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AUDITORY-VERBAL PROCESSING DISORDER AND DYSLEXIA IN ADULTHOOD

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Introduction

According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-V), the neurodevelopmental disorders are characterised by an atypical development of some cognitive domains, with a dysfunctional behavioural correlation supported by phenotypes with a genetic connection.

Among these are the specific learning disabilities, which are united by a single condition characterised by difficulty in learning and using academic skills in the presence of an adequate IQ; these include dyslexia, dyscalculia and dysorthography.

The clinical features are an inaccurate or slow and laborious reading of the words, difficulty in understanding the meaning of what is read, difficulty in spelling, in written expression, in mastering the concept of number, numerical data or calculation, and in arithmetic reasoning.

Recently, thanks to the better understanding of the neurobiological mechanisms underlying these disorders and thanks to the improvement of neuroimaging and genetic analysis, we better understood the evolution of these pathologies and consequently we have refined the diagnosis and treatment.

Studies focused particularly more on dyslexia, both due to its high frequency in general population and to the better understanding of its pathogenesis.

Various cognitive models are developed to explain the nature of the processes underlying the recognition of written words; the models explained partially the cause of dyslexia, tracing it back to a phonological deficit of consciousness. Today none of these models seems to prevail, but we believe that, in the context of a general reading disorder, there are several difficulties that can be either phonological or about phonological, motor or visual consciousness, due to the failure of magnocellular/auditory neurons development, because of an altered central processing.

Already in the 80s, Tallal et al. recognised the phonological deficit as a symptom of a deficit of sound processing presented in rapid sequence (proper of verbal oral language) and therefore a deficit of elaboration at the auditory temporal cortex. This difficulty in the sounds analysis could lead to a wrong categorization and to a

failure to recognise the phoneme as the acoustic characteristics change.

From studies carried out on children with dyslexia, deficient performances emerged in conditions of short auditory stimuli presented in rapid sequence, while the performance improved with a longer stimulus interval. These difficulties lead to a need for longer times to discriminate short sounds in rapid sequence. Tallal deduced that children with dyslexia presented not a linguistic deficit but a deficit of temporal elaboration of the variation of the auditory patterns, which then translated into a difficulty in the perception of isolated language.

In auditory perception of sounds, both when proposed in rapid sequences and with a longer time intervals, a primary role is played by auditory attention, especially by focused auditory attention.

The aim of this work is to present the features of adult patients with a specific learning disability in reading and to evaluate the possible correlation with phonological awareness deficits (therefore the ability to analyse and manipulate the linguistic structure of words), and with auditory-verbal processing disorders.

Materials and Methods

The study sample consisted of 70 patients (30 males and 40 females) aged between 17 and 55 years. 40% of the subjects were in the 18-19 age group; 36% between 20 and 25 years, while the remaining 24% were over 25 years old.

Of the 70 patients, 55% studied more than 13 years, 44% studied between 12 and 13 years, 3% studied only 10 years.

All patients approached an Audiology Unit to assess their learning skills.

The patients included in the study had the following requirements:

1. IQ Assessment

DMS-V considers an IQ below the norm (<70 points) as an exclusion criteria. The subjects carried out a cognitive level assessment that highlighted the are a with best functioning and those that result as a weakness. In particular, the WAIS-IV (Wechsler Adult Intelligence

Scale - Forth Edition) multi-behavioral test

detects four dimensions; namely verbal comprehension, visual-preceptive reasoning, working memory, processing speed.

2. *Absence of neurological and sensory deficits*

3. *Instrumental evaluation*

The protocol included some test: ADCL; Raven PM38; reading, comprehension, passage, writing calculation test; Boston Naming Test; lacking in phonemic, semantic influence and rapid naming tests of letters, figures and colours; barrage of figures; Night & Day Test; orientation of Benton lines; counting backwards; Beck's inventory of depression-2; Hamilton Anxiety Rating Scale.

4. *Positive screening of phonological consciousness*

Repetition tests with scores lower than 16/20, especially when confirmed by unshielded mouth tests, require further evaluation of the auditory perceptible system.

