

## Effect of Juggling Therapy® On Dysgraphia and Neurodevelopmental Disorders: A Single Case Study

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### ABSTRACT

This single case study examines the efficacy of jugglingtherapy® in a 12-year-old boy diagnosed with Developmental Coordination Disorder (DCD) and dysgraphia. He underwent eight sessions of jugglingtherapy®, focusing on motor sequencing, tonal relaxation, movement synchronicity, spatiotemporal organization, digital gnosis, and bimanual praxis. Pre- and post-assessments (3 years later) included the BHK French adaptation scale for handwriting abilities, revealing a significant improvement in graphomotor skills post-therapy. The study discusses the positive impact of juggling by jugglingtherapy® on cognitive functions and motor skills. Despite mixed findings in the literature, jugglingtherapy® holds promise as a complementary intervention for individuals with dysgraphia, DCD, and related neurodevelopmental disorders, requiring further research to establish efficacy, mechanisms, and optimal dosage. The study advocates for individualized approaches in clinical practice and underscores the need for rigorous methodology in future research to clarify the role of jugglingtherapy® in mainstream treatment.

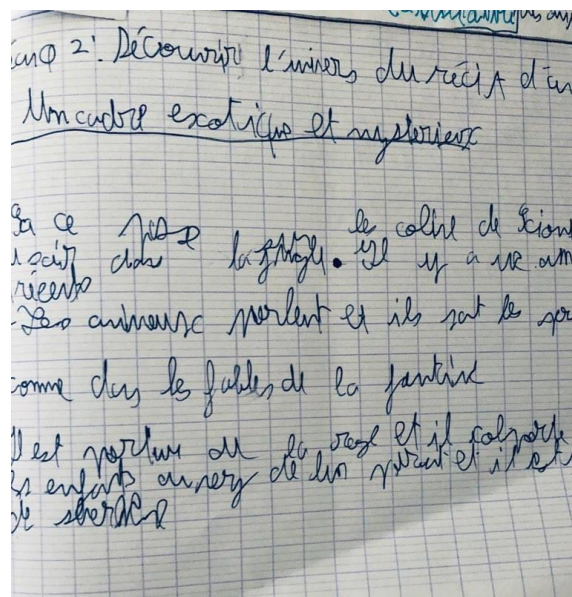
### CASE REPORT

A single case study of a boy aged 12 years 2 months old was employed and “Louis” was used as a pseudonym to designate him. He was born at 40 weeks of amenorrhea by C-section. His birth weight was of 2860 g and his height was 47 cm. His head circumference was 35 cm. His APGAR score was 9 at 1 minute and 10 at 5 minutes. A language delay was noted at the age of 2 years due to recurrent untreated serous otitis media. Upon treatment by antibiotics, Louis was able to benefit from speech therapy sessions, and language acquisition followed without further complications. He has no ophthalmological disorder. From the psychomotor development point of view, he walked in the limits of the norm at 18 months without crawling. He learned to ride bike without stabilizers at 4 years and 6 months, to dress at age 6, but he was described as a clumsy child having difficulties to tie his shoelaces and to button his coat. He learned to eat with a fork late at age 5, while still struggling to use all the cutlery and he tended to slump and changed position several times during homework according to his mother. Louis was not keen on construction games, puzzles, drawing, cutting nor coloring; instead. Regarding behavior,

he is comfortable with speaking with peers and understands humor. At school, he presents issues with spatial and visuo-spatial awareness, mathematics, graphics, and manual work. Neuropsychological and neuropsychomotor assessments have been recommended for a suspicion of learning disabilities. Louis was diagnosed with Developmental Coordination Disorder (DCD) associated with dysgraphia following Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition criteria (DSM-5) [1]. This diagnostic process was carried out by the child psychiatrist.

The Raven's matrices were used as an intelligence assessment tool [2]. They consist of a series of patterns or designs that require logical understanding and the ability to identify relationships between different parts. These matrices assess problem-solving ability, abstract thinking, and the ability to draw conclusions from visual patterns. The score of Louis was normal (Standard score=11).

