

GAIT IMITATION REHABILITATION SYSTEM FOR PARAPLEGICS

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Abstract: The early after surgery rehabilitation has an enormous somatic and psychological importance for patient. In the after surgery phases of injured vertebral column with spinal damage stabilisation, the ordinary rehabilitation treatment is concentrated on patient positioning on the bed and also for training of sitting position with perspective transfer to wheelchair.

The aim of presented work was to tray the possibilities of early rehabilitation of paraplegic's patients in vertical plane with imitation of physiological movement of extremities.

Keywords: Vertical rehabilitation, paraplegics,

1 THE METHODOLOGY OF REHABILITATION SYSTEM DESIGN.

Considering that normal human gait is in standing position, the methods of paraplegic's patient rehabilitation struggle to be oriented in vertical plane. The target function of applied method of rehabilitation was approximation of loosed motorics function. The behaviour of separate organs in human system shows different loading in dependence of patient position, it is necessary to create such conditions, which are the most identical with physiological conditions of healthy human. The next from the argue for using of described system are function of cardiovascular and pneumology system which serve for better disposition of human body skeleton and partially in instantaneous availability for muscle systems of extremities.

From above mentioned results, that objective function of application will be patient motivation, which increase the approximation process between damage and therapeutic state of patient. Important role plays the construction of separate system modules and also using of suitable materials.

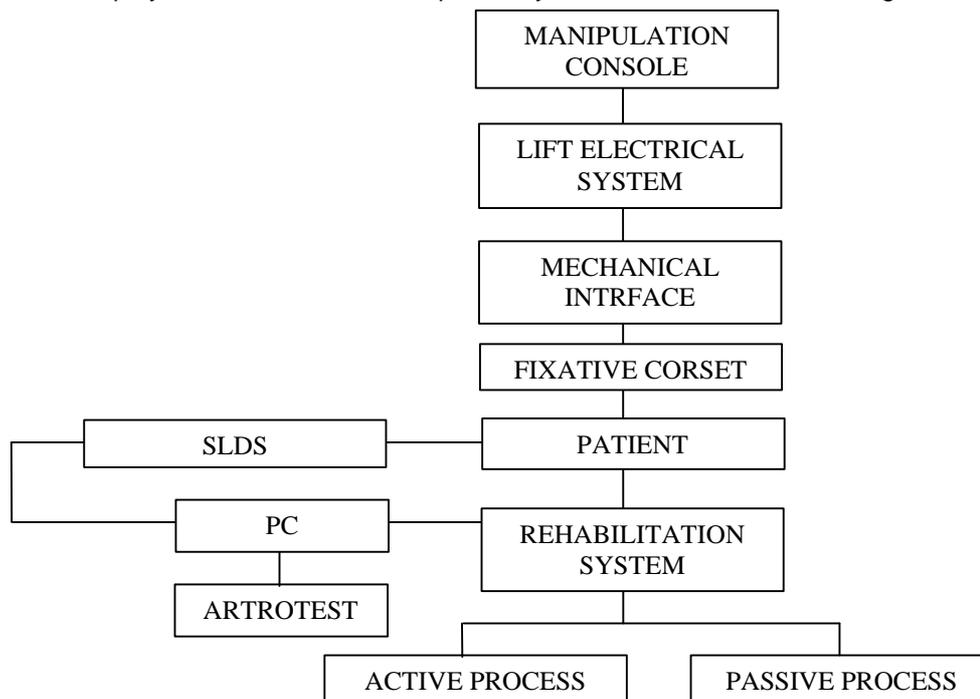


Figure 1. The positional arrangement of vertical rehabilitation system

Patients with damage classified as a paraplegics are immobile, that is why it is necessary to solve the question of manipulation and fixation in vertical direction. The figure 1 shows the block diagram of vertical rehabilitation system, where are given separate modules in interaction.

By manipulation console we can fasten the patient by fixating corset which is constructed in that manner, that it does not obstruct the blood microcirculation. The categories of paraplegics patient are different according the previous kinesiology and present muscular dispositions, for these reasons are used the peripheral bottoms, which support the blood microcirculation and prevent dekubits. By the lift system we regulate actual high and ensure the comfort for rehabilitation. To achieve the goals functions we need also simulate the gait, and for this purpose was used commercial system Orbitrek. System Orbitrek fulfil also extended function of rehabilitation which is the movement of lower extremities through kinematics modification of device, with use of upper extremities. Presented effect is improved by human unconditioned reflex.

The complex utilisation of system functions makes possible only rehabilitation process in active mode, but there are some patients which have residue of movement of upper extremities, it is necessary to wide the functions also for passive regime. It is electro mechanical system, where we adjust the number of cycles and time of rehabilitation. The result of rehabilitation process to achieve the movement range in separate joints and find out the present disposition of partial muscle groups. This is provided by sensor of local disposition of muscle, which monitors on line changes and statement. The result of muscle disposition diagnostics is artrotest, which is helpful to the clinical orientation for treatment.

