

The impact of PNF and NDT Bobath rehabilitation concepts on stroke patients with sensory disturbances.

Topic of the doctoral thesis: Investigation of the impact of sensory disturbances and methods targeting them, in the context of the effectiveness of rehabilitation of motor deficits in acute phase of stroke

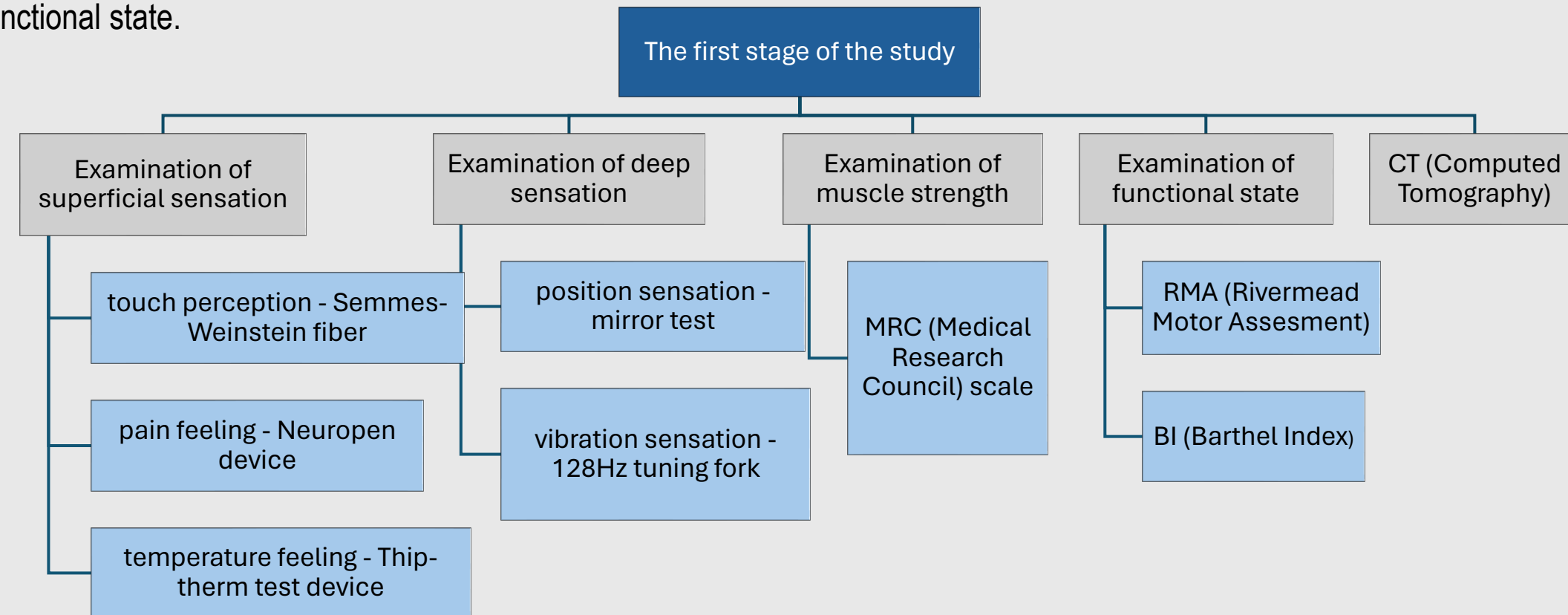
The aim of the study was to determine the frequency of sensory disturbances in patients after stroke and to examine the effectiveness of the PNF (Proprioceptive Neuromuscular Facilitation) and NDT Bobath techniques as a methods of stimulation of disturbed sensory perception, its impact on the improvement of sensation, muscle strength and return to functional efficiency.

Research hypothesis: Additional sensory stimulation using the PNF and NDT Bobath methods improves sensation, muscle strength and increases the functional efficiency of patients.

Subject of research: In the period from January 2023 to January 2024, 329 patients with a diagnosis of stroke were admitted to the ward. Exclusion criteria were recorded in 87 patients who were not eligible for the study. The remaining part – 242 patients were enrolled in the study.

