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140 YEARS ANNIVERSARY OF THE FIRST RUSSIAN MILITARY REHABILITATION CENTER NAMED AFTER G.A. ALBRECHT

© *Gennady N. Ponomarenko, Konstantin K. Shcherbina, Gennady N. Burov,
Vladimir A. Bolshakov, Marina V. Chernikova*

Federal Scientific Center of Rehabilitation of the Disabled named after G.A. Albrecht. Bestuzhevskaya 50,
Saint-Petersburg, Russian Federation, 195067

Contact information: Marina V. Chernikova — Head of the design department.
E-mail: chernikovamarinavl@gmail.com ORCID ID: 0000-0002-3881-7521

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ABSTRACT. The 140th anniversary of the Albrecht Federal Scientific Center of Rehabilitation of the Disabled Persons is celebrated in March 2023. On March 5, 1883, the Military Department of the Russian Empire issued an order approving the regulations of the Military Council on the organization of the Mariinsky Shelter for amputated soldiers. Creation of such an institution was the beginning of the opening of new areas of rehabilitation and created prerequisites for the formation of enterprises and institutions that dedicated their activities to assisting disabled people. It was in 1916 when G.A. Albrecht started reformation of prosthetic care for disabled veterans at the Mariinsky shelter. Thanks to the activities of professor Albrecht, the Mariinsky shelter was transformed into a scientific and methodological center managing the entire organization of prosthetic practice. During the Great Patriotic War, the activities of the Institute did not stop and the remaining staff, headed by doctor B.A. Betekhtin, continued active work on providing special surgical and prosthetic care to the wounded soldiers. In 1983 clinics of the Leningrad Research Institute of Prosthetic and the Leningrad Research Institute for the Examination of the Ability to work and the Organization of work of the disabled were united. Today, the successor of the noble cause of the Mariinsky shelter is the Albrecht Federal Scientific Center of Rehabilitation of the Disabled — the undisputed leader in solving diverse issues of complex rehabilitation of disabled people not only with diseases and defects of the musculoskeletal system, but also with disorders of the central nervous system. Between the date of the formation of the Mariinsky shelter and present days lies a long and difficult path of formation and development of the rehabilitation system in the Russian Federation, primarily for disabled people due to combat traumas.

KEY WORDS: Federal Scientific Center of Rehabilitation of the Disabled named after G.A. Albrecht; rehabilitation; prosthetics; anniversary; disabled people.

ПЕРВОМУ В РОССИИ ЦЕНТРУ РЕАБИЛИТАЦИИ ИНВАЛИДОВ ИМ. Г.А. АЛЬБРЕХТА 140 ЛЕТ

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Контактная информация: Марина Владимировна Черникова — руководитель проектно-конструкторского отдела.
E-mail: chernikovamarinavl@gmail.com ORCID ID: 0000-0002-3881-7521

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РЕЗЮМЕ. В марте 2023 г. исполнилось 140 лет Федеральному научному центру реабилитации инвалидов им. Г.А. Альбрехта Минтруда России. 5 марта 1883 г. Военным ведомством Российской Империи был издан приказ, которым утверждалось положение Военного Совета об организации Мариинского приюта для ампутированных воинов. Создание подобного учреждения стало началом открытия новых направлений реабилитации и создало предпосылки для образования предприятий и учреждений, которые связали свою деятельность с помощью инвалидам. С приходом в 1916 г. Г.А. Альбрехта в Мариинский приют начинается реформация протезной помощи инвалидам войн. Благодаря деятельности Германа Александровича Мариинский приют трансформировался в научно-методический центр, руководящий всей организацией протезной практики. Во время Великой Отечественной войны деятельность института не прекратилась, и оставшиеся сотрудники во главе с врачом В.А. Бетехтиным выполняли работу по оказанию раненым специальной хирургической и протезной помощи. В 1983 г. происходит объединение клиник Ленинградского научно-исследовательского института протезирования и Ленинградского научно-исследовательского института экспертизы трудоспособности и организации труда инвалидов. Сегодня продолжателем благородного дела Мариинского приюта является Федеральный научный центр реабилитации инвалидов им. Г.А. Альбрехта Минтруда России — бесспорный лидер в решении разноплановых вопросов комплексной реабилитации инвалидов не только с заболеваниями и дефектами опорно-двигательного аппарата, но и с нарушениями центральной нервной системы. Между датой образования Мариинского приюта и сегодняшним днем лежит долгий и трудный путь становления и развития системы реабилитации в Российской Федерации, в первую очередь для инвалидов вследствие боевой травмы.

