

# **DYNAMIC ELECTRONEUROSTIMULATION IN THE SYSTEM OF ORTHOPEDIC-SURGICAL TREATMENT OF CHILDREN WITH CEREBRAL PALSY**

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Infantile cerebral paralysis (ICP) or cerebral spastic infantile paralysis is a sufficiently widespread and complex orthopedic-neurologic disorder which is characterized by multiple contractures of joints of upper and lower extremities of complex genesis against the background of high muscle tone of central origin, up to hyperkinesias. Treatment of motor disorders of patients is carried out by means of different conservative (massage, exercise therapy, correcting putting to bed in plaster bars, physiotherapy, drug therapy) and surgical methods (reconstructive surgeries on tendomuscular and oste-articular apparatuses of extremities). Local pain syndrome and edema of soft tissues, intensity and duration of which slow down rehabilitation measures, are frequent concurrent syndromes or consequences of performed manipulations.

We had a choice of adequate method of treatment which was capable of indicated symptomatology stopping. Adequacy to the pathogenesis of the disease, simplicity and safety of usage and possibility of continuous application not only in a hospital but also at home, were the requirements here.

From one hand, experience of dynamic electroneurostimulation (DENS) application on different stages of rehabilitation of patients with orthopedic pathology that was available in Orthopedic children's research institute named by Turner G.I. and, from the other hand, potential possibilities of DENS apparatuses (portability, adaptability for particular patient, handleability, possibility of patients and their parents teaching) became a precondition for development of DENS-maintenance approach of orthopedic-surgical treatment on preoperative and postoperative stages of complex rehabilitation of children with ICP.

The purpose of the research was the multi-factor evaluation of dynamic electroneurostimulation effectiveness on orthopedic-neurosurgical stages of treatment of children with ICP.

## **Materials and methods of the research**

Over 40 children from 4 to 18 years old were getting DENS therapy on the different stages of complex orthopedic-surgical treatment during 1.5 years in the clinic of children's cerebral palsy of Orthopedic children's research institute named by Turner G.I. Patients who received DENS on all three stages of complex treatment (before the operation, during the postoperative period and at the time of following motor rehabilitation) were chosen for the present research. 26 children 4 to 14 years old with spastic types of ICP, 19 out of them had spastic diplegia, 7 had hemiparesis, made up a group of patients under study. Children of similar age who had similar motor disorders and did not receive DENS made up a control group.

Children from both groups were clinically examined (orthopedic-neurological status indices) before the treatment and repeatedly on the stages of postoperative motor rehabilitation.

During the preoperative period attention was mostly paid to the muscle tone and motor activity change. Muscle tone was registered according to the Ashworth scale, and general motor activity was registered according to Arens scale. During the postoperative period dynamic of pain syndrome, local edema and symptoms of soft tissues trophism disorder was emphasized. Pain syndrome degree of manifestation was evaluated according to visual-analog scale (VAS). Objective and subjective indices of muscle tone and voluntary movements were evaluated on the postoperative motor rehabilitation stage.

Dynamic electroneurostimulation was carried out by means of "DENAS" and "DiaDENS-T" apparatuses. Individual program of hardware exposure was created for each patient according to methodological guidelines of DENS formulation. During the postoperative period the treatment was carried out in "Therapy" mode at 77 or 140 Hz frequency in a form of a course with 6-10 sessions in length, once a day, mostly in the zones of frontal projection of a complaint within 15-20 minutes in a presence of full-blown pain syndrome. The indicated treatment was carried out in a "Test" mode during the preoperative period and in the postoperative rehabilitation period. An application was performed in a zone of frontal projection of a complaint, on the symmetrical conditionally healthy zones and in projecting zones of the corresponding segments of the spinal cord (lumbar enlargement after the operations on lower extremities and cervical intumescence after the operations on upper limbs), that is in the area of cervical spine and lumbosacral region. Treatment course consisted of 12 sessions where each of them was 20-45 minutes long. Cream "Malavtilin" was used in some cases for medical effect strengthening.

## **The results**

Statistically significant changes were not revealed in the observable joints before and after DENS course in the preoperative period analyzing amplitude indices of active and passive movements. At the same time, subjective signs of some spasticity level decrease were observed. The results of questioning of the parents confirm this fact: movements performing facilitation was noticed at the time of therapeutic exercises practicing and in the everyday life in 38% of cases (10 people).

General motor activity increase was detected in 46% of children (12 people). Reduction of local vegetative disorders in a form of hyperhidrosis and extremity coldness which is typical for children with ICP, was observed in 9 out of 26 children (34.6%) after the course that included DENS of reflexogenic zones in a projection of cervical and lumbosacral part of spinal cord. Dynamic electroneurostimulation that was applied directly after operative interventions, was prescribed for children in order to cut off the pain syndrome and affect postoperative edema of soft tissues starting on the 2-3 day after the operation. Medical effect was experienced after the first session, after 3-5 sessions indicated phenomena were cut off completely. In the case of significant postoperative edema of soft tissues DENS procedures were carried out directly in the edema area, in the sclerotome areas and in the projection areas of corresponding segments of the spinal cord. Edema symptoms in the wound area disappeared after 3-4 sessions.

Stimulation of motor activity of a child as well as cutting off pain syndrome, that appeared as a result of movement development in a limb after a surgery, were the purpose of DENS at the postoperative rehabilitation stage. Significant reduction of reflex muscle hypertone which was evaluated according to Ashworth scale was registered in all patients at this stage. Spasticity in the femoral muscles (flexor and extensor muscles of tibia, adductor muscles) during the treatment reduced more distinctly than in gastrocnemius muscles.

During the research of dynamic of muscle pain syndrome at the postoperative rehabilitation stage its reduction up to 5-6 points according to VAS was registered, which means it was poorly apparent or even disappeared completely. Herewith, distinctive reduction up to 3-4 points was observed already in the first 2-3 days after the treatment was started. Steady anesthetic effect was registered, in average, after 8-10 sessions (in some cases it was necessary to extend the treatment up to 14 sessions).

Thus, DENS application at the stages of complex orthopedic-surgical treatment of children with ICP is effective and clinically demonstrates the following:

- 1) DENS results are expressed in some balance of central and vegetative nervous system, subjective signs of spasticity reduction (38%), and general motor activity increase (46%) in a complex of conservative preoperative treatment;
- 2) DENS significantly effects pain syndrome in the early postoperative period and on the stage of motor rehabilitation of a patient with ICP;
- 3) Psychological moods of a patient changes which makes doctor and patient cooperation easier, with positive results in the rehabilitation measures realization;
- 4) DENS causes distinctive reflex muscle hypertone reduction which assists other motor rehabilitation measures quality improvement at the postoperative rehabilitation stage;
- 5) Technical characteristics of DENS apparatuses allows one to perform procedures at home which could cause reduction of the length of hospital stays of a patient and increase of economic effectiveness of treatment.

The results of the developed approach indicate that wide application of DENS-maintenance of orthopedic-surgical treatment of children with ICP is reasonable.