Inclusion criteria: age >18 years, diagnosis - first ever vascular incident - ischemic or hemorrhagic stroke, and in the case of the second part of the study - the presence of sensory disturbances with motor deficit (2-3 on the MRC scale).
Exclusion criteria: significant sensory aphasia, significant hearing loss, significant dementia, neglect syndrome, previously diagnosed polyneuropathy, other neurological diseases with motor and/or sensory deficits (e.g. CNS tumors, MS).

Methodology: The first stage of the study involved 242 patients and included testing of sensation, muscle strength and functional state.

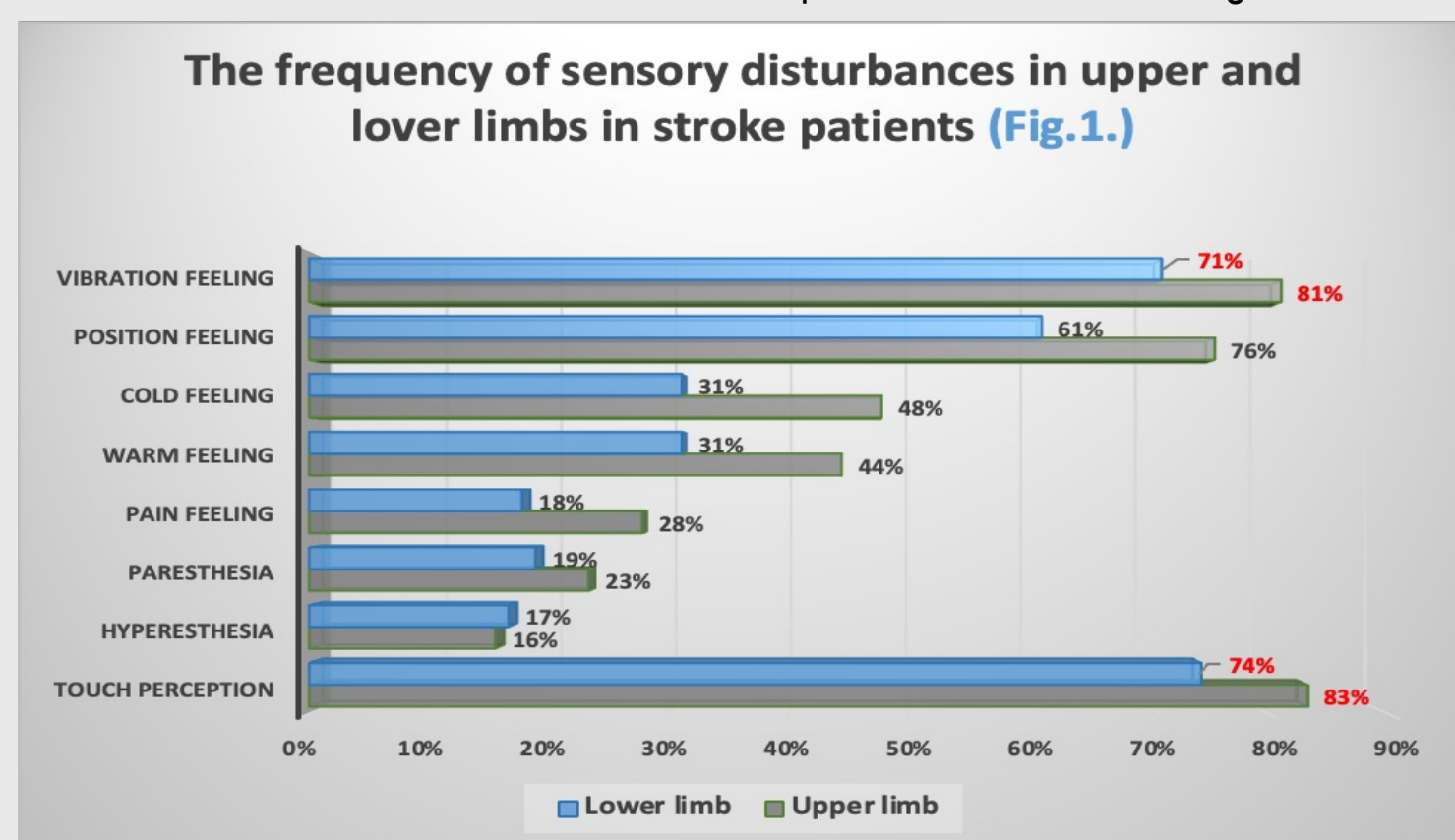


The second part of the study involved 90 patients with a comparable motor deficit, who (in the first stage of the study) were diagnosed with sensory disturbances with paresis of the limbs at the level of 2-3 on the MRC scale. Patients were divided into three groups: **Control group:** 30 patients who underwent standard physiotherapy in the stroke ward; **Study group I:** 30 patients who (apart from standard physiotherapy) underwent PNF therapy; **Study group II:** 30 patients who (apart from standard physiotherapy) underwent NDT Bobath therapy. Patients underwent physiotherapy 1.5h/day for 8 days and then they were re-examined for sensation, muscle strength and functional state.