2 THE RESULTS OF REHABILITATION PROCESS

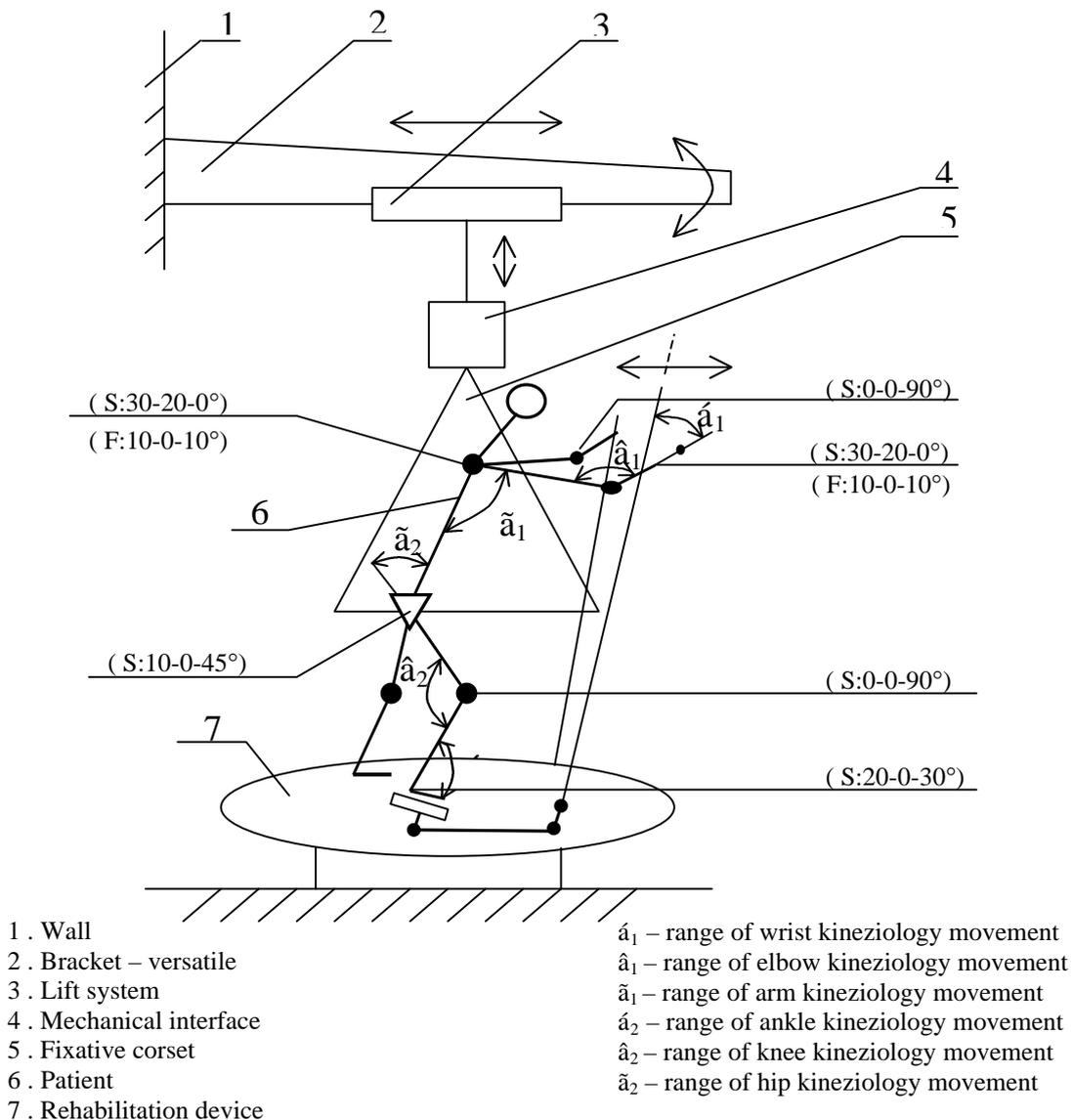


Fig. 2 Kinesiology analysis in rehabilitation process

After design of vertical rehabilitation system we explored the kinesiology analysis of lower extremities passive movement and upper extremities active movement in three patients with isotonic spinal damage under the T4 -10.

The training of gait imitation was performed after stabilisation of patients, 7-10 days after surgery. Kinesiology analysis of gait imitation was performed by visual monitoring and by measurement with goniometer according the SFTR method. According the kinesiology analysis of gait imitation we served the following movement ranges of extremities in joints, which are on figure 2.

Arm joint (S: 10-0-45°), elbow joint (S: 0-0-90°), wrist joint (S: 30-20-0°) (F: 10-0-10°), hip joint (S: 10-0-45°), knee joint (S: 0-0-90°), ankle joint (S: 20-0-30°)

3 CONCLUSION

In the acute after surgery period in patients with injured vertebral column and spinal damage is very important the care about vital functions together with prevention of complications (urine, excrement, dangerous of decubits). In subacute period which is characterised with recession of spinal shock has except of nursing care which prohibits secondary complications big importance also early rehabilitation.

The original vertically rehabilitation by imitation of patients gait satisfy the need to keep up by training undamaged functions and locality (active involving of upper extremities and trunk muscles) with synchronous passive continuous movement of lower extremities, which affected positive the patient flexion. Monitoring of real muscle disposition in rehabilitation process will affect the time and way of selected treatment. Presented rehabilitation system is applied at Clinic of accidental surgery of Faculty hospital of LP in Košice.

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