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Original Research Article

NDT-Bobath method in post-stroke rehabilitation in adults aged 42–55 years – Preliminary findings

Emilia Mikołajewska [a,b,*]

[a] *Rehabilitation Clinic, The 10th Military Clinical Hospital with Polyclinic, Bydgoszcz, Poland*
[b] *Disorders of Consciousness Research and Neurorehabilitation Unit, Neurocognitive Laboratory, Centre for Modern Interdisciplinary Technologies, Nicolaus Copernicus University, Toruń, Poland*

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ABSTRACT

Introduction: Stroke is among the leading causes of death in both developed and developing countries. Although stroke is perceived predominantly as a disease of middle aged and older people, its occurrence in younger people is not rare, influencing all aspects of young people's lives, including the ability to work.

Aim: Pilot study – a single group before-and-after preliminary study to investigate the feasibility of conducting a larger randomized controlled trial investigation of the efficacy of the NDT-Bobath method with the younger adult stroke survivor population.

Material and methods: Patients were admitted to the neurological rehabilitation unit after ischemic stroke. Ten sessions of the NDT-Bobath therapy were provided within 2 weeks, constituting 10 days of the therapy. The therapy was performed every day for 5 days a week. Measurements of the Ashworth Scale, the Bobath Scale, the Barthel Index, gait velocity, cadence and stride length were conducted twice: on admission, and after the last session of the rehabilitation.

Results and discussion: Statistically significant and favorable changes in the muscle tone, hand functions, selected activities of daily living, gait velocity, cadence and stride length have been observed.

Conclusions: Findings confirm that the NDT-Bobath method for adults may be perceived as a promising form of post-stroke rehabilitation in young adults.

1. Introduction

There is a need to recognize that stroke is among the leading causes of death in both developed and developing countries: from 1.1 million cases per year (2000) and an estimated 1.5 million in 2025 in Europe, with significant variations worldwide.[1,2] Although stroke is considered predominantly a disease of middle aged and older people, its occurrence in younger people is not rare. Stroke is considered a common and

* *Correspondence to*: Powstańców Warszawy 5, 85-681 Bydgoszcz, Poland. Tel.: +48 725 889 909.
E-mail address: e.mikolajewska@wp.pl

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long-term condition, affecting the physical, cognitive and emotional abilities of stroke survivors.

Suffering a stroke represents a particularly heavy loss for young adults of working age. Depending on the country, the working age range might be identified as between 18 and 55 years. No doubt stroke in young adults results in a greater loss of potential working years in life. Effective prevention programs and acute care and long-term rehabilitation restoring patients to their highest possible functioning are crucial and reflect the greater interest of society. This emphasizes the importance of looking for effective rehabilitation approaches in post-stroke therapy.

This Neuro-Developmental Treatment-Bobath (NDT-Bobath) intervention method is considered one of the most common in contemporary post-stroke rehabilitation. It is not specifically a set of exercises, but rather an entire concept of 24 h 7 days a week neurorehabilitation and care based on proper patterns and stimulation, optimal utilization of patients' nervous system neuroplasticity, avoiding of compensatory patterns, and maximal independence of the patient in activities of daily living. Despite a long tradition (since the 1940s) and the wide use of NDT-Bobath concept, there are only a few studies in the area of its outcomes in stroke survivors.[3–9] The magnitude of the results of the intervention using the Bobath concept does not exceed other intervention approaches. What is more, there seems to be a lack of outcome studies that focus on younger adults with stroke. Generally, the limited amount of reliable evidence is regarded as a key problem in contemporary neurorehabilitation faced with the Evidence-Based Medicine paradigm.[10,11] This paper aims to change this situation. The current investigation is regarded as a pilot study. The design presented is a single group before-and-after preliminary study to investigate the feasibility of conducting a larger randomized controlled trial investigation of the efficacy of the NDT-Bobath method with the younger adult stroke survivor population.

The importance of this problem seems to have significantly increased in the new millennium.[1,2] The influence of stroke on the ability to work may be perceived as more significant than other factors, causing long-term problems for the stroke survivors, their families, the community, and society. The possible consequences of stroke in young adults that are considered severe are as follows:

- for individuals: no doubt being a young post-stroke adult is a difficult experience, reflected in shock, fear, disorientation, changed attitude toward life, and changed priorities,[12]
- for employees: discontinuation of work during recovery with possible change of position, or even unemployment,[12–18]
- for employers: temporary or permanent loss of some talented employees; adaptation of work places for stroke-survivors,
- for government: changes in health care policy; increased costs (in societies with government administered health-care),
- for society: increased number of young frustrated people.[12–18]

Problems associated with the return to work of stroke-survivors were studied in the past.[13–18] The younger adult stroke survivor population has special rehabilitation needs, specifically with regard to promoting return to work.