КЛЮЧЕВЫЕ СЛОВА: Федеральный научный центр реабилитации инвалидов им. Г.А. Альбрехта; реабилитация; протезирование; юбилей; инвалиды.

140 years ago, on March 5, 1883, an order was issued by the Military Department of the Russian Empire and approved the position of the Military Council “On the organization of the Mariinsky shelter for soldiers after amputation”.

Nowadays, the successor to the noble work of the Mariinsky shelter is the Federal State Budgetary Institution “Federal Scientific Center for Rehabilitation of Disabled Persons named after H.A. Albrecht” of the Ministry of Labor and Social Protection of the Russian Federation (FSCRD named after H.A. Albrecht), which is

an undisputed leader in solving diverse issues of complex rehabilitation of disabled persons not only with lesions of musculoskeletal system, but also with disorders of the central nervous system.

A long and difficult path of formation and development of the rehabilitation process, accompanied by numerous transformations both structural, and functional lies in period from the day of formation of Mariinsky shelter and present days.

The organization of Mariinsky shelter was the beginning of an opening of new areas for



Fig. 1. Vasily N. Kochetkov. Peter Borel's engraving

Рис. 1. Василий Николаевич Кочетков. Гравюра Петра Бореля

rehabilitation, which, in turn, created the prerequisites for the formation of other institutions and enterprises connected in their activities with helping disabled. This process took place continuously throughout the historical development of the Mariinsky shelter, regardless of the forms of government of our state. That is why this historical path is so attractive and interesting [4].

Historical prerequisite for the establishment of the Mariinsky shelter is the outcome of bloody and liberating Russo-Turkish War that ended in 1878. More than 35,000 soldiers and officers became disabled as the result of the fighting. According to the information of the Main Military Medical Department, in 1879, about 1600 veterans of military operations needed prosthetics [6]. The issue of enterprising the first multifunctional rehabilitation center for medical care and preparation for prosthetics for armless and legless disabled people in Russia, their professional and social rehabilitation and adaptation became actual.

The March 5, 1883 may be considered the starting point of the system of state assistance to armless and legless soldiers who were maimed in military operations.

The creation of the Mariinsky shelter, which expanded assistance to the disabled, was quite predictable, as the supply of "artificial arms or legs" also included "lower ranks" who had served in the army for 25 years and had no civilian specialty. The first private workshops for prosthetics and orthopedic footwear were estab-



Fig. 2. The building of the Mariinsky shelter, built in 1902 according to the project of a military engineer, Colonel A.M. Vishnyakov

Рис. 2. Здание Мариинского приюта, построенное в 1902 г. по проекту военного инженера, полковника А.М. Вишнякова

lished by maimed men who had received civilian specialization in the Mariinsky shelter.

Thus, the main reasons for the organization of the world's first specialized center for prosthetics, medical and social rehabilitation should be considered the political situation that developed in Russia in the second half of the nineteenth century — numerous wars, which were accompanied by a massive flow of amputees, and high social consciousness, when charity was the norm of social morality.

At that time, at the end of the nineteenth century, in military medical and administrative circles, there was a mature understanding of the fact that the mobilization resources of the Empire were not unlimited. A significant part of maimed soldiers in need of prosthetics were experienced, skilled, battle-hardened soldiers.

Russian society of past time knew the story of the soldier V.N. Kochetkov, whom contemporaries called “the soldier of three emperors” (Fig. 1).

