Application of an ATNR Rating Scale to Normal Preschool Children

(diagnosis, occupational therapy, reflex, tests)

Ruth Zemke

An Asymmetrical Tonic Neck Reflex Rating Scale was applied to data from 40 normal 3- and 5-year-old children. Raw scores representing degrees of elbow flexion in response to passive head rotation were converted using a four-point scale, and the results of eight trials in quadrupedal posture were summed. These results reinforce those of previous studies: the mean inhibition scores increased with age, whereas the variance decreased. Results also support further development of normative data for clinical use of the scale.

Research reports of the Asymmetrical Tonic Neck Reflex (ATNR) in normal children have focused on the magnitude of the ATNR response rather than its presence or absence (1-5). The commonalities across studies have suggested a quadrupedal test posture and multiple lateral head rotations as reliable measures (1, 2, 4, 6) of the ATNR. Slow, gentle, passive rotation was used in several studies (1-3, 5, 7). The common measure of a child's response is the degree of elbow flexion in response to head rotation. Parmenter (5, 6) suggested that up to 30° of elbow flexion on repeated measures in first and third graders could be considered normal and that more flexion could be an indication of decreased ability to inhibit the reflex. If a normal range statistically can be considered ±1 standard deviation (SD), the results of Parr et al. (4) are similar. These results suggest an average upper limit of 30° to 31° under relaxed conditions for children aged 3 to 9 years. Zemke (3) reported similar normal scores (1 SD above the mean) of 32° elbow flexion for 5-year-old children; however, normal scores in 3-year-old children (1 SD above the mean) reached 42°.

However, the accuracy of research measurements (4, 5, 8) is difficult to duplicate under clinical conditions. The use of exact numerical scores in research suggests more precision than is currently supported by available data. Clinical application of reported research measures of the ATNR is not currently practicable. However, the four-point rating scale suggested by Parmenter (6) offers a clinical tool with potential usefulness for observing children suspected of maturational lags or neurological dysfunction and comparing the amount of inhibition of the reflex with that of a group of normal children. In addition, the ATNR Rating Scale incorporates qualitative evidence of lessened inhibition of the ATNR through behavioral descriptions accompanying the degrees of flexion. Thus, the scale is an excellent beginning and Parmenter's (5) reanalysis of earlier data offers a beginning guide to expectations for first and third grade children (approx 6 and 8 years old, respectively). This paper reports on the reanalysis and application of the ATNR Rating Scale to data on 20 normal 3-year-old children and 20 normal 5-year-old children's ATNR responses.

Ruth Zemke, PhD, OTR, is Associate Professor, Occupational Therapy Department, University of Southern California, Downey, CA 90242.
The subjects are described in more detail in other reports (1, 3).

The ATNR Rating Scale

Parmenter (6) describes the revision of a six-point rating scale. The six categories from the earlier scale ranged from category 1 (lack of inhibition causing obvious loss of balance when elbow flexed more than 60°) to category 6 (no visible change in muscle tone). While categories 4 (elbow flexion of less than 30°) or 5 (slight muscle tone changes) were seen frequently, category 6 (no flexion or visible change in tone) was rarely seen. Categories 4–6 were combined when the scale was revised. My findings (1), in which seven of eight trials produced measurable changes in elbow flexion, also support the elimination of category 6. In addition, a response magnitude of approximately 30° (including scores about 1 SD from the mean) suggests that categories 4 and 5 (slight muscle tone changes to 30° flexion) do not differentiate in any significant way (3, 4). The combination of categories 4–6 into a single category (category 4) demonstrated differences of equal statistical significance to the original six-point scale between Parmenter’s first and third grade children (5, 6).

The Revised Scale

The revised four-point scale is as follows (6, p 463–464).

1. obvious loss of balance occurs when elbow flexes more than 60°, forearm may touch surface, contralateral leg may leave surface, or both. The quadrupedal position may not be maintained, causing collapsing of the body;
2. elbow flexes more than 60°, causing depression of the shoulder and trunk movement, no balance loss, and the contralateral leg does not leave the surface; 3. elbow flexes 31° to 60°, evidenced by a noticeable flexion of the elbow with little shoulder depression; 4. elbow flexion up to 30°, or no elbow flexion but slight visible muscle tone changes, or no elbow flexion with no visible muscle tone change.

Procedures

Because this report involves reanalyzing the data I collected before Parmenter's (6) scale revision, the testing procedure is not an exact duplication of her standard procedure. However, the similarity in procedures was strong enough to consider them comparable.

