Innovative Equipment for Skin Restoration in Patients with Burn Injury

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Abstract

The advantages of the latest high-tech equipment for donor skin grafting in patients with deep burns are described in this article. Innovative instruments fully comply with the requirements for sterilization and provide a high level epidemiological safety during autodermoplasty in patients with burn injuries. The suggested range of electrodermatomes is widely used in wound reconstructive surgery.

ABBREVIATIONS

HIV: Human Immunodeficiency Virus

INTRODUCTION

Skin burn injuries are one of the most common types of home and industrial injuries [1]. High mortality rate, difficulties in treatment, inadequate functional and cosmetic results claim for new treatments techniques for the patients with burns [2,3].

Today, a number of definitive treatment techniques are administered for patients with burns [4,5]. At the same time, burn wounds plasty by means of autologous skin grafts is still the main method in surgical treatment of deep thermal injuries [6,7]. Today, many different techniques of surgical laceration repair are introduced into clinical practice to solve many problems of burns reconstructive surgery [8-10].

Patients with severe burns need immediate surgical measures. High-tech medical equipment with a high epidemiologic safety should be provided for necrectomy and autodermoplasty in patients with termal injuries [11,12].

Current instruments for skin grafting are usually sterilized using autoclaving. Dynamic drive system in these devices should be chemically sterilized. All phases of cleaning and disinfection should be conducted due to the design of these devices.

So, unified evidence-based techniques of cleaning disinfection and sterilization of surgical instruments that would guarantee complete microbial decontamination should be implemented. Additionally, the use of disposable medical instruments and devices reduce the risk of nosocomial infection for patients [13,14].

MATERIALS AND METHODS

At the Department of Burn Trauma and Plastic Surgery of Ternopil Municipal Emergency Hospital the development of advanced highly-precise medical equipment for skin grafting in patients with burn injuries have been performed for the last 7 years [15-17].

Three models of high-tech instruments were presented:

a) Model 00 – Electrodermatome with a disposable cutting head. Disposable use increases epidemiological safety in in-patient surgical clinic, reduces the risk of nosocomial infection for patients, such as HIV, hepatitis B and C, and it takes less time to prepare for the surgery;

b) Model 01 – Linear electrodermatome with modified disposable knives. To solve the technical problem it was taken into account that a stable position of the blade was possible with regular removal of working parts of the linear motion device. It is advisable to change the configuration of the carriage, to make it of polymers and to integrate the knife into the carriage. Using carriage cutting blade as a single unistructure with short cycle operation makes it possible to prevent the backlash between the working surfaces of the device, which provides its high-quality work.

c) Model 02 – Disk electrodermatome with disposable ring-shaped knives. This electrodermatome model is successfully used for sphacelus abrasion during necrectomy. Also, this device is used for skin grafting in difficult-to-reach donor areas.

The cutting part of the dermatome Models 01 and 02 should be sterilized using autodaving, and the blades in these models are disposable. Local drive system with power batteries are tight and can pass chemosterilization.

These instruments are approved for usage in medical practice by the Order No. 1050 of the Ministry of Public Health of Ukraine and designated into the State Registrar (Registration Certificate

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RESULTS AND DISCUSSION

Universal range of advanced medical equipment for skin grafting solves various problems of dermis deep defects in plastic surgery. The devices are available for doctors in hospitals and departments of surgery and burn trauma of Ukraine.

Design parameters of the disposable cutting head (Model 00) conduct ultrathin skin grafting (0.06-0.1 mm thick), which preserves the donor skin resources in patients with severe burn injuries of a big area, which is especially important for the treatment of children. One of the advantages of this dermatome is its usage in emergency cases by quick replacement of sterile disposable cutting head and a special sterile sleeve to protect the system drive (Figure 1).

The new model of linear electrodermatome (Model 01) performs skin grafting with smooth edges, 120 mm wide. These grafts are used for large defects plastics during plastic surgeries of cosmetically and functionally important areas (defect plastics after scars, tumors removal) (Figure 2).

The disk electrodermatome (Model 02) is presented at the world market of medical equipment for the first time. It is fitted with local dynamic drive system and disposable knives. This device is effective during necrectomy of the early stages of burn injuries surgical treatment. This medical device complies with the current requirements for sterilization and has a number of advantages in comparison with its analogs (Figure 3).

The usage of dermatome disposable cutting head (Model 00) and modified knives (Models 01, 02) eliminate the sterilization of important elements of the dermatome after each donor skin grafting for prevention of HIV, hepatitis B and C and other infectious diseases. Besides, this technique significantly reduces the risk of HIV infection for patients after possible improper instruments presterilization and further sterilization.

The complications were decreased in 2.6 times, the number of surgical treatment was decreased in 1.4 times per 1 patient and the average treatment time was decreased in 2.7 times due to the usage of high-tech range of Ukrainian electrodermatomes at in-patient surgical clinics and departments of burn trauma of Ukraine for the surgical treatment of 7825 patients with burn injuries.

The economic efficiency of innovative equipment is to decrease the length of hospital stay in 2.7 times and to cut the treatment costs in 2.4 times, to reduce the cost effectiveness ratio in 3.6 times.

CONCLUSION

The modified models of the disk and linear electrodermatomes provide a high-level epidemiological safety for medical staff and patients. The use of disposable cutting head reduces the risk of nosocomial infection.

High-tech electrodermatomes produced in Ukraine have successfully passed pre-clinical and clinical trials and are widely used in the departments of burn trauma and surgical clinics of Ukraine.

Clinical usage of innovative high-tech equipment for skin grafting decreases significantly the length of hospital stay of patients with burn traumas and provides material cost-cutting.

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REFERENCES