It is known that the soldier began his military service in 1811 in the Life Guards Grenadier Regiment. He was a participant of the Patriotic War of 1812, the Russo-Turkish wars of 1828–1829 and 1877–1878. As the member of the Kazan Jaeger Regiment, during the Crimean War of 1854–1855 participated in the defense of Sevastopol. By personal example he inspired recruits. In one of the battles during the defense of Shipka Pass, 92-year-old Vasily Kochetkov lost a leg, later he was provided with a working prosthetic hip of the “goat leg” type. The soldier died at the age of 107 and was honored with a state funeral in Vyborg.

Contemporaries unanimously spoke about the Mariinsky shelter as an extremely important institution, bringing great benefit to many thousands of maimed soldiers, bringing them back to useful activity, making them able to work again (Fig. 2). The fact of the existence of such an exemplary institution as the Mariinsky shelter contributed to the strengthening of patriotic feelings of the Russians and the realization of the great importance of charity as a norm of public morality.

In the last third of the 19th century in Russia, the main link in the system of medical care for wounded and maimed soldiers was the Military Department. The selection of those in need of prostheses was made by district and provincial military chiefs in the field. According to the existing instructions (circulars) of the

General Staff of the Military Medical Department, groups of 10–20 people in need were sent together with an escort for treatment at the expense of the treasury.

The diverse activities of the shelter were regulated by the superiors of the Military District, the Main Department of the Red Cross, the Ladies' Trustee Committee and the Honorary Trustee.

The Ladies' Trusteeship or Charity Committee, established in 1878 at the request of Countess Sophia Andreyevna Bobrinskaya (Shuvalova), who headed it until 1903, played an important role in providing prostheses (Fig. 3). Sophia Andreevna experienced the personal tragedy of the death of her favorite son, who was an officer and died of his wounds at the age of 24.

In the first 10 years, the shelter annually accepted up to 100 people and issued up to 250 prostheses. In the next 10 years, after the Russo-Japanese War, the number of patients of the Mariinsky shelter significantly increased to 987 people, to whom



Fig. 3. Portrait of Countess Sophia A. Bobrinskaya. Artist Franz Xaver Winterhalter

Рис. 3. Портрет графини Софьи Андреевны Бобринской. Художник Франц Ксавер Винтерхальтер



Fig. 4. Professor Herman Alexandrovich Albrecht

Рис. 4. Профессор Герман Александрович Альбрехт

3120 prostheses were made. It became necessary to expand the area of the shelter. At the same time a second three-story building was built in the yard [5]. The successful experience of the Mariinsky shelter was replicated throughout the empire: similar institutions were organized in Moscow, Kiev, Saratov, Rostov-on-Don, Kharkov.

With the beginning of the World War I (1914–1918) the number of disabled people increased almost in 10 times. The work of the Mariinsky shelter had to meet the wartime conditions. The period of stay of the disabled on prosthetics was reduced to 1 month, and the period of testing of prostheses — to 1 week. From that time until nowadays, 7 days is considered to be the standard period of trial wear of a prosthetic limb, and the prosthetics time averages 30 to 40 days for complex and atypical prosthetics.

Prosthetics technicians and doctors mobilized to the active army in 1914 were urgently recalled from the front by special decrees to assist amputees. It is worth noting that this situation was repeated in 1941, when it became nec-



Fig. 5. G.A. Albrecht, A.K. Schenk, G.I. Turner, E.Yu. Osten-Saken (standing)

Рис. 5. Г.А. Альбрехт, А.К. Шенк, Г.И. Турнер, Э.Ю. Остен-Сакен (стоит)

essary to take administrative measures to bring prosthetics specialists back to the rear.

In 1915, the future director of the Mariinsky shelter, H.A. Albrecht, was recalled from the front and took up the position of junior doctor at that time (Fig. 4). His personality in the formation and development of the Mariinsky shelter as a scientific and practical institution is so significant that it is difficult to overestimate.

