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Post accessive social policy in the rehabilitation of adolescents following TBI

Leszek Bulinski^{1,2}

¹ Gdansk Centre for Neuropsychological Studies, Non-public Health Care Centre Gdansk-Południe, Gdansk, Poland

² Ateneum – The University in Gdansk, Gdansk, Poland

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Summary

Background:

The aim of this research was to evaluate the effectiveness of the post-accessive Conduct Disorder Therapy Program administered within the “Academy of Life” in the reduction of behavioural disorder in adolescents following traumatic brain injury (TBI).

Material/Methods:

100 adolescents from Gdansk and adjacent areas, psychiatrically diagnosed with “frontal lobe syndrome” following a TBI, were examined. Group A included 50 participants examined and treated at the Reintegration and Training Center of the Foundation for Persons with Brain Dysfunctions. Group B comprised 50 people matched for age and sex, under treatment at the Gdansk Center for Neuropsychological Studies, Gdansk-Południe Non-Public Health Care Center. Group A used the above therapy programme, while group B did not. The studies included an analysis of documentation, neuro-imaging (CT or MRI), clinical interviews, the Mini-Mental State Examination and the Frontal Behavioural Inventory.

Results:

The therapy program had a significant impact on conduct disorders, the most visible differences being within neurological disorders and the least visible within cognitive disorders. It also influenced the social reintegration of adolescents following TBI, as demonstrated by the greater increase in the percentage of participants from group A returning to school and hobbies practised before the accident.

Conclusions:

The results indicate that the evaluated therapy program is effective in reducing behavioral disorders in adolescents following brain injury, and their reintegration into society.

key words:

system therapy • emotional support • family training

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Author's address:

Leszek Bulinski, Gdansk Centre for Neuropsychological Studies, Non-public Health Care Centre Gdansk-Południe, Szuberta 49 Str., 80-171 Gdansk, Poland, e-mail: gda-med-poludnie@wp.pl

BACKGROUND

The studies described in this article aim to prove the effectiveness of certain solutions of post-accessive social policy and the problem of disability in adolescents after a TBI. Both areas complement each other.

The quality of life of adolescents after TBIs, as fully-fledged members of a wider society in which coherence mechanisms should be in place, depends not only on the factors connected with the disorder but on the effects of the implemented social policy, making it easier for them to achieve life satisfaction, improve self-esteem through everyday activities connected with the continuation of education at school, and in the future the improvement of socio-economic conditions and becoming fully-fledged members of society [1].

It is worth noting that the needs of adolescents after TBIs are considered either from an individual perspective or of the environment they live in. These are still two different perspectives, and attempts are made to combine them with the help of postulated integrative procedures. Unfortunately, due to poor competences in the management of rehabilitation and social services, they are only clichés, intentionally convenient, but lacking real implementation.

Thus, the fulfilment of the needs, recognised to various degrees, is often understood as offering support, but one that is selective, partial, and tentative. Such activity is not so much fictitious, as unilateral and thus infirm. Equally infirm for it does not consider the developmental character of adolescents' needs following TBIs [2].

The ontology of disability masks the humanist perspective of needs and cooperation: being a disabled student is different than being a disabled pensioner. The existential understanding of quality of life refers to a disabled person's degree of involvement in life activities and the drawing of appropriate satisfaction from them. Thus, the social anchoring of such activities seems understandable, and the vector of relations covers all actors of social life [3].

The idealisation of social partnership becomes a theoretical basis for the discourse on the aims, tasks, and mechanisms of social integration. The subject concerns also adolescents after TBIs. It should be noted, however, that often the semantics of social coherence means something different than analogical semantics in relation to disability. It seems that this notion of support is characterised by the orientation of "society towards disabled people", while the integration of disabled people is associated with the orientation of "disabled people towards society".

One of the greatest problems of adolescent disabled people following TBIs are behaviour disorders and related difficulties at school, including dropping out of school altogether [4]. Behavioural disorder is a complex neuropsychological process, which engages the brain structures at various levels as well as the nerve routes connecting them [3–8].

In the pathomechanism of such disorders in post-TBI adolescents, the most important role is played by frontal lobe injuries [3,7,9]. Frontal lobe areas are injured quite often as a result of damage related to the mechanism of the brain

injury itself, especially in the case of motor vehicle accidents [10–12]. Although scientific neuropsychological studies of this phenomenon have been conducted for dozens of years [13] the brain mechanisms are not yet fully understood [14]. The development of neurosciences has resulted in constant appearance of new data, complementing and even modifying the actual state of our knowledge in this area [15].

In the meantime the number of injuries suffered both by children and adult people has increased significantly in recent years [4]. Brain injuries are the most common cause of deaths and many years of disability in children and adolescents [16]. This fact is related, among other things, to the direct development of means of transport and, subsequently, to the increasing number of car accidents [17], as well as the specificity of functioning in childhood [3,4,18].

Adolescents who suffer a TBI, the subject of my research, experience mainly complex disorders of the cognitive, emotional and behavioural processes [19]. These disorders may be longer term or shorter term in nature due to the high plasticity of a child's brain. After a year approximately 62% to 78% adolescents involved in motor vehicle accidents still display various behavioural disorders and have tremendous difficulties reintegrating into family, school and social life [20]. Consequently, there is an urgent need to draw attention not only to the evaluation of post-TBI disorders, but also to the methods of helping such people return to life in families, school and society [21,22].

