Robotic orthopedic and trauma systems for external transosseous osteosynthesis

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External fixation devices are playing now a leading role in the operational orthopedics, in treatment of consequences of long bones fractures and functional rehabilitation. Usage of this method involves a long period of treatment and manipulations with external fixation device with the participation of skilled personnel, which requires patient's stay at the hospital.

Today to reduce the period of hospital treatment the work with the device is shifted to the patient, which makes manipulation of the device on a particular algorithm in manual mode. However, this also involves working with the device several times a day for a long time. The probability of errors increases and the frequency of control increases. It should also be noted that not all designs of the device allow the patient to work with it.

Today at the Russian Ilizarov Scientific Center is developed a number of hardware - software systems that can address a wide range of tasks related to orthopedic – trauma patients. The first task: functional rehabilitation of patients within the treatment process (prevention of large joints contractures). The second task: to prevent problems associated with lengthening of long bones. The third task: correction of deformities existing or arising during treatment.

Devices developed in our Center allow conducting manipulations of the apparatus in an automatic mode on a pre-made program with minimal human intervention. The clinical and experimental studies have proven their reliability and clinical efficacy.

Clinical data were obtained on the basis of analysis of 61 case histories of patients aged 15 to 48 years treated at the Russian Ilizarov Scientific Center for the period from 2000 to 2009, whom was produced monofocal distraction osteosynthesis of congenitally shortened tibia by Ilizarov frame in automatic mode.

The effectiveness of this technique in our view provides a number of factors. The most important of which are high granularity and round the clock extension. Obviously, at these rates, the rhythm of distraction is as close to the natural growth of the evolutionary formed limb. In publications devoted to the clinical testing of the automatic distraction method, the authors noted that the lengthening proceeded less painful and less swelling of the limbs. The experimental studies have also shown the possibility of limb lengthening at a faster rate of distraction in terms of its automatic highly granularity option that allows you to significantly reduce the period of fixation. To identify the most appropriate in this aspect method of tibia lengthening, we carried out statistical processing and analysis of range of motion in adjacent with extendable segment joints immediately after frame removal.

Study the mean optical density of radiographic images of extendable limb showed that the highest densities of all parts of distraction regenerate demonstrate patients whom lengthening was carried out in automatic mode.

Quantitative determination of mineral content in bone regenerate performed on a dual-energy bone densitometry using X-ray absorptiometry clearly demonstrated the benefits of the limb lengthening methods used.

So, in particular mineral content (g/cm2) in% of the contralateral limb symmetrical sections showed that the values of this index were significantly higher in patients with automatic distraction.

Thus, obtained findings give us reason to recommend automatic distractiona in a wide range of patients and especially in patients whose age or disease suggests potential problems with the activity of reparative osteogenesis.