2. Aim

The key aim of the research described in this paper is to begin to fill an important gap in the available data by showing the results of post-stroke neuro-rehabilitation using the NDT-Bobath method in the population of younger adults.

3. Material and methods

A group of 21 participants with a mean age of less than 50 and an age range of 42–55 admitted to the neurological rehabilitation unit were assessed according to the criteria described below. The study population represents the younger adult post-stroke group compared to the mean age and age range in conventional stroke rehabilitation literature.

The inclusion criteria were as follows: age (between 18 and 55 years), time after cerebrovascular accident (CVA) 1 month to 3 years, and clinical status of first ischemic stroke confirmed by examination. The exclusion criteria was serious complicating medical illness making rehabilitation not possible. Each of them received the same intervention. The divisions were made due to various age limits accepted by the other researchers and clinicians. The patients' profiles are presented in Table 1.

The study addressed all young adults, but a significantly high mean age of patients was observed: 48.667 (median 49).

The study was accepted by the appropriate bioethical committee. All subjects gave written informed consent before entering the study in accordance with the recommendations of the bioethical committee acting on the rules of Good Clinical Practice and the Helsinki Declaration.

The study design consists of before and after measurement of the selected parameters in the study participants without a control or comparison group. Ten sessions of the NDT-Bobath therapy within 2 weeks were provided, constituting 10 days of the therapy; the therapy was performed every day for 5 days a

Table 1 – Patients' overall profiles.

Parameter	Number and percentage ($n = 21$)
Stroke type	Ischemic (100%)
Side of paresis	
Left	11 (52.38%)
Right	10 (47.62%)
Sex	
Females	13 (61.9%)
Males	8 (38.1%)
Age, years	
Minimum	42
Maximum	55
SD	4.016
Mean	48.667
Median	49

week. Each session lasted 30 min. During the sessions, consistency of intervention was maintained, and fidelity to the NDT-Bobath method or concept was ensured given that all patients were treated according to the current rules of the method by the same experienced therapist (more than 10 years of experience in post-stroke neurorehabilitation) with international certificates: both IBITA (International Bobath Instructors Training Association) and EBTA (European Bobath Tutors Association) recognized. This is the proper methodology to provide up-to-the-date knowledge and experience in the NDT-Bobath method, consistency of intervention, and fidelity to the NDT-Bobath method, useful for comparison-study purposes. There were no additional treatment techniques used in addition to NDT-Bobath. This study provides evidence of effictivity of sole NDT-Bobath method of therapy. This will provide data sets for further comparison-study purposes between application of the sole NDT-Bobath method of therapy and eclectic/mixed method applied usually in clinical practice.

Assessment was based on the change in parameters: the Ashworth Scale for Grading Spasticity to assess upper extremity muscle tone (validity and reliability: Morris,[19] Pandyan et al.,[20] Alibiglon et al.[21]), the Bobath Scale to assess upper limb mobility, the Barthel Index to assess selected activities of daily living (assessed as "valid" Collin et al.,[22] Ghandehari et al.,[23] Huybrechts and Caro[24]), gait velocity, cadence, and stride length. Measurements of the parameters were conducted by the same therapist twice: on admission, and after the last session of the rehabilitation. The author's own gait analysis method published in[9] is based on:

- gait recording (using a digital video camera),
- visual gait evaluation,
- measurement of spatio-temporal gait parameters: gait velocity, cadence and stride length,
- calculating values (including normalized values) using the Clinical Gait Analyzer – free software developed by Chris Kirtley MD (USA), and their interpretation.

The results of measurements, where available, were given as mean, median, maximal value, minimal value and standard deviation (SD). The level of statistical significance was set at $P < 0.05$. The data were analyzed with Statistica 9 software. *T*-tests were used to establish significance to determine if there was significant change from the first to the second measurement. There is a *t*-test for dependent samples, meaning before and after scores using the same sample of participants. It is also called the repeat measures *t*-test.

4. Results and discussion

The results are presented in Tables 2–5.

In the first part of the study – assessment of the normalization of upper limb muscle tones – "no change" outcomes reflected the best possible outcomes, and cannot be improved. Results of all the remaining patients improved with mean value: 1 point.

In the second part of the study – assessment of upper limb mobility using the Bobath Scale – 85.71% recovery was observed. Mean recovery was: 3.278 points.

Table 2 – Assessment of the normalization of upper limb muscle tonus in patients estimated on the Ashworth Scale for Grading Spasticity.