5. *Pure Tone Audiometry, Vocal Audiometry, Matrix Test*

The Matrix Test evaluates the average noise discrimination threshold (the stimulus/noise ratio), relative to the 50% of intellegibility. The reference value for nomoacusia is -6.7 ± 0.7 dB (average \pm standard deviation). Base on the characteristics of the patients examined, the average discrimination threshold was raised, to -3.8 dB.

Results

Among 70 patients examined, 33% presented an insufficient noise threshold (SRT); of these, 56% showed a low repetition of non-words with shielded mouth, 61% a speed less than 4th percentage during the segmentation test, and 39% less than the 5th percentage during the fusion test.

After that we evaluated the patients with low SRT through some neuropsychological tests, as the piece dictation, the Night & Day Test and Milan calculation test; all these trials included a double task and the use of the working memory. During the dictation, 87% of the patients totalized a number of errors which places them under the 5th percentile; during the Night & day Test, only 61% of the subjects presented a speed performance above the 95th percentile.

During the calculation tests, 78% got a score below 2 ds. Evaluating the cognitive profile of patients with low SRT, 30% showed a medium-low IQ (>90) with homogeneous falls in three of four indexes examined (verbal comprehension index 26%; perceptual reasoning index 26%; processing speed index 22%). About the working memory, the deficit seemed to be greater (35%). Among the examined profiles, emerged 4 cases of sensorineural hearing impairment, 2 cases of conductive hearing loss, 4 cases of high auditory-verbal dissociation.

Discussion

From the results obtained, we can hypothesise a comorbidity between the reading disorder and the auditory-verbal dissociation.

Through the analysis of the patient with a loss auditory-verbal dissociation, we observed considerable difficulties in the repetition tests of non-words with shielded mouth, segmentation and fusion.

Then we examined how these patients answered to tests expecting a double task and the recruitment of the working memory (Dictation, Night & Day Test, Milan Test) we found an high percentage of low results understood as an high number of errors in the dictation and, in terms of speed, in attention and calculating test. One third of patients with deficient SRT had a medium-low IQ (>90); this led us to endorse the multi componential theory of Evolutive.

The study didn't analyse data from Benton Line Orientation Test (which could provide important information on visual analysis and processing matched with perceptible reasoning index of WAIS IV Test); a low score in this test should lead the examination to support the Magno-parvo-cellular theory.

Furthermore we didn't carry out a qualitative evaluation of the written papers, in which phonological, non-phonological and perceptible-visual errors should confirm the Magno-parvo-cellular theory.

From the analysis of the whole sample, we found 10 cases that could not be classified as mixed disturbance of scholastic capacity (4 cases of sensorineural hearing impairment, 2 of conductive hearing impairment, 4 case of high verbal auditory dissociation).

Conclusion

The purpose of this study was to detect auditory-verbal alterations in patients belonging to our service for the diagnosis of ED, highlighting the correlation between the Matrix test and auditory perceptible phonological awareness screening.

We particularly focused on audiometric profile, phonological awareness, cognitive level and performance of instrumental skills (reading, writing, calculation).

Even considering the importance of auditory processing of speech sounds, because it mimics a correct phonological representation and therefore a graphic relationship, we believe that the only perceptible-auditory alteration is not sufficient to cause a disorder such as evolutive dyslexia (ED).

We drawn up a table data based on the performance obtained from the Marix Test, pure tone audiometry, IQ evaluation, trial of the short-term memory test, quick naming test, linguistic tests such as the Boston Naming Test, test of physiological awareness, repetition tests and from the analysis of errors in writing tests.

The results of this work would seem to agree with the thesis that sees DE as a multifactorial disorder with possible phonological deficit with a possible deficit of auditory perception.

Would be needed more studies with a larger sample for further investigation.