The procedure was as follows. The examiner faced the child, who assumed a quadrupedal position with shoulders and hips flexed to 90°. The child's hands and knees were beneath his or her shoulders and hips; elbows were extended but not locked, and hands were flat with fingers extended. The child's head began in neutral position. The examiner gently rotated the child's head laterally to 90° (or until resistance is felt close to but less than 90°) where it was held briefly. The head was then rotated back to midline, and the examiner paused briefly again. Eight measures (4 rotating the head toward the left shoulder and 4 toward the right) were made.

Differences from Parmenter's (6) procedure included the following points. The child's knees were directly beneath his or her hips, not 15.24 cm (6 in.) apart. Instead of using the shoulder line as a limit to rotation, I used a pendular electrogoniometric reading of 90° or resistance to further movement at somewhat less than 90° for the limit.

Another procedural difference was in the testing sequence. Parmenter (6) describes an alternating sequence of left and right lateral head rotation, whereas the data for this report were collected with random presentation of head rotation sequence in an attempt to control for possible central nervous system sequence preference or bias. Also, half of the trials used a blindfold and half did not. Because the presence or the absence of a blindfold had no statistically significant effect on the ATNR response, these scores were all included in the analysis.

Although procedurally there was little impact, there was a measurement instrumentation difference. We used electrogoniometers to provide a continuous record of head and elbow movement, whereas Parmenter (6) used a manual goniometry.

Parmenter feels that the subject’s head must remain in lateral rotation for at least five seconds to allow the reflex to occur; however, this hold was not part of our procedures. A short pause (approx 2 sec) occurred, but the electrogoniometric measurements that were continuously recorded did not suggest any change in response during that time period. I did not observe any data loss by this procedural difference. Further research documentation of clinical impressions relating to time (rate of rotation and holding stimulus head rotation) have been recommended (2, 8, 9), and microcomputer system analyses of electrogoniometric measurements should make this possible (9).

Analysis and Results

Each response is scored 1–4 based on the ATNR Rating Scale category, and the sum for eight trials is recorded. The maximum possible score is 32, which indicates inhibition of the ATNR sufficient to limit elbow flexion to less than 31° across all trials. Table 1 presents the resultant descriptive data.

The mean scores demonstrate
Table 1
ATNR Inhibition Rating Scale Scores of Normal Preschool Children

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean Age</th>
<th>Range of Scores</th>
<th>Mean Score</th>
<th>SD</th>
<th>Scores of Inhibition of ATNR (±1 SD)</th>
<th>Scores of Decreased Inhibition of ATNR</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 yr olds</td>
<td>20</td>
<td>3 yr, 6 mo</td>
<td>21-32</td>
<td>26.80</td>
<td>3.75</td>
<td>23-32</td>
<td>&lt;23</td>
</tr>
<tr>
<td>5 yr olds</td>
<td>20</td>
<td>5 yr, 4 mo</td>
<td>23-32</td>
<td>28.65</td>
<td>2.50</td>
<td>26-31</td>
<td>&lt;26</td>
</tr>
</tbody>
</table>

ATNR, Asymmetrical Tonic Neck Reflex.

the expected increase in inhibition (decreased ATNR response) with age. These mean scores also fit the trend of scores reported by Parmenter (6) of first and third graders (mean = 30.33 and 31.61, respectively). The range of scores and SDs represents the dispersion of scores. They too reflect a trend. When considered with Parmenter’s data, the low end of the scoring range gradually raises with age and the standard deviation decreases; this represents an increased cluster of scores around the mean with less variation.

Parmenter (6) suggests that a score which is more than 1 SD below the mean score represents diminished inhibition of the ATNR compared with the sample group. Table 1 also presents these scores based on the data from 40 normal preschoolers. The scores representing levels of decreased inhibition of the ATNR were as follows: less than 23 for 3-year-old children and less than 26 for 5-year-old children. These decreased inhibition scores continue a trend of age-related change when compared with the scores representing decreased inhibition for Parmenter’s (6) first (<28) and third graders (<31).

Summary

An ATNR Inhibition Rating Scale described by Parmenter (6) was applied to data obtained from 20 normal 3-year-old children and 20 normal 5-year-old children. Although some procedural differences were apparent, they presented no apparent impact when the results were compared. Trends of increased inhibition and decreased dispersion of scores were evident in the descriptive statistics for the preschool children and Parmenter’s elementary schoolchildren. Neither sample is sufficient to provide normative data; however, the results of the study can serve as pilot works. The clinical potential for such a scale, when based on larger samples and for similar measures of inhibition of other reflexes, is great. Such normative development of a scale for clinical assessment of central nervous system functional maturation level is needed to provide a firm basis for clinical identification of dysfunctional children.

REFERENCES