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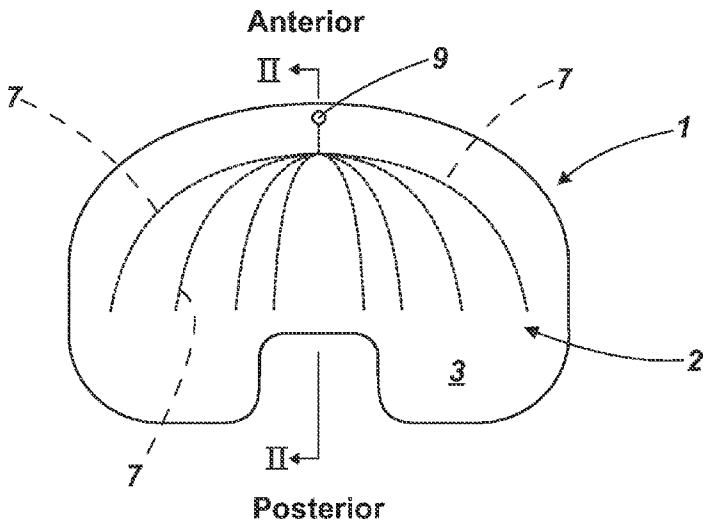

Fig. 1

(57) Abstract: An orthopaedic implant system is provided that comprises an orthopaedic implant (1; 11; 12; 26; 31) for implantation within a body and that is adapted for the pressurized delivery or removal of a fluent material respectively to or from an interface between the implant (1; 11; 12; 26; 31) and the body. The implant (1; 11; 12; 26; 31) defines at least one channel (7; 23; 34) that communicates with at least one aperture (8;19; 28; 35) defined at the surface of the implant (1; 11; 12; 26; 31) and with at least one port (9; 20; 29; 37) positioned at a location on the implant (1; 11; 12; 26; 31) that is accessible when the implant has been implanted. The fluent material may then be either introduced into or removed from the implant (1; 11; 12; 26; 31) intraoperatively or postoperatively and pressurized either to be delivered to the interface or sucked out of said implant (1; 11; 12; 26; 31). The implant system may comprise a short-term implant, a long-term implant or a trauma implant

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FLUENT MATERIAL DELIVERY IMPLANT

The present invention relates to an orthopaedic implant system adapted for the delivery of a therapeutic fluent material or removal of a fluent material respectively to or from an interface between an implant and a human or an animal body and in particular, but not exclusively, for delivery of a therapeutic fluent material facilitating one or more of the following, namely healing, fusing of adjoining bones, inciting osteointegration of implants, combating infections, preventing inflammatory response and treating areas with tumours.

The use of therapeutic agents to improve healing of skeletal structures, fusing of adjoining bone and osteointegration of orthopaedic implants, and to prevent postoperative complications, for example deep infection of orthopaedic implants, is well accepted and is increasing in clinical use. The main reason for the failure of orthopaedic or trauma implants is thought to be owing to loosening of the implant, which is usually the result of inadequate or failed osteointegration, sepsis, deep infection or other conditions that limit the healing response of the surgically affected area, for example osteoporosis or bone metabolic disorders causing bone resorption. In order to assist osteointegration of implants, coatings of titanium or hydroxyapatite (HA) are sprayed on to implants during their production. Such surface coated implants have been shown to reduce the incident of loosening but not completely eliminate it. Another therapeutic agent, bone mineral proteins (BMP) have been shown to stimulate the osteogenic response to assist in the healing of fractured bones. BMP are usually used in combination with bone grafts or as a putty which has limited load-bearing capabilities. However, the use of BMP with orthopaedic implants is not in widespread use which for several reasons including undesirable ectopic bone formation proximal to the implant. In clinical practice, the placement of therapeutic agents has been generally limited to the coating of orthopaedic implants, for example HA coated implants, but since the therapeutic agent is present as a coating only skeletal tissue immediate to the implant comes into contact with the therapeutic material.

Therapeutic agents are sometimes incorporated within temporary implants or bioabsorbable materials. For deep infections, the surgeon removes an existing implant from an affected area and creates a temporary implant during surgery with antibiotic

bone cement or uses a preformed antibiotic bone cement temporary implant. However, temporary implants may restrict the range of motion of patients and only limited weight bearing is allowed. Key to the healing and recovery of the patient is the early mobilization of the affected joint in order to limit the amount of scar tissue and joint stiffening. Bioabsorbable materials are known to have inferior loading carrying characteristics in comparison to long-term permanent orthopaedic implants. Bioabsorbable materials have also been shown in some cases to weaken proximal areas of skeletal tissue.

Implants are also known that have a reservoir enabling sustained delivery of therapeutic materials using various mechanisms. However, the quantity of therapeutic fluent material released and the time period of therapeutic fluent material delivery depends on the release mechanism of the implant. The condition of the surgically affected area immediately following surgery is usually considered to be key to successful healing with an orthopaedic implant. Such implants do not enable therapeutic fluent materials to be delivered as desired during surgery by the surgeon.

It is therefore an object of the present invention to provide an orthopaedic implant system adapted for the instantaneous delivery of a therapeutic fluent material directly to an interface between an implant and a human or animal body that overcomes the aforementioned disadvantages of conventional systems.

