Tabriz University of Medical Sciences, Tabriz, Iran

Imam Reza General Hospital Newsletter

Tabriz University of Medical Sciences

Volume 2, Issue 3, July 2022

Imam Reza General Hospital, Tabriz University of Medical Sciences, Tabriz, Iran

In This Issue We Read:

Innovative Achievements of The Center

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The Internationalization of Imam Reza General Hospital, Tabriz, Iran is an Inevitable Necessity

• **Mojtaba Mohammadzadeh**
Director-In-Charge's Message
Assistant Professor of Anesthesiology and Intensive Care Medicine
Dean of Imam Reza Generel Hospital, Tabriz, Iran

In today's modern world, the aim of all reputable hospitals in the world is to provide the most up-to-date educational, research and high quality treatment services. All these services are defined based on the global standards, innovations and most importantly creation of wealth along with scientific development and knowledge that paves the way for responding to the needs and problems of patients. Having special attention to international standards and moving forward in alignment with the leading hospitals makes it convenient to achieve these great goals. In this regard, improving the quality of education and research based on international standards, aligning the hospital with global developments and advances in science and knowledge, strengthening scientific and research communications at the national and international levels and attracting international collaborations in the field of education and research give rise to attracting foreign students, identifying weaknesses and strengths, improving the scientific level of professors, updating their knowledge, identifying competitors and gaps, improving quality standards, improving documentation and facilitating the flow of information, increasing international visibility are significant and effective points in achieving to these great goals. I am the head of the Imam Reza General Hospital in collaboration with our colleagues in the deputy of research and education, treatment and the financial support are determined to further expand the process of internationalization of this Hospital. In this regard, preliminary collaborations with the World Health Organization (WHO) are being completed and institutionalized. Furthermore, the necessary coordinations are being developed to establish scientific and educational cooperation with several reputable hospitals in Turkey that will be done in the near future. It is worth mentioning that the English website of the hospital has improved its contents in line with the internationalization of activities of the center. It should be noted that the establishment of new institutional units in the hospital, including the Covid studio and its new English programs that will be produced by the professors of the center, the establishment of the clinical skill units in the center, the establishment of the innovation office, and the publication of the seventh issue of the Imam Reza General Hospital bilingual Newsletter indicate the important fact that Imam Reza General Hospital is transitioning from a national state to an international institution. In the end, it should be mentioned that the most important resources of the hospital and university include respectful and knowledgeable professors, diligent students, and the experienced staff of the center. Special thanks to all who have shone brightly during the Covid-19 pandemic in three fields of education (creating and producing novel programs in Covid studio for the first time in the country which was awarded the first place in the Shahid Motahari Educational Festival, 2022), research (publishing more than ten percent of the articles related to Covid-19 in the country) and treatment (providing services to 40,000 patients with covid-19 and 15,000 hospitalized patients with covid-19).

1. Visibility

• **Hassan Soleimanpour**
Editorial
Editor in Cheif
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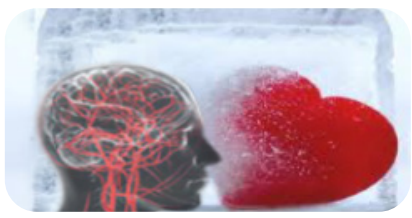
Establishment of Hypothermia after Cardiac Arrest Protocol in Imam Reza General Hospital, Tabriz University of Medical Sciences, Tabriz, Iran

It has been recommended by well-known guidelines of the American Heart Association (AHA) and the European Resuscitation Council (ERC) to induce hypothermia for patients with cardiac arrest. Hypothermia is one of the most effective ways to reduce cerebral complications of cardiopulmonary arrest. According to the American Heart Association, brain resuscitation is essential procedure in patients with cardiac arrest who is unresponsive and/or having a Glasgow Coma Score (GCS) ≤ 8 after return of spontaneous circulation (ROSC). Therefore, the term cardiopulmonary resuscitation has been replaced by term cardiopulmonary-cerebral resuscitation. It is due to the importance of maintaining brain function in a person with cardiac arrest. One of the most important steps for cerebral resuscitation is inducing mild hypothermia in patients with cardiac arrest. Since 2003 the American Heart Association have recommended it for all patients who have a spontaneous circulation but are unconsciousness after resuscitation and since 2010 it has been mandatory to all mentioned patients. It is worth saying that induction of mild hypothermia in patients after cardiac arrest has increased survival, significantly reduced mortality, and improved neurological outcome meaningfully. Although the induction of mild hypothermia after cardiac arrest has been going on for years in Europe, Australia and the United States, in our country this lifesaving procedure has not been considered. We thank God that we will be the first medical center in the country establishing Hypothermia after Cardiac Arrest. In the end, we complete our statement with two meaningful sentences from the father of modern Resuscitation and pioneer in the Induced hypothermia after cardiac arrest: Dr. Peter Safar - A Life Devoted to Cheating Death, and CPCR is for the person with a heart and brain too good to die.