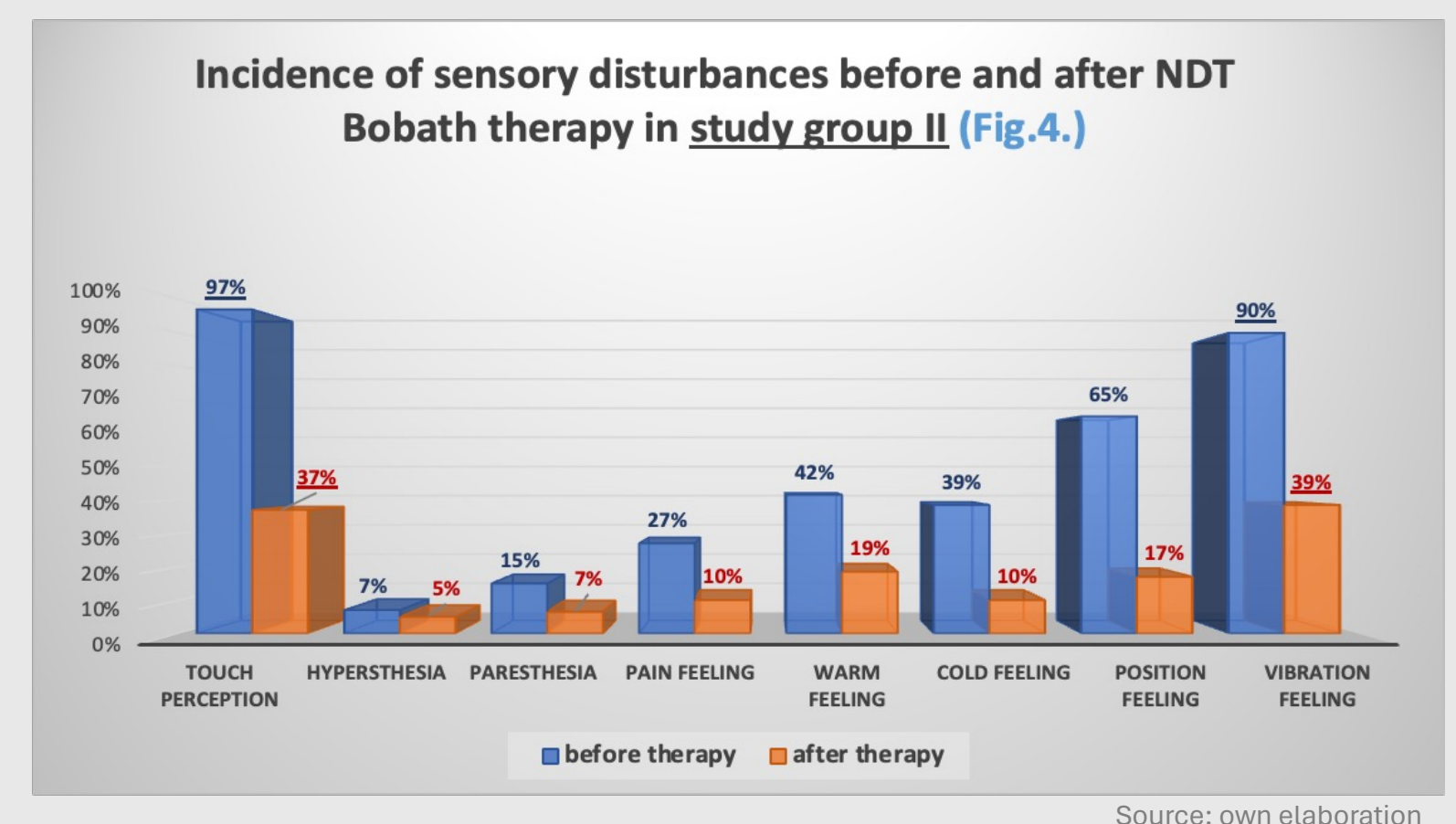
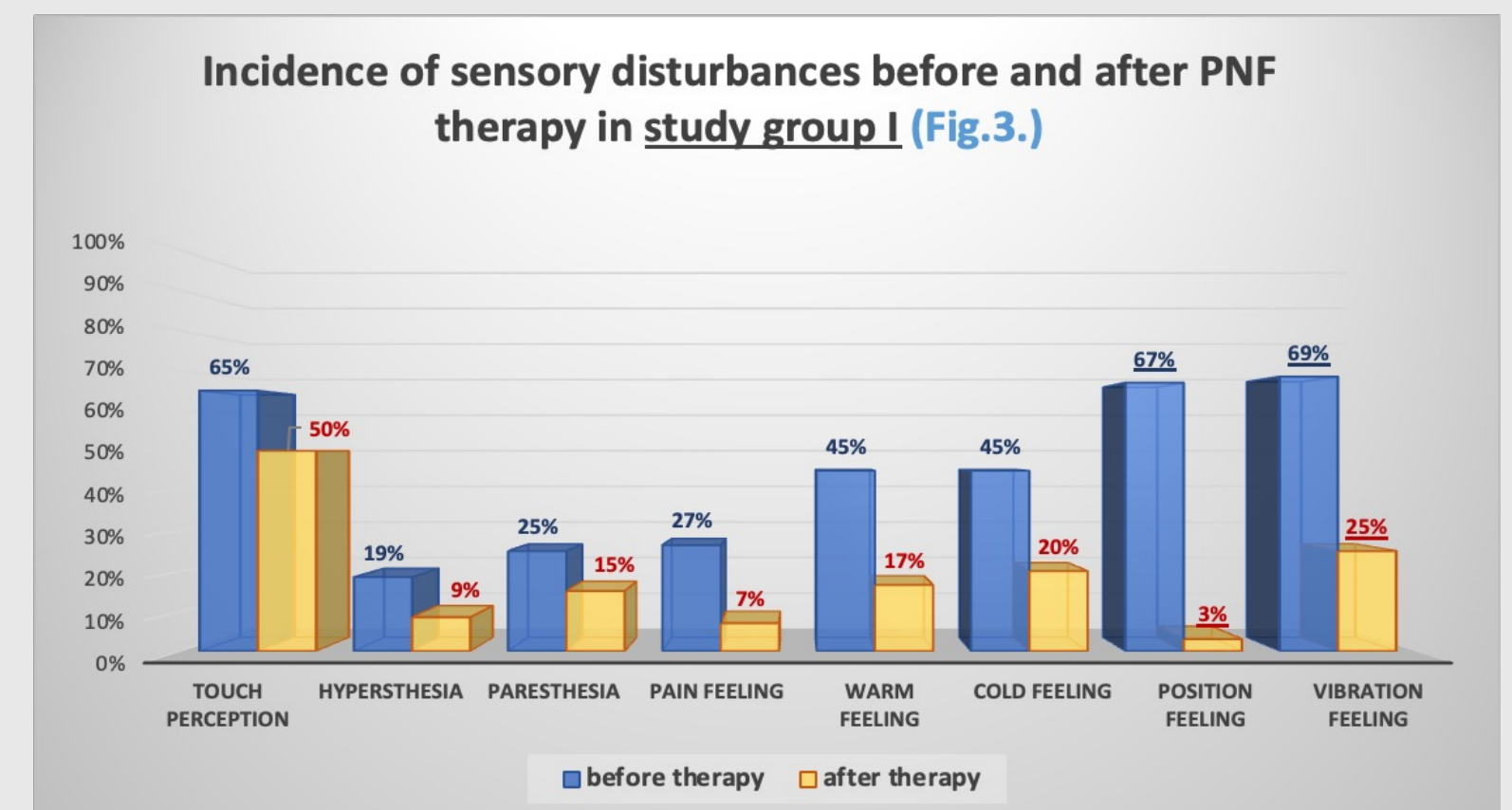
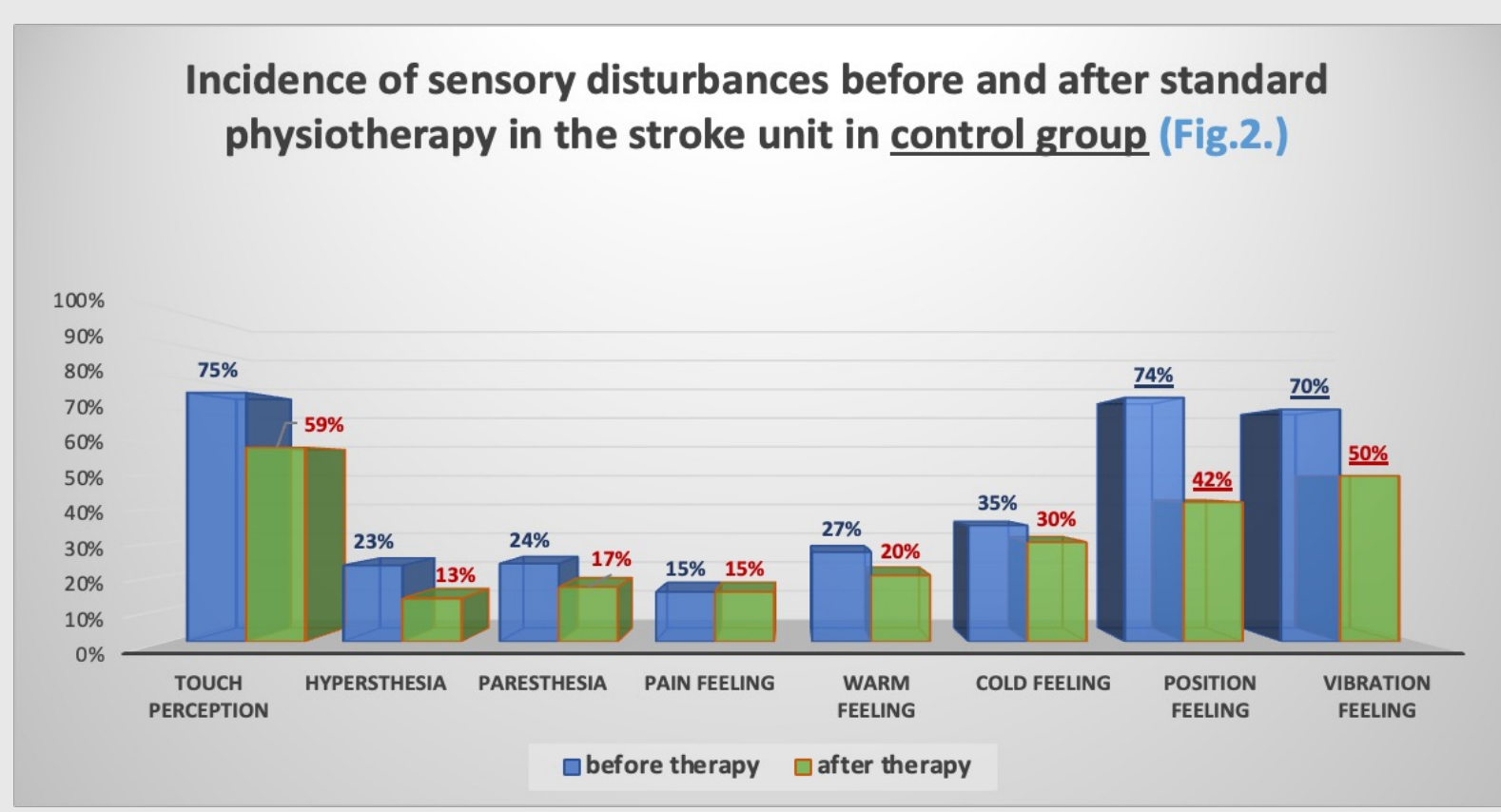
PNF therapy is neurorehabilitation concept based on multi-sensory stimulation, special movement patterns, techniques such as movement reproduction and rhythmic stabilization. This method focuses on functionality of movement tasks.

