Title: ARTICULAR TREATMENT DEVICE BY ULTRASONIC

Abstract: An ultrasonic articural treatment device has a plurality of ultrasonic elements for making ultrasonic vibrations under the application of driving voltages. A support band has an inner surface with the plurality of ultrasonic elements arranged in a predetermined pattern, and a width so large as to sufficiently surround the arm or leg to be treated. A pair of female and male fasteners are detachably attached to both end portions of the support band. A female or male connector is externally fitted to the support band, and coupled to a male or female connector connected to an external power supply via an electric wire to apply power to the ultrasonic elements.
For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.
ARTICULAR TREATMENT DEVICE BY ULTRASONIC

BACKGROUND OF THE INVENTION

(a) Field of the Invention

The present invention relates to an ultrasonic articular treatment device and, more particularly, to an ultrasonic articulation joint treatment device which applies ultrasonic waves to the relatively wide area of repeated flexing and stretching, such as knee and elbow, and increasingly activates the chondrocyte to thereby treat arthritis.

(b) Description of the Related Art

Generally, an articulation joint is the site of junction or union between two or more bones, especially one that admits of motion of one or more bones. The joint is found at knee, jaw, shoulder, hip, finger, toe, elbow, neck, and spine. The joint has an epiphysis covered by articular cartilage, which is formed with chondrocyte and a mass of organic matrix to prevent the epiphysis from being abraded.

In case the articular cartilage is abraded and worn, the bone placed thereunder is also damaged, and wrongly regenerated accompanying with pains and articular malformation, causing degenerative arthritis (osteoarthritis). That is, the articular cartilage is repeatedly abraded and regenerated, and liable to be seriously damaged due to aging, obesity, dysplasia, trauma, special jobs, past history of arthritis, and family history (genetic factor). In such a case, the epiphysis is exposed and damaged,
and the bone is malformed through regeneration while incurring pains.

Among the treatments for curing the degenerative arthritis are mainly there an appropriate mixture of rest and moves, cartilage regeneration agent, analgesics, articular injection, anti-inflammatory agent, arthroscopic debridement, osteotomy, arthroscopic surgery, and total knee replacement.

Ultrasonic treatment devices have been recently developed based on the fact that when ultrasonic waves are applied to the articulation regions, the vibrations thereof are transmitted to the chondrocyte in the cartilage tissue, and directly influence the activation thereof. The ultrasonic vibrations lessen the activation of the chondrocyte to thereby cure the degenerative arthritis.

The ultrasonic treatment devices have been commonly made in a large scale, and supplied to physiotherapy rooms of hospitals or clinics such that patients can be treated while being sitting or lying.

The large-scaled ultrasonic treatment devices are not adapted to the personal or household purpose, and inconvenient in that the patients should always visit the hospitals or clinics to take the treatment.

In this connection, portable massager type ultrasonic treatment devices have been newly developed, and distributed. The portable ultrasonic treatment device is operated such that the knob thereof is taken by hand, and the ultrasonic element is pressurized against the body area to be treated. However, the treatment for the largely curved knee portions by the device is made very inconveniently. Furthermore, fatigues due to the long-
termed massages are accumulated so that the desired treatment effect cannot be easily achieved.

**SUMMARY OF THE INVENTION**

It is an object of the present invention to provide an ultrasonic articular treatment device which has a plurality of ultrasonic elements structured to tightly contact the largely curved joint area in the body such that the ultrasonic waves are three-dimensionally applied to the joint area to make the treatment thereof effectively and conveniently.

This and other objects may be achieved by an ultrasonic articular treatment device with the following features.

The ultrasonic articular treatment device has a plurality of ultrasonic elements for making ultrasonic vibrations under the application of driving voltages. A support band has an inner surface with the plurality of ultrasonic elements arranged in a predetermined pattern, and a width so large as to sufficiently surround the arm or leg to be treated. A pair of female and male fasteners are detachably attached to both end portions of the support band. A female or male connector is externally fitted to the support band, and coupled to a male or female connector connected to an external power supply via an electric wire to apply power to the ultrasonic elements.

