

Programmable electro-medical system

Abstract

A medical system for functional integration of at least one diagnosis device (21 - 27) and at least one surgical or therapeutic device (31 - 34) is described.

Classifications

[A61B5/0059](#) Detecting, measuring or recording for diagnostic purposes; Identification of persons using light, e.g. diagnosis by transillumination, diascopy, fluorescence

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Description

"Programmable electro-medical system" Technical Field

The present invention relates to the field of the electro-medical equipment. More in particular, the present invention relates to improvements to the electro-medical equipment for diagnosis and therapy, in particular treating laser sources.

More in particular, the present invention relates to a set of devices interfaced and integrated for the

Claims (5)

Claims

1. A medical system for functional integration of at least one diagnosis device and at least one surgical or therapeutic device.

2. A system as claimed in claim 1, wherein said at least one diagnosis device and said at least one surgical or therapeutic device are interfaced with an electronic control unit, programmed to receive data from said

Skin ulcers fall into the family of the chronic disabling diseases with high recurrence risk which affect mainly elderly people. In these cases, the direct and indirect social costs resulting from the care of this pathology are extremely high, and cannot be easily controlled. For example, in Italy the chronic skin ulcers affect about 2,000,000 people. These chronic disabling diseases are furthermore characterized by a high socio-economical impact and by a high recurrence risk, and present a very low clinical effectiveness/costs index. In other words, these are expensive diseases for the Italian National Health service (S. S. N.), and it is therefore necessary to identify all the possible solutions towards an effective therapy.

Currently, the diagnosis and therapy of this and other types of chronic disabling diseases require long time and the use of many devices and equipment for the diagnosis, the-treatment and the verification of the treatment results. Summary of the Invention

According to one aspect, an object of the present invention is to provide an electro-medical system or device which entirely or in part overcomes one or more of the drawbacks and of the limits of the known devices.

The object of one embodiment of the present invention is to provide an electro-medical device or an electro-medical system (which can be defined also as electro-medical "complex", i.e. a system which collects and integrates also functionally a plurality of devices and/or equipment), which allows the diagnosis and care of chronic skin ulcers (for example due to decubitus, varicosity and diabetes) through the integration of diagnosis and therapy. The study of the diagnostic therapeutic procedure which has been performed resulted in the development and setting of an opto-mechatronic programmable electro-medical system. This system integrates more systems for diagnosis and care, introducing multidisciplinary minimally invasive solutions, able to improve the clinical performances of the procedure, reducing, at the same time, the socio-economic impact. Briefly, the core of the present invention is the functional integration of the various diagnostic-therapeutic devices used. Functional integration means such a combination between diagnostic and surgical or therapeutic devices, that the data detected

3. A system as claimed in claim 1 or 2, wherein said system comprises in combination:

- one diagnosis system;
- one surgical system;
- one therapeutic system.

4. A system as claimed in claim 1, 2 or 3, comprising in combination: • one modeling system, having at least one camera used both for creating a three - dimensional model of a tissue injury to be treated, and for acquiring morphological structural information (tissue analysis - edge detection) as well as colorimetric information;

- one system for both surgical and therapeutic treatment, comprising at least one source of electro - magnetic radiation;
- one manual or robotized system for handling the devices provided by the modular system;
- one processor electronic control unit;
- one archiving data base.

5. A system as claimed in one or more of the previous claims, wherein said devices are physically integrated according to one or more of the following configurations:

- separated and manually handled by the operator;
- separated and handled through a robotized system;
- united and manually handled by the operator;
- united and handled through a robotized system.

integration is performed through a software and a control system interfaced with the diagnostic devices and the therapeutic and/or surgical devices.

The system functionally integrated via software could provide at least four different configurations of the above mentioned devices, which can be:

- 1) physically separated and manually handled by the operator;
- 2) physically separated and handled through a robotized system;
- 3) physically united and manually handled by the operator;
- 4) physically united and handled through a robotized system. Essentially, in one embodiment the present invention provides a mini invasive system for diagnosis and care, integrated and modular with the use of at least:

- one diagnosis system;
- one surgical system and/or one therapeutic system.

