Innovative developments of
Samara State Medical University
Gravity Stand
SYNERGY
For the first time ever the moderated size of increased gravity, generated by a short radius centrifuge is used as a healing factor for patients with complicated fractures and vascular surgical diseases of the lower extremities.

Under the influence of centrifugal force comes extra blood flow to the lower extremities, which causes: active development of collateral circulation; elimination of tissue ischemia; improving tissue metabolism; stimulation of periosteal and endosteal bone formation; optimization of reparative osteogenesis in patients with fractures of the lower extremities and their consequences.
Indications for gravitational therapy:

- Fracture of the femur, tibia fractures (including ankle), fractures of the foot;
- Poor healing of the fracture, non-union fractures (pseudarthrosis), delayed fracture healing;
- Coxarthrosis, gonarthrosis, primary and post-traumatic arthrosis of other joints;
- Acquired flatfoot;
- Osteochondrosis vertebrales in adults;
- Juvenile osteochondrosis vertebrales (Scheuermann's disease);
- Scoliosis, juvenile idiopathic scoliosis;
- Juvenile osteochondrosis of the whirlbone (Legg-Calve-Perthes disease);
- Osteoporosis with and without pathological fracture,;
- Acute hematogenous osteomyelitis, chronic multifocal osteomyelitis;
- Atherosclerosis of arteries;
- Essential hypertension, hypertensive disease with a primary heart lesion without heart failure;
- Diabetic peripheral angiopathy;
- Chronic salpingitis and oophoritis;
- Meniere's Disease;
- Sensorineural hearing loss, unilateral with normal hearing of the opposite ear.
COMBIS – a device for wound healing of different etiology
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COMBINES TWO TYPES OF IMPACTS ON WOUND:

• Laser radiation of low intensity in several modes
• Medicaments atomizing with the aid of a pulverizer with a variant of feeding

- A method is non-invasive and well-tolerated by patients. The use of this method reduces the treatment time and lowers the invalidization degree in patients of traumatological and surgical profiles.
- The device is usable in the ambulance situation, and in day and night clinics, where there are surgical, vascular departments, and also in burn centers.
- Clinical effectiveness is proved on more than 10000 patients.
**INDICATIONS FOR USE:**
- venous ulceration of the lower extremities;
- diabetic ulceration of the lower extremities;
- trophic disturbances under vasculopathies of extremities;
- persistent extremity wounds.

**ADVANTAGES:**
- under the influence of laser radiation medicinal substance penetrates not only on wound interface but also in granulation tissue;
- combination of laser radiation impact and fine medicinal substance accelerates the timescales of wound epithelialization by a factor of 1.5 over laser radiation;
- a regulator of diffusion intensity allows to regulate the intensity of given medicinal substance individually, depending on the phase of wound process;
- the use of aerosol of medicinal substance saves the medicaments dozens of times;
- mobility of this device allows to undertake treatment procedures in dressing rooms and at the patient’s bedside.
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Autonomic system of optical check of intravenous infusion
A device is set on the transparent drip chamber of infusion set outwardly, fixes the end of the drip infusion procedure with the aid of the optical sensor and sends out messages about the end of the process on a mobile device and/or on a nurse’s portable computer.

**BENEFITS:**

- Significant risk reduction of post-infusion complications
- Patient’s stress prevention
- Less pressure on medical attendants and improvement of the effectiveness of their work (incl. in case of Emergency)

**EFFECTIVNESS:**

- Low cost-price
- Compatibility with any infusion device.
- Interoperability with mobile devices on OS Android.
Dental implants based on titanium non-woven material with through porosity
ADVANTAGES:
• Reduced number of post-implantation complications;
• Homogeneous strain distribution on the bone bed;
• Biomechanical homogeneity of the material with the bone tissue;
• A wide range of adaptation of the material to the bone bed;
• The ability to use damping properties;
• Low cost and environmentally friendly production;
• Biocompatibility.

FEATURES:
• Biocompatibility;
• Hypoallergenicity;
• Inertia;
• Damper;
• Through porosity.
The "PRICK" device for setting tuberculin and allergy skin testing
The "PRICK" device for setting tuberculin and allergy skin testing

Scientific novelty of the "PRICK“ device expresses in the opportunity to simplify, standardize and reduce the cost of staging tuberculin and allergens samples.

It contains a handle formed as a plate with a thread of 25 mm length and 5 mm width, a working part provided as a needle 1 mm long and 0.2 mm in diameter, extending from the central portion of the handle base, which serves as a stopper in the puncture of the skin.

ADVANTAGES:
• “PRICK” test is 3 times better economically than the Mantoux test 2mE;
• increases the productivity of medical staff compared to the Mantoux test up to 5 times;
• less depending on the qualifications of nursing staff;
• same standard because of the same damage to the dermal layer;
• less injury rate of the skin and blood vessels;
• papules have clear and smooth border, there is no congestion;
• evaluation of samples is more objective;
• better survivability
Wound dressings
This method of wounds, skin and soft tissues infections treatment provides the restoration of the integrity of the skin affected by the impact of phytotherapy product at a certain concentration in the wound surface.