Herman A. Albrecht was born in Pskov on September 11, 1877, graduated in 1903. He graduated from the Military Medical Academy (MMA) in 1903, “recognized in the degree of a physician with distinction” and then arrived to the Ryazan regiment as a junior doctor. In 1904 he was seconded to the Military Medical Academy as an assistant of the clinical military hospital. For 10 years he had been working in the clinic of Prof. H.I. Turner, where he acquired extensive knowledge in the field of orthopedics, which formed the basis of his further activity. In 1907, his dissertation “About pathology and therapy of lateral curvatures of a knee” was published, and at the meeting of the Academy H.A. Albrecht was awarded the degree of Doctor of Medicine.

During The World War I, Herman Aleksandrovich worked as chief physician of a hospital

and head of an evacuation station on the North-Western Front (1914–1915). After his appointment to the Mariinsky shelter in 1916, he presented a project of state reform, which envisaged a complete reorganization of prosthetic care for disabled warriors. H.A. Albrecht regarded prosthetics as a special field of medicine and technology with important state and economic significance. He believed that the work in this field requires cooperation of various specialists: doctors, engineers, masters of prosthetics, who should be trained at appropriate courses. He also believed that it was necessary to deploy a network of prosthetic workshops throughout the country and to organize an experimental base for the development of new, more advanced prostheses [2].

The scientist did a lot for the development of prosthetics, but he took a special interest in the design of artificial upper limbs. He created the first domestic samples of active prostheses for people with amputated hands, as well as so-called working aids. H.A. Albrecht significantly reorganized the work of the Mariinsky shelter, which was not only engaged in supplying disabled war veterans with prostheses. At the same time, at other medical sites (Turner Institute,



Fig. 6. Celebration of the 25th anniversary of G.A. Albrecht's activity: guests, employees of the Institute, representatives of the authorities, 1928

Рис. 6. Празднование 25-летия деятельности Г.А. Альбрехта: гости, работники института, представители власти, 1928 г.

Mariinsky shelter) numerous operations were carried out to prepare disabled people for prosthetics. A great role in this process belonged to graduates of the MMA — H.I. Turner, R.R. Vreden, A.K. Shenk, E.Yu. Osten-Saken, M.S. Yusevich, T.M. Stepanov, and many others (Fig. 5).

The events of October 1917 radically changed the fate of the Mariinsky shelter. At the beginning of 1918 it was transferred by the Soviet authorities from the Military Department to the People's Commissariat of Social Welfare (Order of the Commissar for Military Affairs No. 76 of 21.01.1918). At the same time, funds were allocated for the purchase of prosthetic and orthopedic products for the supply of maimed citizens of the country, a project was developed and the necessary allocations were determined for the organization of prosthetic-assembly, bandage and shoe and orthopedic workshops [3]. In March 1919, the Petrograd Mariinsky shelter for supplying maimed soldiers was renamed into the Institute for supplying maimed citizens with prosthetic and orthopedic products, and in 1932 it became the Leningrad Research Institute of Prosthetics (LRIP). H.A. Albrecht was appointed director of the Institute. In 1928, the 25th anniversary of H.A. Albrecht's scientific acti-

vity was widely celebrated. The photo of that time depicts leading orthopedic traumatologists, as well as representatives of the authorities, engineers, prosthetists and other employees of the Institute (Fig. 6).

H.A. Albrecht was the director of the institute until the end of his life, until 1933. He transformed the institute into a scientific and methodological center, personally directing the entire organization of prosthetic practice and training personnel in all medical fields, as well as technical workers. Since 1922 the Institute became the training base of the Department of Orthopedics, Traumatology and Prosthetics of the Leningrad Institute for Advanced Training of Doctors. It also organized advanced training courses for master prosthetists of various specialties.

