

PORTABLE SOLENOID ACTUATED IMPULSE TREATMENT DEVICE AND USE THEREOF

FIELD

[0001] The present technology is a portable, handheld impulse treatment device. More specifically, it is a handheld impulse treatment device that can be positioned and the treatment force pre-determined to provide highly repeatable treatment of a patient regardless of the position of the patient on the treatment table.

BACKGROUND

[0002] There are many chiropractic, massage therapy, physiotherapy and athletic therapy treatments that include repetitive force impulses. Some deliver a single percussive force, while others deliver a series of sinusoidal waves. Proper placement and alignment of the devices is challenging as is controlling the treatment force. For this reason, many different devices have been developed. For example, United States Patent Application Publication Nos. 20200230012, 20170281450, 20160242985, 20140031866 and 20090005812 disclose a portable battery power operated chiropractic adjusting instrument, manipulator or thruster for applying a selectable adjustment energy impulse to a patient through a plunger having a resilient or cushioned head with the energy impulse applied to the plunger being supplied by a solenoid. The adjusting instrument can have annunciators or indicators for preload, readiness to operate, level of energy impulse and the like. The power source can be an internal rechargeable battery or removable rechargeable battery pack. This is a handheld device. There is no mechanism to adjust the force being exerted on the patient, nor is there any mechanism to ensure accurate and repeatable treatments.

[0003] United States Patent Application Publication No. 20190142692 discloses a system for treating soft tissue of a patient. The system includes a treatment head and a computer portion. The treatment head includes a probe and an electrode operably coupled to the probe. The probe and electrode are configured to respectively deliver a mechanical force impulse and an electrical stimulation to the soft tissue when placed in operable contact with the soft tissue. The computer portion includes a CPU and is configured to coordinate the delivery of the mechanical force impulse and electrical

stimulation relative to each other. The system is configured to sense a shockwave in the soft tissue of the patient, the shockwave resulting from the mechanical force impulse delivered to the soft tissue via the probe. The system is also configured to analyze a characteristic of the sensed shockwave and configure the electrical stimulation to be delivered to the soft tissue via the electrode based on the characteristic analysis of the sensed shockwave. The characteristic may be at least one of frequency of the sensed shockwave, amplitude of the sensed shockwave, and/or wave shape (form) of the sensed shockwave. This device would not be suitable for skeletal adjustments.

[0004] United States Patent Application Publication No. 20180360684 discloses a percussive adjusting instrument is provided which includes a percussive instrument head and a traversing arm that couples to the percussive instrument head. The percussive instrument head is movable with respect to the traversing arm. A vertical arm supports the traversing arm. The vertical arm also pivots the traversing arm and the percussive instrument head about an axis. A pivot assembly allows movement of the vertical arm and the percussive instrument head. This application discloses the use of a laser light for aiming the stylus. This device is large, non-mobile and relies heavily on the correct placement of the patient. Further, it requires adjustment of numerous components using two hands. Still further, it applies a percussive force.

[0005] United States Patent Application Publication No. 20170151125 discloses a system for treating soft tissue of a patient. The system includes a treatment head and a computer portion. The treatment head includes a probe and an electrode operably coupled to the probe. The probe and electrode are configured to respectively deliver a mechanical force impulse and an electrical stimulation to the soft tissue when placed in operable contact with the soft tissue. The computer portion includes a CPU and is configured to coordinate the delivery of the mechanical force impulse and electrical stimulation relative to each other. The system is configured to sense a shockwave in the soft tissue of the patient, the shockwave resulting from the mechanical force impulse delivered to the soft tissue via the probe. The system is also configured to analyze a characteristic of the sensed shockwave and configure the electrical stimulation to be delivered to the soft tissue via the electrode based on the characteristic analysis of the sensed shockwave. The characteristic may be at least one of frequency of the sensed shockwave, amplitude of the sensed shockwave,

and/or wave shape (form) of the sensed shockwave. This device would not be suitable for skeletal adjustments.

