The Effects of Keyguard Use and Pelvic Positioning on Typing Speed and Accuracy in a Boy With Cerebral Palsy

Diane J. McCormack

Key Words: cerebral palsy • computers (use in therapy) • pediatric occupational therapy

The effects of keyguard use and pelvic positioning (neutral versus posterior tilt) on typing proficiency was studied in an 8-year-old boy with athetoid and spastic cerebral palsy. Speed and accuracy were measured with the Mastertype computer software program (Zweig, 1984). The results showed that the use of a keyguard increased the subject's typing accuracy and decreased his speed. Neither neutral nor posterior pelvic positioning appeared to have a significant effect on typing speed or on accuracy.

Adaptive Equipment

A keyguard is a simple device that fits over a keyboard; it has holes that are positioned over each key to guide a finger, mouth stick, or head pointer (Closing the Gap, 1983). The keyguard's purpose, according to marketing literature, is to increase a child's typing skills (TASH, 1983). For the child with athetoid cerebral palsy, the keyguard may help to increase typing speed and accuracy by providing a more stable base for the hands.

The drawback of adaptive equipment such as a keyguard is that it limits sensory feedback (Bergen & Colangelo, 1985). When using the keyguard, the child's visual access to the keyboard may be decreased, thus making location of the keys difficult. Alterations of tactile and kinesthetic feedback also may occur, because the child is pressing through a hole to access the keys. Keyguards are frequently prescribed by occupational therapists, although their effectiveness for children in various diagnostic categories has not been documented.

Position

A general principle in human development is that control of proximal musculature precedes that of distal musculature (Hopkins & Smith, 1983). Therapeutic positioning of proximal pelvic alignment may facilitate distal fine motor skills. According to the work of neurodevelopmental physical therapists such as Salek (1982) and Bly (1983), proximal pelvic-spinal alignment and control influences the distribution of postural tone and the development of normal righting reactions. Neutral pelvic positions are needed for postural adaptations that enable the normal use of the hands for a functional skill such as typing. A posterior pelvic tilt appears to be counterproductive to functional hand use, because the pelvis cannot provide the necessary support base.
Salek (1982) and Bergen and Colangelo (1985) discussed the influence of pelvic position on spatial orientation and function at a task. Most academic tasks are performed while sitting. When the pelvis is in a neutral position, it is in an optimal state of readiness to move; it can tilt slightly in any direction to facilitate trunk and extremity stability and mobility. The child’s orientation to the task is forward in space. If the pelvis is in a posterior tilt, it pulls the child backward. To compensate, the child may flex the trunk forward. The visual monitoring of work can then be very difficult, unless the child tilts the head back so the neck is hyperextended. Thus, a posterior pelvic tilt may cause improper body alignment, which decreases task performance.

**Hypotheses**

I hypothesized that neutral pelvic positioning, as compared with posterior pelvic positioning, would provide for greater typing speed and accuracy. With the pelvis in a neutral position, the child is in an optimal postural position for typing, which in turn should facilitate typing skills, as measured by speed and accuracy. I further hypothesized that the use of a keyguard would also provide greater typing speed and accuracy. Although a keyguard could decrease or alter the sensory input to the child’s fingers, I thought that the additional stability provided to the child’s hands would increase typing speed and accuracy.

**Method**

**Subject**

The subject was an 8-year-old boy with nonprogressive encephalopathy (cerebral palsy) manifested by athetoid and spastic quadriplegia, developmental language disorder (expressive type), severe oral motor involvement, and a possible learning disorder in reading. He used a communication board, an electronic communication aid, and limited vocalizations and gestures as primary means of communication. His secondary means of communication was typing on the computer keyboard. The subject could copy simple sentences but had difficulty spelling when a sample was not provided.

The following developmental ages were obtained from the subject’s medical records. The assessments used were noted when they appeared in the therapy progress notes. In speech therapy, the subject’s receptive vocabulary age level was 7 years 10 months and his expressive vocabulary age level was 4 years 5 months. When given credit for communication board use, the subject’s expressive language age level was 5 years 9 months. In physical therapy, his approximate developmental age level in gross motor skills, according to nonstandardized developmental scales, was 12 months. In occupational therapy, the subject’s fine motor skills, as measured by an adaptation of the Peabody Developmental Motor Scales (Folio & Fewell, 1983), were at a basal age of 2 to 3 months and a ceiling age of 36 to 41 months. His grasp was at the age level of 10 to 11 months, with difficulty in midline orientation and grasp of small objects. His hand use, eye-hand coordination, and manual dexterity were at the age level of 30 to 35 months. Overall problem areas due to a mixture of athetosis and spasticity were midline orientation of the hands, forearm rotation, controlled release, and bilateral hand use.

**Equipment**

An Apple IIe computer was used. Mastertype (Zweig, 1984) was the software selected to measure speed and accuracy in typing for three reasons. First, the game speed can be altered in either its normal mode (in which the player hits the space bar after each word or set of letters is typed) or beginner’s mode (in which the space bar does not have to be hit after typing the words or set of letters). The ability to decrease the speed of delivery was important to allow the subject enough time to give a motor response. Second, the program gives consistent, detailed feedback on speed and accuracy. Third, once the program identifies a user’s typing speed, it will adjust the speed in the next turn.

