

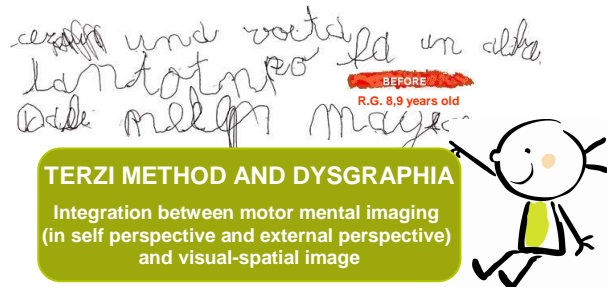
Rehabilitation of graphomotor disturbances by means of the spatio-temporal Terzi's Method



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AIM This work presents the results pertinent to the evaluation of a new rehabilitation treatment, the Terzi Method, utilized to recover grapho motor problems and dysgraphia of 14 non-proficient handwriters Italian children (www.ulss7.it),

INTRODUCTION
 Many different treatment approaches, mainly based on perceptual-motor, visual-motor, motor control, individualized interventions /exercises, and supplementary handwriting instruction, have been applied for poor handwriting remediation in school-aged children [4].
 In this paper a new treatment protocol (Spatio-temporal Terzi's Method www.metodoterzi.it) is proposed; it is based on a motor-cognitive approach [1] aimed to correct process and integrate spatio-temporal information coming from different sensorial inputs (kinesthetic, vestibular, proprioceptive, tactile, visual) [5]. Its effectiveness are evaluated on the graphomotor problem and/or dysgraphia and the other correlated cognitive and motor functions.



TERZI METHOD AND DYSGRAPHIA

Integration between motor mental imaging (in self perspective and external perspective) and visual-spatial image

MATERIAL AND METHOD

Sample group
 14 children (2 girls, 12 boys, average age 9.7 years)
 Main diagnosis and comorbidity with graphomotor problem and/or dysgraphia. I.Q. included between the average standard and the border level (WISC-R); no neurological damage.

Prevalence in Italy
 (3-4% of the students from 8 to 13 years old)



Standard test protocols

- Before and after rehabilitation process: investigated areas
- **Neurological:** neurological examination
 - **Cognitive/motivational:** Wisc-R, WPPSI; Evaluation of the Leiter-R marker
 - **Visual-spatial and Spatio-temporal organization:** V.M.I.; REY complex Figure Test; Apraxia constructive graphic performance; Terzi Method evaluation Protocol
 - **Motor/praxis:** Movement ABC; Bimanual praxia evaluation scale; Posture and grasping observation scheme
 - **Handwriting:** Letter's check-list; analyses of the writing quality (sequence of "lelele" and sentence to be transcribed in italic as better and as faster as possible) acquired by a digitizing tablet (Intuos3®, Wacom); static and kinematic parameters linked to pressure, trajectory and velocity features of each identified stroke [2].
- Rehabilitation project**
 Treatment: Terzi Method for about 15 sessions of 45 min. each (individual or in couple), carried on by speech therapist and development age neuro-psicomotor therapist.
 Involvement: the "contract", the "evaluation", 10 minutes daily exercises (child); sharing the aims, strategies and enhancement of the child effort (family and teachers).

TERZI METHOD

Scientific basis

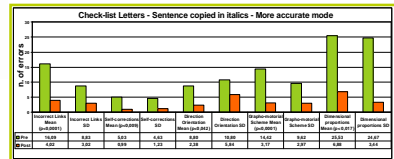
- Cognitive neuropsychology; Neuroscience and mental imaging
- Internal representation of the personal space can be modified through experience
- Space is a transverse sensory function

Characteristics

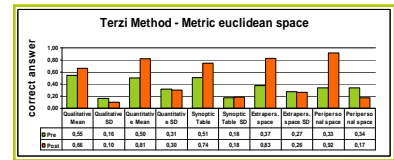
- Improves the construction of correct kinesthetic-motor, proprioceptive and visual-spatial mental images through the body "lived experience" phase and "external representation"
- Use **diversified tasks** (motor, visual, imitative, verbal) that fit to the age and the cognitive level of the subject
- **Ecologic and metacognitive approach** to the task: it does not directly intervene in a sectoral way on the "error-symptoms", but it analyses the outcomes and it investigates the mental processes that could have determined such a result..