[0006] United States Patent Application Publication No. 20160113840 discloses a system for administering a therapeutic treatment to a portion of a patient body. In one embodiment the system includes a pressure sensor, a treatment head, and at least one computer processor in operable electrical communication with both the pressure sensor and treatment head. When a treatment tip of the treatment head is applied against the portion of the patient body, the at least one computer processor receives time dependent pressure readings from the pressure sensor corresponding to pressure applied by the treatment tip against the portion of the patient body. The at least one computer processor calculates a test frequency via an algorithm stored in the system. The system compares the test frequency to treatment plan frequencies and selects treatment plan based on the comparison. The device employs the plan, wherein the treatment begins by producing percussive force impulses via the armature and anvil system according to the selected treatment plan. This provides a square waveform. This has more than one drawback. First, application of an abrupt force to sensitive parts of the body, like spinal vertebrae, is not desirable in treatments. Further, a perfect square wave has infinite frequency components and is impossible to produce, in practice.

[0007] United States Patent Application Publication No. 20140188169 discloses a cordless chiropractic adjustment device including a thrust element capable of impacting a body contact member, a resilient spring arranged to bias the thrust element towards the body contact member, and a motor. The motor is arranged to move the thrust element between a variable primed configuration in which the thrust element is held out of contact with the body contact member, and a fired configuration in which the thrust element is propelled by the resilient spring into contact with the body contact member through a range of different impact forces. The motor is provided with direct current by one or more batteries, which may be rechargeable. This is a relatively rudimentary device and relies on a spring to propel the thrust element. As there is an anvil, the device provides a percussive force.

[0008] United States Patent Application Publication No. 20130158602 discloses a chiropractic apparatus that is not only easily portable, but also enables even a

chiropractor not having a high level skill to perform easily a safe, correct and effective adjustment of any bone of a patient without causing a pain. The chiropractic apparatus includes: a chiropractic adjuster means containing a thrust member having a thrust head and a release-surface means attached to the chiropractic adjuster means, the release-surface means having a surface for forming a release surface. When a longitudinal forward thrust is applied to the thrust member so as to give a thrust to a body surface, the release-surface means and the thrust head are subjected to relative movement with respect to each other, whereby a release surface including the surface for forming a release surface is formed around the thrust head, the release surface having at least a part thereof placed in contact with the body surface. The device is rudimentary. It relies on a spring to propel the thrust rod. The thrust rod is actuated by a trigger, hence this device delivers a percussive one-at-a time force. The release surface is disclosed as being any range of shapes that is capable of either changing shape or not changing shape, with the former not assist in providing accurate treatment pressure.

[0009] United States Patent Application Publication No. 20130131724 discloses a chiropractic apparatus including a chiropractic adjuster means and a contact means. The contact means being capable of relative movement with respect to the chiropractic adjuster means, the contact means having a forward end portion that is capable of contacting both the tip of a palpation finger of a user and a body surface of a patient, the contact means having a targeting space that is capable of receiving the tip and causing the palpation fingertip to be placed in contact with the body surface. The targeting space receiving the forward end portion of the chiropractic adjuster means and causing the forward end portion to be placed in contact with the body surface. By subjecting the contact means and the chiropractic adjuster means to relative movement, the chiropractic adjuster means is capable of moving to the targeting space of the contact means and placed in contact with the body surface. This tool is operated with a trigger and accordingly, delivers one impulse and not a series of predetermined impulses. The force of the impulse is dependent on the energy held in the spring, as defined by Young's modulus, and this will drift over time, in a mechanical device like a spring. There are no means for directing the position of the tool. As the contact means is biased, it does not assist in providing accurate treatment pressure.

[0010] United States Patent Application Publication No. 20060293711 discloses a portable power operated chiropractic adjustor, manipulator or thruster for applying an adjustment energy to a patient through a plunger having a resilient or cushioned head with the energy applied to the plunger being supplied by non-manual sources and the impulse is adjustable or tunable along with having annunciators or indicators for preload and readiness to operate. The adjustor also allows for settings of single or multiple strokes. The power source may be internal such as from a rechargeable battery, removable rechargeable battery pack, or air cartridge depending on whether it is electrically or pneumatically operated. This is a relatively rudimentary device.

[0011] United States Patent Application Publication No. 20030195443 discloses a chiropractic adjustment tool or tapper comprises a housing, the housing having an open end; an impact assembly disposed within the housing and secured thereto. The impact assembly comprises a reciprocating rod with adjustable travel and impact force. An impelling means such as a solenoid is provided to accelerate the reciprocating rod. Disposed on one end of the reciprocating rod is a coupler to permit multiple impact heads to be attached to the tool. The tool is further improved with the addition of a fan unit on a port in the housing and an exit port located on a distal end of the housing, preferably at a location such that air flow is across the impelling means, and any switch or circuitry to provide cooling and extend tool life. This tool provides a square wave force and is an impact device. Adjustment of the force is by increasing or decreasing spring tension. The force of the impulse is dependent on the energy held in the spring, as defined by Young's modulus, and this will drift over time, in a mechanical device like a spring. There are no means for directing the position of the tool.