In 1928, thanks to the efforts of H.A. Albrecht, a 30-bed inpatient clinical base for prosthetics and surgery was established. In 1932, while Herman Alexandrovich was still alive, the institute received a research status. The Institute established the Department of Orthopedics and Prosthetics, which was headed by H.A. Albrecht. At the same time the workshops of the Institute were reorganized into a prosthetic fac-



Fig. 7. The Leningrad Research Institute of Prosthetics staff during the war. P.I. Belousov, A.N. Vitkovskaya, V.A. Betekhtin, representative of the Red Army, L.I. Schwindt

Рис. 7. Коллектив ЛНИИП во время войны. 1-й ряд, слева направо: П.И. Белоусов, А.Н. Витковская, В.А. Бетехтин, представитель Красной армии, Л.И. Швиндт

tory. In 1935 it was separated into an independent enterprise, and the shoe shop was reorganized in 1938 into a factory of orthopedic footwear. In the 1930s, the Institute began to disseminate knowledge on prosthetics in printed form. Since 1936, instructions, methodological letters, and manuals were published, in particular, "Practical Guide to Prosthetic Technology" and "Instruction on the Use of Lower Extremity Prostheses (Artificial Legs)" compiled by Dr. S.O. Weinzwieg. For the first time, a scientific analysis of the static-dynamic characteristics of the hip prosthesis from the perspective of theoretical biomechanics was published (Albrecht H.A., 1937). The theoretical basis for a number of studies was the work of S.O. Weinzwieg published in 1929 "About the types of gait of a healthy person and its relation to the gait on an artificial limb". In 1936, the first Russian "Guide to Prosthetic Technology" by V.A. Betekhtin was published. In 1935, under the editorship of Prof. E.Yu. Osten-Saken, the first issue of the Institute's works "Issues of Prosthetics" was published [3].

In the same year, a research and development design bureau was established to ensure professional development of new prostheses and related equipment.

The Great Patriotic War (1941–1945) did not interrupt the scientific work of the Institute, although most of the staff, including doctors and technicians, were mobilized to the Red Army. Leningrad was in the enemy siege. However, in spite of the most difficult conditions amid hunger, bombing and destruction, the work of the Institute continued. The remaining employees of the Institute — doctors B.A. Betekhtin (Director of the Institute), P.I. Belousov, A.N. Vitkovskaya, L.D. Shvindt and several people of the middle and junior staff performed the work on rendering special surgical and prosthetic aid to the wounded (Fig. 7). During the war years, 1221 patients passed through the Institute's hospital and 915 operations were performed.

After the end of the war, due to the considerable flow of wounded and maimed, it was necessary to quickly restore the activities of the Institute's pre-existing departments. The set tasks were practically solved already in 1948. A laboratory for testing prostheses and laboratory for researching new materials were opened. Later, departments for adults (male and female), physical therapy and physiotherapy departments, biomechanical and clinical laboratories, X-ray room and, for the first time in

Russia, department for children were opened. The leading specialists of the Institute — I.S. Shermet (Director of LRIP in 1946–1948), Professors L.E. Rukhman and M.S. Pevzner.

In the post-war years, new designs of prosthetic arms and legs for disabled war veterans appeared, and the Institute's specialists, having experience in practical prosthetics and prosthetic construction, were in dire need of scientific confirmation of the correctness of the chosen areas of activity and search for new solutions. In the 1960s, groups were established for the development of upper and lower limb prostheses and orthopedic footwear. The main direction was the creation of highly functional, repairable active plastic prostheses of upper limbs. This work was headed by Dr. F.S. Vorontsov, who was a Doctor of Technical Sciences.

In the work of clinical departments, it is necessary to note the establishment of the first pediatric department in Russia. L.E. Rukhman, Head of the Children's Clinic, made a great contribution to this, both in practical and scientific aspects. The closest assistant of Prof. L.E. Rukhman was a doctor of the pediatric clinic, and later — a senior researcher A.N. Vitkovskaya. Thanks to her initiative, the Institute developed the scientific direction of prosthetics for disabled children with limb defects.