1. Dr. Peter Safar

• Hamid Tayebi Khosroshahi
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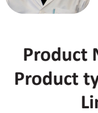
Product Name: Etholack, Etholack Plus Product type: Etholack for Filling Dialysis Lines (Dialysis Catheter)

This product contains 60% sterile Ethanol and Aspirin, which is used to treat and prevent dialysis catheter infection. In 2017, it was patented with the number 93288 in the Intellectual Property Center of the Registry under the name of Hamid Tayebi Khosroshahi. The main purpose of manufacturing this product is to reduce the rate of permanent dialysis catheter infection. As permanent dialysis catheter is associated with a very high cost and many complications. This innovative product reduces the requirement to remove and replace the permanent dialysis catheter.

An article on the treatment of dialysis catheter infection was published in Saudi Journal of Kidney Diseases and Transplantation in 2015. In addition, this product can be used to prevent infection of other catheters inside the central veins. These products are useful and practical to use in dialysis catheter lines such as heparin or Taurolock that are filled at the end of dialysis to the exact space inside of the lines and at the beginning of the next dialysis leave the lines. According to studies, it doesn't seem to have a special side effect for the patient and also based on in vitro studies, there has not been reported any specific complications for the dialysis catheter itself. This product apply to treat catheter infection in accompany with systemic antibiotics for 2-3 weeks inside the lines and also can be used periodically or once a week to prevent catheter infection. Recently, another new product called containing 30% Ethanol and 40% Citrate, was designed by me and Dr. Basmenji in Serum Sazi Shahid Ghazi Tabriz. Heparin or Taurolock are very expensive; therefore they can be replaced by Etholack Plus.



• Parham Maroufi
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• Tala Pourlak
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Controllable Femoral Lengthening (Parham Nail)

Introduction

At the moment, limb lengthening with illizarov s distraction using massive external fixator done. If we use the intramedullary nail for limb lengthening can be removed external fixator, we have lower complications during limb lengthening.

Technical Explanation

In this way, we use previous methods location of femoral Osteotomy and intramedullary nailing for fixation of femoral fracture at the same location of Osteotomy, except we used Parham nail that it is intramedullary nail include two separate pices with controllable pitch between tow pices and control rod outside skin for control the speed of separation of nail and limb lengthening. This type of nail (Parham nail) was previously unused and now is completely new.

In this technique we start surgery with small incision in the subtrocanteric and drilling of bone, then we start small incision in the buttek for access to periformiss fossa or throcantric and guide wire inserted up to distal end of the femur. Parham nail is inserted up to the Osteotomy site with C-Arm. Then Parham nail is passed across Osteotomy site up to distal end of the femur, distal leg and bone are rotated to confirm Osteotomy. Locking screw are inserted in the proximal and distal with guide and controllable pitch are inserted with guide in the proximal. After a week we started limb lengthening with rotation of controllable pitch 1/3mm 3 times a day.

The benefits of working

In this way we used simultaneous of all previous experiences in the limb lengthening with another devices and we deleted external fixator and used specially designed (Parham nail) that used the same as other for insertion. The device (Parham nail) according to simple and completely mechanical design can be more available. Although complications of bone lengthening have decreased.