The therapy of conduct disorders is extraordinarily difficult and various therapeutic solutions are being sought around the world [20–23]. The Conduct Disorder Therapy Programme administered within the "Academy of Life" was developed by Pachalska [4]. The programme was implemented into clinical practice at the Gdansk Centre for Neuropsychological Studies, Non-public Health Care Centre Gdansk-Południe and suitably adapted for the needs of post-TBI children [1–3]. In the article the programme is evaluated with regard to the reduction of conduct disorder in post-TBI.

The article assumes the concept of conduct disorder suggested by Kertesz et al. [24,25], who divided all conduct disorders into *positive* (resulting from insufficient inhibition) and *negative* (when behaviour is inhibited too strongly and does not "go out") comprising the so-called "frontal syndrome", in which the disorder concerns the control system comprising attention and awareness, judgement and assessment, and the inhibition of unwanted or purposeless actions [3,26–28]. Also the division of this syndrome suggested by Kertesz et al [24,25] into four components: emotional, cognitive, behavioural and neurological, was assumed. The Conduct Disorder Therapy Programme within the "Academy of Life" was based on microgenetic theory, with special emphasis put on the theory of the microstructure of perception and action, as understood by Pachalska [4].

Carer knowledge of behavioural disorders in post-TBI older children and adolescents was used in the studies. This knowledge acted as a guideline in the heuristically administered individual neuropsychological rehabilitation, that is, adjusted to the exceptional needs of this type of patient.

Table 1. The causes of TBIs in the studied groups A and B.

| Group | Sex | N | Motor vehicle accident | | Other [including being beaten] | |
|-------|------|----|------------------------|-------|--------------------------------|-------|
| | | | N | % | N | % |
| A | Boy | 26 | 23 | 88.46 | 3 | 11.54 |
| | Girl | 24 | 18 | 75.00 | 6 | 25.00 |
| B | Boy | 26 | 21 | 80.77 | 5 | 19.23 |
| | Girl | 24 | 17 | 70.83 | 7 | 29.17 |

The aim of the studies was to answer as to whether the post accessive Conduct Disorder Therapy Programme administered within the “Academy of Life” influences the global level of the functioning of post-TBI adolescents, and whether it supports the reduction of conduct disorder of “frontal lobe syndrome” type, thus contributing to the return of these children to school.

MATERIAL AND METHODS

Study material

The studies covered a total of 100 adolescents from Gdansk and adjacent areas, with psychiatrically diagnosed “frontal lobe syndrome” following a TBI confirmed in neuroimaging tests. Group A comprised 50 participants, 26 boys and 24 girls, examined and treated at the Reintegration and Training Centre of the Foundation for Individuals with Brain Dysfunctions. Group B comprised 50 participants, 26 boys and 24 girls, selected according to age and sex, who reported to the Gdansk Centre for Neuropsychological Studies, Non-public Health Care Centre Gdansk-Południe. Group A had the post accessive Conduct Disorder Therapy Programme administered within the “Academy of Life”, while group B did not.

Group C, constituting 39 people, was introduced for comparison, solely in the analysis of data obtained by me from the children studied in the Frontal Behavioural Inventory (FBI_{Inv}). Group C data for the comparative analysis was obtained in the process of the standardisation and adaptation of this questionnaire to the Polish conditions with regard to the occurrence of frontal lobe syndrome in post-TBI children with a confirmed focus in the frontal lobes [29].

The study was conducted from the beginning of January 2009 to the end of June 2009. The experiment was approved by the Independent Bioethical Committee for Scientific Research of the Medical Academy in Gdansk and the consent of patients and their carers was obtained.

Characteristics of the participants

The average age of the patients in group A, was for boys 13.36 [SD=1.95] years, for girls 12.56 [SD=1.92] years, while in group B for boys 12.49 [SD=1.87] years, and for girls 14.01 years [SD=1.99]. Patients from both groups, as they were selected by the method of pairing, do not differ significantly with regard to sex and age. Most of the participants were 12 years old; in group A – 27 children (54%),

and in group B – 26 (52%). The smallest number of children was of 14 and 15 years of age. The youngest of the patients were born in 1998 and the oldest in 1992. Only two children turned 17 in June of 2009 – one boy from group A and one girl from group B.

The causes of the TBIs were classified according to two categories. The first was a brain injury resulting from a motor vehicle accident (e.g. coming out of a seat as a result of a car hitting a tree, being hit by another car), and the second category – due to the difficulty of assigning certain aetiology to brain injuries – included other types of injuries, with causes like: a skateboarding accident, fall from a height, a beating.

The proportion of the two categories is presented in Table 1.

The most common cause of TBI was a motor vehicle accident, both in group A (23 boys, that is 88.46% and 18 girls, that is 75%) and B (21 boys, that is 80.77% and 17 girls, that is 70.83%). The differences between the studied groups were not significant statistically (Yates' $\chi^2=2.244$; $df=3$; n.s.).

The data concerning the duration of coma or post-traumatic amnesia in both studied groups, as well as accompanying neurological disorders and brain lesions, suggest that most of the children from groups A and B have suffered a severe brain injury.

Most of the participants from group A (19 boys, i.e. 73.08% and 18 girls, i.e. 75%) and B (21 boys, i.e. 80.77% and 19 girls, i.e. 79.16%) stayed in a long coma, lasting more than 14 days. The differences between the studied groups were not significant statistically (Yates' $\chi^2=2.321$; $df=3$; n.s.).

The duration of post-traumatic amnesia was similar in both groups. In both groups, A (19 boys, i.e. 73.08% and 17 girls, i.e. 70.83%) and B (19 boys, i.e. 73.08% and 18 girls, i.e. 75%), the duration of post-traumatic amnesia was 1 month. The differences between the studied groups were not significant statistically (Yates' $\chi^2=1.163$; $df=6$; n.s.). Therefore groups A and B are comparable with regard to the depth of brain injury.