NDT Bobath therapy is based on movement quality, improvement of muscle tone and elimination of incorrect reflexive response. NDT Bobath therapy included: leading limb movements (guiding), learning the ability to follow and maintain a given movement (placing) and increasing the flow of sensory stimuli to the joints (approximation).

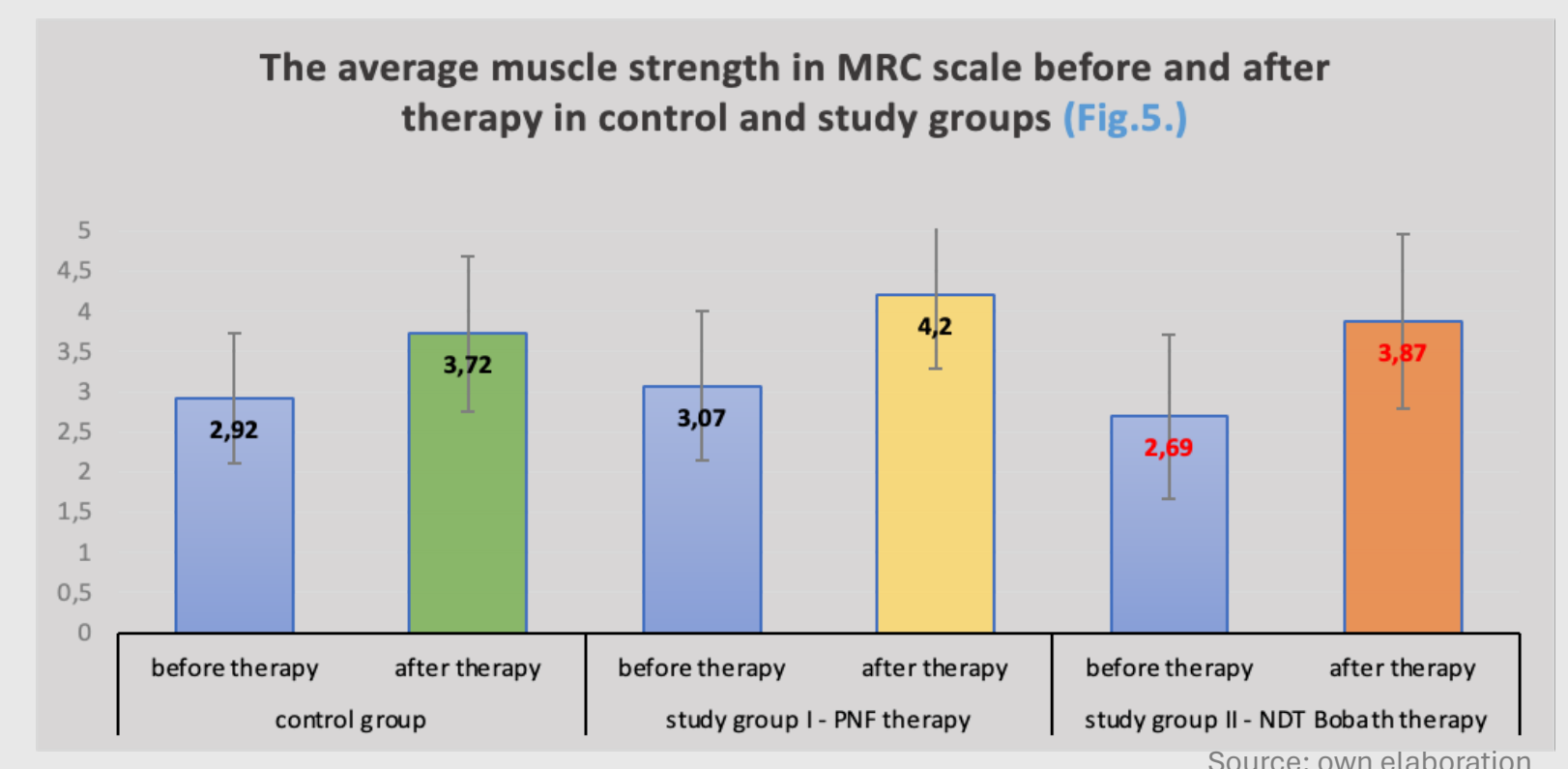
Results: In the group of 242 patients participating in the first part of the study ischemic stroke occurred in 93% of individuals and hemorrhagic stroke – 7% of patients. Right hemisphere stroke occurred in 58% of subjects and left hemisphere stroke in 42% of patients. **Sensory disturbances occurred in 43% of all individuals.** 90 patients had sensory disturbances co-occurring with limb paresis at the level 2-3 according to the MRC scale, who were qualified for the second stage of the study. None of the patients qualified for the study presented selective disturbances of superficial sensation. Patients presented with either only deep sensation alternations or disturbances of deep sensation co-occurring with alternations of superficial sensation.