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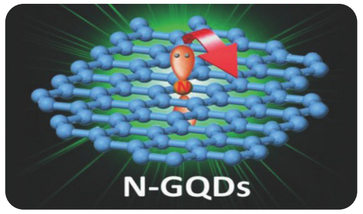
Introduction of Nitrogen-doped Graphene Quantum Dots (N-GQDs) as a New Antibacterial And Antiviral Agents

The Graphene Quantum Dots (GQDs) as a zero dimensioned of carbon derivatives have more potentials in clinical, pharmacological and industrial works based on specific structure. The general structure is the presence of ≤10 carbon layers in range ≤100 nm. Apparently, the GQDs look like graphite structure with having carbon layers indeed. But, there is physicochemical important differences between them. Basically, the GQDs are the oxidative derivatives of graphite. In the other hand the in oxidative derivatives have functional groups binding to carbon in the middle or edge of layers. There are some well-known oxidative derivatives of graphite including graphene oxide, graphene quantum dots and carbon dots. The most important difference among the derivatives is just related to their size and oxidative degree. It should be mentioned that the word «quantum» backs to «quantization» when the source start to break in small fragments as each fragments get new physicochemical characterization, for example, the GQDs has fluorescence characteristics despite graphene. Because of individual characteristic of



GQDs, for instance, high capacity to load of agent up to 200%, negligible toxicity through 80%-90% of RBC viability, photoluminescence properties with high quantum yields, they are big interests in photodynamic therapy, bioimaging fields, therapeutic affairs and new drug delivery systems (DDS). According to this properties, the GQDs are considered as multi-potential agents. If they should bear targeting, they would be able to simultaneously do imaging and deliver agents (like drug) to special cells. So, some hybrid systems based on GQDs have been designed as a drug delivery system, imaging and photodynamic therapy agents. Furthermore, based on high potential of dispersion in aqueous media, a wide range of water-insoluble drugs could be soluble in water through conjugation with GQDs. Generally, two basic method, top-down and bottom-up processes, are used for synthesis of GQDs. In the top-down method the big source is broken into small fragments through chemical oxidation, hydrothermal method and ultrasonic assisted method. Through bottom-up method the starting material as small molecules, for example, citric acid, amino acid, phenyl compounds and sugar molecules, are used for synthesis initially by the microwave method, molecular carbonization or electron beam irradiation (EBI) methods. There are many studies show that carbon-based nanomaterials especially graphene quantum dots and carbon quantum dots have bacteriostatic and bactericidal activities. The effect back to photodynamic property under a certain wavelength of light against antibiotic resistant bacteria. Z.Ristic et al showed that the GQDs kill two methicillin-resistant Staphylococcus aureus and Escherichia coli by generating reactive oxygen species when photoexcited (470 nm, 1 W). Liwei Hui et al demonstrated that in spite of the GQDs that kill bacteria through photodynamic mechanism, some GQDs structures could disrupt the bacterial cell envelope. They showed that the C60-GQD could kill antibiotic-tolerant persisters, Staphylococcus aureus, but not Bacillus subtilis, Escherichia coli, or Pseudomonas aeruginosa. It is guessed that the effect related to Surface-Gaussian-curvature match between a GQD and a target bacterium. D. Rojas-Andrade et al showed that the graphene oxide quantum dots have antibacterial properties in the dark and under photoirradiation (400 nm) condition. A new derivative, Nitrogen -doped graphene quantum dots (N-GQDs) were synthesis by A.Fakhari and A.Shomali in Shimi-Sanat Company as a knowledge enterprise company in 2017. The N-GQDs were characterized and the company received the Certificate of Compliance for first time in Iran. The N-GQDs was synthesized by bottom-up processes through microwave and got more noticeable because of special physicochemical characterization including low toxicity, strong fluorescence, biocompatibility, thermal and electrical conductivity, flexibility of chemical property and as an effective antibacterial and antiviral agent. Furthermore, the product are used in preparation of optical sensors, chemical catalysts, optical products like LED, conductive dye and polymer and improvement of «Heat transfer coefficient» in industrial oil. The XRD showed the layer space of N-GQDs is 4.2 angstrom. The particle size of N-GQDs was demonstrated by SEM (scanning electron microscope) in 5-25 nm and the «Analysis Diagram» showed the 200 C° of decomposition. Also, we studied the antibacterial and antiviral ability for N-GQDs. The our investigation showed the N-GQDs kills the E. coli, staphylococcus aureus, pseudomonas aeruginosa and candida albicans during 5, 15, 30 and 60 min effectively. The 102, 104 and 106 CCID50/ml concentration of virus (Herpes Simplex Type 1 and Enterovirus) were added to each hole in plate. The result showed that the N-GQDs are able to kill the high concentration of the virus in a short time. Also, the agent could protect steal and polyethylene surface up to 24 h. So, it could be considered as a strong virucide accorfding to EPA protocol. It should be mentioned that the product got allow to preparation and marketing by food and drug administration, and it has been done in Shimi Sanat Company by me and Dr. Ashkan Sahomali.