According to the present invention there is provided an orthopaedic implant system comprising:

an orthopaedic implant for implantation within a body and adapted for instantaneous pressurized delivery of a therapeutic fluent material or removal of a fluent material respectively to or from an interface between said implant and said body,

said implant defining at least one channel communicating with at least one aperture defined at the surface of the implant and with at least one port positioned at a location on the implant that is accessible when the implant has been implanted whereby either therapeutic fluent material is introduced into or fluent material is removed from said implant and is pressurized either to deliver therapeutic fluent material directly to said interface or to suck fluent material out of said implant.

Such an orthopaedic implant system provides for the instantaneous delivery of a therapeutic fluent material in a pressurized manner during and/or after surgery. Such a delivery is expected to optimize the postoperative healing process. The system may also be used postoperatively to treat post-operative complications, for example deep infections, and enable the required therapeutic fluent materials to be delivered specifically to those areas requiring additional treatment. The system also enables the surgeon to determine the correct quantity of therapeutic fluent material required for each particular case. More or less therapeutic fluent material can be used as required and, if necessary, removed from the interface and implant via suction. Hence, the invention provides control of therapeutic fluent material delivery in terms of amount delivered and its delivery location.

In addition to the foregoing, the invention permits the pressurization and pumping of therapeutic fluent materials into the surrounding skeletal tissue proximal to the implant so that more skeletal tissue comes in contact with the therapeutic fluent material. This wider distribution of a therapeutic material is expected to accelerate the healing process, to inhibit postoperative complications such as infections and to reduce the formation of scar tissue. Similarly, the pressurized localized delivery of oncological fluent materials and chemotherapeutic agents via the implant to tumours is expected to slow or halt the tumour growth more than the present methodologies. Such delivery is also targeted so that the dose of the therapeutic fluent material required to treat a tumour may be decreased, thereby also having the advantage of a possible reduction and minimization of unwanted side effects. The injected therapeutic fluent material may also be held under pressure during delivery to allow its curing or enable the fluent material to invade skeletal tissue as deemed appropriate.

Preferably, said implant comprises a plurality of channels which communicate respectively with a plurality of apertures and with a common port. It will be appreciated that the shape, the size, the position, the distribution, the uniformity and the number of apertures and channels can be determined dependent on the application of the implant. In this regard, preferably the implant comprises a plurality of apertures that

communicate with said at least one channel. Advantageously, said at least one channel is a macro-, micro- or nano- channel.

Preferably also, said channel or channels each have diameter in a range of 300μm to 600μm.

Hence, the implant may be hollow or partially hollow to receive the therapeutic fluent material. Alternatively or in addition, said implant defines, at least in part, a sponge-like, open-cell structure defining a plurality of said channels therethrough.

Preferably also, said aperture or apertures are in the form of any of the following, namely holes, gaps, slits, fenestrations and open pores. Advantageously, said aperture or each of said apertures is a macro-, micro- or nano- aperture.

The channels and aperture may be created during one or more manufacturing processes, which may include a rapid prototyping process (i.e. laser sintering) and a coating process. Therapeutic fluent material may also be integrated in one or more aperture or channels during one or more manufacturing processes. The shape, the size, the position, the distribution, the uniformity and the number of apertures and channels can be determined dependent on the application of the implant.

Preferably also, said port or ports each comprises a sealable means whereby it can be opened or closed as desired. Such sealable means preferably comprises a resealable plug.

Preferably also, a means is provided to selectively close one or more of said apertures.

Preferably also, said implant defines a hollow interior space with which said apertures are in communication.

Advantageously, said means provided to selectively close one or more of said apertures comprises a sheath located in said hollow interior space that selectively closes one or more of said apertures. Said sheath is preferably removably located within said space.

Preferably also, the exterior surface of at least part of the implant is coated with a porous coating. Preferably, said porous coating porous coating comprises a hydroxyapatite coating and/or titanium beads.

Preferably also, the system comprises an adaptor that can be plugged into said port and that can be attached to a pressurizable injector, for example a medical syringe or equivalent apparatus.

Preferably also, said implant incorporates a pressurizable injector that is permanently secured to said port.

Preferably also, such a pressurizable injector comprises a tubular component attached to said port and adapted for implantation along with said implant, said component being adapted for delivery or suction of material to or from said implant respectively.

Preferably also, said tubular component is adapted for post-operative removal from said implant. Alternatively or in addition, said tubular component is comprised of a bioabsorbable or biocompatible material.

Preferably also, said tubular component comprises or is comprised of a radiographic material.

Preferably also, said implant comprises a natural or an artificial bone graft.

Preferably also, said implant comprises one of a short-term implant, a long-term implant and a trauma implant.

Preferably also, said implant system enables an arthrodesis (fixed joint).

Preferably also, said implant comprises an arthroplasty implant or a part thereof.

Preferably also, said implant comprises or forms a part of an implant adapted for implantation in one of a hip joint, a knee joint, an ankle joint, a toe joint, a shoulder joint, an elbow joint, a wrist joint, a hand joint, a finger joint, and the spine.

Preferably also, said implant comprises a femoral stem of a hip joint prosthesis.

Preferably also, said implant comprises a tibial tray.

Preferably also, said implant comprises an intervertebral disc prosthesis.

Preferably also, said implant comprises an acetabular shell.

Preferably also, said implant comprises one of a screw, a nail, a plate and an internal/external fixation device.