Study methods

The following study tools were used in the studies:

1. Analysis of documentation, including medical history, results of tests, and neuroimaging tests: computer tomography (CT) or magnetic resonance (MRI). The data

Table 2. Descriptive statistics of the results obtained in study I and II in MMSE by the participants from group A.

| Statistics | Study I | Study II | ▲ (pt) | ▲ % |
|--------------------------|---------|----------|--------|--------|
| Mean | 19.2 | 12.1 | -7.1 | -38.8% |
| Standard error | 0.83 | 0.84 | 0.42 | 2.48% |
| Median | 18.5 | 11.5 | -7 | -38.8% |
| Mode | 18 | 7 | -8 | -66.7% |
| Standard deviation | 4.56 | 4.62 | 2.27 | 13.61% |
| Variance of a sample | 20.76 | 21.37 | 5.17 | 1.85% |
| Range | 19 | 18 | 9 | 50.7% |
| Minimum | 9 | 3 | -3 | -16.0% |
| Maximum | 28 | 21 | -12 | -66.7% |
| Confidence level (95.0%) | 1.70 | 1.73 | 0.8489 | 0.0508 |

obtained from the analysis of documentation was used to characterise groups of participants.

- Interview and psychological interview, where attention was paid to the relatives confirming data obtained from the post-TBI adolescents, who for various disorders, including memory disorders, cannot properly give some of the necessary information by themselves [3].
- Mini-Mental State Examination – MMSE, which allows for the determination of cognitive disorders and their depth [30].
- Frontal Behavioural Inventory (FBIInv) which in the authorised Polish version [31], includes a series of 24 questions for the evaluation of conduct disorder. It also includes an evaluation of motor and language skills, as well as alien hand syndrome. A 4-point scale was employed in the evaluation of results:
0 – no conduct disorder,
1 – mild or occasional disorder,
2 – moderate disorder,
3 – serious disorder, almost constant.

The questionnaire was filled in by the patients' carers. The final version of the questionnaire is a series of questions written so as to classify the proper and improper forms of behaviour, giving the carer the possibility of choice. If a carer seemed undecided, or a question was incomprehensible, it was paraphrased in an easier way.

RESULTS

Results obtained from participants of group A compared to those obtained from participants of group B

Global evaluation of the functioning of participants from group A in comparison with the evaluation of participants from group B

Before analysing the results obtained in studies through standard neuropsychological tests allowing for an evaluation of conduct disorder, the results of the Mini Mental State Examination (MMSE) will be presented, allowing for a closer look at the global functioning of the adolescents from groups A and B following TBIs. Although the data is

used for screening, it is important in the analysis of results undertaken in this paper and then in the summary of results and discussion.

Descriptive statistics of the results obtained in study I and II in MMSE by the participants from group A is presented in Table 2.

It can be seen that the results obtained by the participants in group A in study II (an average of 12.1 pt) are significantly lower than the results obtained in study I (an average of 19.2 pt). The obtained difference is 7.1 pt and it is statistically significant ($p=0.000$).

Descriptive statistics of the results obtained in study I and II in MMSE by the participants from group B is presented in Table 3.

The results obtained by the participants in group B in study II (an average of 12.5 pt) are significantly lower than the results obtained in study I (an average of 19.1 pt). The difference is -6.61 pt and this is statistically significant ($p=0.000$).

Comparing the results of groups A and B obtained from the MMSE test, there were no statistically significant differences found between groups, neither in the first study ($t=-0.2$, $p=0.816$, n.s.), nor in the second ($t=-0.4$, $p=0.719$, n.s.). The difference between the first and second study shows deteriorations of the brain functions, and it does not differ significantly between the study participants from groups A or B, neither with regard to the decreased number of points ($t=0.5$, $p=0.4015$, n.s.), nor the percentage deterioration ($t=0.3$, $p=0.3681$, n.s.).

Summing up, we can say that both studied groups were at the baseline (that is in study I) and in the process of therapy (that is in study II), comparable in terms of the intensity of general symptoms of global brain efficiency.

The decrease in the results in the MMSE test for both the studied groups in study II, despite participation in the Conduct Disorder Therapy Programme administered within the "Academy of Life", requires comment. The fact can

Table 3. Descriptive statistics of the results obtained in study I and II in MMSE by the participants from group B.

| Statistics | Study I | Study II | ▲ (pt) | ▲ |
|--------------------------|---------|----------|----------|--------|
| Mean | 19.1 | 12.5 | -6.61 | -37.4% |
| Standard error | 0.89 | 0.96 | 0.554776 | 3.26% |
| Median | 19 | 13 | -7 | 38.5% |
| Mode | 18 | 17 | -4 | 19.0% |
| Standard deviation | 4.73 | 5.06 | 2.935596 | 17.26% |
| Variance of a sample | 22.4 | 25.6 | 8.617725 | 2.98% |
| Range | 19 | 20 | 9 | 75.67 |
| Minimum | 9 | 1 | -3 | 16.0% |
| Maximum | 28 | 21 | -12 | 91.7% |
| Confidence level (95.0%) | 1.834 | 1.961 | 1.14 | 6.69% |

probably be attributed to the growing disorder of cognitive functions linked to post-traumatic dementia, which could occur after severe brain injuries, especially since brain atrophy in the neuroimaging tests increased for most participants.