In particular, the diagnostic system can comprise:

- a modeling system, having at least one camera used both for creating a three-dimensional model of the injury, and for acquiring morphological structural information (tissue analysis - edge detection) as well as colorimetric information;
- a system for both surgical and therapeutic treatment, comprising at least one source of electro - magnetic radiation;
- a manual or robotized system for handling the devices provided by the modular system;
- a processor electronic control unit; • an archiving data base.

In particular, the diagnostic system can comprise one or more of the following devices: oximeter, laser Doppler, Doppler echocardiography, three-dimensional scanner for volumetric analysis, colorimeter, thermo-camera, pyrometer, and other generic diagnostic devices. For diagnostic purposes, the devices can be furthermore integrated with diagnostic procedures outside the complex, for example functional evaluation of the perfusion capacity of the tissues through oxygen inflation and monitoring of the peripheral partial pressure. The

electron beam scanning and smoke extraction system, CO₂ cutting laser, Nd:YAG laser for sterilization of the fistulous tracts through optical fiber, electrotome, thermocauter, vacuum, system for refrigerating the tissues to be treated with the laser, device for washing the lesion with sterile water, water tissue dissector, as well as other generic treatment devices. Also in surgery the integrated system can use devices outside the object, such as traditional surgical knife and other similar devices.

The therapeutic system can provide one or more of the following devices: laser sources with different wavelengths (λ : 632 nm - 10.600 nm) with different possibilities of pulsing (CW - PW), non-coherent electromagnetic radiation sources (IPL, LEDs, etc.), ultrasounds, ionophoresis, electroporation, vibration systems, vacuum, TECAR- (capacitive - resistive electric transfer), magneto - therapy, PEMF (Pulsed Electromagnetic Field), focusing Shockwaves, electro- therapy, RF (radio frequency), as well as other generic devices for therapeutic use. Brief description of the drawings

The invention will be better understood by means of the description below and the attached drawing, which shows a non-restrictive practical embodiment of the invention. More in particular, in the drawing: figure 1 shows a functional diagram of an integrated system according to the present invention; figure 2 shows a block diagram of a system according to the present invention; figure 2A shows a scheme of possible connections of some functional blocks of the system of figure 2 figure 3 to 7 show schemes and functional diagrams of the system according to the present invention and the operating modes thereof; and figure 8 shows a map with some advantages which can be obtained with the system according to the present invention. Detailed description of embodiments of the invention

Figure 1 shows the main functional blocks forming the opto - mechatronic programmable electro-medical system of the invention. Essentially, in the illustrated embodiment the integrated opto-electronic programmable electromedical system comprises in combination the following main functional blocks: a protection system 1 , a diagnosis system 2, a control system 3, a three- dimensional vision system 4, a smoke extraction system 5 for the smoke produced

system.

Figure 2 shows a more detailed block diagram of an integrated system according to the present invention. In this embodiment the system comprises a plurality of diagnosis devices or systems and in particular: a thermocamera 21, an oximeter 22 and the three-dimensional vision system, here represented by the block 23. The three-dimensional vision system can include one or more cameras and allows collection of both diagnostic and morphologic information about the treatment area and production of a 3D model of the treatment area.

The three -dimensional vision system can be housed both on a robotized arm and on a stationary support system.

The diagnostic systems can be handled by the robotized system or by the operator. In the block diagram of figure 2 other devices are also shown for the collection of physical and/or physiological quantities useful for the diagnosis and/or the control of the treatment, such as in particular: a Doppler laser 24, a system for measuring the volumetry 25, a system for measuring the colorimetry 26 and a generic diagnostic device 27. Number 28 indicates generic sensors which can be used for the detection of further quantities.

In the functional scheme of figure 2, treatment systems or devices are also shown, and in particular: a therapeutic CO2 laser 31, a surgical CO2 laser 32, an Nd:YAG laser 33, a non-coherent electromagnetic radiation source 34, a generic treatment system 35. These systems can also integrate a device for laser scanning.

