for from 3 to 5 minutes before testing, in case the previous activity might affect their responsiveness to testing. Most children were called out of gym class or play time. A few were taken out of class.

Results

The means and standard deviations for the duration of postrotary nystagmus (PRN) for children divided by age and sex are shown in Table 1. Three 2 by 5 ANOVAs were used to compare the mean number of seconds of nystagmus after rotation to the left, to the right, and the total by age in months, and by sex (see Table 2). There were neither significant differences in the mean number of seconds after rotation to the left, to the right, nor in the total number of seconds when boys were
compared by age, girls were compared by age, and boys and girls were compared with each other. An $F$ test was done to compare the total variance between boys and girls.

$$F(104, 116) = 1.34, p > .05.$$ No significant difference was seen.

The Syracuse data were compared with Ayres' original standardization data (the means and standard deviations for the SCPNT are available in the manual) (2). Inspection of the data revealed that most of the Syracuse means and variances were somewhat higher than those of Ayres. A series of $t$ tests was used to compare the means, and $F$ tests were used to compare the variances of the two samples: Ayres' data and Syracuse data (see Walker and Lev (9) for a description of the procedures used). The significant differences can be seen in Table 3.

In examining Ayres' data (2), it was evident that she found the females significantly more variable than the males. Her finding necessitated separate SCPNT standard scores for males and females. No significant sex difference in variance was found in the Syracuse study, permitting a single table of norms. These standard scores are shown in Table 4.

Discussion

The differences in the norms affect interpretation of the SCPNT. Unlike many standardized tests, on the SCPNT, scores both above and below one standard deviation are considered dysfunctional, as both depressed (below -1.0) and prolonged (above +1.0) PRN can indicate a problem. Since no significant variation between boys and girls was found, the first difference between the California and Syracuse norms is that there is only one standard score table (Table 4) for the Syracuse norms. Because the standard deviations on the Syracuse norms were larger and the 0 point on the scale cannot be lowered (one cannot judge the degree of 0 or below with this test), the effect of the slightly higher means and the larger standard deviations is to raise the cutoff point for diagnosing prolonged postrotary nystagmus. The cutoff point for diagnosing depressed postrotary nystagmus is approximately the same (See Table 4). With a higher cutoff point, one must be careful in diagnosing prolonged nystagmus, because children with borderline scores could have prolonged PRN using the California norms and high normal PRN using the Syracuse norms. To see this easily one can visually compare the overall means and standard deviations of the California and Syracuse data (Table 5).

Although there was no signifi-
cant difference by sex or age in the Syracuse data, inspection of the data revealed an interesting irregularity. The difference in means and standard deviations between 7- and 8-year-old girls was larger than the remainder of the differences. The 8-year-olds had shorter duration nystagmus and the 7-year-olds, longer duration nystagmus than the rest of the sample, though not significantly so.

There were two children in the 8-year-old group with extremely low nystagmus scores. One child scored zero in both directions, a score that Ayres did not see in her sample. This child was an exceptional gymnast and an excellent student. It is possible that she had learned to inhibit postrotary nystagmus. The other child had zero duration to the left and 3 seconds to the right; she was a well-coordinated, intelligent child with no learning problems. These two low scores tended to depress the duration of nystagmus in the 8-year-old sample.

The 7-year-old girls tended to have longer duration of nystagmus than the other age groups. When the gym teacher and nurse were asked about differences between children of any ages, they both voiced concern about the 7-year-old girls who appeared heavier, generally, and had poorer skills in gym than the rest of the school population. The slight irregularity in the data thus can be accounted for by these unusual scores.

Implications for Occupational Therapy

The normative comparison of the SCPNT revealed sufficient differences between the two sets of standardization data to suggest either regional differences or differences due to small sample size, therefore regional norming appears indicated. It is possible that the differences between the two sets of data would not be significant if larger samples were used. However, if there are regional differences in SCPNT scores, this definitely needs to be investigated.

The sensory integration tests and clinical observations also need to be researched more fully and their theoretical basis expanded so we are better able to understand what aspects of the central nervous system we are assessing and how these assessments relate to each other. Occupational therapists and others using sensory integrative testing and motor assessments need to realize the incredible complexity of the parameters they are attempting to measure and understand that they are only at the frontier of explaining interrelationships.

Conclusions

Normative comparison of the SCPNT was undertaken using 222 normal children from a suburban Syracuse, New York elementary school. Approximately 40 children at each age level 5 through 9 were used. No differences were seen in postrotary nystagmus scores by sex, age, or sex-age interaction. Trends revealed were similar to those found by Ayres in her original standardization (2) with the exception that differences in variances between males and females were not significant, allowing one standard score chart.

Comparison was made between Ayres’ standardization data and the Syracuse standardization data. For the most part, the Syracuse means and variances were significantly higher than what Ayres (2) reported, which had the effect of shifting upward the +1.0 cutoff point for diagnosing prolonged nystagmus. This is an extremely important finding for occupational therapists using the SCPNT as it can substantially change a diagnostic picture.

Acknowledgments

The author thanks the staff and students of Onondaga Road Elementary School, Camillus, New York, for their cooperation, and especially Christy Browne, Physical Education Teacher. Dr. William Meyer from Syracuse University served as project consultant, and Dr. Edward O'Connell from Syracuse University served as statistical consultant. Introduction reprinted by permission of the Center for the Study of Sensory Integrative Dysfunction, 1980.

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