In 1971, Prof. V.I. Filatov was appointed Director of LRIP. The beginning of the 1970s was a period of increased attention to prostheses with an external energy source (electric and pneumatic drive). Under the guidance of S.F. Godunov and his students, bone-plastic methods of lower limb amputation with displacement of the medial plantar flap taken from the foot were developed in the Department of Complex Prosthetics for Adults. Reconstructive surgery received a new leap. New treatment technologies have been proposed for malformations of limb stumps. In the rehabilitation of disabled people, the main attention was paid to the methods of physiotherapeutic treatment and therapeutic physical training. In 1972, the idea of creating special functional and aesthetic clothing as a means of domestic and social rehabilitation of people with physical disabilities was proposed, and in 1976 a new subdivision — a group for the creation of functional and aesthetic clothing appeared in the Institute under the leadership of V.M. Volkova.

In 1983, the Institute moved to a new building at 50 Bestuzhevskaya Street. At the same

time, the clinics of the Leningrad Research Institute of Prosthetics (LRIP) and the Leningrad Research Institute of Expertise of Working Ability and Organization of Work for the Disabled (LRIEWAADV) were merged. Candidate of Medical Sciences A.I. Boldyrev, who had been acting Director of the Institute of Prosthetics until the appointment of Dr. A.N. Keyer to this position, was appointed Chief Physician.

Since July 1983, the clinic organized orthopedic departments for children (preschool and school), prosthetic and orthopedic rehabilitation departments for adults and complex hand prosthetics. Prosthetics were performed both at the Leningrad Prosthetic-Orthopedic Enterprise and in the scientific laboratories of the Institute. In 1983, new operating rooms, departments of physical treatment methods, physiotherapy and four expert departments were opened.

In the first decade after the unification of the clinics, more than 11,000 patients were provided with high-tech prostheses of the upper and lower limbs. The number of reconstructive and restorative surgeries, especially for hand defects in children and adults, increased dramatically, and methods of lengthening short stumps using the Ilizarov distraction and compression apparatus were introduced to correct limb deformities [8]. Reconstructive surgery was widely used to restore the bearing capacity of malformed stumps of the lower limb. In amputations at the level of the foot, tibia, and thigh, it was proposed to apply skin transplantation of the plantar surface of the foot on the neurovascular bundle using microsurgery.

In 1989 there was an important event in the life of the Institute. The country's government decided to industrialize the prosthetic industry. This task was entrusted to the "Energia" Space Corporation (RSC "Energia").

The great experience of the Institute was in great demand. In order to scale up the practical application of research and practical results, a group of Institute specialists was created, which had direct contact with "RCC «Energia representatives»".

Providing rehabilitation (vocational and social) assistance to disabled people has been the main activity of the clinic since 1990. A Rehabilitation Council was formed, approving rehabilitation programs for each patient and giving work recommendations.

The fifth orthopedic department of surgical training and prosthetics for disabled military

service personnel was organized in 1991 as a rehabilitation center for soldiers-internationalists who were injured during military operations in the Republic of Afghanistan. O.N. Gorchaninov, Candidate of Medical Sciences, Honored Doctor of Russia, was appointed head of this department, with Dr. K.K. Shcherbina as his scientific supervisor.

It should be noted that in the current conditions of the special military operation in Ukraine, the lessons and experience of the Great Patriotic War and the Afghan campaign have never been more in demand.

It was shown that the primary prosthetics of warriors who underwent amputation due to mine blast wounds should be carried out exclusively in the conditions of a specialized hospital, and the prosthetics itself should be implemented in the form of therapeutic and training.

The consequences of mine blast wounds of the limb are characterized by a significant number of stump diseases and malformations that prevent further prosthetics. During the Great Patriotic War at least 39% of those in need of prosthetics had pronounced stump diseases and malformations, during the Afghan campaign — up to 44%. During the counter-terrorism operation in the Caucasus, at least 77% of the wounded needed operative and conservative preparation of the residual limb for prosthesis [7].

Such significant number of stump diseases and malformations is an inevitable consequence of the severity of modern mine blast trauma and the only correct tactic of military surgeons is to save the wounded person's life, and the formation of a stump suitable for prosthetics is referred to the rehabilitation stage. It is the therapeutic and training prosthetics that allows to determine the necessity and volume of reconstructive intervention on the stump in order to eliminate its diseases and malformations, as well as the interdependence of the stages of surgical treatment and prosthetics.