The male and the female fasteners are formed with Velcro, snap, ring, latch or string.

The ultrasonic element is detachably attached to the support band.
The support band is formed with an elastic material such that it can apply a predetermined pressure to the body area to be treated.

**BRIEF DESCRIPTION OF THE DRAWINGS**

A more complete appreciation of the invention, and many of the attendant advantages thereof, will be readily apparent as the same becomes better understood by reference to the following detailed description when considered in conjunction with the accompanying drawings in which like reference symbols indicate the same or the similar components, wherein:

Fig. 1 is a perspective view of an ultrasonic articular treatment device according to a preferred embodiment of the present invention;

Fig. 2 is a rear perspective view of the ultrasonic articular treatment device shown in Fig. 1;

Fig. 3 is a cross sectional view of the ultrasonic articular treatment device taken along the A-A line of Fig. 1;

Fig. 4 is a partial amplified sectional view of the ultrasonic articular treatment device, illustrating the state where an ultrasonic element is fitted to a coupling groove of a support band;

Fig. 5 is a side view of the coupling groove when viewed from the B direction of Fig. 3;

Fig. 6 is a perspective view of the ultrasonic element; and

Fig. 7 is a side view illustrating the state where the knee joint is treated using the ultrasonic articular treatment device.
DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Preferred embodiments of this invention will be explained with reference to the accompanying drawings.

As shown in Figs. 1 to 3, a plurality of ultrasonic elements 10 are detachably attached to a support band 20 in a predetermined pattern such that they are ultrasonic-vibrated under the application of driving voltages. The support band 20 has a width so large as to surround the arm or leg. A pair of male and female fasteners 30 and 32 are detachably attached to both end portions of the support band 20. An electric wire 44 is externally connected to the support band 20 to supply power to the ultrasonic elements 10. A male connector 42 connected to an external power supply 60 is fitted to a female connector 40.

As shown in Figs. 4 to 6, the ultrasonic element 10 has a piezoelectric element 12 for generating ultrasonic waves upon receipt of driving voltages, and an element case 14 fitted to the support band 20 to hold the piezoelectric element 12.

A coupling groove 24 is formed at the support band 20 to hold the element case 14.

One or more mini protrusions 15 are formed at the outer periphery of the element case 14, and mini grooves 25 are formed at the coupling groove 24 of the support band 20 to receive the mini protrusions 15. When the element case 14 is inserted into the coupling groove 24, the mini protrusions 15 are fitted to the mini grooves 25 to thereby strengthen the coupling state.
of the element case 14.

Although it is explained that the ultrasonic element 10 is detachably coupled to the coupling groove 24 of the support band 20, the coupling may be made fixedly.

The piezoelectric element 12 fills in the element case 14. For instance, the piezoelectric element may be fixedly fitted to the element case 14 using adhesives.

First and second contact points 27 and 28 are formed at the coupling groove 24 of the support band 20 while contacting the electric wire 44 connected to the female connector 40.

Third and fourth contact portions 17 and 18 are formed at the top of the element case 14 (opposite to the piezoelectric element 12) such that they are electrically connected to the first and second contact portions 27 and 28.

Electrode lines 19 are buried in the element case 14 such that they are connected to the first and the second contact portions 17 and 18 to apply driving voltages to the piezoelectric element 12.

The support band 20 is preferably formed with an elastic material such that it can apply a predetermined pressure to the body.

The male and the female fasteners 30 and 32 attached to the both end portions of the support band 20 are formed with Velcro, snap, ring, latch or string.

Two to ten (preferably, three to seven) ultrasonic elements 10 may be arranged at the support band 20 in one, two or three rows, and patterned
with various shapes, such as rectilinear lines, polygons of triangle and rectangle, circles, ovals, and stars.

The male connector 42 coupled to the female connector 40 is connected to the external power supply 60 to supply the power.

Although it is explained that the female connector 40 is sided with the support band 20 and the male connector 42 with the power supply 60, they may be arranged reverse thereto.

