

A product of the American Occupational Therapy Association's Evidence-Based Literature Review Project

Vestibular and visual stimulation together, especially vestibular stimulation, may benefit children with Attention Deficit/Hyperactivity Disorder (ADHD)

CITATION: Arnold, L. E., Clark, D. L., Sachs, L. A., Jakim, S., & Smithies, C. (1985). Vestibular and visual rotational stimulation as treatment for attention deficit and hyperactivity. *American Journal of Occupational Therapy, 39,* 84–91.

LEVEL OF EVIDENCE: IIA1a

RESEARCH OBJECTIVE/ QUESTION

To find the relative importance of the vestibular component separate from that of the visual component of sensory stimulation.

DESIGN

| RCT | Single case | Case control |
|--------|--------------|-----------------|
| Cohort | Before-after | Cross-sectional |

RCT = randomized control trial

Split sample, Latin-square crossover study

Nonrandomized control trial

SAMPLING PROCEDURE

| | Random | Consecutive |
|---|------------|-------------|
| Χ | Controlled | Convenience |

SAMPLE

| N = 37 | M age = 7 years | Male = 27 | Ethnicity = NR | Female = 10 |
|--------|-------------------|-----------|----------------|-------------|
| | (range 5–9 years) | | | |

NR = Not reported Nonclinical sample

PARTICIPANT CHARACTERISTICS

ADHD (DSM-III)

- Rating of 24 or more of the first 6 items of the Davis Hyperkinetic Rating Scale
- Mean item rating of 1.5 or more for the Hyperkinetic factor of the 39-item Conners Teacher Rating Scale
- Ages 9 years or younger
- Normal intelligence
- Consent (parental and child)

MEDICAL DIAGNOSIS/CLINICAL DISORDER

ADHD

OT TREATMENT DIAGNOSIS

N/A

OUTCOMES

Behavioral measures after vestibular and visual rotational stimulation in children with ADHD

| Measures | Reliability | Validity |
|---|-------------|----------|
| Davis Hyperkinetic Rating Scale by teachers | NR | NR |
| Conners 39-item teacher rating scale | NR | NR |
| ADHD checklist (DSM-III) filled out by teachers | NR | NR |
| Davis Hyperkinetic Rating Scale by parents | NR | NR |
| Conners short-form parent's questionnaire | NR | NR |
| Bender-Gestalt | NR | NR |

NR = Not reported

Measures were collected at screening (baseline 1), before treatment (baseline 2), every 2 weeks for 12 weeks of treatment, and at the 1-year follow-up.

Outcome—OT terminology

Performance areas:

Work and productive activities

Performance components:

Psychosocial skills and psychological components

Outcome—ICIDH-2 terminology

- Activity limitations
- Impairments

INTERVENTION

Participants were randomly assigned to series of

- Vestibular-only condition
- Visual-only condition
- Control condition

Description

Vestibular only:

The participant was seated in a rotary chair with lap belt restraint in a designated position. The child wore goggles with an opaque lens and was instructed to close his or her eyes. The chair was accelerated clockwise and counterclockwise manually to 150° (25 rpm) for 1 minute each, respectively, in 3 designated positions.

Visual only:

The participant was seated in the chair (same position) motionless, wearing goggles with a clear lens, while a surrounding 3-ft-diameter optokinetic drum was spun at the same angular velocity as the chair.

Control condition

TAV (tactile-auditory-visual stimulation)

Who delivered

Not specified

Setting

Clinical setting (specially adapted van with research equipment)

Frequency

2 times a week for a total of 8 consecutive sessions

Duration

4-week period

Follow-up

1-year follow-up

RESULTS

Analysis of variance showed that the improvement from baseline 2 to follow-up was significant at p < .005 for the Davis Hyperkinetic Rating Scale and at p < .05 for the Conners 39-item scale.

- Conners scale improvement occurred during the 12-week treatment phase (significant at p < .004-.0005).
- In the vestibular-alone series, this condition showed a trend of advantage that was not matched by the visual-alone condition in its series. Improvement was greater following vestibular-alone condition than following combined or TAV conditions on all 3 scales.
- A cursory power analysis showed that, if the originally targeted 18 vestibular-alone participants showed the same trend, then the difference would have been significant (p < .05).
- The trend of vestibular-alone advantage in that series contrasts sharply with the more randomly appearing data in the visual-alone series. The visual-only condition showed just slight advantage over combined or TAV conditions. Thus, on the Conners scale sums, 20% of the total variance in the vestibular-alone series was due to differences

between treatment conditions, whereas only 1% of the variance was due to betweentreatment differences in the visual-alone series.

CONCLUSIONS

Of the 42 children who started the study, 37 completed all 3 treatment conditions.

- Impressive improvement in behavior ratings occurred between baseline 2 and the end of treatment. This improvement was sustained at follow-up more than 1 year later.
- The amount of improvement from baseline 2 to follow-up was significant, both statistically and clinically.
- The effect size calculations make a strong argument for vestibular stimulation being the most effective component of the rotary sensory stimulation. In fact, vestibular rotary stimulation alone seems more effective than vestibular and visual combined. Possibly, in the combined stimulation, the visual input has a damping or modulating effect.
- If rotational vestibular stimulation is effective for ADHD, data does not support the theory that the mechanism of benefit is through improvement of visual motor function, as measured by the Bender–Gestalt Koppitz score.
- While this study does not definitively establish that rotational vestibular stimulation benefits selected cases of ADHD, it does suggest that, if the stimulation is effective, then the vestibular stimulation is more effective than the visual.

LIMITATIONS

Conclusion that vestibular stimulation alone results in significant improvement in hyperactivity is not supported by the statistics as reported. The use of questionable statistical analyses.

Biases

| Attention | Masking/blinding | X Drop outs |
|---------------|------------------|-------------|
| Contamination | Co-intervention | |

Terminology used in this document is based on two systems of classification current at the time the evidence-based literature reviews were completed: *Uniform Terminology for Occupational Therapy Practice—Third Edition* (AOTA, 1994) and *International Classification of Functioning, Disability and Health (ICIDH-2)* (World Health Organization [WHO], 1999). More recently, the *Uniform Terminology* document was replaced by *Occupational Therapy Practice Framework: Domain and Process* (AOTA, 2002), and modifications to *ICIDH-2* were finalized in the *International Classification of Functioning, Disability and Health* (WHO, 2001).

This work is based on the evidence-based literature review completed by Erna Imperatore Blanche, PhD, OTR/L, FAOTA, and Gustavo Reinoso, OTR/L. Contributions to the evidence brief were provided by Michele Youakim, PhD.

For more information about the Evidence-Based Literature Review Project, contact the Practice Department at the American Occupational Therapy Association, 301-652-6611, x 2040.

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