The Effect of Music on Head Posturing of a Student with Cerebral Palsy: A Case Study

V. Timmons, T. F. McLaughlin, and V. Kinakin

This study investigated the effects of music on the head posture of a profoundly handicapped cerebral palsied individual. An ABCABC single case design consisting of two baseline conditions, two treatment conditions (physical assistance which activated music), and a third condition. Head raising contingent on music was used to evaluate the effects of the treatment procedures. The subject wore a mercury switch device attached to headphones secured to a baseball hat. The mercury switch activated the music. A digital tape counter monitored the length of time the head was raised. Results indicated that music became an effective reinforcer for head lifting. Data were also collected on number of head lifts during feeding. An improvement during feeding was also evident. Questionnaires given to teachers, family, and the respite care worker demonstrated that the program had a slight effect on significant others’ perceptions and on the subject’s awareness of his environment.

The number of children with disabilities served in a classroom setting has increased dramatically (Bigge, 1993; Heward & Orlansky, 1992; Kirk & Gallagher, 1994). The passing of Public Law 94-142 and Individuals with Disabilities Education Act (IDEA) mandated that schools integrate students with special needs (Hallahan & Kauffman, 1994; Heward & Orlansky, 1992; Jellison, 1977). The Mills case secured the right of all individuals, despite their degree of impairment, to an appropriate education (Alley, 1977). Teachers are responsible for implementing effective programs for children with severe disabilities. They need programs to model and access to equipment that is easily constructed and effective in a classroom situation (Bigge, 1993).

The first significant stage in a child’s motor development is that of mid-line orientation and the start of head control. Both of these activities make it possible for the baby to begin to make contact with his/her environment. By definition and common usage, cerebral palsy is a non-progressive disorder of movement or posture beginning in childhood, due to a malfunction or damage of the brain (Bigge, 1993; Bleck, 1975). When observing the motor development of the cerebral palsied child, the head control is often delayed and abnormal (Finnie, 1975). Non-traditional teaching methods may need to be implemented to develop this behavior (Bigge, 1994).

The use of music as a reinforcer has been used extensively for persons with disabilities. Music can be administered and withdrawn immediately, and it may be paced continuously thus making possible a longer period of response (Metzler, 1974). Presentation of music listening strengthens the auditory attending processes and brings the subject one step closer to accepting verbal reinforcers. Music also eliminates many of the problems found with using food as a consequences (Saperston, 1980). Also, many severely handicapped individuals with severe cerebral palsy have difficulty in swallowing.

Studies which focused on the use of music for children with cerebral palsy have generally reported positive outcomes (Michielutte, 1974). Also, a mercury switch has been widely used with music for people with severe handicaps. Mercury switches can promote correct head posturing (Ball & McCrady, 1975; Wolfe, 1980). Earphones cut down on distracting noises and help the subjects to be more aware (Greenwald, 1978). In the present research, the behavior that was attempted to be developed was that of head posturing in an individual with cerebral palsy using music as a reinforcer. A treatment phase was implemented using physical assistance to teach the connection that erect head position was contingent on music. The research project was also carried out in a special education classroom in a regular elementary school, rather than in an institution or special day school. Finally, a
measure of social validity or clinical significance (Wolf, 1978; McLaughlin, 1981) was obtained from the subjective impressions of persons who worked with the student, as to changes in the participant’s behavior.

Method

Participant and Setting
The participant was a seventeen-year-old male with cerebral palsy. He was also clinically diagnosed by medical doctors with microcephaly, profound mental retardation, spasticity, and quadriplegia. The participant spent the school day in a Mulholland seating system. This allowed him to be comfortable throughout the school day. He received physiotherapy maintenance treatment twice daily. The physical therapist felt that the subject was physically able to exhibit an erect head position, but due to the severity of the cerebral palsy, emitted little voluntary behavior. Music was selected as a reinforcer because the subject’s auditory sense was strongest. This was supported by the parents’ and physiotherapist’s recommendations.

The study was conducted in a segregated classroom in a public elementary school in rural British Columbia, Canada. The participant’s classroom contained four additional students who were able to work independently. The data were collected during math period (10:30 a.m. and 1:00 p.m.), which was a quiet, structured time.

Apparatus
A mercury switch head device was used to monitor erect head position (See Figure 1). The switch was attached to Walkman head phones sewn on a baseball cap which insured the head phones were stable (See Figure 2). The head phones plugged into a small, pocket-sized Sony tape recorder that rested on the subject’s lap. Tape recorded music was produced when the mercury wasn’t touching a wire which activated the relay, which turned off the music and stopped the digital tape counter. A stopwatch was used to time the program to exactly ten minutes.

Dependent Variables and Measurement Procedures
The first dependent variable was the length a tape ran as measured by a digital tape counter on the tape recorder. The counter was set at zero before each session, and the number on the digital tape counter was recorded at the conclusion of each session. Data were gathered in the morning and afternoon for a total of 20 minutes. Feeding occurred after the music during the first stage of the program and before the music, when the procedure was repeated.