The present invention will now be described by way of example with reference to the accompanying drawing in which:

Fig. 1 is schematic plan view of first embodiment of the invention in the form of a tibial tray;

Fig. 2 is a sectional view along the line II-II of Fig. 1;

Fig. 3 is schematic side view of a second embodiment of the invention in the form of femoral stem of a hip joint prosthesis;

Fig. 4 is a is view similar to Fig. 3 but of another embodiment of a femoral stem of a hip joint prosthesis;

Fig. 5 is a schematic side view of a fourth embodiment of the invention in the form of an intervertebral disc prosthesis;

Fig. 6 is a schematic cross-sectional view of a fifth embodiment of the invention in the form of a hip acetabular shell pre-assembled with a liner to form an acetabular implant; and

Fig. 7 is an exploded side view of the implant shown in Fig. 6

In a first embodiment of the invention a knee joint prosthesis comprises a tibial component in the form of a tibial tray 1, as shown in Figs. 1 and 2. The tibial tray 1 comprises a platform-like tray 2 defining a superior surface 3 and an inferior surface 4 and an inferiorly extending tibial stem 5. The tibial stem 5 is adapted to be implanted in a corresponding opening made by a surgeon in a proximal tibia. In the present embodiment the stem 5 is integrally formed with the tray 2. A porous coating 6, for example a coating comprising a hydroxyapatite coating and/or one including titanium beads may be disposed on the inferior surface 4 of the tray 2 and over the stem 5. In accordance with the invention, formed within the body of the tray 2 and the stem 5 are channels 7. Preferably, these channels 7 are small-bore channels have an approximate diameter in a range of 300μm to 600μm. The channels 7 each communicate with an aperture 8 defined at the inferior surface 4 of the tray 7 or at the surface of the stem 5 implant and with a common port 9 located on the superior surface 3 of the tray 2 at a location that is accessible when the tibial tray 1 has been implanted. In this way a therapeutic fluent material can be introduced into the implant for dispersal through the apertures 8 via the porous coating 6. Preferably, the port 9 is sealed by means of a resealable plug 10. Therapeutic fluent material can then be pumped into the implant 1 both intraoperatively and postoperatively when required.

It is envisaged that some conventional tibial trays could be adapted by traditional machining techniques to introduce one or more channels 7 and at least one port 9. However, preferably, trays 1 will be especially manufactured and the channels 7 sized and orientated within the tray 2 and stem 5 to achieve maximal and even spread of the therapeutic fluent material to the interface between the bone and the implant. Such trays 1 will also enable a port 9 to be incorporated that comprises a micro-screwhole that sits flush with the superior surface 4 of the tray 2. The port 9 can then be adapted to connect to a delivery means for the therapeutic fluent material. For example an

adaptor (not shown) could be plugged into the port 9 that can be attached to a pressurizable injector, for example a medical syringe or equivalent apparatus.

Turning now to the embodiments of the invention shown in Figs. 3 and 4, these both show an embodiment 11 and 12 respectively of a femoral stem of a hip joint prosthesis. In both embodiments, in conventional fashion the stem 11, 12 comprises a neck 13 and an anchoring blade 14 that tapers towards a distal end 15. The blade 14 widens conically from the distal end 15 in the direction of the proximal end. The neck 13 is terminated by a conically tapering pin 16 on which a spherical joint head (not shown) can be located. On the side of the blade 14 opposite the neck 13, the cone widens out and then defines a trochanter wing 17 before merging, via a shoulder 18, into the neck termination plane. The cross-sectional profile of the blade 14 is preferably rectangular, but may also be circular, trapezoidal, rhombic or any other appropriate shape.

However, in accordance with the invention, in the embodiment shown in Fig. 3 channels (not shown) are formed within the blade 14 of the stem 11 that terminate in apertures 19 defined in the surface of the blade 14. The channels communicate with a common port 20 positioned in the shoulder 18 of stem 11 so as to be accessible when the stem 11 has been implanted both intraoperatively and postoperatively when the spherical joint head has been located in a cup implanted in the patient's pelvis. The shape, size, position, distribution, uniformity and the number of apertures 19 is variable as appropriate and is preferably optimized to enable an instantaneous flow of therapeutic fluent material through and out of the blade 14 when the therapeutic fluent material within the stem 11 is pressurized via the port 20. As in the previous embodiment, the port 20 may be appropriately adapted to allow surgical devices, such as a pressurizable injector, for example syringe 21, shown schematically in Fig. 3, to be attached to deliver the therapeutic fluent material under pressure into the stem 11 or to suck fluent material out of it as determined by the surgeon. The port 20 is preferably closable by a sealable means (not shown), for example a cap, when the pressurized means 21 is absent in order that it can be opened or closed as desired. Alternatively, the sealable means may comprise a resealable plug or by a means forming part of an adaptor that is located in the port 20 and that is used for the attachment of the pressurizable injector 21.

The embodiment of stem 12 shown in Fig. 4 differs from that shown in Fig. 3. Here, the interior of the blade 14 is defines a hollow space 22 with which all of the apertures 18 are in communication. A common channel 23 communicates the space 22 with the port 20. In this embodiment the apertures 19 are in the form of elongated fenestrations. The apertures 19 are also only located in the distal part of the blade 14. This stem 12 has therefore been adapted only to treat areas of the skeletal structure that will be in the proximity of this part of the blade 14 after implantation.