Results obtained in the Frontal Behavioural Inventory (FBI_{inv}) by the participants from group A compared to those obtained by the participants from group B

As has been already mentioned, for the purpose of statistical analysis, the authors of the original FBI_{inv} scale [24,25] divided the characteristics from the questionnaire into four disorder categories:

1. The category of “emotional disorders” includes 6 traits, namely: apathy, indifference, emotional shallowness, oversensitivity and irritation, excessive jollity, anxiety, aggressiveness.
2. The category of “behavioural disorders” includes 9 traits, namely: passiveness, negligence of appearance, disorganisation, inappropriateness and lack of good manners in behaviour, impulsiveness, unreasonable behaviour, hyperorality, hypersexuality, compulsiveness.
3. The category of “cognitive disorders” includes 5 traits, namely: stubbornness and rigidity of thinking, concreteness, lack of attention, loss of insight, logopenia.
4. The category of “neurological disorders” includes 4 characteristics, namely: perseverations, speech apraxia, incontinence, the presence of alien hand.

Table 4 presents the average results of both studied groups (A and B) and published data from the comparison group (C) for the category of “emotional disorders”.

With regard to emotional disorders in groups A and B as compared to group C we can observe significant intensification of indifference, emotional shallowness or oversensitivity. These results may seem paradoxical, as it is difficult to accept the complaints of families on the lack of normal emotional reactions, and on some other occasions, on their excessive expression. The resolution of this dilemma lies in the great changeability of phenomena in this population, both between individually studied patients, where some are

more indifferent, others – more irritable, and between the behaviour of a given patient on one day and another. As carers often underline, “days of indifference” and “days of oversensitivity” can be observed.

Excessive jollity, characteristic for the “frontal lobe syndrome”, is more visible in patients from group B in comparison with patients from group A, and to patients from group C. An interesting observation is that aggressiveness in patients from both studied groups was less intensified than from the patients from group C. The carers of these patients, asked about possible outbursts of aggression, most often denied that any such events took place and added that patients became rather very “warm” and rarely criticised the behaviour of other people (I did notice exceptions to this rule, however, average marks indicate a strong tendency in that direction, especially in group A), which would prove the influence of the therapy used in this regard.

Table 5 presents the average results of both studied groups (A and B) and published data from the comparison group (C) in the category of “behavioural disorders”.

The analysis of data in Table 5 shows that the most visible is the strong, more than four times greater than for the comparative group C, intensification of compulsiveness in both studied groups. It turns out that a characteristic of post-TBI adolescents is the “rigid keeping” of regime and schedule and an almost panic reaction to a lack of order or “mess” in one’s surroundings as well as disturbance of an already commenced activity.

Interesting results can be observed in the case of hyperorality, which is one of the main characteristics of “frontal lobe syndrome”. In patients from group A significantly lower results were found than in group B, and slightly lower than in patients from group C. The effect should be most probably assigned to the therapy programme used.

This means that the rehabilitation programme has no special influence on the reduction of compulsiveness, but it influences the decrease of hyperorality.

Table 4. Average results of both the studied groups (A and B) and published data from the comparison group (C) for the category of “emotional disorders”.

| Trait | Average mark | | | Comparison | |
|-------------------------------------|--------------|---------|---------|------------|-------|
| | Group A | Group B | Group C | A-C | B-C |
| Apathy | 2.2 | 2.3 | 2.1 | 3.3% | 8.0% |
| Indifference, emotional shallowness | 2.0 | 2.4 | 1.3 | 60.0% | 92.0% |
| Oversensitivity and irritation | 1.8 | 2.5 | 1.3 | 36.4% | 89.4% |
| Excessive jollity | 2.4 | 2.1 | 2.0 | 21.2% | 6.1% |
| Anxiety | 2.9 | 2.9 | 2.7 | 10.0% | 8.6% |
| Aggressiveness | 2.4 | 2.7 | 2.9 | -17.0% | -6.6% |
| Sum | 13.7 | 14.9 | 12.2 | 12.2% | 21.7% |
| Mean | 2.3 | 2.5 | 2.0 | – | – |
| Standard deviation | 0.39 | 0.29 | 0.67 | – | – |

Table 5. Average results of both the studied groups (A and B) and published data from the comparison group (C) in the category of “behavioural disorders”.

| Trait | Average mark | | | Comparison | |
|---|--------------|---------|---------|------------|--------|
| | Group A | Group B | Group C | A-C | B-C |
| Passiveness | 2.4 | 2.7 | 2.3 | 4.8% | 17.9% |
| Negligence of appearance | 2.8 | 2.8 | 2.5 | 10.0% | 11.6% |
| Disorganisation | 2.9 | 2.9 | 3.0 | -2.7% | -2.7% |
| Unreasonable behaviour | 2.1 | 1.7 | 2.4 | -12.9% | -29.5% |
| Inappropriateness of behaviour and lack of good manners | 2.5 | 2.7 | 2.5 | 0.4% | 8.4% |
| Impulsiveness | 2.8 | 2.9 | 2.9 | -3.1% | 0.3% |
| Hyperorality | 1.7 | 2.4 | 1.8 | -3.4% | 36.4% |
| Hypersexuality | 2.1 | 1.9 | 1.0 | 114.3% | 93.9% |
| Compulsiveness | 1.7 | 1.8 | 0.3 | 448.4% | 480.6% |
| Sum | 21.0 | 21.8 | 18.6 | 12.6% | 17.1% |
| Mean | 2.3 | 2.4 | 2.1 | – | – |
| Standard deviation | 0.46 | 0.49 | 0.90 | – | – |

Parents of adolescents from both studied groups complained that after being roused from a long-lasting coma they wanted something to drink and to eat, and to put into their mouths everything within their reach (of course, provided that they had no tetraplegia or tetraparesis and could grab something).

