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**A COMPREHENSIVE SYSTEM FOR ASSESSING
THE EFFECTIVENESS OF BIONIC PROSTHESES
WITH A NEUROINTERFACE**

Modern neuroprosthetics is undergoing revolutionary changes associated with the development of bionic prostheses that can not only reproduce movements, but also provide tactile feedback. Restoration of sensory function is critically important for:

1. Full rehabilitation of patients after amputations;
2. Clinical limitations of modern prostheses;
3. Scientific breakthrough in neurotechnologies;
4. Socio-economic impact.

Key problems limiting mass implementation are: the high cost of neurointerfaces, the need for individual customization for each patient, ethical issues regarding device implantation.

The aim of the study is to identify and describe tools for assessing the effectiveness of bionic prostheses with a neurointerface.

Research objectives:

- conduct a systematic analysis of existing neurointerfaces for tactile feedback;

- identify and describe groups of tools that can be used to assess the effectiveness of the use of bionic prostheses with a neurointerface.

The object of the study is the rehabilitation process of amputees.

The subject of the study is bionic prostheses with a neurointerface.

Analysis and generalization of scientific sources revealed the possibility of comprehensive application of the following groups of methods to assess the effectiveness of the use of bionic prostheses with a neurointerface:

1. Theoretical and analytical methods (analysis and generalization of scientific and scientific and methodological sources, cluster analysis of tactile feedback technologies);

2. Neurophysiological studies: EEG monitoring of cortical responses to tactile stimuli; transcranial magnetic stimulation to assess cortical reorganization; intraoperative neurophysiological mapping (for patients with implanted electrodes).

3. Biomechanical tests: kinematic analysis of movements using the Vicon MX system; dynamometry of the prosthesis's compression force; electromyography of the stump muscles (sEMG).

4. Tactile studies: determination of sensitivity thresholds according to the von Frey method; spatial discrimination testing (two-point discrimination test); assessment of reaction time to tactile stimuli.

5. Clinical methods: prospective cohort study with randomization of patients; double-blind test of the effectiveness of different types of feedback; long-term monitoring (6-12 months) using: phantom pain scale (PLP), vision-hearing-touch questionnaire (VHT), quality of life test (WHOQOL-BREF).

6. Technological methods: 3D modeling of individual prosthetic sockets (CAD/CAM); machine learning for classification of EMG signals (SVM, CNN algorithms); virtual reality for sensorimotor control training.

7. Psychophysiological methods: testing of the "embodiment" of the prosthesis; fMRI study of somatosensory cortex activation; psychometric tests (STAI, BDI).

8. Statistical methods: multivariate analysis (MANOVA) to assess relationships; Kaplan-Meier curves to analyze the duration of adaptation; factor analysis to identify key predictors of successful rehabilitation.

9. Economic methods: cost-utility analysis; calculation of the ICER index to assess economic efficiency; modeling of the marketing potential of the technology.

Bionic prostheses with tactile feedback are not just a technical achievement, but a fundamentally new stage of rehabilitation, which allows not only to restore motor functions, but also to return basic sensory sensations. This opens a new era in prosthetics - the era of "sensitive" limbs, as close as possible to biological analogues.