References

1. Facoetti A et al, Visual-spatial attentioning development dyslexia, *Cortex*, , 36, 109-123
2. Tallal P., Auditory temporal perception, phonics, and reading disabilities in children (1980), *Brain and Language*, volume 9, capitolo 2, pp 182-198
3. Teggi R et al, Clinical features of headache in patient with diagnosi of definitive vestibular migraine: the VM-Phenotype projects, *Front Neurol*. 2018 Jun 5;9:395
4. Bullegas D, La dislessia – La teoria del deficit di processamento temporale- Mediazione & Apprendimento
5. Cassandro E et al, Inner ear conductive hearing loss and unilateral pulsatile tinnitus associated with a dural arteriovenous fistula: case based review and analysis of relationship between intracranial vascular abnormalities and inner ear fluids, *Case Rep Otolaryngol*. 2015;2015:817313 4.
6. Lee SH, Adults with reading disabilities: converting a meta-analysis to practice, *Journal of Learnig Disabilities*
7. Casani AP et al, Approach to residual dizziness after successfully treated benign paroxysmal positional vertigo: effect of a polyphenol compound supplementation, *Clin Pharmacol*. 2019 Aug 1;11:117-125
8. Buschermohle M et al, International Matrix Test – Reliable speech audiometry in noise
9. Balota DA et al, Attentional control of lexical processing pathways during word recognition and reading, in S. Garrod e M. J. Pickering , *Language Processing*. Hove, UK: Psychology Press
10. Rayner K et al, Eye movements in reading: psycholinguistic studies, in M.A. Gernsbacher (Ed), *Handbook of psycholinguistic*. New York: Academic Press
11. Lucas M, Context effects in lexical access: a meta-analysis. *Memory & Cognition*, 27,385-398
12. Penolazzi B et al, Early semantic contextontegration and lexical access as revealed by event-related brain potentials. *Byological Psychology*,
13. Coltheart M et al, The DRC model: a model of visual word recognition and reading aloud. *Psychological review*, 108, 204-258
14. Ellis AW et al, *Human cognitive neuropsychology*. Hove, UK: Psychology Press
15. Ciuffo M et al, BDA 16-30, Batteria Dislessia Adulti, Giuntu Psychometrics
16. Coltheart M et al, Models of reading aloud: dual-route and parallel-distributed-processing approaches. *Psychological review* 100 (4), 589
17. Talla P et al, Neurobiological basis of speech: a case for the preeminence of temporal processing, *Ann NY Acad Sci*, 682, p.27-47
18. Moschen R et al., Validation of the Chronic Tinnitus Acceptance Questionnaire (CTAQ-I); the Italian version, *Acta Othorinolaryngol Ital*. 2019;39(2):107-116
19. Lieberman P, Some effect of semantic and grammatical context of the production and perception of speech, *Language and speech* 6 (3), 172-187
20. Teggi R et al, Genetics of ion homeostasis in Meniere's disease, *Eur Archives Otorhinolaryngol*. 2017 Feb;274(2):757-763
21. Cherry EC et al, Some experiment on the recognition of speech with one and two ears, *Journal of the Acoustical, Society of America*, 25, 975-979
22. Ponticorvo S et al, Cortical pattern perfusion in hearing loss revealed by ASL-MRI, *Hum Brain Mapp*. 2019 Jun 1; 40(8):2475-2478
23. Broadbent DE, *Perception and communication*. Oxford:Pergamon
24. Allports DA et al, On the division of attention: a disproof of the single channel hypothesis. *Quarterly Journal of Experimental Psychology*, 24, 225-235
25. Scarpa A et al, Food-induced stimulation of the anti secretory factor to improve symptoms in Meniere's disease: our results, *Eur Arch Othorinolaryngol*. 2019 Oct 11
26. Vellutino FR et al, Specific reading disability (dyslexia): what have we learned in the past four decades?, *Journal of Child Psychology and Psychiatry*, 45 (1), 2-40
27. Swanson HL et al, Rapid Naming, phonological awarness and reading: a meta-analysis of the correlation evidence, *Review of Educational Research*, 73, 4, 407-440
28. Chiarella G et al, Chronic Subjective Dizzines: analysis of underlying personality factors, *J Vestib Res*. 2016 Nov 3;26(4):403-408
29. Ramus F et al, Theories of developmental dyslexia: insights from a multiple case study of dyslexic adults, *Brai* 2003, 126, 841-865,
30. Tressoldi PE et al, Valore predittivo della consapevolezza fonemica sul livello di lettura e scrittura nel primo anno di scuola elementare, *Giornale Italiano di Psicologia*, XVI (2), 279-292
31. Faralli A et al, Modifications of perineuronal nets and remodelling of excitatory and inhibitory afferents during vestibular compensation in the adult mouse, *Brain Struct Funct*. 2016 Jul;221(6)3193-209
32. Orsolini M, *Il suono delle parole*, La Nuova Italia
33. Stein J et al, To see but not to read; the magnocellulartheory of dyslexia, *Trends in Neuroscience* 20(4): 147-52
34. Fawcett AJ et al, Naming Speed in children with dyslexia, *Journal oh Learning Disabilities*, 27, 10:641-646
35. Scarpa A et al, Low dose intratympanic administration for unilateral Meniere's disease using a method based on clinical symptomatology: preliminary results, *Am J Otolaryngol*. 2019 Sep 9:102289
36. Finch A et al, Evidence for a neuroanatomical difference within the olivo-cerebellar pathway of adultswith dyslexia, *Cortex* 38, 4. 529-539