The results obtained in groups A and B for “unreasonable behaviour” are thought-provoking, being significantly lower than for group C. This may be explained by the fact that the adolescents’ families thought that in many situations the patients were too scared to be unreasonable in certain situations, and with the physical limitations (motor disorders, such as tetraplegia or tetraparesis) they entered into

potentially dangerous situations relatively rarely. Moreover, most financial decisions were up to the parents and carers, therefore, unreasonable behaviour or unpredictable spending (being the classic cases of such behaviour in patients with frontal lobe syndrome symptoms) could not have taken place in the studied group anyway.

Table 6 presents the average results of both the studied groups (A and B) and published data from the comparison group (C) in the category of “cognitive disorders”.

The differences between the results obtained by the participants from group A and B with regard to cognitive functions as compared to the data published from group C were less

Table 6. Average results of both the studied groups (A and B) and published data from the comparison group (C) in the category of “cognitive disorders”.

| Trait | Average mark | | | Comparison | |
|---------------------------------------|--------------|---------|---------|------------|-------|
| | Group A | Group B | Group C | A-C | B-C |
| Stubbornness and rigidity of thinking | 2.3 | 2.7 | 2.4 | -2.1% | 14.9% |
| Concreteness | 2.7 | 2.8 | 2.4 | 14.4% | 18.6% |
| Lack of attention | 2.9 | 2.9 | 2.9 | -0.3% | -0.3% |
| Loss of insight | 3.0 | 3.0 | 2.9 | 3.8% | 3.8% |
| Logopedia | 2.4 | 2.7 | 2.8 | -13.7% | -2.9% |
| Sum | 13.3 | 14.1 | 13.3 | 0.1% | 6.1% |
| Mean | 2.7 | 2.8 | 2.7 | 0.0 | 0.1 |
| Standard deviation | 0.30 | 0.13 | 0.28 | -0.02 | -0.15 |

Table 7. Average results of both the studied groups (A and B) and published data from the comparison group (C) in the category of “neurological disorders”.

| Trait | Average mark | | | Comparison | |
|-----------------------|--------------|---------|---------|------------|--------|
| | Group A | Group B | Group C | A-C | B-C |
| Speech apraxia | 2.5 | 2.8 | 2.3 | 10.0% | 21.2% |
| Incontinence | 1.1 | 2.2 | 1.9 | -40.9% | 18.3% |
| Feeling of alien hand | 0.1 | 1.5 | 0.2 | -56.5% | 552.2% |
| Perseverations | 1.7 | 2.2 | 1.7 | 0.6% | 30.2% |
| Sum | 5.4 | 8.7 | 6.1 | -10.7% | 42.9% |
| Mean | 1.4 | 2.2 | 1.5 | -0.1 | 0.7 |
| Standard deviation | 1.03 | 0.53 | 0.90 | -0.13 | -0.43 |

distinct. It can be observed that patients from group A and B slightly more often showed difficulties in understanding metaphor and abstract notions, when compared to patients from group C. The rigidity of thinking was lower in group A, and greater in group B, which should most probably be associated with the enormous difficulties experienced by these patients in adjusting to changing conditions, especially due to a lowered state of awareness related to a severe brain injury. We can also attribute the results obtained by patients from group A to the therapy programme used.

Table 7 presents the average results of both studied groups (A and B) and published data from the comparison group (C) in the category of “neurological disorders”.

With regard to neurological disorders we can observe much more diversified results than in the case of other categories of disorders, both when comparing groups A and B with group C, and when comparing groups A and B. Thus, the families of patients from group A complained much less about incontinence, while such problems were slightly more frequent in patients from group B, when compared with group C. We can consider to what extent such problems result from purely physical causes (that is lack of control

over constrictors), and to what extent from more mental or behavioural causes (that is the patient does not want to go to the toilet, or cannot discontinue an activity to take care of their physiological needs, etc.). It is worth noting that similar observations were made by Pachalska in her article, studying adults after TBIs [4] and children after TBIs. In the last case we would obviously be dealing with disorders of planning and activity control, which, as I have already emphasised numerous times, is the function of the frontal lobes [32,33]. Therefore, the obtained results could be related to the conducted therapy programme.

Differences between the groups obtained with regard to the “alien hand” symptom were shocking, unless the fact that this extreme is rather explained by the “law of small numbers”. It is worth noting, however, that in some patients from group B there were also cases of an “alien hand”, when a patient has a feeling that one of their hands (most often the left) does not belong to them and behaves independently of their consciousness (e.g. when the patient takes food from a plate with the right hand and immediately puts it back with the left hand) [3,4].

Perseverations were observed at the same level in patients from group A as in those from group C, while behaviour of

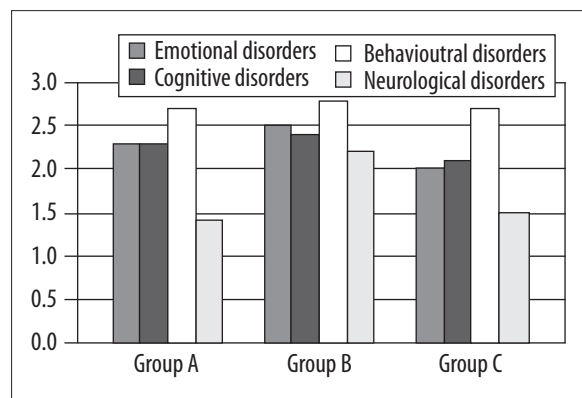


Figure 1. Average results obtained by patients from group A and B with regard to emotional, cognitive, behavioural and neurological disorders compared to published data (group C).

this type (that is the purposeless repeating of identical behaviour – motor or verbal) was observed in patients from group B much more often. It seems that the therapy programme employed influenced the results.