The scientific and technical part underwent changes at the same time. G.N. Burov, Candidate of Medical Sciences, was appointed Deputy Director for Scientific and Technical Work, who united the scientific medical and technical parts in 1991. Seven scientific and technical departments were formed, including laboratories and sectors. New designs of upper and lower limb prostheses were developed, orthotics was developed, new samples of orthopedic footwear

were created, and the technology of manufacturing of receiving sleeves was improved [1].

The end of the 20th century was marked by the merger of two institutes, which already had a common clinic and were located in the same building. The St. Petersburg Scientific and Practical Center for Expertise, Prosthetics and Rehabilitation of Disabled Persons named after H.A. Albrecht after the merger not only allowed the institutes to retain their status and all scientific directions, but also made it possible to acquire a greater thematic diversity.

Doctor of medical sciences, Prof. I.V. Shvedovchenko became the General Director of the Center. With arrival of Igor Vladimirovich, one of the main directions of the clinic's work was defined — reconstructive surgeries for children with congenital and acquired limb defects.

Since 1999, the clinic has been developing and implementing measures for the development of medical and social expert assessment of children. In 2003, a rehabilitation center for disabled children was opened in the old building of the Mariinsky shelter on Bolshoy Sampsonievsky avenue.

In 2017, the St. Petersburg Scientific and Practical Center for Medical and Social Expertise, Prosthetics and Rehabilitation of Disabled Persons named after H.A. Albrecht was transformed into the Federal Scientific Center for Rehabilitation of Disabled Persons named after H.A. Albrecht. The Center was headed by Corresponding Member of the Russian Academy of Sciences, Doctor of Medical Sciences, Professor, Honored Scientist Gennady Nikolayevich Ponomarenko. His arrival was marked by innovative

transformations in the Center. The task was difficult: on the one hand, to raise the prestige of the institution to the level that has always been inherent in the Mariinsky shelter, and on the other hand, to develop and introduce innovative digital technologies into rehabilitation practice, which at the modern technical level will make it possible to solve those tasks that are united by the modern concept of “rehabilitation”.

The structure of the Center included the Institute of Rehabilitation and Habilitation, the Institute of Prosthetics and Orthotics, a clinic and the Children's Rehabilitation and Rehabilitation Center for Children with Disabilities (RCCD); later, the Institute of Early Assistance and Support and the Federal Methodological Center were opened.

A laboratory of innovative technologies of prosthetics and medical robotics has been established at the Institute of Prosthetics and Orthotics. Among the main directions of its activities: development of technologies for individual prosthetic and orthopedic products using additive technologies: 3D-scanning, 3D-modeling and 3D-printing; development of remote technologies using 2D- and 3D-scanning; performing finite element calculations of prosthetic and orthopedic parts and assemblies in order to simulate tests conducted in accordance with the requirements of national and international regulatory and technical documentation; manufacturing and testing of prosthetic and orthopedic devices (POI) samples manufactured using additive technologies, including for patients who have been injured as a result of mine blasts.