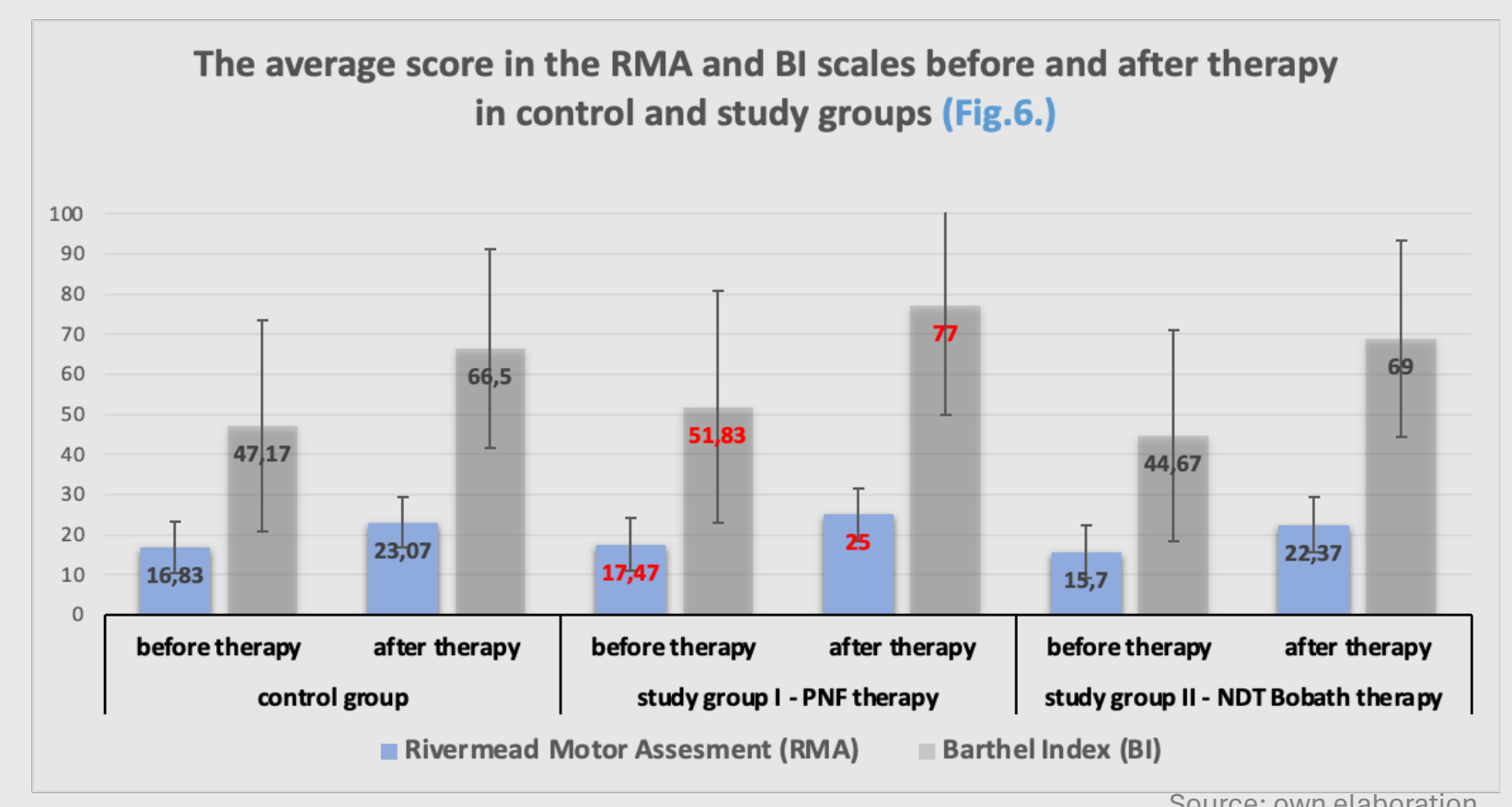
Sensory disturbances in the study group occurred more often in the upper limb than in the lower limb. The most common types of sensory alternations were disturbances of touch perception (UL 83%, LL 74%) and vibration feeling (UL 81%, LL 71%) – Fig.1.