Figure 1 shows the average results obtained with regard to individual emotional, cognitive, behavioural and neurological disorders when compared to published data (group C).

In analysing the data in Figure 1 we can see that both in group A and B there is a greater intensity of frontal lobe syndrome when compared to group C, which has already been presented above. The differences are statistically significant in the case of group A, but not for group B. This can be linked to the therapy programme used in group B.

We should underline the fact that with regard to average evaluation of points obtained in the FBIInv questionnaire, the most distinct are the differences in neurological disorders, while the least are in cognitive disorders, which can

be linked to growing disorders of cognitive functions related to increasing post-traumatic dementia.

Reintegration with society

An important issue in the undertaken studies appears to be the reintegration with society, understood as a return of post-TBI adolescents to activities from before the accident, both in terms of education, and participation in general social activities, especially with regard to hobbies practised before the accident.

Return to school

In Table 8 we present the percentage results for returns to school, obtained by post-TBI adolescents (with a division as to sex) who were or were not subjected to the post-accessive Conduct Disorder Therapy Programme.

Detailed analysis of the results presented in the table above, further developed by results obtained in a chi-square test, indicates that in group A (children covered by the therapy programme) both for boys (chi-square=5.04, p=0.024), and girls (chi-square=4.12, p=0.041) there are statistically significant differences between the two studies in relation to return to school. It proves that participation in the therapy programme significantly more often allowed the post-TBI adolescent to return to school, regardless of their sex.

Similar statistics concerning children from group B (not covered by the therapy programme after a TBI) indicates no significant differences with regard to a return to school between study I and II, both for boys (chi-square=0.34, p=0.560), and for girls (chi-square=0.000, p=1.000). This means that without therapy adolescents after a TBI do not return to school, and, what is more, in the case of boys we can even observe a reverse relationship; in between the two studies, approx. 8% of the boys decided not to attend school. A similar case was not reported in group A.

Table 8. Return to school in studied groups.

| Sex | Group A | | | | Group B | | | |
|-------|---------|-------|----------|-------|---------|-------|----------|-------|
| | Study I | | Study II | | Study I | | Study II | |
| | n | % | n | % | N | % | n | % |
| Boys | 11/26 | 42.3% | 19/26 | 73.1% | 10/26 | 38.5% | 8/26 | 30.8% |
| Girls | 10/24 | 41.7% | 17/24 | 70.8% | 9/24 | 37.5% | 9/24 | 37.5% |

Table 9. Return to a hobby practised before the accident in the groups studied.

| Sex | Group A | | | | Group B | | | |
|-------|---------|------|----------|------|---------|------|----------|------|
| | Study I | | Study II | | Study I | | Study II | |
| | n | % | N | % | N | % | n | % |
| Boys | 3/26 | 11.5 | 21/26 | 80.8 | 4/26 | 15.4 | 6/26 | 23.1 |
| Girls | 2/24 | 8.3 | 19/24 | 79.2 | 3/24 | 12.5 | 7/24 | 29.2 |

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Additionally a comparison between the sexes from both groups (group A and group B) in both studies (I and II) was performed. An analysis of the results in relation to a return to school of post-TBI children in study I, that is, before the beginning of therapy (only with regard to group A) indicates a lack of statistical differences both between the boys (chi-square=0.44, $p=0.508$), and between the girls from groups A and B (chi-square=0.17, $p=0.676$). On the other hand, in study II statistically significant differences were observed both between the group of boys (A and B) (chi-square=9.32, $p=0.002$), and girls (also A and B) (chi-square=5.37, $p=0.020$). Post-TBI boys and girls from group A (who underwent therapy) returned to school after the accident significantly more often than boys and girls from group B who had not attended the therapeutic programme.

Return to a hobby practised before the accident

Apart from the return to school activity, the analysis covered also the return to a social activity, with special attention paid to a hobby practised before the accident.

Table 9 presents the results obtained by the post-TBI children studied (divided by sex) who did or did not undergo the therapy programme, with special attention paid to a hobby practised before the accident.

The results indicate that there are statistically significant differences in study I and II in group A between boys (chi-square=25.07 $p=0.000$), and girls (chi-square=27.46 $p=0.000$) with regard to a return to a practised hobby. Participation in the therapy programme significantly more often allows post-TBI children, regardless of their sex, to return to a social activity from before the accident, especially to their hobbies.

Similar statistics concerning children from group B (not covered by the post-TBI therapy programme) indicates no significant differences with regard to a return to hobbies practised before the accident both for boys (chi-square=0.50, $p=0.481$), and for girls (chi-square=2.02, $p=0.150$).

We observed a lack of statistically significant differences between boys in study I and II in group B (chi-square=25.07 $p=0.000$) and girls in study I and II in group B (chi-square=24.46 $p=0.000$) with regard to their hobbies practised before the accident, which means the therapeutic help that the participants did not receive is necessary in this area.

DISCUSSION

The studies that I conducted confirmed that post-TBI adolescents suffer from conduct disorders of the "frontal lobe syndrome" type; however, the profile of these disorders connected with the occurrence of negative and positive conduct disorders varies between individual patients. Similar results were also obtained by Pachalska [4], who observed that it is mainly due to the fact that a TBI can have various characteristics, location and depth.