Parameter	Number and percentage ($n = 21$)
Recovery	6 (28.57%)
No change	15 (71.43%)
Relapse	0
N/A	0
Minimum change for recovery	1
Maximum change for recovery	1
Mean change for recovery	1
Median change for recovery	1
t-Test results for changes between before and after therapy	Before therapy: Mean = 1.095, SD = 1.48, SE = 0.32 After therapy: Mean = 0.809, SD = 1.209, SE = 0.26 $P = 0.005$

Table 3 – Assessment of the upper limb mobility using Bobath Scale.

Parameter	Number and percentage ($n = 21$)
Recovery	18 (85.71%)
No change	3 (14.29%)
Relapse	0
N/A	0
Minimum change for recovery	1
Maximum change for recovery	6
Mean change for recovery	3.278
Median change for recovery	3
SD for recovery	1.592
t-Test results for changes between before and after therapy	Before therapy: Mean = 11.05, SD = 5.33, SE = 1.16 After therapy: Mean = 13.52, SD = 3.87, SE = 0.84 $P = 0.000$

Table 4 – Assessment of the selected ADLs using of Barthel Index.

Parameter	Number and percentage ($n = 21$)
Recovery	6 (28.57%)
No change	15 (71.43%)
Relapse	0
N/A	0
Minimum change for recovery	10
Maximum change for recovery	10
Mean change for recovery	10
Median change for recovery	10
t-Test results for changes between before and after therapy	Before therapy: Mean = 37.38, SD = 4.9, SE = 1.07 After therapy: Mean = 39.76, SD = 1.09, SE = 0.23 $P = 0.01$

Table 5 – Results of the gait velocity, cadence, and stride length.

Parameter	Number and percentage ($n = 21$)
Velocity	
Recovery	15 (71.43%)
No change	2 (9.52%)
Relapse	3 (14.29%)
N/A	1 (4.76%)
Minimum change for recovery	0.1
Maximum change for recovery	0.8
Mean change for recovery	0.407
Median change for recovery	0.5
SD for recovery	0.277
Minimum change for relapse (abs)	1
Maximum change for relapse (abs)	2
Mean change for relapse (abs)	1.333
Median change for relapse (abs)	1
SD for relapse (abs)	0.471
t-Test results for changes between before and after therapy	Before therapy: Mean = 0.64, SD = 0.23, SE = 0.05 After therapy: Mean = 0.91, SD = 0.44, SE = 0.1 P = 0.000
Normalized velocity	
Recovery	14 (66.66%)
No change	3 (14.29%)
Relapse	3 (14.29%)
N/A	1 (4.76%)
Min change for recovery	0.01
Max change for recovery	0.43
Mean change for recovery	0.14
Median change for recovery	0.08
SD for recovery	0.138
Change for relapse (abs)	–
Min change for relapse (abs)	0.03
Max change for relapse (abs)	0.1
Mean change for relapse (abs)	0.053
Median change for relapse (abs)	0.03
SD for relapse (abs)	0.032
t-Test results for changes between before and after therapy	Before therapy: Mean = 0.22048, SD = 0.08291, SE = 0.01809 After therapy: Mean = 0.32, SD = 0.15, SE = 0.03 P = 0.000
Cadence	
Recovery	15 (71.43%)
No change	1 (4.76%)
Relapse	4 (19.05%)
N/A	1 (4.76%)
Minimum change for recovery	5
Maximum change for recovery	42
Mean change for recovery	18.133
Median change for recovery	10
SD for recovery	13.21
Change for relapse (abs)	-
Minimum change for relapse (abs)	6
Maximum change for relapse (abs)	30
Mean change for relapse (abs)	18
Median change for relapse (abs)	18
SD for relapse (abs)	9.192
t-Test results for changes between before and after therapy	Before therapy: Mean = 87, SD = 22.18, SE = 4.84 After therapy: Mean = 104, SD = 32.11, SE = 7.0 P = 0.01

Table 5 (*Continued*)