The stem 12 shown in Fig,. 4 may also be further adapted so that only certain areas of the body are treated by therapeutic fluent material pumped through the stem 12. As shown in Fig 4, a sheath 24 may be located in the space 22 that selectively closes one or more of the apertures 19. This sheath 24 is preferably removably located within the space 22 so that a surgeon, using a stem 12 can adapt it as he chooses by location of an appropriate sheath 22 within it to close off some apertures 19 and keep open others.

In yet a further adaption, the pressurization mechanism for the therapeutic fluent material may be intrinsic to the implant, in this case the stem 12. Such a mechanism may comprise a tubular component 25, for example a catheter, that is attached to the port 20 and that is adapted for implantation along with the stem 12. This component 25 is adapted for delivery or for suction/siphoning out of material to or from the blade 14, for example it may contain a predetermined dose of a therapeutic fluent material for delivery into and through the stem 12 after implantation by pressurization of the component postoperatively at an appropriate juncture. The tubular component 25 is adapted such that when trigger to deliver the therapeutic fluent material that it contains, it is fully discharged so that none of the material is held in reserve, the component 25 not being intended to act as any form of reservoir for the material.

The component 25 may also be adapted for post-operative removal from said implant. If the component 25 comprises a catheter, then it may be removed when necessary without a surgical procedure being required. Alternatively, it may be comprised of a bioabsorbable or biocompatible material. So that it can be left in place after use. In a

further modification, the component 25 may comprise or be comprised of a radiographic material or comprise a radiographic marker.

The embodiment shown in Fig. 5 comprises an intervertebral disc prosthesis, a prosthetic disc 26 being shown between two vertebrae 27. As with the other embodiments of the invention, channels (not shown) are formed within the disc 26 that terminate in apertures 28 defined in the surface of the disc 26 and a port 29 is positioned at the posterior side of the disc that can be secured to a syringe 30 or other pressurizable injector similar to the one shown in Fig. 3. Whereas the implants described above and shown in Figs. 1 to 4 are all rigid implants, typically being comprised of any or a mixture of the metals, namely titanium, titanium alloy, stainless steel, stainless steel alloy, cobalt chrome alloy, polymer or polymer composite. The implant system shown in Fig. 5 may be comprised, at least in part, of a sponge or sponge-like material with an open-cell structure that is porous so as to define a plurality of channels therethrough. As in previous embodiments, the shape, size, position, distribution, uniformity and the number of apertures 28 is variable as appropriate but in this particular embodiment the apertures may comprise holes, gaps, slits, fenestrations or open pores. However, more generally, an implant system in accordance with the invention may be comprised of any biocompatible material or combinations or composites of such materials, for example the aforementioned metals, ceramic materials or a polymers or polymer composite. The implant system may also be either rigid or flexible as required or comprise a sponge or sponge-like material as shown in Fig. 5

The embodiment shown in Figs. 6 and 7 comprises an acetabular shell 31 forming part of an acetabular implant 32 adapted for implantation into the acetabulum of a hip such that it can receive a head of a femoral stem such as, for example, that shown in Figs. 3 and 4. It is possible, however, for the implant 32 to be adapted for interaction with a natural femoral head. The implant 32 comprises two components, namely the acetabular shell 31 and a liner 33. Usually, the acetabular shell 31 is metal and the liner 33 is a plastics material, such as an ultra high molecular weight polyethylene, but the shell 31 and the liner 33 may each be formed from any desirable material. However, as in the other embodiments of the invention channels 34 are formed within the body of

the shell 31. These channels 34 will typically be small-bore channels and, as with the small-bore channels described above, have an approximate diameter in a range of 300μm to 600μm. The channels 34 each communicate with an aperture 35 defined on the exterior surface 36 of the shell 31 and with a common port 37 located on the rim 38 of the shell 31 at a location that is accessible when the implant 32 has been implanted. It may be appropriate with some embodiments of implant 32 for there to be more than one common port 37 each communicating with a proportion of the channels 34, especially given the substantially hemi-spherical shape of the shell 31. Therapeutic fluent material can then be pumped into the implant 32 both intraoperatively and postoperatively when required for dispersal through the shell and out of the apertures 35 to treat the acetabulum and underlying bone. Such treatment may be used to facilitate rapid primary fixation of the shell 31 or to resolve post-surgery complications. As with the other embodiments, the port or ports 37 may be sealed by means of a sealing means 39 such as a resealable plug or have a tubular component 25 fitted as described above. Alternatively, an adaptor may be plugged into the port 37 that can be attached to a pressurizable injector as described above for the other embodiments of the invention.

The acetabular shell 31 of the invention may be used with different types of liner 33, as appropriate. Typically, the implant 31 is assembled by press fitting the liner 33 into an interior cavity of the shell 31 but it may be secured in any appropriate manner. Usually, the shell 31 and the liner 33 will be pre-assembled to form the implant 32 by the manufacturer. The shell 31 may also comprise a retaining ring 40 that can be used to secure additional components to the implant 31, as desired.

In a modification of any of the embodiments described above, an implant system according to the invention may comprise a natural or artificial bone graft.

In use, the implant systems described above in accordance with the invention enables a therapeutic fluent material to be injected under pressure into a surgical affected area during surgery. The fluent material travels through the channels 7, 23, 34 and out of the apertures 8, 19, 28, 35 to the area. The injected fluent material may be held under pressure to allow its curing or enable the fluent material to invade skeletal tissue as

deemed appropriate. The instantaneous delivery of therapeutic fluent materials in a pressurized manner during surgery is expected to optimize the healing process postoperative. However, the system may also be used postoperatively to treat post-operative complications, for example deep infections. Such postoperative infections may be treated during surgery by repeated injection of therapeutic fluent materials at appropriate intervals.