37. Wechsler D, Wechsler Adult Intelligence Scale – Fourth Edition (WAIS-IV)
38. American Psychiatric Association (2013), Manuale Diagnostico e statistico dei disturbi mentali, DSM-5, Raffaello CortinaEditore
39. Ghidoni E et al, Un protocollo di diagnosi di DSA nell’adulto: i risultati del Progetto Diagnosi AID-FTI
40. Pech-Georgel C et al, Valutazione delle difficoltà di lettura, scrittura, competenze metafonologiche, memoria e attenzione, Erikson
41. Tressoldi PE et al, Batteria per la valutazione della Scrittura e della competenza ortografica nella scuola dell’obbligo, Giunti Pssychometric
42. Gerstad CL et al, The relationship between cognition and action: performance of children 3-and-a half to 7 years on a stroop-like-day-night-task, *Cognition*, 53, 2, 129-153
43. Gioacchini FM et al, Hyperglycemia and diabetes mellitus are related to vestibular organs dysfunction: truth or suggestion? A literature review, *Acta Diabetol.* 2018 Dec;55(12):1201-1207
44. Gioacchini FM et al, The role of diabetes mellitus in favouring peripheral vestibular system dysfunctions: clinical and scientific evidence, *Otorinolaringol.* 2019 Jun(2):107-12
45. Peterson RL et al, Developmental Dyslexia. *The lancet* 379 (9830), 1997-2007
46. Landerl K et al, Temporal processing, attentio and learning disorders, *Learning and individual differences*, 20 (5), 393-401
47. Benton AL et al, Contribution to neuropsychological assesment. A clinical manual, vers It. Ferracuti S. et al, Giunti OS
48. Scarpa A et al, Clinical application of cVEMPs and oVEMPs in patients affected by Meniere’s disease, vestibular neuritis and benign paroxysmal positional vertigo: a systematic review, *Acta Otorhinlaryngol Ital.* 2019 Oct;39(5):298-307
49. Serniclaes W, Allophonic Perception in Dyslexia: an overview. *Psychology*, 4, 2, 25-34
50. Serniclaes W, Allophonic Perception in developmental Dyslexia: origin, reliability and implication of the categorical perception deficit. *WrittenLanguage &literacy*, 9 (1), 135-152
51. Denkla MB et al, Rapid Automatized Naming (RAN): dyslexia differentiated from other learning disabilities, *Neuropsychologia*,14
52. Kaplan E et al, Boston Naming test, experimental edition
53. Swanson HL et al, Reading Disabilities in adult: a selective meta-analylsis oh the literature, “Review of educational research”, vol 79, n.4