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

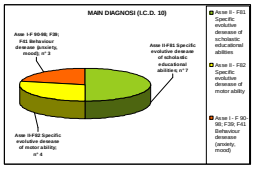
Many different treatment approaches, mainly based on perceptual-motor, visual-motor, motor control, individualized interventions /exercises, and supplementary handwriting instruction, have been applied for poor handwriting remediation in school-aged children [4].

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 correctly 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.

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/praxic**: 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®, Watcom); 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 psicomotion therapist.
Involvement: the "contract", the "evaluation", 10 minutes daily exercises (child); sharing the aims, strategies and enhancement of the child effort (family and teachers).

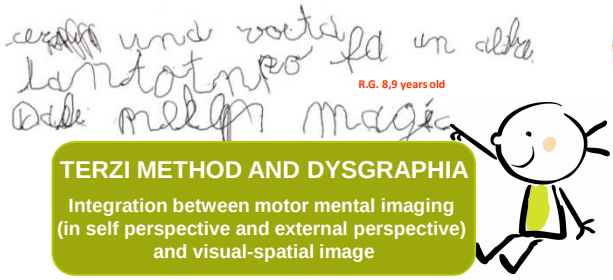
TERZI METHOD

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 kinestetic-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.



PERSONAL and PERIPERSONAL SPACE
Body scheme organization (static and dynamic)

PERIPERSONAL SPACE
Space close to the body that can be explored with our hands.

From EXTRAPERSONAL to PERIPERSONALSPACE
Relationship between subject and space, geometrically defined

POSTURE
- ✓ Awareness of a correct posture during handwriting
- ✓ Modulation and differentiation in the complementary roles of the upper limbs

PEN GRASPING
- ✓ Isolated and coordinated movements of the fingers
- ✓ Angle of the wrist and finger posture relationship
- ✓ Pressure, modulation and speed

HANDWRITING
- ✓ Organization in the handwriting space
- ✓ Correct letters grapho-motor scheme and metric relations between letters

Ø closed eyes
O open eyes

SYNCHRONIZED RHYTHM Ø
- Body axis perception,
- Bilateral integration
- Wrist and limbs relaxation
- Complex motor scheme synchronized with vocal computation

"ATTITUDE" and "TOUCHES" Ø O
- Correct metric and angular relations among the positions of body parts
- Overcoming the midline body axis

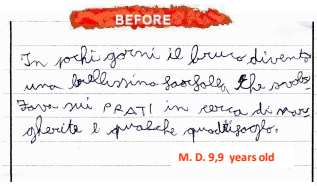
MODELING WITH PLASTICINE Ø
- Tactile and proprioceptive sensitivity
- In-hand manipulation

GAME OF "THE PAINTER" Ø
- Pronosupination palm/hand-back
- Movements of shoulder progression

METRIC SPACE / GRAPHIC SPACE ØO
- Qualitative and quantitative distinctions and modal integration: translation, rotation, circle
- Maintenance of stable metric parameters

CONSTRUCTION OF LETTERS Ø O
-Spatio-temporal geometric analysis of each alphabetic symbol
- Ambulatory construction of the letter in italic, _blindfolded (on verbal or motor task)
Motor and grafic rapresentation

BEFORE



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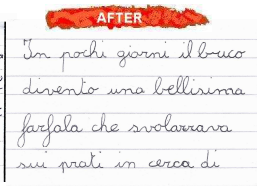
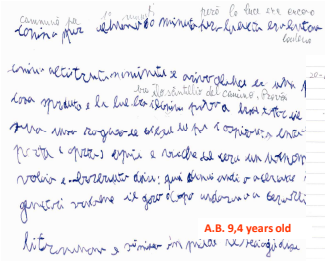
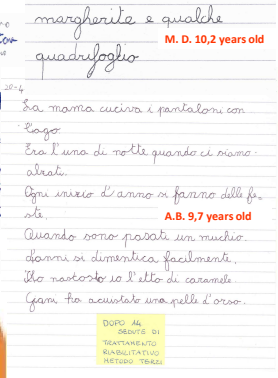
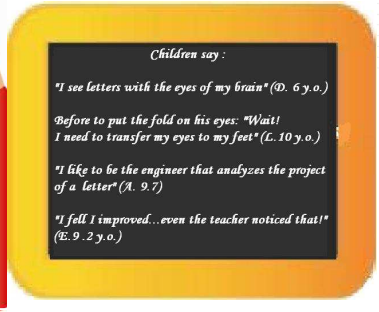








R.G. 9,4 years old

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 with another more automated, ables to produce a more fluent tract. During locomotion along curved trajectories, "perceptuo-locomotor" interactions are comparable with the "perceptuo-motor" are likely to be part of the planning strategies.[4]

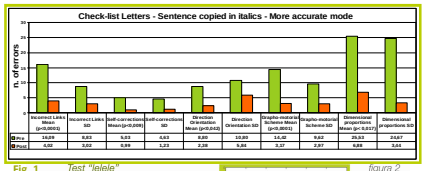
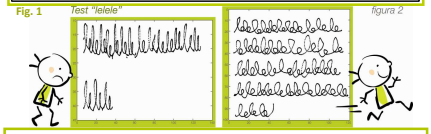


Fig. 1



Example of writing test ('lelele') in a child before (left) and after (right) the rehabilitation program. In both cases the subject wrote for one minute. It is evident that after the treatment the total number of written letters is more than doubled as well as the corresponding curvilinear velocity.

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 dinamic equilibrium.

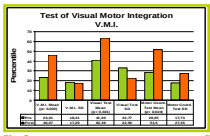


Fig. 3

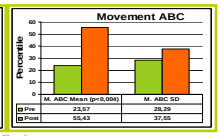


Fig. 4

Personal, peripersonal and far extrapersonal space

Improves in the topological accuracy and temporal sequence, syncrony and timing of movements; in the mental representation of space, both in the "lived experience" and in the "graphic rapresentation" (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]

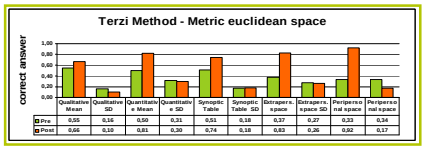


Fig. 5

CONCLUSION

The application of the Terzi's rehabilitation method improves the graphomotor patterns and the handwriting quality, in both the accuracy and speed parameters.
The digitizing tablets allowed objective quantitative kinematic analyses of the writing quality in non-proficient handwriters children in order to measure the treatment efficacy and to evaluate what parameters are more sensitive to the recovery process.
Terzi method permits to develop the ability to obtain aware of the spatio-temporal information in order to correctly process and integrate them for a conscious use of the body during movement.
Since the space is a transverse sensory function and sensory information coming from different modalities its motor-cognitive approach positively influences also cognitive and motor functions.

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