Although most of the illustrated embodiments only show one common port 9, 20, 29 for each implant, other embodiments of the invention may have more than one port, which may either be an input port or an output port. It will be appreciated that a surgeon may determine during a surgical procedure the amount of therapeutic fluent material required. Input/output ports or separate input and output ports enable the surgeon to add more or through suction remove therapeutic fluent material as required. Hence, the invention enables intraoperative control of therapeutic fluent material delivery in terms of amount delivered and its delivery location.

The tubular component 25 described above with reference to Fig.4 may be a temporary or permanent implant component as described. It is intended to have a delivery and suction functionality which is location-, volume and dosage-specific and, as indicated above is intended to fully discharge its contents when triggered. It enables additional required therapeutic fluent materials to be delivered immediately postoperative if required by the surgeon or fluent materials to be removed via suction in certain cases, for example in the event of sepsis.

The injected therapeutic fluent materials can be determined by the surgeon as appropriate. It is expected that such materials will be biological, biocompatible, bioactive material or therapeutically active agents. Such agents include bone slurry, bone morphogenic protein (BMP), bone growth factor, a pallet gel, anti-inflammatory agents, analgesic agents, anti-microbial, anti-viral agents, oncological drug, chemotherapeutic agent, antibiotic agent, osteogenic agent, osteoinductive agent, osteoconduction agent, osteostimulative agent or a combination of these.

The implant system may be available in different lengths and geometries including thickness and cross-sectional shape, according to the characteristics of the patient, the patient bone or the requirements of the surgical procedure. The surface of the implant system as a whole or its components may be surface treated or surface roughened to assist the osteointegration of the implant. This treatment may include, for example, adding surface layer(s) of titanium, hydroxyapatite, biocompatible phase-transforming material or other, pressure or grit blasting with zirconium oxide or other grit material(s). Alternatively, the surface of the implant may also be produced with rapid prototype or manufacturing procedure(s) (i.e. laser sintering).

The channel or channels of the implant may comprise a macro-, micro- or nano-channel. Similarly, the aperture or apertures may each comprise a macro-, micro- or nano- aperture.

In some embodiments, the implant system may comprise or be at least partially comprised of a radiographic material or comprise a radiographic marker.

The implant system may comprise or forms a part of an implant adapted for implantation in one of a hip joint, a knee joint, an ankle joint, a toe joint, a shoulder joint, an elbow joint, a wrist joint, a hand joint, a finger joint, and the spine. Alternatively, the implant system may enable an arthrodesis (fixed joint).

The implant system may comprise a short-term implant, a long-term implant or a trauma implant and it is primarily, but not exclusively, intended that the therapeutic fluent material will facilitate one or more of the following, namely healing, fusing of adjoining bones, inciting osteointegration of implants, combating infections, preventing inflammatory response and treating areas with tumours. The system in accordance with the invention may be utilized intraoperatively or postoperatively when intervention is required to combat deep infections, to treat tumours or to improve a healing response. In the case of trauma implants, the affected area may be treated with a therapeutic fluent material to assist its healing process prior to explantation of the trauma implant.

Reference Numerals

1	Tibial tray
2	Tray
3	Superior surface of tray
4	Inferior surface of tray
5	Stem
6	Porous coating
7	Channels
8	Apertures
9	Port
10	Sealable means
11	Femoral stem
12	Femoral stem
13	Neck
14	Blade
15	Distal end
16	Pin
17	Trochanter wing
18	Shoulder
19	Apertures
20	Port
21	Pressurized means
22	Interior space
23	Channel
24	Sheath
25	Tubular means
26	Prosthetic disc
27	Vertebrae
28	Apertures
29	Port
30	Syringe
31	Acetabular shell

32 Acetabular implant
33 Liner
34 Channels
35 Apertures
36 Exterior surface of shell
37 Port
38 Rim of shell
39 Sealable means
40 Retaining ring

Claims

1. An orthopaedic implant system comprising:

an orthopaedic implant for implantation within a body and adapted for instantaneous pressurized delivery of a therapeutic fluent material or removal of a fluent material respectively to or from an interface between said implant and said body,

said implant defining at least one channel communicating with at least one aperture defined at the surface of the implant and with at least one port positioned at a location on the implant that is accessible when the implant has been implanted whereby either therapeutic fluent material is introduced into or fluent material is removed from said implant and is pressurized either to deliver therapeutic fluent material directly to said interface or to suck fluent material out of said implant.

2. A system as claimed in Claim 1, wherein said implant comprises a plurality of channels which communicate respectively with a plurality of apertures and with a common port.

3. A system as claimed in Claim 1, wherein said implant defines, at least in part, a sponge-like, open-cell structure defining a plurality of said channels therethrough.

4. A system as claimed in Claim 1, wherein said channel or channels each have diameter in a range of 300μm to 600μm.

5. A system as claimed in Claim 1, wherein said aperture or apertures are in the form of any of the following, namely holes, gaps, slits, fenestrations and open pores.

6. A system as claimed in Claim 1, wherein said port or ports each comprises a sealable means whereby it can be opened or closed as desired.

7. A system as claimed in Claim 6, wherein said sealable means comprises a resealable plug.

8. A system as claimed in Claim 6, wherein said sealable means comprises a cap.

9. A system as claimed in Claim 1, wherein a means is provided to selectively close one or more of said apertures.

10. A system as claimed in Claim 1, wherein said implant defines a hollow interior space with which said apertures are in communication.

