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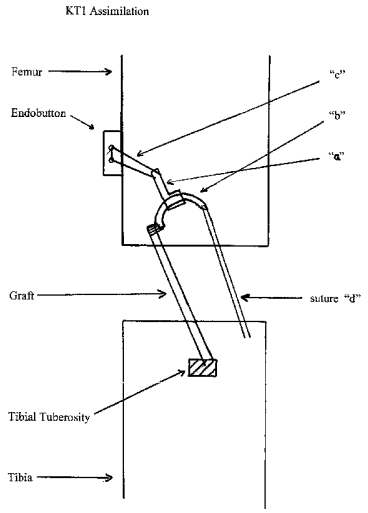
For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: LIGAMENT TENSIONING DEVICE



(57) Abstract: Ligament tensioning device comprising the combination of 1) an endobutton for abutment of the femoral bone, 2) a first strap having teeth which has a number of holes at each end of the strap for attachment to a ligament and suture at each end, and 3) a second strap having a locking head at one end of the strap and a number of holes at the end for attachement to the endobutton, where the locking head allows the passage of the first strap through it in one direction only. The Khashaba Tensioner 1 (KT1) is an assimilation concept that provides a novel way of simultaneously fixing and tensioning the ACC graft in ACL reconstruction of the knee. In the way my operation is described I keep the graft attached to the tibial tuberosity in order to preserve its blood supply. However, even if it is detached it will still need to be reattached with a screw, therefore the KT1 still provides a tensioning device for ACL reconstruction.

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LIGAMENT TENSIONING DEVICE

DESCRIPTION

The anterior cruciate ligament (ACL) is an important ligament in the centre of the knee that provides the knee with stability. It can rupture after certain types of trauma and in some cases requires ACL reconstruction.

Currently we use substitute ligaments (grafts) such as a portion of the patella tendon or hamstrings to surgically replace the deficient ACL. Usually these grafts are free grafts ie detached at both ends and then reattached at both ends by a fixation device- be it "interference screws" or "endobutton suspension".

In my operation, I propose to leave one end of the graft attached (therefore preserving blood supply) and to TENSION the other end. This has not been described before. I also intend to tension the graft within a tight tunnel thereby preventing further unnecessary incisions to the knee.

My invention will incorporate parts of 2 preexisting separate inventions ie my invention is a concept of assimilation.

1) I will modify a cable tie (drawing 1). Original text of drawing 1 has been transferred here in this description: *The standard 80mm cable tie will be cut near the head end and a few small holes will be made as shown. Each cut end will be used separately as shown in drawing 3.*
2) I will modify the use of the endobutton® (drawing 2, U.S patent no's: 5,306,301; 5,645,588; other patents pending). Original text of drawing 2 has been transferred here in this description: *Metal button is approximately 15mmX3mmX2mm in dimensions.*

Drawing 3 will illustrate how I intend to use my invention as a rachet mechanism to tension the ACL graft. Drawing 3 shows basically the end result. Original text of drawing 3 has been transferred here in this description: *The KT1 is a new way of fixing and tensioning the ACL graft in ACL reconstruction surgery of the knee (whether or not the graft is left attached to the tibial tuberosity or detached from the tuberosity and fixed there with a screw instead).*

In my operation the ACL graft will be left attached to the tibial tuberosity as shown in drawing 3. I will detach the top end of the graft from the knee cap and then stitch that bit to the 3 drill holes on the cut tail of the cable tie as shown. I will also loop some suture through the 2 drill holes at the other end of the cut tail of the cable tie. I will then thread that suture loop ("d") through the head end of the cut cable tie ie "b" will pass through "a" hence creating a one way tensioning valve effect. The head ("a") also has 3 drill holes in a remnant of the tail left attached to the head. I will suture the nylon ribbon ("c") to the head via the drill holes. The length of nylon ribbon is variable and has to be calculated intraoperatively. Once the graft has been set up to the KT1 (ie combination of endobutton and cable tie) I will then pull up the endobutton via its leading suture up the 9mm (average) bony tunnel in the femur (by recognised routine methods) until it abuts and seats onto the femoral bone as shown in (3) and hence is fixed there. I will then pull down on the suture "d" which will pull on the graft as the tail of the cable tie loops over and through the cable head until the graft becomes taut, when adjusted at approximately 20 degrees of knee flexion. The suture "d" is then pulled out of the knee. This invention is unique and has not been described before. It allows a) tensioning of the ACL graft, b) does it closed (ie no need to make an extra incision over the lateral aspect of the femur where the endobutton is, c) the cable tie has a very high pull out strength, approximately 25 kg, is more than the interference screws. The cable tie remains in the bony tunnel of the femur.