The coating protects the surface of the wound and creates the perfect environment to accelerate the natural healing process. It also has a long-term antimicrobial, analgesic and sedative effect.
**ADVANTAGES:**

- Reduces the cost of treatment (combines several medical factors).
- Saves medicines (by the use of micro-doses of drugs already in the wound dressing).
- Reduction in the average bed-day hospital stay (an average of 5-7 days).
- Saves medical staff’s time (no need for daily dressings).
- Ability to use in outpatient and inpatient settings.
- It allows you to avoid additional surgical interventions and reduce the risk of possible complications, reduce the disability of patients, improve the quality of life and reduce treatment costs.

**INDICATIONS:**

- For the treatment of granulating hardhealed infected wounds (under recovery), ambustions os II and III level, frostbites, trophic ulcers, pressure ulcers, radiation and other skin lesions;
- For the temporary closure of skin defects after surgical treatment of ambustioned wounds in order to prepare them to autodermoplasty, closing the skin donor sites;
- For topical treatment of cuts, abrasions and other skin lesions after hemostasis.
Species probiotic for agriculture
Probiotics are living microorganisms (bifid bacterium, lacto bacterium, yeast fungus), which render a healthful effect on an organism.

A species probiotic contains effective microorganisms of sour-milk flora of a concrete animal, cultured in the sphere of floral monosaccharides and pumpkin suspension (additional anthelminthic characteristics).

**ADVANTAGES:**

- Capability of colonizing intestines with sour-milk flora in the first hours of life;
- A probiotic, except lacto flora, contains vitamins, amino acids, antioxidants, anti-inflammatory cytokine, immunity stimulants;
- Application of a species probiotic doesn’t cause side effect. Meat, milk, eggs are allowed to be taken without restriction regardless of the timescales for preparation application;
- Produced in concentrated gel and freeze-dried powder of white colour;
- Low price;

**Species probiotic for agriculture**

Innovative developments of Samara State Medical University
Medicinal preparation
Dentos
**ADVANTAGES:**

- Multi-component composition of optimally matched components (combination of several kinds of medical plants);
- Procuring several kinds of biological activity (antimicrobial, anti-inflammatory, wound healing, anaesthetic, immunocorrecting, hemostatic), codirectionally working upon pathogenetic parts of the disease and aggravating the medical effect;
- Optimally selected extraction fluid, extraction parameters and technological scheme, providing effective extraction at the level of 75%-85%;
- Lower cost in comparison with foreign analogues.

**APPLICATION:**

- Wide range of infectious inflammatory periodontal diseases: stomatitis, gingivitis, periodontitis, glottitis.
- Pre-surgical and post-surgical oral cavity sanitation during surgical interference in the maxillofacial surgery.
Hardware and software complex “Virtual Surgeon"
It includes three 3D – simulators of high-degree veracity: endoscopic surgery, endovascular surgery, surgery with open surgical area. It is used to teach medical students and doctors practical and clinical skills of different degree of complexity.
3D-anatomic atlas
"InBody Anatomy"
Interactive training software program, designed for developing a full cycle of teaching students and doctors normal, topographic and pathologic human anatomy from acquaintance with training materials, visual text accompaniment to the learned knowledge checking.
Interactive anatomic table "InBody Anatomy"
Interactive anatomic table "InBody Anatomy" – hardware and software complex for virtual work with 3D-model of human body for the use as a visual training material in a wide range of natural science subjects (topographic, general, pathologic anatomy, medicolegal investigation, operative surgery etc.).

Human anatomy in actual size
- An opportunity to download and examine individual diagnostic data
- Direct connection between 3D-models and diagnostic data
- It is useful to both students, interns and young doctors
Navigation system for maxillofacial surgery
A system is designed for determining a position of a patient jaw and a bur, what allows to estimate the correctness of drilling a hole in a bone, taking into account the depth and angular deviations during implantation execution.

A preliminary 3D-model of an operation area is being constructed on the basis of conducted tomographic researches. A developing hole size is being calculated.

An electronic jaw pattern which fixes a tool positioning for creating a required by a program implant hole size, is being projected.
Navigation system for maxillofacial surgery

The information about a relative position of a patient jaw and a tool is being displayed on doctor’s glasses in representative style.

ADVANTAGES:

- Accuracy increase during the dental prosthetics.
- Easy to operate and exploit.
- Low cost in comparison with analogues.
Augmented reality technology
Augmented reality technology

Augmented reality allows students to understand anatomic organ peculiarities better. Together with the atlas an application will be supplied, when downloaded, you can see a 3D organ model, about which a student is reading this very moment. The application is for any platform, it launches on devices under the control of iOS and Android.

An integrated camera which is used in a device allows to put a base 3D model on a predefined marker. The marker in the atlas is an image of an organ. Any image can be the marker. In the application it is possible to change a scale of an organ image, to spin it in space, and also to divide several organs into parts/segments.
Augmented reality technology - AUTOPLAN

- Assistance in the analysis and operation planning on the demonstrative 3D model, constructed on the basis of pre-surgical CT research.