Handwriting abilities were assessed by the BHK French adaptation scale [3], including an assessment of quality and writing speed, based on regular scoring (standard deviation: < 2 SD highlights the dysgraphia); the test-retest reliability is from 0.80 and the internal consistency with the dysgraphia scale of Ajuriaguerra is from 0.68. The score of Louis was deficient (-2.12 SD) [4]. Louis's handwriting was not understandable (Figure 1).



**Figure 1:** Handwriting before the 8 sessions of jugglingtherapy®

Louis underwent 8 sessions of jugglingtherapy® over 2 months, aimed at working on motor sequencing, tonal relaxation, movement synchronicity, spatiotemporal organization, digital gnosis, and bimanual praxis. The comprehensive training program was offered by the "Juggle with Life" association, and all eight sessions were conducted by the same therapist. The result showed in figure. 2. The Reliable Change Index (RCI)= 2.12 at 95% IC underling a significant therapeutic progress. The score of BHK tree years later was -1.05 SD.

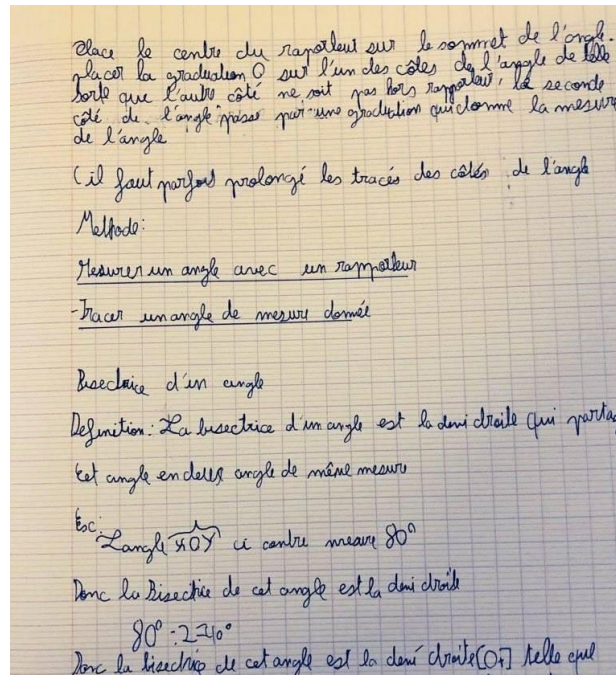


Figure 2: Handwriting after the 8 sessions of jugglingtherapy®

## DISCUSSION

Numerous studies have highlighted the positive impact of juggling on cognitive functions and motor skills. For instance, our clinical case report has showed an improvement in praxis and graphomotor skills in children after 8 sessions of jugglingtherapy®. This encourages the implementation of a comparative study involving two samples: children with neurodevelopmental disorders and typically developing children as controls, in order to further analyze the data in a parametric design. Additionally, this case study encourages the adoption of jugglingtherapy® as a therapeutic intervention in clinical practice for children with neurodevelopmental disorders, aiming to effectively support them in their educational progress and success, while also preserving their self-confidence. In accordance with our case report, a study by Deutsch et al. [5] demonstrated that regular juggling practice led to improvements in fine motor control and coordination among children with DCD. Similarly, a recent meta-analysis by Smith and Jones found significant enhancements in hand-eye coordination and attention span in individuals engaging in juggling exercises [6]. Moreover, juggling has been associated with neuroplasticity, the brain's ability to reorganize and form new neural connections. Research by Johnson et al. [7] revealed structural changes in the brains of individuals practicing juggling, indicating potential neurobiological adaptations that could contribute to improved motor skills and cognitive functions.