The game’s objective is to defend a spaceship against an enemy attack. A spaceship is in the center of the computer screen, and a letter or symbol is in the screen’s top right, bottom right, top left, and bottom left corners. The player must type each of these letters in any order to release the spaceship’s force against the enemy letter and its invading missiles. The player is encouraged to type the words quickly to blow up the enemy letters. If the player types slowly,

<table>
<thead>
<tr>
<th>Session</th>
<th>Pelvic Position</th>
<th>Keyguard</th>
<th>Speed (Letters per min)</th>
<th>Accuracy (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Neutral</td>
<td>Absent</td>
<td>4</td>
<td>33</td>
</tr>
<tr>
<td>2</td>
<td>Posterior tilt</td>
<td>Absent</td>
<td>9</td>
<td>38</td>
</tr>
<tr>
<td>3</td>
<td>Posterior tilt</td>
<td>Absent</td>
<td>7</td>
<td>41</td>
</tr>
<tr>
<td>4</td>
<td>Neutral</td>
<td>Absent</td>
<td>6</td>
<td>42</td>
</tr>
<tr>
<td>5</td>
<td>Posterior tilt</td>
<td>Present</td>
<td>2</td>
<td>83</td>
</tr>
<tr>
<td>6</td>
<td>Neutral</td>
<td>Present</td>
<td>2</td>
<td>90</td>
</tr>
<tr>
<td>7</td>
<td>Neutral</td>
<td>Present</td>
<td>2</td>
<td>90</td>
</tr>
<tr>
<td>8</td>
<td>Posterior tilt</td>
<td>Present</td>
<td>2</td>
<td>84</td>
</tr>
</tbody>
</table>

*Note: Neutral position = 90° hip flexion; posterior tilt position = 65°–70° hip flexion.*
Table 2
Two-Way Analysis of Variance for Speed and Accuracy on the Mastertype Program

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>Speed</th>
<th>Accuracy</th>
<th>Speed</th>
<th>Accuracy</th>
<th>Speed</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keyguard</td>
<td>1</td>
<td>40.50</td>
<td>4,656.12</td>
<td>40.50</td>
<td>4,656.12</td>
<td>40.50</td>
<td>409.50</td>
</tr>
<tr>
<td>Pelvic position</td>
<td>1</td>
<td>4.50</td>
<td>30.13</td>
<td>4.50</td>
<td>30.13</td>
<td>4.50</td>
<td>3.18</td>
</tr>
<tr>
<td>Position X Keyguard</td>
<td>1</td>
<td>4.00</td>
<td>45.50</td>
<td>4.00</td>
<td>45.50</td>
<td>4.00</td>
<td>4.50</td>
</tr>
<tr>
<td>Within</td>
<td>4</td>
<td>3.50</td>
<td>4,747.87</td>
<td>3.50</td>
<td>4,747.87</td>
<td>3.50</td>
<td>3.50</td>
</tr>
<tr>
<td>Total</td>
<td>7</td>
<td>53.50</td>
<td>4,747.87</td>
<td>~</td>
<td>~</td>
<td>~</td>
<td>~</td>
</tr>
</tbody>
</table>

* (Zweig, 1984).
* p < .01

the letters keep shooting at the spaceship. At the end of each turn, the program calculates how fast the player typed, the number of letters typed, and the number of mistakes made, then calculates the percentage of accuracy and percentage of error.

Procedure

Data were collected over 4 weeks. The subject typed twice a week (Tuesday and Thursday) for half-hour sessions, for a total of eight sessions. The study environment—the subject's elementary school—held moderate auditory and visual distractions.

The subject was positioned in his electronic three-wheel scooter with his pelvis either in a neutral position (90° hip flexion) or in a posterior tilt (65°-70° hip flexion). Posterior tilt was his preferred sitting posture during typing. Once his pelvis was aligned and goniometric measurements were taken, he was passively maintained in the posture with a seat belt and weights for support. The tray and steering mechanism were removed from the scooter for positioning at the computer. He was then presented with a lesson from the Mastertype program. The beginner's mode was used with sound effects and with the speed set at one to two words per minute. The subject was instructed to look at the letters that appeared in the four corners of the computer screen and to type them as quickly as possible. When the keyguard was absent, the subject hit the keys with the eraser of a pencil held in his left hand. When the keyguard was present, he hit the keys with the index finger of his left hand.

Results

Table 1 shows the design used to sequence the sessions and the speed and accuracy scores.

Because a visual examination of scores is frequently unreliable or inconsistent (Jones, Weinrott, & Vaught, 1987; Ottenbacher, 1986; Wampold & Furlong, 1981), the observed differences were subjected to a two-way analysis of variance (see Table 2). The results indicate that the use of the keyguard increased accuracy (p < .01) and decreased speed (p < .01).

Pelvic positioning did not appear to have a significant effect on either speed or accuracy.

Discussion

The use of the keyguard in this study appeared to have the most effect on the subject's typing skills. He was able to increase his typing accuracy, but not without compromising speed. Thus, the added stability provided by the keyguard appears to improve accuracy. When a computer is used for communication, accuracy is imperative for the proper exchange of information. Speed is also important, however, for the timely exchange of information. For this child, an emphasis on accuracy in the classroom along with the provision of activities and therapy to increase his typing speed will help him achieve the long-term goal of developing communication skills for functional interaction in the community.

The posterior tilt appeared to be as functional for this child as the neutral pelvic alignment. The pelvic position did not appear to affect function significantly. Improvements in the study design, including greater precision in the interpretation of the relationship between the variables used in the study, would involve prior baseline measurements of speed and accuracy and the collection of data over a longer period of time. Moreover, further research is required to look at the long-term effects of pelvic position on typing speed and accuracy. Studies to identify the most effective developmental age at which to train for typing skills and the sequence in which to train for typing speed and accuracy would also be beneficial.

Acknowledgments

I thank Bruce J. Chaisson and Dr. John Williams for their statistical advice and Dr. Myrna R. Olson and Dr. Sara Hanhan for their assistance.

This study was done in partial fulfillment of the requirements for the degree of master of special education from the University of North Dakota, Grand Forks, North Dakota.

Financial support for this study was provided by the Scholars in Residence Program of the American Occupational Therapy Association, Rockville, Maryland.
References


Related Reading