CLAIMS

Claim (1)

Ligament tensioning device comprising the combination of 1) an endobutton for abutment on the femoral bone, 2) a first strap having teeth which has a number of holes at each end of the strap for attachment to a ligament and suture at each end, and 3) a second strap having a locking head at one end of the strap and a number of holes at the end for attachment to the endobutton, where the locking head allows the passage of the first strap through it in one direction only.

Claim (2)

Ligament tensioning device as claimed in claim (1) wherein the endobutton is attached to holes of the second strap via a nylon ribbon and the first strap is looped through the locking head to lock the teeth of the first strap in position thereby simultaneously fixed and tensioning a ligament attached to the first strap.

Claim (3)

Ligament tensioning device as claimed in claims (1) or (2) wherein the endobutton is made of metal.

Claim (4)

Ligament tensioning device as claimed in claim (1) substantially as herein before described with reference to the drawings.

KT1 DRAWINGS

Figure (1) Cable tie

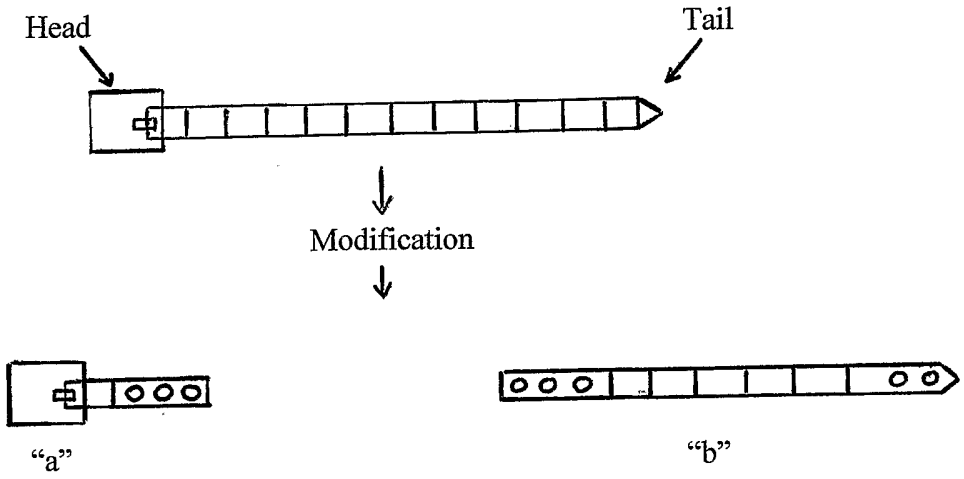


Figure (2) Endobutton

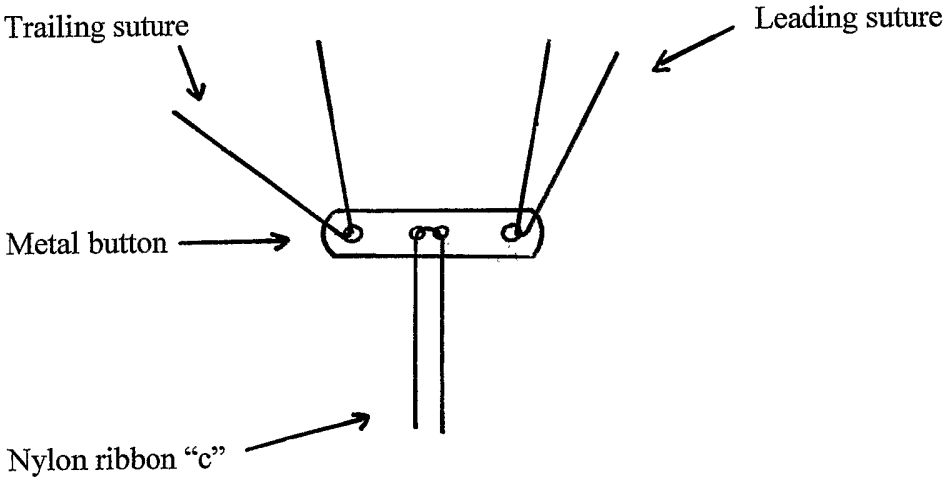
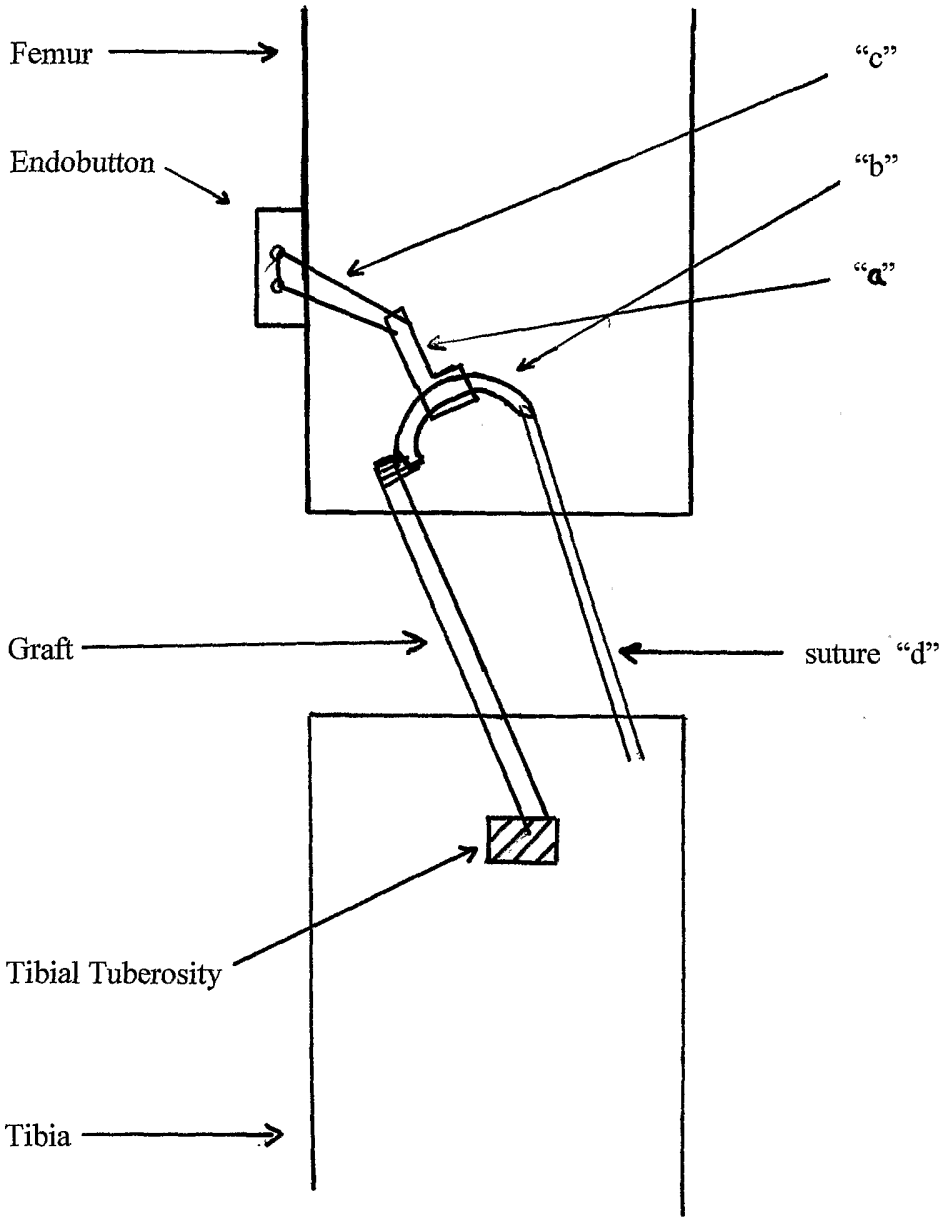


Figure (3) KT1 Assimilation



INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
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B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A61F A61B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 98 11839 A (MEDICINELODGE INC) 26 March 1998 (1998-03-26) page 3, line 14 - line 24 figure 2 ---	1,2,4
A	WO 98 22048 A (HART RICKEY D ;INNOVASIVE DEVICES INC (US)) 28 May 1998 (1998-05-28) page 9, line 4 -page 10, line 2 page 11, line 24 -page 12, line 30 figures 4A-4D,6 ---	1,2,4
A	DE 201 01 791 U (AESCULAP AG & CO KG) 3 May 2001 (2001-05-03) page 20, last paragraph -page 21, paragraph 1 page 28, paragraph 2 -page 29, line 2 figures 1,18 --- -/--	1,2,4

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
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Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Buchmann, G

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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