RESULT AND DISCUSSION The effectiveness of the Terzi's rehabilitation program is proved by statistically relevant improvements in the following areas:

Handwriting
Letter's Check-list parameters (Fig. 1): decrement of the number of errors sign of an increased mental representation of the correct grapho-motor scheme
Static and kinematic parameters: "lelele" test: mean curvilinear velocity increment (Fig. 2) during single stroke ($p < 0,02$), index of the old motor program substitution with another more automated, ables to produce a more fluent tract. The interaction between perceptive and motor aspects (for the hand) and locomotive aspects (for the walking) is confirmed in the planning strategy.[4]

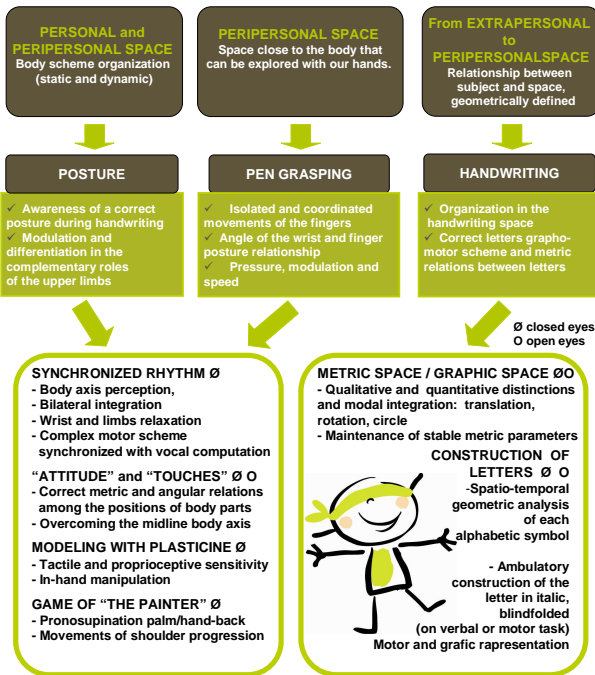
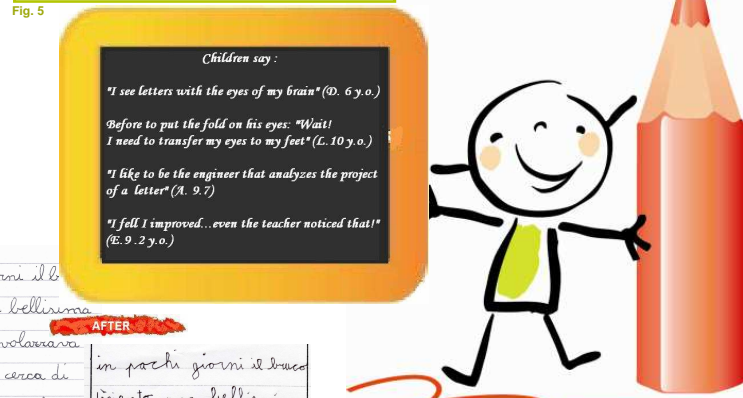
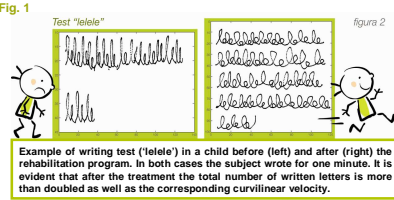
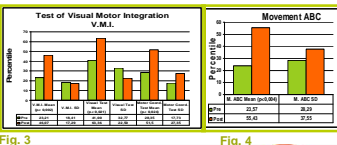


Personal, peripersonal and extrapersonal space
 Improves in the topological accuracy and temporal sequence, synchrony and timing of movements; in the mental representation of space, both in the "lived experience" and in the "graphic representation" ($p < 0,0001$); in the projects of motor planning (Terzi Method - Metric space Fig. 5). It is possible that comparable coupling between eye and body movements exists for locomotion. [5]



Visual-spatial and motor/praxis organization

- **Visual-motor integration (V.M.I. Fig. 3)** and coordination, on the graphic reproduction of geometric shapes of increasing difficulty.
- **(Movement ABC Fig. 4)** in the ability with the ball and in static and dynamic equilibrium.



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CONCLUSION

The application of the Terzi's rehabilitation method improves both the accuracy and speed parameters of:
 • posture and pen grasping,
 • graphomotor patterns
 • handwriting quality.

The digitizing tablets allowed objective quantitative kinematic analyses of the writing quality. It measures the treatment efficacy and evaluates what parameters are more sensitive to the recovery process in non-proficient hand writers children.

The Terzi Method approach improves the mental and visual-spatial imaging through the conscious use of body movements.

Since space is a transverse sensory function, this approach improves not only the handwriting, but also the cognitive processes that utilize the mental images representation.