In addition to the vision and treatment devices indicated above, the programmable electro-medical system represented in the block diagram of figure 2 comprises one or more handling systems, generically indicated with the number 41, such as for example one or more robotized arms, able to handle the laser beam and other functional blocks in the space around the patient, and in particular on the treatment area. In addition to the handling systems, one or more stationary supports can be provided, suitable to house and support one or more functional blocks with particular reference to the three - dimensional vision system.

controls the functional blocks through software. To this control unit a database 45 is integrated, containing data useful for the diagnosis, used for example to give suggesting and non binding information to the operator. The control unit 43 can also be interfaced to an hospital information system 47.

Furthermore, the scheme of figure 2 shows: a machine/man interface, for example an LCD monitor 49 with touch-screen technology, through which the operator enters the operational data, receives diagnostic and therapeutic information and alarm signals; a printer 50, for example for printing a report of the diagnosis and/or the treatment; a system 52 for extraction of smoke generated by the laser-assisted debridement of the tissue; one or more protection systems 51 against electric, electromagnetic, mechanical and functional risks. Merely by way of example, hereunder possible types of protection are listed against some of the risks mentioned above:

> against the mechanical risks, for example, the use may be provided of an accelerometer system or any other device, which through the aid of the control system, interrupts the power of the laser source;

> against the electromagnetic risks, for example a protection against multiple reflections and undesired trajectories of the laser beam. The equipment can be fitted with a system, integrated thereto and destined to house and move the patient (for example a chair similar to that of the dental chairs) and to contain some bulky parts of the equipment.

Figure 2A shows a block diagram in which the connections are schematically represented between a personal computer or server for controlling the entire complex of integrated devices, interfaced to a scanning system, an oximeter, two therapeutic and/or surgical lasers, a monitor on which the doctor can observe the patient and/or a portion for example of the skin of the patient being treated, and a touch-screen display. In particular, in figure 2A the USB, serial, firewire, VGA ports or interfaces, usable for the connections, are indicated.

In figure 3 the main characteristic of the present invention are listed. These characteristics shall be also considered as key terms characterizing the

more diagnosis and therapy blocks, according to the characteristics of the pathology and the tissue to be treated. This system is also integrated, as it provides at least one diagnosis system and at least one therapy system. The integration is not limited to the space - time physical condensation of these systems, but it adds the functional aspect, as schematically represented in figure 4.

For example, the device gives elements useful to the operator for defining the therapeutic procedures, having acquired, in the diagnostic phase, data on the characteristics of the lesions to be treated. Furthermore, the device offers the possibility, through the diagnostic systems, of controlling the therapeutic procedure through retroactive information, as illustrated in figure 5.

The system expands the classical concept of mini invasivity which is destined exclusively to the surgical action. In fact, a surgical procedure is defined mini invasive if it is able to minimize the histio-offending impact on the healthy tissues (for example all the surgeries performed endoscopically). The base of the present invention is the principle according to which the concept of mini invasivity must be extended to all the aspects of the medical action, this action comprising: diagnosis, therapy and surgery. In other words, the traditional concept of mini invasivity tends to preserve the healthy tissues adjacent to the injured area; whilst the concept of mini invasivity which is the base of the present invention aims at preserving the quality of the patient's life, as schematically indicated in figure 6. The system according to the present invention allows to make a medical action mini invasive, as it allows:

- spatial condensation of the multi-specialist and/or multi-disciplinary procedures;
- time condensation of the multi-specialist and/or multi-disciplinary procedures. The extension of the concept of mini invasivity to the time and the space represents a new element relative to the state of the art. It is important to underline that the above mentioned elements can be both contemporary present and disjointed each from the other, without the system losing its characteristic of mini invasivity. Consequently, the mini invasive integrated system



patient: one biological and the other emotional, as reported in figure 7.

The biological advantages relate to the effectiveness of the medical action (for example quickly and less painful intervention, less post-operative edema and less bleeding) with positive effects for the patient mainly in the medium and short term. All this indirectly entails benefits both for the operator and for the National Health System, mainly as regards direct cost savings.