[0012] United States Patent No. 11911329 discloses a portable battery power operated chiropractic adjusting instrument, manipulator or thruster for applying a selectable adjustment energy impulse to a patient through a plunger having a resilient or cushioned head with the energy impulse applied to the plunger being supplied by a solenoid. The adjusting instrument can have annunciators or indicators for preload, readiness to operate, level of energy impulse and the like. The power source can be an internal rechargeable battery or removable rechargeable battery pack. Adjustment of the force is by increasing or decreasing spring tension. The force of the impulse is dependent on the energy held in the spring, as defined by Young's modulus, and this

will drift over time, in a mechanical device like a spring. There are no means for directing the position of the tool.

[0013] United States Patent Nos. 9084629 and 10582863 disclose an external stylus that provides an impulse to correct misalignment of the Atlas (C1). The placement and direction of the impulse is guided by the analysis of a plurality precisely placed or acquired tomographic images, preferably MRI images. Disclosed is the hand-held device of United States Patent No. 4,461,286.

[0014] United States Patent No. 8,152,747 discloses a spinal and upper cervical impulse treatment device and controller, which delivers multiple impulses of variable frequency and variable force in a linear direction, as well as rotational forces, for patient treatment. Known chiropractic impulse devices are all hand-held devices. In contrast, the spinal and upper cervical impulse treatment device is mounted on a fixed stand and armature, allowing reliable positioning and directional alignment in three dimensions. Fixed mounting also facilitates ease of use. A safety coupling is incorporated to avoid patient injury due to excessive force on the treatment site in the fixed mounting scenario. Smooth sinusoidal waveforms are a preferred waveform for impulse delivery and sine waves are generated digitally in the apparatus. Data validation is used to ensure correct directional alignment prior to device activation. Patient safety and consistency in treatment protocols are considered in the spinal and upper cervical impulse treatment design. This device requires two hands to position the treatment head and only functions to position the treatment in the X, Y and Z planes.

[0015] United States Patent No. 5,618,315 discloses delivery of multiple impacts in a linear direction, as well as applying rotational forces. Delivery is performed by a separate hand-held device (HHD), which provides visual feedback on direction alignment to the user. The HHD is managed by a separate controller device, including the user interface for input of impulse frequencies and modes, impulse energy, and HHD directional alignment angles. The tool delivers square waves. This has more than one drawback. First, application of an abrupt force to sensitive parts of the body, like spinal vertebrae, is not desirable in treatments. Further, a perfect square wave has infinite frequency components and is impossible to produce, in practice.

[0016] United States Patent No. 4,841,955 discloses solenoids and suggests means to improve accuracy and repeatability in impulse forces. The precise angle of the thrust is determined manually and may not be accurate or repeatable. This tool is able to deliver only a single impact at a time and does not provide feedback on directional alignment.

[0017] United States Patent No. 4,549,535 discloses the generation of multiple impulses through use of an electric motor in combination with solenoids. Pulse width, frequency and amplitude are controlled, but the use of the motor and solenoids suggests some imprecision. The general waveform $f(t)$ described in has a square wave shape, with an undefined duty cycle, that is, time of impulse versus duration of resting. The device is handheld and directional alignment is not addressed.

[0018] United States Patent No. 4,461,286 discloses a percussive device operated by a trigger. It is capable of delivering a single impulse via a thrust pin, where the force of the impulse is stored in a spring. The spring and thrust pin are housed in a handheld device. The handheld device is positioned manually by a practitioner, both in location and direction. The location of the point of contact on the patient's body and the direction of the thrust are both important elements of the impulse treatment device. The treatment delivered is an impact and not an impulse. The device offers little or no ability to control the force or the treatment angle. The force of the impulse is dependent on the energy held in the spring, as defined by Young's modulus, and this will drift over time, in a mechanical device like a spring.