11. A system as claimed in Claim 10 when dependent on Claim 9, wherein said means provided to selectively close one or more of said apertures comprises a sheath located in said space that selectively closes one or more of said apertures.

12. A system as claimed in Claim 11, wherein said sheath is removably located within said space.

13. A system as claimed in Claim 1, wherein the exterior surface of at least part of the implant has been surface treated to assist the osteointegration of the implant.

14. A system as claimed in Claim 1, wherein the exterior surface of at least part of the implant is coated with a porous coating.

15. A system as claimed in Claim 14, wherein said porous coating comprises a hydroxyapatite coating and/or titanium beads.

16. A system as claimed in Claim 1, comprising an adaptor that can be plugged into said port and that can be attached to a pressurizable injector.

17. A system as claimed in Claim 1, incorporating a pressurizable injector that is permanently secured to said port.

18. A system as claimed in Claim 17, wherein said pressurizable injector comprises a tubular component attached to said port and adapted for implantation along with said implant, said component being adapted for delivery or suction of material to or from said implant respectively.

19. A system as claimed in Claim 18, wherein said tubular component is adapted for post-operative removal from said implant.

20. A system as claimed in Claim 18, wherein said tubular component is comprised of a bioabsorbable or biocompatible material.

21. A system as claimed in Claims 18, wherein said tubular component comprises or is comprised of a radiographic material.

22. A system as claimed in Claim 1, adapted to comprise or be at least partially comprised of a radiographic material or to comprise a radiographic marker.

23. A system as claimed in Claim 1, wherein said implant comprises a natural or an artificial bone graft.

24. A system as claimed in Claim 1, wherein said implant comprises one of a short-term implant, a long-term implant and a trauma implant.

25. A system as claimed in Claim 1, wherein said implant comprises an arthroplasty implant or a part thereof.

26. A system as claimed in Claim 1, adapted to enable an arthrodesis (fixed joint).

27. A system as claimed in Claim 1, wherein said implant comprises one of a screw, a nail, a plate and an internal/external fixation device.

28. A system as claimed in Claim 1, wherein said implant comprises or forms a part of an implant adapted for implantation in one of a hip joint, a knee joint, an ankle joint, a toe joint, a shoulder joint, an elbow joint, a wrist joint, a hand joint, a finger joint, and the spine.