In the control group, the greatest improvement in sensation was observed in the vibration feeling - Fig.2. In the study group I, patients have achieved the greatest progress in improving the feeling of positioning and vibration feeling - Fig.3. In study group II, the greatest improvement was observed in touch perception and vibration feeling - Fig.4. Taking into account the improvement of all types of sensation, the best therapeutic effects were achieved in study group II, and the worst in the control group.



The greatest improvement in muscle strength after therapy was observed in study group II, and the smallest in the control group – Fig.5. The differences in the improvement of the average values of muscle strength before and after therapy between the control group and the test groups are statistically significant (in the comparison of the control group and study group I p-value= 0.04; in the comparison of control group and study group II p-value= 0.03, with a significance level of $\alpha=0,05$).



Both in the control group and in the study groups, after the therapy, an improvement in the score in the RMA and BI scales was observed, which indicates an improvement in the functional state of patients. The greatest improvement in functional state was observed in study group I, and the smallest in the control group - Fig.6. The differences in the improvement of the average score in the RMA and BI scales before and after therapy between the control group and the study groups are not statistically significant ($p>0,05$, with a significance level of $\alpha=0,05$).

Conclusions: Sensory disturbances occurred in 43% of the examined stroke patients. The use of PNF and NDT Bobath therapy allowed patients to achieve better therapeutic effects in terms of improving sensation, muscle strength and functional efficiency compared to the control group, which shows the validity of supplementing basic rehabilitation techniques with additional neurorehabilitation therapies, i.e. PNF and NDT Bobath.

The use of NDT Bobath therapy was most effective in regaining sensation and improving muscle strength, while PNF therapy had the best effect on improving the functional state of patients.