The results of the studies confirm general assumptions of microgenetic theory, stating that conduct disorders occurring in post-TBI adolescents can be generally classified from the lowest and oldest dysfunctions to the highest and at the same time the filogenetically youngest structures of the

brain. Therefore, first of all, there may be a lack in general cortical activity due to the disorders of the activities of the ascending reticular formation of the brain stem; secondly, there can also be a dysfunction of the cingulate gyrus, influencing an increase of anxiety, emotional instability and excessive excitation; thirdly a disorder of prefrontal-striato-thalamic system activities can occur, which will cause hyperactivity of the frontal lobes and, as a result, an increase in antisocial behaviour.

In summarising my studies, it is worth emphasising the important role of neuroimaging, which was conducted on all the adolescents studied. These tests allowed one to show which parts of the brain are injured, being linked to the profile of behaviour disorder. The knowledge is necessary to suggest more precise and specific neuropsychological diagnostics of the cognitive, emotional and behavioural disorders. It also promotes a better selection of more effective therapy of these disorders.

In my studies the knowledge used while administering the post accessive Conduct Disorder Therapy Programme, which assumed a heuristic strategy, was selected on the basis of feedback according to the needs of individual patients. Such an action, as has been proved, promoted the reduction of many symptoms occurring in adolescents after a brain injury.

The principles of microstructure action turned out to be helpful [3,4], which states that the behaviour of a person is based mostly on action, understood as a process of creating an intention to act and undertaking to perform it. According to Brown [21], the action remains in the same relationship with behaviour, as cognition is with sensual perception. In other words, action, in a similar way to cognition, comprises brain processes which start, continue and end in the brain. Obviously, the action is realised externally, in a manner visible to the environment [20].

It should also be mentioned that both the microstructure of action and the microstructure of perception are a result of reproducing the filogenesis and ontogenesis of a human being. Each realised action in a split second passes through certain phases, corresponding to the phases of the brain and prosencephalon, from the brain stem with the mesencephalon through the basal ganglia and limbic system to the cerebral cortex. These are, respectively, the spheres: drives, emotions and thinking, while each lower level is a separate system, considered subjectively, not objectively in the work of the higher level. At each level the whole cycle: *perception–action* starts, develops and ends. Behaviour is an action realised externally, in a way visible to the environment. This is illustrated in Figure 2.

In Figure 2 the thick, grey arrow represents the brain process realised in time.

An arrangement of three triangles represents the three main levels of the central nervous system. Each process starts in the deepest, filogenetically and ontogenetically oldest layers and goes "upwards" through newer layers of the cortex. When a given process reaches point "a" at the lowest triangle of Figure 2. the perception–action cycle can be closed at that level (**brain stem with mesencephalon**) and it is possible

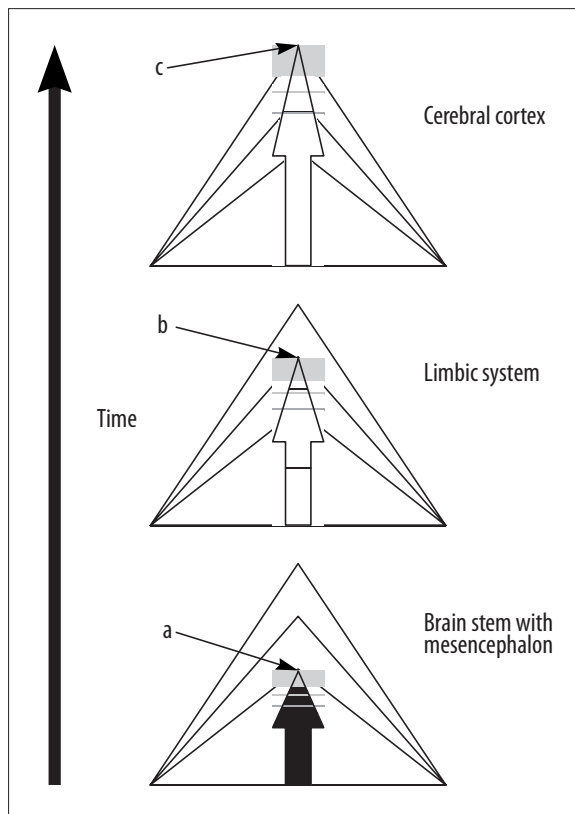


Figure 2. Cycle perception – action according to microgenetic theory. Source: Pachalska [4].

to activate certain behaviour. At this level the organism sees the world in very simple categories, such as e.g. dangerous – safe, pleasant – unpleasant and reacts also simply and directly, approaching what is safe and pleasant, and leaving the dangerous and unpleasant. This is the perception of large, poorly diversified whole parts, while action is the reaction of the whole body. It should be emphasised that further development of that process through newer, higher layers of the cortex is not necessary, since, as was mentioned above, the perception–action cycle is already closed.

Another level (**limbic system**) accepts the activities of lower levels as the subject of perception given in the developing situation. The course and result of the perception – action cycle at the lower levels do not make decisions concerning the character of perception–action at higher levels; however, it is not indifferent to them. In other words: a higher level can react in the same way as the lower, or the other way round, when the behaviour initiated before is inhibited. At the level of the limbic system, when the process reaches point “b” in the middle triangle on Figure 2, the perception and action are performed at the emotional level, which means we perceive the quality of objects, whether we like them or not, and these reactions are in fact physiological, starting with the ejection of hormones. Both perception and action may proceed according to the reactions of the lower level, though not necessarily, which creates a possibility of internal conflict. A trivial but interesting example is riding on a big wheel, when the brain stem “shouts”: “*This is dangerous!*”, and the child holds its breath, but the limbic system responds: “*Yes, I like that!*”, and the child gets a thrill of emotion.