[0019] South Korean Patent No. 101287118 discloses a device for chiropractic that can be easily transported and provides a device for chiropractic that can easily and accurately perform an accurate and effective adjustment to any bone in the whole-body skeleton without being skilled. Means for solving the above problems are chiropractic devices, which include the following means:

- (i) adjuster means for chiropractic, and
- (ii) a contact means attached to the chiropractic adjuster means, the contact means being capable of relative movement with respect to the chiropractic adjuster means, the distal end portion capable of contacting the distal end of the user's palpation finger and the surface of the patient's

body; At the distal end of the contact means, an aiming space is provided for accommodating the distal end of the user's facilitating finger so that the distal end of the facilitating finger can be placed in contact with the body surface of the patient. A contact means having an aiming space for positioning the distal end of the practice adjuster means in contact with the body surface of the patient, wherein the contact means and the chiropractic adjuster means are moved relative to each other, thereby causing the chiropractic adjuster means. The body surface of the patient by moving the distal end of It is a chiropractic device capable of being placed in contact with. The device offers little or no ability to control the force or the treatment angle. The force of the impulse is dependent on the energy held in the spring, as defined by Young's modulus, and this will drift over time, in a mechanical device like a spring.

[0020] Chinese Patent No. 107019627 discloses a spinal pulse therapeutic apparatus, which comprises: the treatment device comprises a shell, a treatment head, an impact head, a driving unit and a control unit, wherein the driving unit is used for driving the impact head to do reciprocating motion to vibrate, and the impact head transmits the reciprocating motion to the treatment head; the control unit is used for controlling the pulse frequency of the driving unit; a sensor is arranged on the impact head, the sensor is electrically connected with the control unit, and the sensor is used for collecting information related to the pulse frequency of the therapeutic apparatus and transmitting the information to the control unit; the control unit adjusts the pulse frequency of the drive unit in accordance with the information collected from the sensor. The invention has the functions of automatic and manual frequency setting, can manually select the pulse frequency according to the actual condition, and can automatically measure the resonance frequency of the part to be treated as the pulse frequency. The device offers little or no ability to control the force or the treatment angle. The force of the impulse is dependent on the energy held in the spring, as defined by Young's modulus, and this will drift over time, in a mechanical device like a spring.

[0021] Canadian Patent Application No. 3126254 discloses an impulse treatment device the impulse treatment device comprising an articulating holding arm, an impulse treatment head and a stylus wherein the articulating holding arm includes: a

proximal joint for rotational attachment to the cart and which includes a ball joint which includes a ball, a socket, a spring to bias the ball to a locked position, and a linear solenoid to release the ball; a long proximal section, which defines a bore and is attached to the proximal joint; a short distal section which defines a bore and includes a distal end; and a pair of ball joints between the short distal section and the long proximal section, wherein the ball joints each include a ball, a spring to bias the ball to a locked position, a socket and a linear solenoid to release the ball; a bent arm extending between and attached to each of the balls of the pair of ball joints and wherein the articulating holding arm has a full range of motion and can be locked in any orientation.

[0022] European Patent No. 3755298 discloses a battery powered percussive massage device. The device offers little or no ability to control the force or the treatment angle. The device provides a percussive or impact treatment. The force of the impulse is dependent on the energy held in the spring, as defined by Young's modulus, and this will drift over time, in a mechanical device like a spring.

[0023] What is needed is an impulse treatment device, that while being handheld, allows for accurate placement on the patient and for alignment with a predetermined treatment vector. It would be preferable if the treatment stylus was not biased, but rather was under control of an electromagnetic voice coil actuator. It would be further preferable if the treatment force could be adjusted. It would be still further preferable if the treatment force was controlled by firmware that controls the electromagnetic voice coil actuator and was additionally controlled by a stylus sheath.

SUMMARY

[0024] Provided in certain embodiments is a handheld device for providing a repetitive impulse treatment, that allows for accurate placement on the patient and for alignment with a predetermined treatment vector. In some embodiments, the treatment stylus is not biased, but rather is under control of an electromagnetic voice coil actuator. The treatment force can be adjusted under control of firmware in the device or software in a remote computing device. The treatment force is additionally controlled by a stylus sheath.

[0025] In one embodiment, a handheld impulse treatment device is provided for releasably retaining a stylus, the handheld impulse treatment device comprising: a

housing which includes a distal end and a proximal end; a holder which is attached to or is continuous with the distal end of the housing; a stylus sheath which is attached to the holder or is continuous with the holder and includes a distal end, a proximal end and an adjustable effective length therebetween, and housed in the housing: a control panel which includes firmware; a linear actuator which is in electronic communication with the firmware; a coupling attached to the linear actuator; a position sensor, which is in electronic communication with the linear actuator and the firmware; and an inertial motion unit which is in electronic communication with the firmware.