Medical-evaluation- of the lesion, which results from the comparison of the data acquired (for example photographic images, quantity indexes of volumetry, oximetry, colorimetry, etc.), greatly affects the emotional sphere of the patients and of their relatives, giving new viable stimuli, fundamental for recovery in the medium and long term. This furthermore gives social and healthcare benefits, mainly related to the indirect costs. Figure 8 shows a map of the advantages produced by the mini invasive integrated system according to the invention.

Patent Citations (3) ▲

Publication number	Priority date	Publication date	Assignee	Title
US4718417A *	1985-03-22	1988-01-12	Massachusetts Institute Of Technology	Visible fluorescence spectral diagnostic for laser angiography
US5836872A *	1989-04-13	1998-11-17	Vanguard Imaging, Ltd.	Digital optical visualization, enhancement, quantification, and classification of surface and subsurface features of body surfaces
US20030153825A1 *	2002-02-12	2003-08-14	Science & Engineering Associates, Inc.	Cancer detection and adaptive dose optimization treatment system

* Cited by examiner, † Cited by third party

Cited By (1) Search Within Citing Patents ▲

Publication number	Priority date	Publication date	Assignee	Title
CN103519890A *	2013-08-22	2014-01-22	浙江工业大学	Control system of on-line laser feature beautifying and freckle removing

Similar Documents 

Publication	Publication Date	Title
Wu et al.	2004	Extracorporeal high intensity focused ultrasound ablation in the treatment of 1038 patients with solid carcinomas in China: an overview
Young et al.	1990	The effect of therapeutic ultrasound on angiogenesis
US7871406B2	2011-01-18	Methods for planning and performing thermal ablation
US8262591B2	2012-09-11	External ultrasound lipoplasty
US20070016079A1	2007-01-18	Hyperspectral imaging in diabetes and peripheral vascular disease
US20080033419A1	2008-02-07	Method for planning, performing and monitoring thermal ablation
US5533082A	1996-07-02	Computer tomograph
US20080033417A1	2008-02-07	Apparatus for planning and performing thermal ablation
Schaden et al.	2007	Shock wave therapy for acute and chronic soft tissue wounds: a feasibility study
US20060100530A1	2006-05-11	Systems and methods for non-invasive detection and monitoring of cardiac and blood parameters
US20050054900A1	2005-03-10	Ophthalmic orbital surgery apparatus and method and image-guided navigation system
US20090196480A1	2009-08-06	Methods And Apparatuses For Planning, Performing, Monitoring And Assessing Thermal Ablation
Manuskiatti et al.	2010	Efficacy and safety of a carbon-dioxide ablative fractional resurfacing device for treatment of atrophic acne scars in Asians
Sugrue et al.	1990	The use of infrared laser therapy in the treatment of venous ulceration
Eivazi et al.	2009	Update on hemangiomas and vascular malformations of the head and neck
Ennis et al.	2006	Evaluation of clinical effectiveness of MIST ultrasound therapy for the healing of chronic wounds
Palmer et al.	2011	In vivo optical molecular imaging and analysis in mice using dorsal window chamber models applied to hypoxia, vasculature and fluorescent reporters
US20130303904A1	2013-11-14	System and Method for Non-invasive Cosmetic Treatment
WO2008144274A2	2008-11-27	Method, system, and apparatus for line-focused ultrasound therapy

Patents



3

visualizing, imaging, or information providing

US20100160904A1	2010-06-24	Photothermal treatment of soft tissues
JPH0747079A	1995-02-21	Ultrasonic therapeutic system
US20080033418A1	2008-02-07	Methods for monitoring thermal ablation
Tan et al.	2001	The evaluation of aluminum oxide crystal microdermabrasion for photodamage

Legal Events 

Date	Code	Title	Desc
2010-03-10	121	Ep: the epo has been informed by wipo that ep was designated in this application	Ref docu numl 0978 Cour ref docu EP Kind of re docu A1
2011-01-18	NENP	Non-entry into the national phase in:	Ref coun code
2011-08-10	122	Ep: pct app. not ent. europ. phase	Ref docu numl 0978 Cour ref docu EP Kind of re docu A1

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