The female and male connectors 40 and 42 are structurally similar to those used in the common household electric equipments, and hence, detailed descriptions thereof will be omitted.

The power supply 60 is preferably provided with a power switch 62 for making the On/Off operation, and a control switch 64 for controlling the strength of the ultrasonic waves.

In operation, as shown in Fig. 7, the support band 20 is placed at the knee such that the piezoelectric element 12 of the ultrasonic element 10 three-dimensionally surrounds the knee joint. The support band 20 is wound around the knee joint one or more times, and the male and the female fasteners 30 and 32 formed at the both end portions thereof are coupled to each other. At this time, the coupling of the male with the female fasteners is made while elastically pulling the both ends of the support band 20 such that the piezoelectric elements tightly contact the knee.

The male connector 42 connected to the power supply 60 is coupled to the female connector 40, and the power switch 62 of the power supply 60
turns on while controlling the strength of the ultrasonic waves by the control switch 64.

Upon receipt of driving voltages, the piezoelectric elements 12 are vibrated to thereby generate ultrasonic waves, which are transmitted to the articular cartilage. At this time, the chondrocyte is activated, and the regeneration is actively made.

Although it is explained that the ultrasonic articular treatment device makes the ultrasonic treatment for the knee joint, it may be similarly applied for use in the elbow, wrist, or shoulder.

As described above, with the inventive ultrasonic articular treatment device, the ultrasonic elements detachably attached to the support band can be cleaned, repaired, or replaced at any time.

As the power supply and the support band are connected to each other using male and female connectors, the storage or carriage thereof can be made in a simplified manner.

Furthermore, with the inventive ultrasonic articular treatment device, a plurality of ultrasonic elements are arranged at the support band in a predetermined pattern, and the ultrasonic waves therefrom are simultaneously applied to several joint portions. Accordingly, the treatment operation can be easily conducted without moving the ultrasonic elements here and there.

In addition, with the inventive ultrasonic articular treatment device, the user can make the treatment operation while performing other works at
home or office with reduced tediousness or rejection and increased treatment effect.

While the present invention has been described in detail with reference to the preferred embodiments, those skilled in the art will appreciate that various modifications and substitutions can be made thereto without departing from the spirit and scope of the present invention as set forth in the appended claims.
WHAT IS CLAIMED IS:

1. An ultrasonic articular treatment device comprising:
   a plurality of ultrasonic elements for making ultrasonic vibrations under the application of driving voltages;
   a support band having an inner surface with the plurality of ultrasonic elements arranged in a predetermined pattern, and a width so large as to sufficiently surround the arm or leg to be treated;
   a pair of female and male fasteners detachably attached to both end portions of the support band; and
   a female or male connector externally fitted to the support band and coupled to a male or female connector connected to an external power supply via an electric wire to apply power to the ultrasonic elements.

2. The ultrasonic articular treatment device of claim 1 wherein the ultrasonic element is detachably attached to the support band.

3. The ultrasonic articular treatment device of claim 1 or 2 wherein the ultrasonic element comprises a piezoelectric element for generating ultrasonic waves under the application of driving voltages, and an element case fitted to the support band to hold the piezoelectric element;
   wherein a coupling groove is formed at the support band such that the element case is fitted to the coupling groove;
   wherein one or more mini protrusions are formed at the outer periphery of the element case, and mini grooves are formed at the coupling groove of the support band such that the mini protrusions are inserted into
the mini grooves.

4. The ultrasonic articular treatment device of claim 3 wherein first and second contact portions are formed at the coupling groove of the support band, and contact the electric wire connected to the female connector;

wherein third and fourth contact portions are formed at the top of the element case, and electrically connected to the first and second contact portions;

wherein electrode wires are buried in the element case, and connected to the third and fourth contact portions to apply power to the piezoelectric element.

5. The ultrasonic articular treatment device of claim 1 wherein the support band is formed with an elastic material to apply a predetermined pressure to the body area to be treated, and two to ten ultrasonic elements are arranged at the support band in one, two or three rows with the shape of rectilinear line, polygon including triangle and rectangle, circle, oval or star.
FIG. 2