During the treatment phase, the teacher aide physically lifted the subject’s head. Both the number of head lifts and the number on the digital tape counter were recorded. The subject was fed twelve spoonfuls of food each feeding time. The number of times he raised his head or his head was erect during feeding was also recorded. Before each spoonful, the aide said the subject’s name clearly. Data were collected by a teacher’s aide. The aide kept a daily journal with the subject’s performance and the type of food provided.

Subjective Data
Questionnaires were distributed to all the significant persons (e.g., family members, teacher, and respite care worker) in the subject’s life. They were asked to rate the subject’s general awareness of his environment and his alertness. People received the same questionnaire at the beginning and the end of the study. The questionnaire employed can be seen in Figure 3.

Experimental Design and Conditions
An ABCABC single case design (Barlow & Hersen, 1984; Kazdin, 1982) was employed to examine the effects of music contingent on erect head posture. A description of the experimental conditions follows.

Procedure
Baseline 1 and 2. During this condition the teacher aide collected data on how often the subject’s head was erect. Data were collected by scoring the number on the digital tape counter at
Figure 2. Walkman head phones attached to a baseball cap.
Figure 1. Mercury switch head device
1. How often does lift his head voluntarily? -circle-
   - Not at all  - Sometimes  - All the time
   Not at all 2 3 4 5

2. Does lift his head more often during specific times of the day -check-
   - Yes  - No
   If answer is yes, specify:

3. How would you rate his overall awareness of his environment? -circle-
   - Not aware at all  - Aware sometimes  - Always aware
   Not aware at all 2 3 4 5

4. Are there certain times when seems more aware? -check-
   - Yes  - No
   If answer is yes, specify:

5. How would you rate his overall alertness during the day? -circle-
   - Not alert at all  - Alert sometimes  - Always alert
   Not alert at all 2 3 4 5

6. Is more alert during certain times of the day? -check-
   - Yes  - No
   If answer is yes, specify:

---

Figure 3. Questionnaire used to rate the subject's general awareness and alertness.

the end of a ten-minute session. A blank tape was used. The subject was fed before the baseline data were taken during the first baseline condition, and following the program during the second baseline condition. Baseline data were gathered for four weeks during the first phase and for three weeks during the second baseline phase.

**Physical assistance.** The treatment condition consisted of the teacher aide physically raising the subject's head to activate the music. A tape with music was used during this phase. If the subject dropped his head, it was lifted again. The sessions were twice each day for a ten-minute duration at 10:30 a.m. and 1:00 p.m. The feeding was after the treatment for the first stage and before the treatment during the second stage. Both the number of physical prompts and length of time the head was lifted were recorded from the number on the digital tape counter. The first response contingent on music ran two weeks and the second five weeks.

**Follow-up.** To assess the maintenance of treatment effects, data were collected five weeks after the research project was completed, for six days, five weeks after the research project. Follow-up data were collected the same as Baseline 1 and 2.

**Reliability.** Reliability of measurement was taken by another teacher in the building three times a week. An independent scoring of the number on the tape recorder was made.
For the number of head lifts on whether or not the subject's head was erect, a simultaneous but independent tally was made. The speech therapist randomly dropped in to assess if the program was carried out as outlined. If the number on the digital tape counter and number of head lifts were found to be consistent by all three people, this was defined as an agreement. Any difference was defined as a disagreement. Reliability of measurement for the length the digital tape counter traveled and the number of head lifts was always 100 percent between the speech therapist and the classroom teacher.

Results

Tape Length
There was a marked increase in the length of time the subject's head was raised at the completion of the study. As Table 1 indicates, the mean length tape was low during both baseline phases.

During the first Physical Assistance phase, the average length that the tape ran was 71.3 (range 66 to 156). The use of Contingent Music without physical prompts generated a decrease in the mean length of time that the tape ran (Mean= 5.6; range 0-53). During the second Physical Assistance phase, a reduction in the mean length of time the tape ran was noted, especially when compared to the first Physical prompting phase 52.6 (range 63-175). The last phase (Response Contingent Music), the mean length of time the tape ran increased to 46.1. As Charts 1 and 2 show, there was a great deal of variability in the subject's performance.

Head Raising During Feeding
There was gradual improvement in head raising during feeding. The first Baseline indicated the subject's head was lifted or erect on an average of 1.9 (range 1-6) during feeding. This behavior increased to 3.5 (range 1 to 10) during the Physical Assistance phase. There was an additional increase in the first Contingent Music condition to 4.9 (range 1-12). The number of times the subject lifted his head or kept it erect stabilized in the replication of the last three conditions: (a) Baselines (Mean = 4.3; range 2-9), (b) Physical Assistance 4.4 (range 1-10) and (c) Contingent Music 4.5 (0 to 12). Charts 3 and 4 reveal there was again variability in the subject's performance during feeding.

Follow-up
In the Follow-up condition, the length of time the subject's head was raised, as indicated by length of time a blank tape ran, decreased to a mean of 29.7 (range 0 to 122). The number of times the subject's head was erect or lifted during feeding maintained at 4.9 (range 2-7). There was still variability in the subject's performance.