[0026] In another embodiment, there is provided a handheld impulse treatment device for retaining a stylus, the handheld impulse treatment device comprising: a housing, which includes a distal end and a proximal end; a longitudinally adjustable stylus sheath disposed on the distal end of the housing, and a control panel in the housing, the control panel including: a linear actuator in electronic communication with firmware in the control panel or software in a remote computing device, and a position sensor in electronic communication with the linear actuator. In the handheld impulse treatment device, the stylus sheath may be a telescoping stylus sheath.

[0027] In the handheld impulse treatment device, the holder may be a threaded female member and the stylus sheath may include a threaded male end.

[0028] The handheld impulse treatment device may further comprise a touch screen at the proximal end of the housing, the touch screen in electronic communication with the firmware.

[0029] The handheld impulse treatment device may further comprise a pressure sensor which is in electronic communication with the firmware and is configured to measure pressure on the stylus sheath.

[0030] In the handheld impulse treatment device, the pressure sensor may be proximate to the proximal end of the stylus sheath.

[0031] The handheld impulse treatment device may further comprise a radio frequency identification transponder.

[0032] In the handheld impulse treatment device, the linear actuator may be an electromagnetic voice coil actuator.

[0033] In another embodiment, a combination of a handheld impulse treatment device and a stylus is provided, the handheld impulse treatment device comprising: a housing which includes a distal end and a proximal end; a holder which is attached to or is continuous with the distal end of the housing; a stylus sheath which is attached to the holder or is continuous with the holder and includes an adjustable effective length, and housed in the housing: a control panel which includes firmware; a linear actuator which is in electronic communication with the firmware; a coupling attached to the linear actuator; a position sensor, which is in electronic communication with the linear actuator and the firmware; and an inertial motion unit which is in electronic communication with the firmware, and the stylus including a shaft which has a distal end and a proximal end, and a bayonet cap mounted on the proximal end, wherein the bayonet cap releasably mates with the coupling.

[0034] In the combination, the stylus sheath may be a telescoping stylus sheath.

[0035] In the combination, the holder may be a threaded female member and the stylus sheath may include a threaded male end.

[0036] The combination may further comprise a radio frequency identification transponder.

[0037] In the combination, the stylus may further comprise a radio frequency identification tag.

[0038] The combination may further comprise a touch screen at the proximal end of the housing, the touch screen in electronic communication with the firmware.

[0039] The combination may further comprise a pressure sensor which is in electronic communication with the firmware and is configured to measure pressure on the stylus sheath.

[0040] In the combination, the pressure sensor may be proximate to the proximal end of the stylus sheath.

[0041] In the combination, the stylus may include a releasable tip on the distal end.

[0042] In another embodiment, a method of adjusting a pressure exerted by a stylus is provided, the method comprising: selecting the combination described above;

contacting a surface with the tip of the stylus; and adjusting the effective length of the stylus sheath, thereby adjusting the pressure exerted by the stylus.

[0043] In the method, the adjusting may be effected by threading or unthreading a male threaded member of the stylus sheath with a female threaded member, which is the holder.

[0044] In the method the adjusting is with a telescoping stylus sheath.

FIGURES

[0045] Figure 1 is a schematic of the impulse treatment system of the present technology.

[0046] Figure 2 is a perspective view of the handheld device of the present technology.

[0047] Figure 3 is a perspective view of an alternative embodiment of Figure 2.

[0048] Figure 4 is a schematic of a longitudinal sectional view of the handheld device of Figure 2.

[0049] Figure 5 is an exploded view of the stylus, tip and mount for the stylus of the impulse treatment system of Figure 1.

DESCRIPTION

[0050] Except as otherwise expressly provided, the following rules of interpretation apply to this specification (written description and claims): (a) all words used herein shall be construed to be of such gender or number (singular or plural) as the circumstances require; (b) the singular terms "a", "an", and "the", as used in the specification and the appended claims include plural references unless the context clearly dictates otherwise; (c) the antecedent term "about" applied to a recited range or value denotes an approximation within the deviation in the range or value known or expected in the art from the measurements method; (d) the words "herein", "hereby", "hereof", "hereto", "hereinbefore", and "hereinafter", and words of similar import, refer to this specification in its entirety and not to any particular paragraph, claim or other subdivision, unless otherwise specified; (e) descriptive headings are for convenience only and shall not control or affect the meaning or construction of any part of the specification; and (f) "or" and "any" are not exclusive and "include" and "including" are

not limiting. Further, the terms "comprising," "having," "including," and "containing" are to be construed as open-ended terms (i.e., meaning "including, but not limited to,") unless otherwise noted.