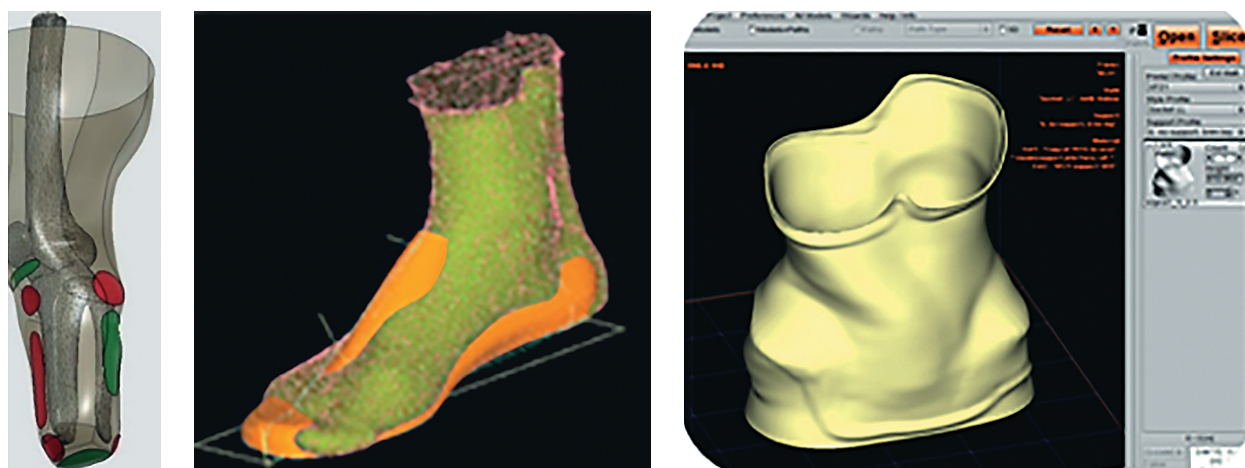


Fig. 8. Digital modeling of the POI: the receiving sleeve of the prosthesis, orthopedic pads, functional corset

Рис. 8. Цифровое моделирование ПОИ: приемной гильзы протеза, ортопедических колодок, функционального корсета



Fig. 9. Manufactured using digital technologies (3D scanning, 3D printing and computer-aided design of POI)

Рис. 9. Изготовленные по цифровым технологиям методом 3D-сканирования, 3D-печати и автоматизированного проектирования ПОИ

For the first time in the Russian Federation, scientific and technical development and implementation of a complex of innovative digital technologies for the production of highly specific individual prostheses and limb orthoses, corsets, orthopedic footwear, functional and aesthetic (special) clothing as a single technological process, including: remote data collection with 3D-scanning of the patient's figure, torso, limb, limb stump; analysis of objective biometric information; formation of electronic geometric 3D models of body segments and digital profiles of POI; 3D-printing of POI; instrumental biomechanical assessment of functional properties of POI (Fig. 8).

Due to the use of 3D-scanning and additive manufacturing process, the production of POI of the same quality as with the use of traditional plaster technologies is achieved, but at the same time the duration of their production is significantly reduced, the financial costs of providing patients with POI are reduced, and the degree of satisfaction of the population's need for POI is increased (Fig. 9).

The clinic of the Center annually provides specialized, including high-tech medical care and rehabilitative treatment to 5000 patients from 75 regions of the Russian Federation. It is the clinical base of the Center's research institutes. Activities are carried out within the framework of social policy, high-tech medical care and compulsory medical insurance.

The Children's Rehabilitation and Restoration Center provides outpatient and inpatient conservative treatment for children with neurological pathology (including cerebral palsy) and diseases of the musculoskeletal system (including various forms of posture disorders, scoliosis). An interdisciplinary center has been established for children with autism spectrum disorders (ASD) in order to improve the quality of rehabilitation.

From 2017 to 2022, the Centre organized the National Congresses "Rehabilitation — XXI Century: Traditions and Innovations". In June 2018, Federal Service for Supervision in Education and Science successfully accredited the educational activity on training in the system of higher professional education (postgraduate studies, residency). The results of many years of work of the Center's staff were summarized in 2018 in the National Guide "Rehabilitation of Disabled People", written by a team of leading specialists in various sections of comprehensive rehabilitation of disabled people [9].

Nowadays, the Scientific Center for Rehabilitation of Disabled Persons named after H.A. Albrecht is the oldest and only one institution in Russia, which includes unique scientific and practical laboratories of innovative digital technologies of prosthetics, prosthetics and orthotics, a center for expert evaluation and pro-

duction of prosthetic and orthopedic products. The Center's employees continue and multiply the glorious heritage of the Mariinsky shelter with their high professionalism and loyalty to the age-old traditions of Russian science.

ADDITIONAL INFORMATION

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