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Injectable Hydrogel Carrier to Repair Tissue Defects

Many advances have been made in cell isolation and culture and the fabrication of tissue engineering scaffolds in regenerative medicine in recent years. The use of hydrogel injectable scaffolds in tissue engineering is expanding and promises novel methods to repair tissue defects. In this product, by using a injectable scaffold making of small intestinal submucosa of sheep and adipose mesenchymal cells is obtained a suitable structure and source for repairing tissue defects. After achieving the required density through various methods such as catheters, catheters, endoscopy, angiography and coated on the prosthesis are delivered to the damaged tissues.

According to a search of international databases, there are no similar cases registered in the country. In the United States alone, the small intestine (SIS) in the U.S. Pat. No. 5,275,826, bladder submucosa in the U.S. Pat. No. 5,554,389 and liver submucosa and liver basement membrane in U.S. respectively. Pat. No. 6,099,567 and U.S. Pat. No. 6,379,710 are described that all of them are processed of pig source and in sheet form. Because tissue engineering is growing in a field that seeks to combine cellular, molecular, technological and medical advances to create suitable alternative tissues for implantation. Promising work has been done on a variety of tissues but the issue of mass transfer of oxygen and optimal delivery of nutrients to cells and removal of waste is one of the most important issues in the field of tissue engineering. The main issue in the formation of functional tissue in vitro is the penetration of cells into the depth of the scaffold. The scaffold is used as an extracellular matrix and a substrate for cell growth and proliferation in tissue engineering. Therefore, in this product, a scaffold is obtained from sheep intestine in the form of a gel. This matrix contains a variety of cell adhesion molecules and creates a level of dense and large growth area with cell infiltration pores. The cells are injected in the biomass of the scaffold to the production of the final product. This forms the core and innovative part of the platform. Therefore, the cells are immobilized and fixed in a fixed bed and cultured in vitro, either in an incubator or in a bioreactor.

In this product can be used different types of mesenchymal and mature cells for growth and colonization, which can be of therapeutic and clinical importance. With this method an injectable gel device containing cells can be produced in a higher volume and presented to medical centers to be implanted in tissue defects such as wounds, burns, fractures, etc.

The initial idea of this product was created in 2017, when for the first time in Tabriz University of Medical Sciences, we were able to obtain scaffold and cellular carrier as a research project for a doctoral dissertation, and since then by studying and searching the scientific databases, the main purpose of producing this product was to make a SIS scaffold and turn it into a liquid state and then to coagulate and create a gel state. In 1398, this product was registered in patent and intellectual property office and now it is trying to perform pre-clinical studies of this product and one of the future goals is during the process of obtaining ethical licenses and performing the clinical stages of the desired product. Also, one of the long-term goals is how to use this product and carrier in the bioprinter in order to create uniform structures of the body.

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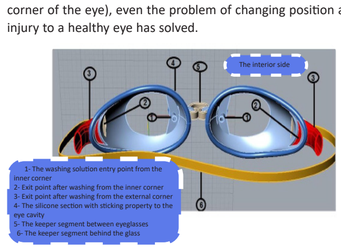
Eye Wash Glasses

The eye is one of the most important organs in the body and therefore prompt treatment of eye injuries is essential to prevent severe and permanent complications. Chemical eye injuries can be caused in industry or laboratories, and sometimes intentionally by others. The most important action in these cases is irrigating the eyes with the first liquid (water) available regularly for at least twenty minutes. In the pre-hospital emergency setting, while dealing with chemical eye injuries immediate transfer to a specialized center and eye irrigation are the best interventions. Due to the fact that rapid ambulance driving can lead to severe shakes in the patient›s cabin and this can lead to a decrease in the quality of proper eye irrigation and even the possibility of injury to other healthy eye.