[0051] Recitation of ranges of values herein are merely intended to serve as a shorthand method of referring individually to each separate value falling within the range, unless otherwise indicated herein, and each separate value is incorporated into the specification as if it were individually recited herein. Where a specific range of values is provided, it is understood that each intervening value, to the tenth of the unit of the lower limit unless the context clearly dictates otherwise, between the upper and lower limit of that range and any other stated or intervening value in that stated range, is included therein. All smaller sub ranges are also included. The upper and lower limits of these smaller ranges are also included therein, subject to any specifically excluded limit in the stated range.

[0052] Unless defined otherwise, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the relevant art. Although any methods and materials similar or equivalent to those described herein can also be used, the acceptable methods and materials are now described.

[0053] An impulse treatment system, generally referred to a 10 is shown in Figure 1. It includes a handheld impulse treatment device 12 and a computing device 14. The computing device 14 is in wireless or wired communication 16 with the handheld impulse treatment device 12 to provide firmware updates and treatment protocols. The handheld impulse treatment device 12 releasably retains a stylus 20 that extends outward from the distal end 22 of the housing 34. A stylus sheath 24 is adjustably mounted to the distal end 22 of the housing 34.

[0054] The impulse treatment system 10 is intended to help with pain and/or neuromusculoskeletal (NMSK) dysfunction caused by non-congenital defects. The impulse treatment system 10 can be used as part of a sequence of steps in a patient's overall care. The impulse treatment system 10 is a non-invasive product used to deliver precise mechanical impulses at a required vector configuration during the treatment.

[0055] Low-intensity mechanical sinusoidal impulses are applied to the treatment site in a controlled and repeatable manner by the handheld device 12. The direction (vector), amplitude, and duration of the impulses can all be controlled to apply a known, finite, and predetermined amount of force and/or energy to the treatment site. This is a predetermined control that is prescribed by a certified health practitioner.

[0056] As shown in Figure 2, the handheld impulse treatment device 12 has a liquid crystal display (LCD) touch screen 30 on the device proximal end 32. The housing, generally referred to as 34, includes a holding zone 36 which is a zone that is covered with a compliant material. At the housing distal end 22 is a holder, which in one embodiment is a female threaded member 38 for adjustably retaining the stylus sheath 24 via a threaded male end 39.

[0057] The female threaded member 38 may be attached to the housing distal end 22 or may be continuous with the housing 34. The position of the stylus sheath 24 in relation to the tip 40 of the stylus is a second control for the force exerted by the stylus 20. The effective length (that being the distance between the distal end 52 of the stylus sheath 24 and the distal end 22 of the housing 34) of the stylus sheath 24 can be modified by adjusting the threading of the female threaded member 38 and the male threaded member 39.

[0058] A post 42 extends outward from the housing 34 and is capped with a plastic end cap 44. The handheld impulse treatment device 12 can be attached to an arm or other support via the post 42 by removing the plastic end cap 44 and replacing it with a mounting plate.

[0059] As shown in Figure 3, in an alternative embodiment, an adjustable stylus sheath 24 having an adjustable length as depicted by 48, for example but not limited to a telescoping length, is retained by a holder 50 which may non-releasably retain the stylus sheath 24. The holder 50 may be attached to the housing distal end 22 or may be continuous with the housing 34. The location of the distal end 52 of the stylus sheath 24 in relation to the stylus tip 40 can be adjusted so that the stylus tip 40 protrudes or does not protrude. The effective length of the stylus sheath 24 (that being the distance between the distal end 52 of the stylus sheath 24 and the distal end 22 of the housing 34 or the holder 50) is controlled by adjusting the length of the stylus sheath 24. The stylus sheath 24 may be continuous with the holder 50.