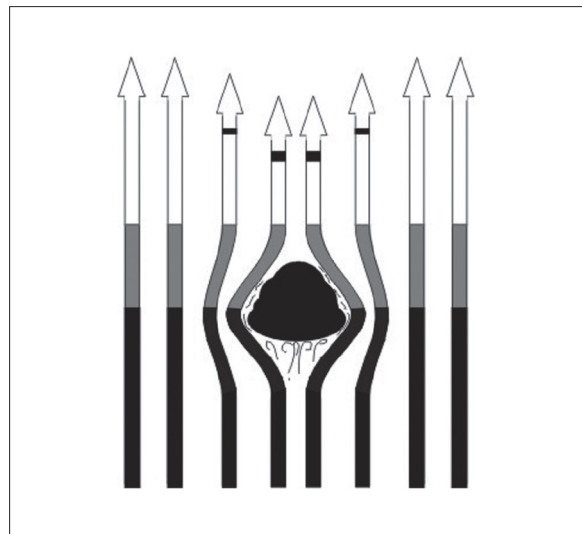


Figure 3. Influence of damage on the cognitive processes and behaviour. According to microgenetic theory, damage to the brain delays the development of a given part of the process. As a result of the delay, there is an unfinished specification for that part of the process, which despite that unfinished specification proceeds further to subsequent stages of processing until its natural finish. Then the revealed, final act contains a more or less distinct fault, that is, the disorder. The rule applies to cognitive processes, behaviour, as well as communication. Source: Brown & Pachalska [28].

Next level (**cerebral cortex**) is responsible for the “articulation” of perception and action, when the process reaches point “c” in the highest triangle. The cortex, especially the frontal lobes, is responsible for the inhibition or the continuation of the initiated behaviour, that is, for the so called state of “*I want it or I do not want it*”.

From the microgenetic perspective the conduct disorder (a symptom) does not constitute only a *deviation from the norm*, but rather an *earlier stage of appropriate behaviour* that is revealed externally too early. A brain injury cannot *add* anything to a person’s behaviour, it can only *remove* something. A disturbance in the microevolution of action connected with the damage to certain neurons results in more primitive phases of action formation, which becomes further processed in a healthy brain, being revealed in the performed action (Figure 3).

As was mentioned before, in post-TBI adolescents conduct disorders known as “frontal lobe syndrome” are often observed. Of course, the component of individual symptoms in the “frontal lobe syndrome” is formed according to the rules of the microstructure of action proceeding at certain levels, as described above. The symptoms itself (in the case of these studies – conduct disorder) forms on the basis of the location and extent of the brain damage.

The assumption of the presented microgenetic theory as the basis for studies and administering exercises intended to modify unwanted behaviour allowed for the reduction of selected characteristics of the “frontal lobe syndrome” in post-TBI adolescents, and enabled them to integrate more with society. The most enjoyable and highly evaluated on

the part of adolescents (and their families) were exercises on the basic functions of the frontal lobes, aiming at:

- *starting* (starting an activity),
- *stopping* (inhibiting the activity),
- *shifting* (changing the mode of action during the activity).

It is worth noting that these functions are also assigned by some authors to the category of “cognitive functions” [4,32].

In the therapy of conduct disorder in post-TBI adolescents it was important to distinguish between programmes aimed at the “*reduction of disorder and programmes aimed at the reduction of activity limitations*”. Adolescents (and their families) highly appreciated rules according to which such therapy:

- *proceeded on the basis of the selected therapy model including certain guidelines and regularities* (algorithmic or heuristic), the breaking of which may result in ineffectiveness or inefficiency of the therapeutic process,
- *had a specific bank of strategies and therapeutic techniques*, which determine the methods of influencing, in other words, being the core of the rehabilitation.
- *included the purposeful activity* of as many people as possible with the environment of a client (with the client himself or herself), including the therapist, parents, carers, friends, etc.

Similar observations were also made by Pachalska [4].

Training carers in this programme was also an important moment in the reintegration of adolescents following a TBI. It facilitated the cooperation with the family and observance of the general rules of the programme when the adolescent was already at home during the final stage of rehabilitation. A trained family understands that the “conduct of conduct” includes complementary mechanisms of stimulation and inhibition of reactions, similar to the hormones and enzymes in the body, which depending on the biochemical and biophysical processes increase or decrease the speed of certain extracellular processes. It also shows that some symptoms of the “frontal lobe syndrome” result from the lack of inhibition (stopping), while others from the lack of stimulation (activation). Thus, the expression of some symptoms of this syndrome is paradoxical: some patients are apathic, reticent, and others are excited and excessively talkative [3].

A trained family learns that the paradoxical expression always results from the same pathomechanism. In a healthy person the frontal lobes *regulate* behaviour; in the case of pathology the regulation is disturbed and the behaviour is either completely uninhibited, exaggerated, or the action does not form at all; in other words, the patient is apathic and does not initiate any activity. It is understood then that contact with a therapist is needed to receive advice and in extraordinarily difficult cases to obtain help in resolving a problem through crisis intervention. This knowledge is used when working with a post-TBI adolescent.

CONCLUSIONS

As a result of these studies, it was concluded that the post accessive Conduct Disorder Therapy Programme administered within the “Academy of Life” influences significantly:

1. The resolution of conduct disorder of the “frontal lobe syndrome” type, with regard to emotional, cognitive, behavioural and neurological processes, which is proved by a smaller intensity of the disorders of individual “frontal lobe syndrome” characteristics in participants from group A when compared with the participants from group B, while the most distinct differences are those within neurological disorders, the least in cognitive disorders.
2. The social reintegration, and, indirectly, the quality of life of adolescents after a TBI, which is proved by a greater growth of the percentage of participants from group A returning to school and hobbies practised before the accident, when compared to the participants from group B, in which the percentage even decreased.

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