Due to the feeling of need in the pre-hospital emergency system for a device that helps us with proper irrigation of the injured eye, an eyeglass was designed that in addition to being small and portable, stable during irrigation, and having a suitable inlet for water from the inner corner of the eye with the ability to adjust speed Inlet fluid as well as a suitable outlet with cheap price. This device, due to the precise and principled adjustment of the entry point for irrigation and also being separate and according to the principles of the outlet canal after washing (entry point of the inner corner of the eye and exit point of the outer corner of the eye), even the problem of changing position and injury to a healthy eye has solved.



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Design of Multi-directional Motion Platform for Respiratory Motion Simulation

FDG PET/CT[1] imaging has had a major influence on cancer imaging for many clinical tasks including lesion detection, staging, and monitoring therapy response. Nevertheless, respiratory motion, one of the most important causes of image degradation in lung cancer imaging, has been observed to significantly hamper PET image quality and quantification, in particular in small and low-uptake lesions. For example, in lung lesions, a displacement of 4.9–20 mm due to respiratory motion can result in notable errors in tumor localization and quantification. Several methods have been proposed for compensation of respiratory motion in PET images, such as respiratory gating, data-driven respiratory gating, motion-free method, and banana artifact management. In this study, we developed a post-reconstruction method for compensation of respiratory motion based on deconvolving the reconstructed image with the motion-blurring kernel (MBK).

Performance evaluation of the proposed algorithm was done by simulating respiratory motion using NEMA phantom and dynamic platform. Thus, we designed a dynamic in-house platform that was planned to move phantom with sinusoidal motion profiles in the axial and lateral directions. First, the phantom was placed on the platform and scanned without any motion, yielding a static image (Figure 1). Next, in order to obtain an image with a motion effect, the platform was moved along the longitudinal axis of the scanner with uniform velocity and a 5-sec cycle.

The respiratory Motion Platform is designed to move the phantoms with programmable respiratory and sinusoidal motion profiles for the complex tasks associated with tumor motion (Figure 2). The Platform's unique multi-directional motion simulation capability allows it to move in the superior/inferior direction but can also generate a lateral hysteresis motion with amplitudes up to 1.0 cm. This allows testing with phase separation (Table 1). The platform is made from stiff, low-density plastics. With a weight-bearing capacity of 20 kg, the respiratory motion platform can be used to move any phantom and most third-party phantoms.

The Dynamic platform was designed and built over 6 months at a cost of 400$ in 2018. It should be noted that the cost of purchasing the foreign equivalent of this platform was over 10,000 $. The Dynamic platform is currently used at the Research Center for Molecular and Cellular Imaging of Tehran University of Medical Sciences as well as Masih Daneshvari Hospital for research purposes.

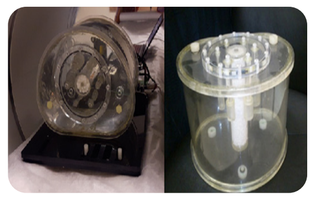

Figure 1. NEMA phantom (right). NEMA phantom preparation along with Dynamic platform for PET scan (left).

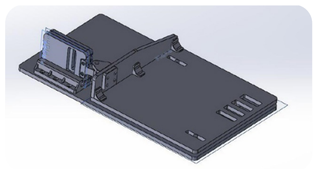

Figure 2. Three-dimensional design of a Dynamic platform in Solid Work software

Table1: Specifications of Dynamic platform

SPECIFICATIONS	
Platform Dimensions	35 × 35 cm
Max. Platform Load	20 kg
AMPLITUDE, IS(inferior-superior)	± 25 mm
AMPLITUDE, AP(anterior-posterior) /LR (left/right)	± 25 mm
CYCLE TIME:	1 - ∞(adjusted based on amplitude)
WAVEFORMS:	sin (t)

1. Fluoro-2-deoxyglucose positron emission tomography/computed tomography (FDG PET/CT)

Congratulations to Dr. Masood Dinevari, former head of the hospital, and Dr. Mojtaba Mohammadzadeh, current head of the hospital, and respectful staff in the deputy of research and education on getting the award of the 15th Shahid Motahari Educational Festival in two areas of «Educational Management and Leadership» and «Design and Production of Educational Products».

Prof. Hassan Soleimanpour
Deputy Dean for Education and Research

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