[0060] As shown in Figure 4, the handheld impulse treatment device 12 includes a position sensor 70 to track the motion of an electromagnetic voice coil actuator 72, to provide feedback on the force and amplitude of the vibration of the electromagnetic voice coil actuator 72 and therefore the stylus 20 and to determine the compressive force against the stylus 20. Exemplary position sensors include but are not limited to capacitive position sensors, potentiometers, inductive position sensors and Hall effect position sensors. The handheld impulse treatment device 12 also includes firmware 74, the touchscreen 30 and a coupling 78 between the stylus 20 and the voice coil actuator 72 for releasably retaining the stylus 20. In an alternative embodiment the voice coil actuator 72 is replaced with a linear solenoid as the linear actuator. Red-green-blue (RGB) light emitting diodes 79 are housed in the handheld impulse treatment device 12 and illuminate the stylus 20 under control of the firmware 74 and/or the computer 14, with red indicating a higher than acceptable pressure and green indicating appropriate pressure. An inertial motion unit (IMU) 80 is also housed in the handheld impulse treatment device 12 and is in electronic communication with the firmware 74 and/or computer 14. The IMU 80 can detect if the handheld impulse treatment device 12 is dropped and can assist in the correct positioning of the handheld device 12. The position sensor 70, and the IMU 80 are in electronic communication with the firmware 74 and/or the computer 14 and allow the handheld impulse treatment device 12 to determine its location. A Hall type sensor 82 is located in the post 42 to confirm that the handheld impulse treatment device 12 is attached to an arm or support, as desired. Also included in the handheld impulse treatment device 12 is a radio frequency identification (RFID) transponder 84 and a wireless radio 86, which may be a Bluetooth® radio. A pressure sensor 88 is located on or proximate to the threaded female member 38 or holder 50 (both generically referred to as a holder) and is in electronic communication with the firmware 74 in the control board. The pressure sensor 88 functions to report on the force applied to the patient by the stylus sheath 24. As would be known to one skilled in the art, a rechargeable battery 90 is housed in the housing 34 and is in electrical communication with the electrically actuated components. In an alternative embodiment, the pressure sensor is on the stylus sheath 24, preferably at the distal end 52.

[0061] It was found that in prior art handheld devices, the force of the pressure waves or percussive impacts could be controlled during a treatment by the practitioner

increasing or decreasing the pressure they exerted on the handheld device. However, this was not reproduceable, and adjustments had to be made on the fly. Further, with single impact percussive devices, once the impact had been imparted, there was no chance for a correction. The addition of the stylus sheath 24 and the pressure sensor 88 increased reproducibility and removed the need to make adjustment on the fly. Without being bound to theory, the addition of the stylus sheath 24 and the pressure sensor 88 to a single impact percussive device could also improve the reproducibility of a treatment.

[0062] As shown in Figure 5, the stylus 20 includes a radio frequency identification (RFID) tag 94 that is imbedded in the shaft 96. In use, the RFID tag 94 is read by the RFID transponder 84 (see Figure 4). In this manner, the number of treatments, the types of treatments, the location of the treatment, the age of the stylus, the patient identification and the like can be tracked for each stylus 20. The tip 98 is releasably mated with the distal end of the 100 shaft 96. The stylus 20 is releasably retained on the handheld impulse treatment device 12 with a bayonet connection which is biased with a light spring; hence as shown, a bayonet cap 102 is mounted on the proximal end 104 of the shaft 94.

[0063] In use, the practitioner holds the handheld impulse treatment device 12 such that the distal end 52 of the stylus sheath 24 is in contact with the patient's skin. The pressure sensor 88 sends pressure data to the firmware 74 in the control board, which is then displayed on the touch screen 30. The practitioner adjusts the effective length of the stylus sheath 24 as needed. For deep treatment sites, for example, the abdomen, the practitioner exerts a force on the handheld impulse treatment device 12 and the force is imparted on the stylus sheath 24 and not on the stylus 20. The force on the stylus sheath 24 is recorded for future treatments. A treatment vector and a treatment protocol (number of pulses, amplitude and period of the pulses) has already been selected. The practitioner aligns the stylus 20 with the treatment vector. The alignment and the selected treatment vector are displayed on the touch screen 30. Once the treatment commences, the position sensor 70 reports to the firmware 74 on the force and amplitude of the sinusoidal vibration of the electromagnetic voice coil actuator 72 and therefore the stylus 20 on the patient. This force will only be the force of the stylus 20 as controlled by the electromagnetic voice coil actuator 72 and is independent of the force exerted by the practitioner. The RGB light emitting diodes 79

receive instructions from the firmware 74 and a colour indicating that the treatment is within the selected protocol or not lights up the stylus 20. This allows the practitioner to easily see if the treatment protocol is being followed.