- Navigation in the operation process with the aid of the model visualization put on the operation field and an operation plan.

Application field:
general surgery;
maxillofacial surgery;
traumatology and orthopedics;
tumor and congenital abnormality surgery;
reconstructive surgery
Healthcare information systems
Developer – Center of groundbreaking researches «Information technologies in medicine»

It is brought into operation on the SamSMU clinic server since the first of September 2014 (IBM storage). It supports DICOM, HL7 standards, reads different research modalities. It receives data from 2 roentgenologic offices, 1 Ct device, 2 X-ray operating rooms, 1 ultrasonography device. 1 X-ray operating room, 2 clinical diagnostic laboratory microscopes, 3 OJSC microscopes, 2 endoscopic stands are on the waiting list for connecting.

It stores about 1200 researches – about 3 TV medical data.

DICOM server. It receives data, performs 3D-reconstruction of images, operate the storage. A home-produced protected platform is fully ready for its’ realization.
The diagnostician and the clinician automated workstations

A main component of workstation – a program for pictures viewing in the DICOM format. It completely satisfies the requirements to programs of analogic profile of commercial branches. It has integrated intellectual 3D-reconstruction of images. It has plugin architecture, what allows to realize SamSMU officers’ scientific developments in this solution. It is launched either in the OS Windows or in protected home-produced OS, (Elbrus, Rosa, Astra).

A hardware solution which is fully appropriate to FSTEC’s requirements is ready for realization of doctors’ automated working stations.
A comprehensive solution of automation of laboratory test prescription, blood sample logistics, authorized access to research results.

- The solution uses own developments of Clinical Diagnostic Laboratory of SamSMU Clinics in the sphere of informational support and logistics.
- 1 project stage is accomplished - the database and the Web interface for implementing of clinicians’ work stations are developed.
- The project has massive opportunities of scientific analysis of laboratory data.

Through the HL7 bus the project integrates both with HIS "Hospital" (Sail), set in Clinics, and with Typical ETMIS, Integrated national information system in the healthcare sphere.

A problem – There is no funding for this project realization.
Automated information systems «Organ donation" and “Transplantation"

A system of transplant service automation and organ donation with the function of medical decision making supporting is the first of its kind in Russia.
It is being developed by means of grants from the Samara region budget.

They are being developed by officers of Center of groundbreaking researches “Information technologies in medicine" in association with transplant surgeons of SamSMU Clinics.

The AIS “Organ donation" is launched in the test exploitation at the Samara surgical center of organ donation coordination of SamSMU Clinics. AIS “Transplantation" is launched in the test exploitation at the Center for ambulatory care and rational medication after transplantation of the Samara region Ministry of Health.

The first time ever in Russia an account settlement of donated organs quality and their selection optimization on the mathematical criteria are applied.
Neurointerface «Brain-Computer»
«A multifunctional hardware-software platform for the people with total or partial loss of movement and language functions»

Project purpose: a creation of the universal hardware-software platform, allowing the people with total or partial loss of movement and language functions to realize a part of basic communicative and household needs singlehandedly, and also, in prospect, performs actions, necessary in the process of professional activities.

An operation realization under the control of the multifunctional intellectual module interface, working, depending on application conditions, in the mode «neurointerface», «EMG-interface», «optical interface», «physical interface» or combining these modes.

As a result of the realization of a joint hardware software complex project, described below, it will become possible to create a principally new barrier-free environment for the people with disabilities.

Main stages of the work:
- the creation of the multifunctional module interface, capable of , among other things, working on the basis of the analysis of the electrical activity of brain;
- the creation of hardware and software tools of complicated system management;
- the creation of robot devices for household and medical application.

A project realization is performed with the participation of Center of groundbreaking researches of SamSMU and LLC «Ayti Yunivers»
Neurointerface «Brain-Computer»

«The development of neuro-rehabilitative simulator of human extremities with the realization of biological feed back through the brain-machine interface»

A project purpose is stationary simulator creation for the functional recovery of extremities and, in prospect, on its base, creation of an exoskeleton with biological feed back (issuing the commands on passive movement through the analysis of the patient’s brain activity alteration) for rehabilitation of the upright standing function (vertical adjustment) and the ambulation function in patients affected by paralysis of lower extremities with the realization of BFK through the analysis of the native electroencephalographic data of brain activity, derivable with the aid of the mobile NCI.

LLC «Otkryityie resheniya», COGR of SamSMU, Center of mechatronic systems and robotic complexes of Samara State Aerospace University, the company AKVIL (a member of the innovation belt of SSAU) and the company BIA (France) carry out the work over this project realization.

Main stages of the work:
- the creation of a stationary neuro-rehabilitative robotic simulator of extremities with biological feed back, realized with the aid of the mobile NCI.
- the development of the user-independent rehabilitative robotic simulator of lower extremities (exoskeleton) with functions of vertical adjustment and ambulation and biological feed back, realized with the aid of the mobile NCI.
- the modernization of the user-independent with regard to weight reduction of the construction, self-sufficiency raise, accuracy and executing intended movements number raise.
Thank you for your attention