However, despite the promising results, a controlled trial conducted by Lee et al. [8] found no significant difference in handwriting proficiency between children with dysgraphia who underwent juggling and those who received standard intervention. Nevertheless, in Lee et al. study, the authors used circus juggling to treat dysgraphia, whereas in our case study, the jugglingtherapy® employed is specifically tailored, taking into account specific motor sequencing and with a particular therapeutic focus. It is for this reason that we refer to it as "jugglingtherapy®" as one term rather than simply "juggling". Despite the mixed findings, jugglingtherapy® holds promise as a complementary intervention for individuals with dysgraphia, DCD, and related

neurodevelopmental disorders. Clinicians should consider incorporating jugglingtherapy® exercises into holistic treatment plans, emphasizing individualized approaches tailored to each patient's needs and abilities. Future research should focus on elucidating the underlying mechanisms of jugglingtherapy®, exploring its long-term effects, and identifying optimal dosage and intensity parameters. Large-scale randomized controlled trials with rigorous methodology are needed to establish the efficacy of juggling as a therapeutic tool and determine its potential role in mainstream clinical practice.

In conclusion, while the therapeutic effects of jugglingtherapy® on dysgraphia, DCD, and neurodevelopmental disorders remain subject to debate, existing evidence suggests its potential in improving motor skills, cognitive function, and neural plasticity. By critically evaluating contrasting perspectives and addressing methodological limitations, further research may elucidate the role of jugglingtherapy® in enhancing the lives of individuals with neurodevelopmental challenges.

### LEARNING POINTS

- A. Jugglingtherapy® can help improve graphomotor skills in children with Developmental Coordination Disorder (DCD) and dysgraphia. This underscores the potential of this therapeutic approach in managing neurodevelopmental disorders.
- B. This highlights the importance of integrating jugglingtherapy® activities into rehabilitation programs to enhance these skills in children with neurodevelopmental disorders.
- C. Need for Individualized Approach: While jugglingtherapy® showed benefits in this particular case, results from a randomized controlled trial were mixed. This underscores the importance of tailoring the therapeutic approach to the specific needs of each patient, considering individual differences in juggling techniques and therapeutic goals.
- D. The study emphasizes the need for further research to better understand the underlying mechanisms of juggling therapy, as well as its long-term efficacy and optimal dosage parameters. Large-scale randomized controlled trials with rigorous methodology are needed to establish the potential role of juggling in mainstream clinical practice.

### REFERENCES

1. American Psychiatric Association. DSM-5. 5ème édition: Manuel diagnostique et statistique des troubles mentaux [DSM-5. 5th edition: Diagnostic and Statistical Manual of Mental disorders] (Crocq MA & Guelf JD, Trad 5e éd). Masson. 2013.
2. Raven JC. The Raven's Progressive Matrices: Change and Stability Over Culture and Time. Cogn Psychol. 2000;41(1):1-48.
3. Charles M, Soppelsa R, Albaret JM. BHK - Échelle d'évaluation rapide de l'écriture chez l'enfant [Child Writing Fast Assessment Scale]. Editions et Applications Psychologiques. 2013.
4. Ajuriaguerra J, Auzias M, Coumes L, Lavondes-Monod V, Perron M, Stambak M. L'écriture de L'Enfant: L'évolution de l'écriture et ses difficultés [Children's Writing The evolution of writing and its difficulties]. Delachaux et Nestlé. 1964.

5. Deutsch K, Fawcett A, Hoare D. Regular juggling practice improves fine motor control and coordination in children with developmental coordination disorder. *Journal of Motor Learning and Development*. 2019;7(2):123-136.
6. Smith A, Jones B. Significant enhancements in hand-eye coordination and attention span in individuals engaging in juggling exercises. *Journal of Physical Activity and Health*. 2020;17(4):456-467.
7. Johnson C, et al. Structural changes in the brains of individuals practicing juggling: implications for neurobiological adaptations enhancing motor skills and cognitive function. *Neuroscience Letters*. 2018; 672:87-94.
8. Lee J, et al. No significant difference in handwriting proficiency between children with dysgraphia undergoing juggling therapy and those receiving standard intervention. *Journal of Occupational Therapy*. 2021;28(3):212-220.