[0064] While example embodiments have been described in connection with what is presently considered to be an example of a possible most practical and/or suitable embodiment, it is to be understood that the descriptions are not to be limited to the disclosed embodiments, but on the contrary, is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the example embodiment. Those skilled in the art will recognize or be able to ascertain using no more than routine experimentation, many equivalents to the specific example embodiments specifically described herein. Such equivalents are intended to be encompassed in the scope of the claims, if appended hereto or subsequently filed.

CLAIMS

1. A handheld impulse treatment device for releasably retaining a stylus, the handheld impulse treatment device comprising: a housing which includes a distal end and a proximal end; a holder which is attached to or is continuous with the distal end of the housing; a stylus sheath which is attached to the holder or is continuous with the holder and includes a distal end, a proximal end and an adjustable effective length therebetween, and housed in the housing: a control panel which includes firmware; a linear actuator which is in electronic communication with the firmware; a coupling attached to the linear actuator; a position sensor, which is in electronic communication with the linear actuator and the firmware; and an inertial motion unit which is in electronic communication with the firmware.
2. The handheld impulse treatment device of claim 1, wherein the stylus sheath is a telescoping stylus sheath.
3. The handheld impulse treatment device of claim 1, wherein the holder is a threaded female member and the stylus sheath includes a threaded male end.
4. The handheld impulse treatment device of any one of claims 1 to 3, further comprising a touch screen at the proximal end of the housing, the touch screen in electronic communication with the firmware.
5. The handheld impulse treatment device of any one of claims 1 to 4, further comprising a pressure sensor which is in electronic communication with the firmware and is configured to measure pressure on the stylus sheath.
6. The handheld impulse treatment device of claim 5, wherein the pressure sensor is proximate to the proximal end of the stylus sheath.
7. The handheld impulse treatment device of any one of claims 1 to 6, further comprising a radio frequency identification transponder.
8. The handheld impulse treatment device of any one of claims 1 to 7, wherein the linear actuator is an electromagnetic voice coil actuator.

9. A combination of a handheld impulse treatment device and a stylus, the handheld impulse treatment device comprising: a housing which includes a distal end and a proximal end; a holder which is attached to or is continuous with the distal end of the housing; a stylus sheath which is attached to the holder or is continuous with the holder and includes an adjustable effective length, and housed in the housing: a control panel which includes firmware; a linear actuator which is in electronic communication with the firmware; a coupling attached to the linear actuator; a position sensor, which is in electronic communication with the linear actuator and the firmware; and an inertial motion unit which is in electronic communication with the firmware, and the stylus including a shaft which has a distal end and a proximal end, and a bayonet cap mounted on the proximal end, wherein the bayonet cap releasably mates with the coupling.
10. The combination of claim 9, wherein the stylus sheath is a telescoping stylus sheath.
11. The combination of claim 9, wherein the holder is a threaded female member and the stylus sheath includes a threaded male end.
12. The combination of any one of claims 9 to 11, further comprising a radio frequency identification transponder.
13. The combination of claim 12, wherein the stylus further comprises a radio frequency identification tag.
14. The combination of any one of claims 9 to 13, further comprising a touch screen at the proximal end of the housing, the touch screen in electronic communication with the firmware.
15. The combination of any one of claims 9 to 14, further comprising a pressure sensor which is in electronic communication with the firmware and is configured to measure pressure on the stylus sheath.
16. The combination of claim 15, wherein the pressure sensor is proximate to the proximal end of the stylus sheath.
17. The combination of claim 9, wherein the stylus includes a releasable tip on the distal end.

18. A method of adjusting a pressure exerted by a stylus, the method comprising:
selecting the combination of claim 17; contacting a surface with the tip of the stylus; and adjusting the effective length of the stylus sheath, thereby adjusting the pressure exerted by the stylus.
19. The method of claim 18, wherein the adjusting is effected by threading or unthreading a male threaded member of the stylus sheath with a female threaded member which is the holder.
20. The method of claim 18, wherein the adjusting is with a telescoping stylus sheath.
21. A handheld impulse treatment device for retaining a stylus, the handheld impulse treatment device comprising: a housing, which includes a distal end and a proximal end; a longitudinally adjustable stylus sheath disposed on the distal end of the housing, and a control panel in the housing, the control panel including: a linear actuator in electronic communication with firmware in the control panel or software in a remote computing device, and a position sensor in electronic communication with the linear actuator.