29. A system as claimed in Claim 28, wherein said implant comprises a femoral stem of a hip joint prosthesis.

30. A system as claimed in Claim 28, wherein said implant comprises a tibial tray.

31. A system as claimed in Claim 28, wherein said implant comprises an intervertebral disc prosthesis.

32. A system as claimed in Claim 28, wherein said implant comprises an acetabular shell.

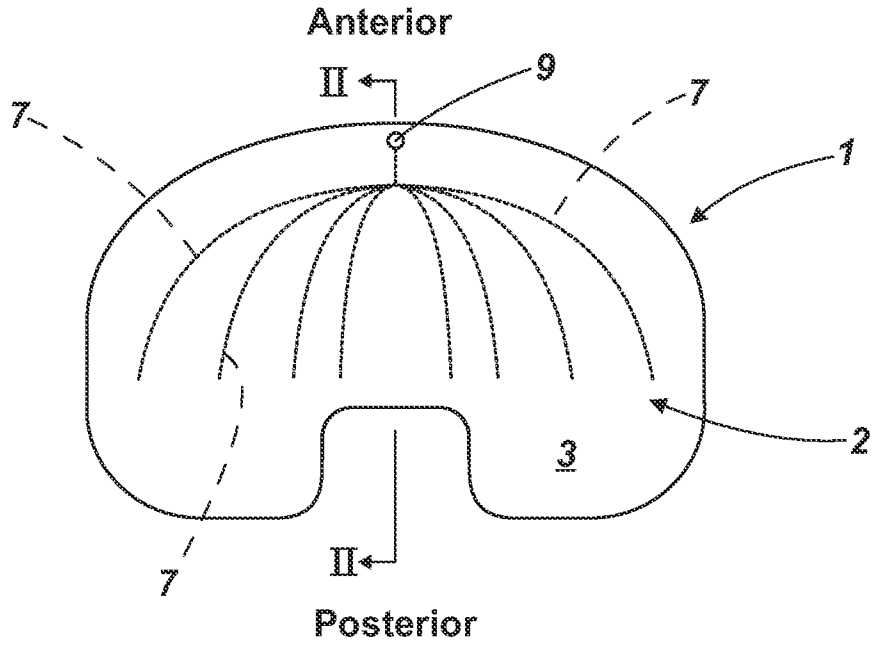

Fig. 1

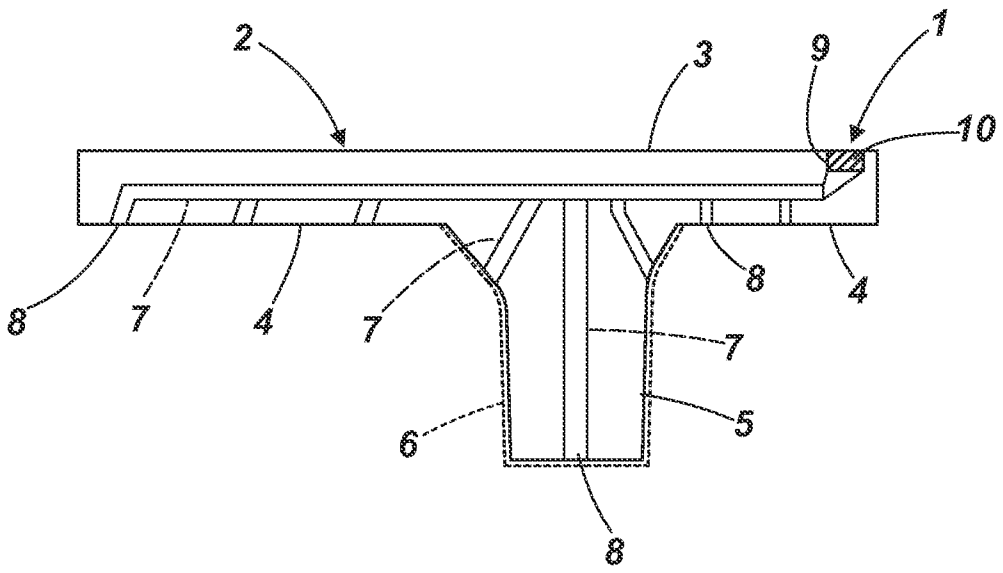

Fig. 2

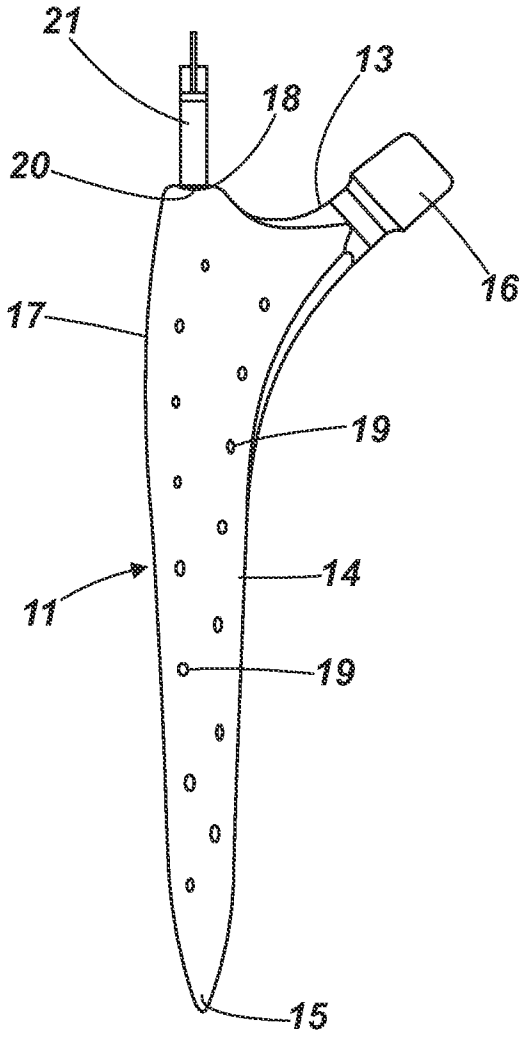

Fig. 3

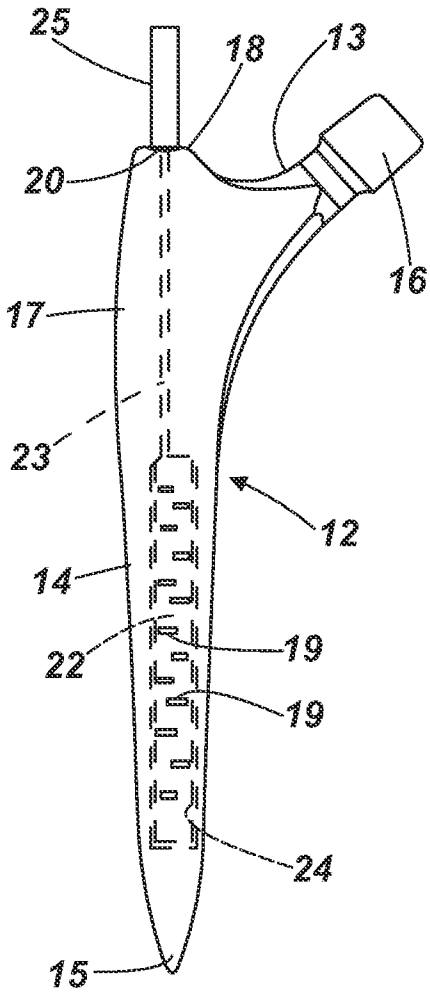

Fig. 4

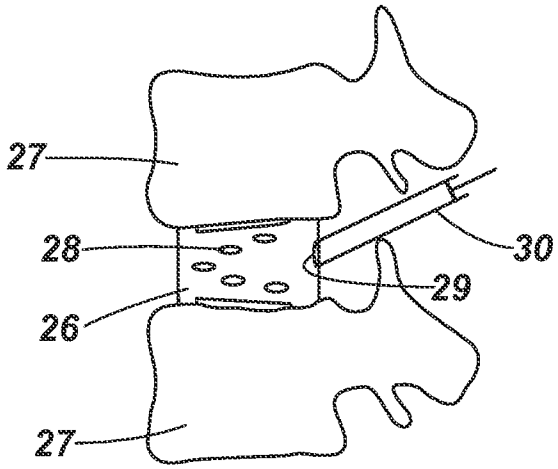

Fig. 5

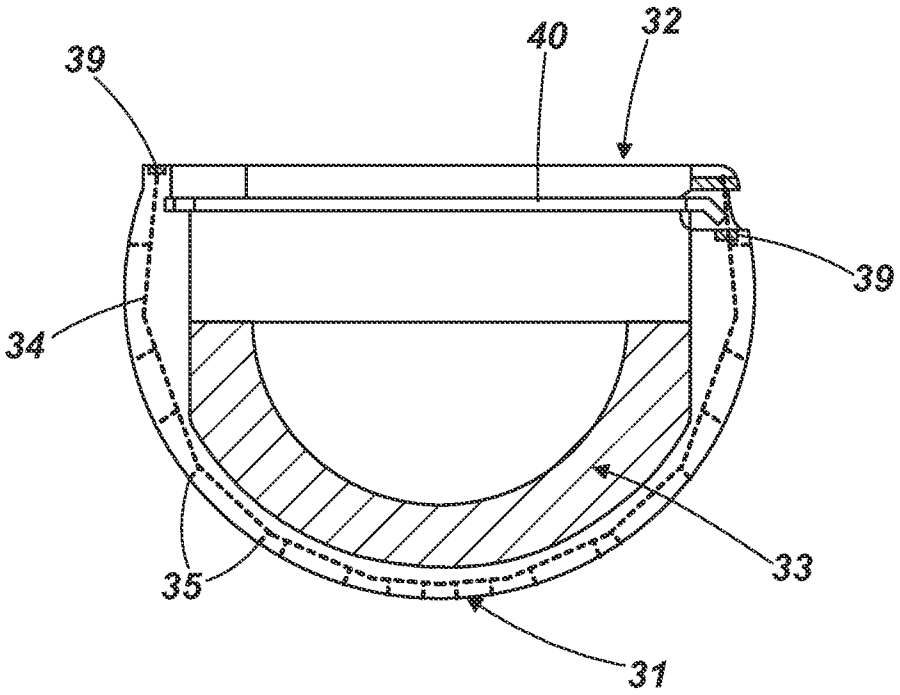

Fig. 6

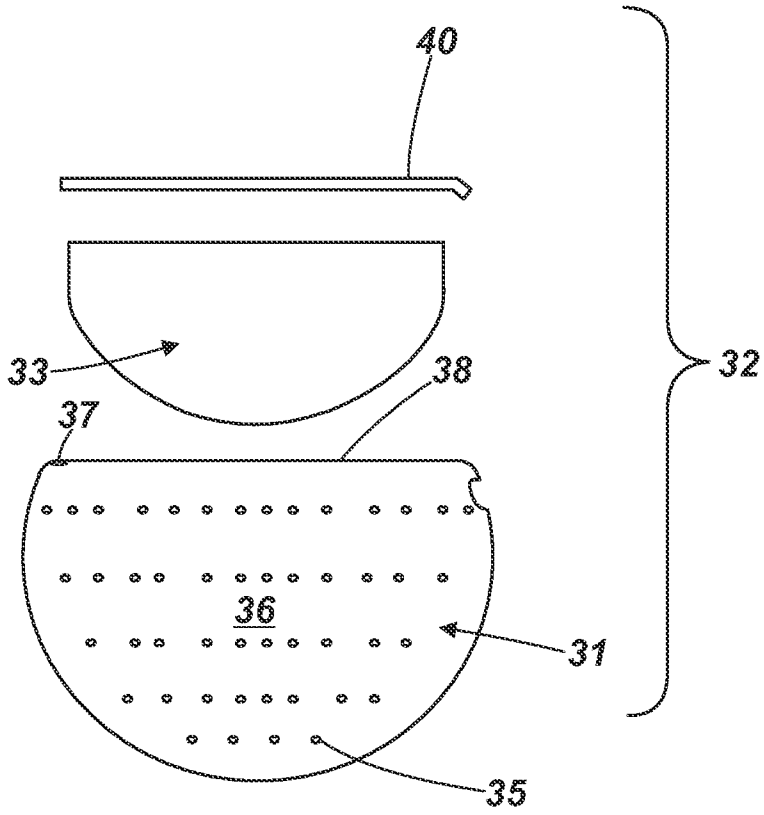

Fig. 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2010/047434

A. CLASSIFICATION OF SUBJECT MATTER

A61F 2/30(2006.01)i, A61L 27/54(2006.01)i, A61L 27/56(2006.01)i, A61L 27/30(2006.01)i, A61L 27/58(2006.01)i, A61B 17/86(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A61F 2/30; A61F 2/28; A61M 31/00; A61F 2/02; A61F 2/44; A61B 17/86; A61B 17/56

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

Korean utility models and applications for utility models
Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: implant, drug, channel

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2010-0042214 A1 (NEBOSKY et al.) 18 February 2010 See abstract, claims 1-37, figures 1-66	1-32
A	US 2006-0093646 A1 (CIMA et al.) 04 May 2006 See the whole document.	1-32
A	US 2005-0137707 A1 (MALEK) 23 June 2005 See the whole document.	1-32
A	US 2004-0034357 A1 (BEANE et al.) 19 February 2004 See the whole document.	1-32

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
26 JULY 2011 (26.07.2011)	**02 AUGUST 2011 (02.08.2011)**

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HAN, SANG SOO

Telephone No. 82-42-481-8648

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2010/047434

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