Subjective Data
There was improvement in all the ratings from the first questionnaire to the second. For question 1, the average rating went from 2.3 to 2.9 out of a possible 5. Question 2 changed from 5 yes to all yes (7 out of a possible 7). Question 3 increased from 2 to 2.9 out of a possible 5. Question 4 increased from 5 yes to 6 yes out of a possible 7. All increases were slight, but were evident in every question. The general consensus of those surveyed indicated that the subject was more alert and aware during contact time with people.

Discussion
This study indicated that music can increase the length of time the subject's head was raised during the day. It is important to note that improvement was most evident for head raising during music in the final condition. In working with persons with severe disabilities, improvements are slight and many times difficult to identify. The program had to be carried out twice and for an extended length of time before any change was noted.

This study is similar to the study carried out by Wolfe (1980). The apparatus used in the present study was a mercury switch similar to the one Wolfe employed with slight variations in the construction. Also, headphones were added to eliminate the difficulty Wolfe encountered with outside noises distracting some of his subjects. Wolfe stated that "correct head posturing and associated movements can be promoted through the use of an assistive conditioning device such as the mercury switch head apparatus" (p. 194).
Table 1
Summary of Results

<table>
<thead>
<tr>
<th>Conditions(^a)</th>
<th>Length of Tape Runs</th>
<th>Head Raises during Feeding(^b)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Range</td>
</tr>
<tr>
<td>A(_1)</td>
<td>9.4</td>
<td>0-140</td>
</tr>
<tr>
<td>B(_1)</td>
<td>71.3</td>
<td>66-156</td>
</tr>
<tr>
<td>C(_1)</td>
<td>5.6</td>
<td>0-53</td>
</tr>
<tr>
<td>A(_2)</td>
<td>6.6</td>
<td>0-53</td>
</tr>
<tr>
<td>B(_2)</td>
<td>52.6</td>
<td>63-175</td>
</tr>
<tr>
<td>C(_2)</td>
<td>46.1</td>
<td>0-209</td>
</tr>
<tr>
<td>Follow-up</td>
<td>29.7</td>
<td>0-122</td>
</tr>
</tbody>
</table>

\(^a\) A\(_1\) and A\(_2\) = Baseline 1 and 2  
B\(_1\) and B\(_2\) = Physical Assistance 1 and 2  
C\(_1\) and C\(_2\) = Contingent Music 1 and 2

\(^b\) out of 12 possible

The results from the present study would support this statement. There was some difficulty with the subject knocking off his headphones, but use of the baseball cap eliminated that problem. The earphones were small and light and cut down on distractions. The same music tape was used during the entire program. A variety of music will be tried in consultation with a music specialist to detect any preferences. This should have been done before the project, but the music was selected on the recommendations of the family.

There was only a slight improvement of perceptions by individuals, or the social validity of the participant’s behavior change (Wolf, 1978). Since the program showed improvement at the end, the final questionnaire may have reflected that. The participant has no communication skills and often can be overlooked due to his quiet nature. If people perceive him to be more aware, they will interact more, thus, possibly encouraging more responses.

The research project also provided the teachers with a day-to-day illustration of the subject’s general health. He was often absent or too physically rigid to carry out the program. Improvements shown in head raising were indicative of improvement in his general health. The project had to be carried out for a long period of time because many days were lost during the year due to absenteeism or the subject being too physically rigid. The variability in the results indicated a fluctuation in the subject’s health. The participant’s health was reflected in the performance and therefore in the results.

The follow-up condition showed that effects from the program were still evident in feeding, but the length of time the subject’s head was raised was decreasing. The physical assist of the subject’s head may have to be done more often during the day to see more of an improvement.

The project was easy to employ in the classroom setting and gave the staff satisfaction from implementing a program that may indicate the subject’s abilities. The program was essential to constructively fill the subject’s school day. When the subject’s head is raised during the day, his peers notice and would speak to him. This may have been an additional factor in the improvement.

Music, and a device, such as the mercury switch in this study, could be used to improve head posture. As head posture improves, a program to reinforce the focusing of vision could be implemented. When the head is raised, it is easier to see and be engaged by stimuli.
DAILY BEHAVIOR CHART (DCM-SEN)

CALENDAR WEEKS

6 CYCLE-140 DAYS (20 WKS 5)

BEHAVIOR RESEARCH CO

Baseline 2

Physical Prompts

Response Contingent on music

Follow-up

COUNT PER MINUTE

SUCCESSIVE CALENDAR DAYS

SUPERVISOR

ADVISER

MANAGER

BEHAVIOR

AGE

LABEL

COUNTED

OPPOSITOR

AGENCY

TIMER

COUNTER

CHARTER
Baseline 1

\[ X = 1.9 \]

Physical Prompts

\[ X = 3.5 \]

Baseline

\[ X = 4.5 \]

Response Contingent on music

\[ X = 4.9 \]
This study can be easily modeled within any classroom setting with minimal cost and time to set up. Detailed data collection provide staff with an indication of any slight improvement.

References