Parameter	Number and percentage ($n = 21$)
Normalized cadence	
Recovery	14 (66.66%)
No change	2 (9.53%)
Relapse	4 (19.05%)
N/A	1 (4.76%)
Minimum change for recovery	0.03
Maximum change for recovery	0.31
Mean change for recovery	0.129
Median change for recovery	0.1
SD for recovery	0.095
Minimum change for relapse (abs)	0.03
Maximum change for relapse (abs)	0.15
Mean change for relapse (abs)	0.088
Median change for relapse (abs)	0.085
SD for relapse (abs)	0.045
t-Test results for changes between before and after therapy	Before therapy: Mean = 0.43, SD = 0.11, SE = 0.02 After therapy: Mean = 0.51, SD = 0.16, SE = 0.04 $P = 0.01059$
Stride length	
Recovery	17 (80.95%)
No change	3 (14.29%)
Relapse	0
N/A	1 (4.76%)
Minimum change for recovery	0.15
Maximum change for recovery	0.68
Mean change for recovery	0.32
Median change for recovery	0.28
SD for recovery	0.173
t-Test results for changes between before and after therapy	Before therapy: Mean = 87, SD = 22.18, SE = 4.84 After therapy: Mean = 104, SD = 32.11, SE = 7.0 $P = 0.01$
Normalized stride length	
Recovery	17 (80.95%)
No change	3 (14.29%)
Relapse	0
N/A	1 (4.76%)
Minimum change for recovery	0.18
Maximum change for recovery	0.79
Mean change for recovery	0.406
Median change for recovery	0.31
SD for recovery	0.205
t-Test results for changes between before and after therapy	Before therapy: Mean = 1.95, SD = 0.66, SE = 0.14 After therapy: Mean = 2.36, SD = 0.57, SE = 0.12 $P = 0.000$

In the third part of the study – assessment of the selected activities of daily living using part of the Barthel Index – 28.57% recovery was observed. Mean recovery was 10 points in both cases. Remaining ''no change'' outcomes reflected the best possible outcomes, and cannot be improved.

In the fourth part of the study – assessment of the spatio-temporal gait parameters – despite the short period of the rehabilitation (two weeks), high percentages of recovery were achieved:

- in gait velocity: 71.43%,
- in normalized gait velocity: 66.66%,
- in cadence: 71.43%,
- in normalized cadence: 66.66%,
- in stride length: 80.95%,
- in normalized stride length: 80.95%.

The NDT-Bobath method (the Bobath concept) has merit as an intervention for survivors of stroke, but outcomes research

on post-stroke rehabilitation in the younger adult is lacking. Properly focused intervention is needed to promote return to work in this population.

This study has focused on the determination of changes observed in a group of young adults after hemiplegic stroke as a result of the therapy conducted according to the NDT-Bobath method. These changes were reflected by the significant changes in measured parameters. The good and very good results of the rehabilitation may confirm both the efficacy of the method used, and the high potential for rehabilitation, which is perceived in young stroke-survivors. Unfortunately, there is a lack of similar studies in relation to this topic and thus descriptive results may be very useful for comparison purposes.

The small study sample and lack of a reference group represents a major limitation of this study. Despite the lack of a reference group, the survey is still valuable due to the limited number of research studies concerning the use of the NDT-Bobath method in post-stroke rehabilitation in this age group. Another potential limitation may be the perceived heterogeneity in the sample, specifically with regard to ethnicity, normal for Polish population. Despite the simplicity, the study may indicate predictive values useful in further research and clinical practice, showing the clinical evolution of young stroke survivors assisted with NDT-Bobath rehabilitation method for two weeks. These results compared with two research studies on older groups of patients (mean age 65.7 years) by Mikołajewska[8,9] showed similar results in the therapy of upper limb spasticity and stride length, and better results than described here for a younger group of patients in terms of gait velocity and cadence. Research (including case studies) in this area is rather rare. There is a need for increasing the number of studies, including proposed effective rehabilitation strategies based on the NDT-Bobath concept or an eclectic approach to intervention,[25] for example.

The proposed rehabilitation based on the rules of the Bobath concept may be a useful approach since it offers a continual 24 h 7 days a week patient-oriented way of recovery with an increase in the patient's quality of life, and, indirectly, successful work reincorporation in young adult stroke survivors. Moreover, the Bobath concept is open to novel strategies and developments of eclectic approaches to intervention.[25] Despite many rehabilitation models and techniques within post-stroke neurorehabilitation we have not reached one dominant model.[4–7,26,27] The knowledge and experience of the therapist still remains main basement of clinical decision making within post-stroke neurorehabilitation.[4]

The next part of the research will be both studies on bigger samples, with reference group, and comparative studies between young adults and older stroke survivors. Level of preserved cognitive functions in patients and their ability to cooperate with therapist(s) should be also taken into consideration.

5. Conclusions

The findings presented confirm that the NDT-Bobath method for young adults may be considered an effective form of post-stroke rehabilitation in young adults, but needs further research. There is a need for a larger randomized controlled trial investigation of the efficacy of the NDT-Bobath method with the younger adult stroke survivor population. If proven, better rehabilitation outcomes may increase self-assessment, quality of life, and the ability to work in this age group.

Conflict of interest

None declared.

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