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Bone graft harvester

Abstract

An apparatus and methods are provided for a trephine bone graft harvester for extracting morselized bone from patients. The trephine bone graft harvester includes a bone cutter affixed to an outer hub. The bone cutter comprises a hollow tube having cylindrical wall and a distal cutting edge. A bone graft collector is sheathed within the bone cutter. The bone graft collector includes a distal scoop adjacent to the distal cutting edge of the bone cutter. The distal scoop is configured to move morselized bone away from the distal cutting edge. An inner hub is affixed to the bone graft collector and coupled with the outer hub. The inner hub includes a proximal shank configured to be engaged with a rotary tool suitable for applying torque to the inner hub.

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Background/Summary

PRIORITY (1) This application claims the benefit of and priority to U.S. patent application Ser. No. 16/285,637 filed Feb. 26, 2019 and U.S. Provisional application, entitled “Bone Graft Harvester,” filed on Jun. 22, 2018 and having application Ser. No. 62/688,980, the entirety of said application being incorporated herein by reference.

FIELD

(1) Embodiments of the present disclosure generally relate to the field of extracting bone grafts. More specifically, embodiments of the disclosure relate to devices and methods for harvesting morselized bone from a patient.

BACKGROUND

(2) Grafting generally is a surgical procedure whereby a portion of living tissue is transplanted from one location on a patient to another operative location on the patient so as to assist with healing following surgery. For example, bone grafting is very common in orthopedic surgery, neuro/spine surgery, and plastic surgery. As will be appreciated, bone generally has an ability to regenerate completely; but in many cases, some sort of scaffold is required to encourage bone adhesion and growth.

(3) In practice, bone grafts may be autograft (bone harvested from the patient's own body, often from the iliac crest), allograft (cadaveric bone usually obtained from a bone bank), as well as synthetic (often made of hydroxyapatite or other naturally occurring and biocompatible substances) with similar mechanical properties to bone. Most bone grafts are expected to be reabsorbed and replaced as the natural bone heals over time.

(4) Autografts are desirable because they are essentially guaranteed to be biocompatible, osteoconductive, osteoinductive, and osteogenic. A drawback to harvesting autograft bone, however, is that it requires harvesting the bone from a separate donor site, thereby requiring additional surgery. Many patients complain that the pain associated with the donor site is greater than the pain associated with the primary operative site. As such, there is a continuing desire to develop bone harvesting capabilities that limit donor site pain, speed the harvesting process, and provide adequate bone volume for a variety of surgical needs.

SUMMARY

(5) An apparatus and methods are provided for a trephine bone graft harvester for extracting morselized bone from a patient. The trephine bone graft harvester comprises a bone graft collector that is sheathed within a bone cutter. The bone cutter includes a distal cutting edge and a proximal handle. The distal cutting edge includes sharpened edges configured to morselize bone during rotation of the bone cutter. A distal scoop comprising the bone graft collector is configured to move the morselized bone away from the distal cutting edge during extracting bone from an autograft site. The proximal handle includes an outer hub configured to engage with an inner hub comprising the bone graft collector. A proximal shank comprising the bone graft collector is configured to engage with a rotary tool suitable for applying torque to the inner hub. The inner hub and the outer hub are configured to cooperatively convey torque from the rotary tool to the bone graft collector and the bone cutter.

(6) In an exemplary embodiment, a trephine bone graft harvester for extracting bone from an autograft site comprises: a bone cutter that includes a distal cutting edge and a proximal handle; a bone graft collector that is sheathed within the bone cutter; and a proximal shank comprising the bone graft collector configured to engage with a rotary tool.

(7) In another exemplary embodiment, the proximal handle includes an outer hub configured to engage with an inner hub comprising the bone graft collector. In another exemplary embodiment, the outer hub and the inner hub are configured to enable removal of the bone graft collector from an interior of the bone cutter. In another exemplary embodiment, the bone graft collector includes pins disposed on opposite sides of the inner hub and configured to be received into slots disposed on opposite sides of the outer hub. In another exemplary embodiment, the pins and the slots are respectively positioned on the bone graft collector and the bone cutter such that a distal scoop comprising the bone graft collector is optimally positioned with respect to the distal cutting edge when the bone graft collector is sheathed within the bone cutter.

(8) In another exemplary embodiment, the pins are configured to be retained within the slots by way of snap lock portions comprising levers disposed on opposite sides of the proximal handle. In another exemplary embodiment, the snap lock portions are biased toward the outer hub by flexible portions that attach the levers to a body comprising the proximal handle. In another exemplary embodiment, the flexible portions are configured to allow the snap lock portions to pivot the levers slightly as the pins are pushed into the slots during insertion of the bone graft collector into the bone cutter. In another exemplary embodiment, the snap lock portions are configured to allow the

pins to be removed from the slots upon a practitioner squeezing the levers together.

(9) In another exemplary embodiment, the bone cutter comprises a cylindrical wall that is joined with a body comprising the proximal handle. In another exemplary embodiment, the distal cutting edge comprises an angled wedge portion of the cylindrical wall and includes sharpened edges configured to morselize bone during rotation of the bone cutter. In another exemplary embodiment, the body is configured to be grasped in a hand. In another exemplary embodiment, the body includes substantially similar levers disposed on opposite sides of the body that are configured to engage with and retain an inner hub of the bone graft collector.

(10) In another exemplary embodiment, the bone graft collector comprises a hollow tube having an open-tube portion that includes a distal scoop. In another exemplary embodiment, the open-tube portion is joined with the proximal shank by way of the inner hub. In another exemplary embodiment, the bone graft collector is configured to position the distal scoop adjacent to the distal cutting edge when the bone graft collector is sheathed within the bone cutter. In another exemplary embodiment, the distal scoop is configured to move morselized bone away from the distal cutting edge during extracting bone from the autograft site. In another exemplary embodiment, the bone graft collector is configured to retain morselized bone within the open-tube portion until retrieval by a practitioner.

(11) In an exemplary embodiment, a trephine bone graft harvester comprises: a bone cutter including a distal cutting edge; an outer hub affixed to a proximal end of the bone cutter; a bone graft collector disposed within the bone cutter; and an inner hub affixed to the bone graft collector and coupled with the outer hub.

(12) In another exemplary embodiment, the bone cutter comprises a tube-shaped member having an interior that slidably receives the bone graft collector. In another exemplary embodiment, the inner hub is configured to allow removal of the bone graft collector from the interior of the bone cutter, such that morselized bone may be retrieved from the bone graft collector. In another exemplary embodiment, the bone graft collector includes a distal scoop configured to retain morselized bone within an interior of the bone cutter. In another exemplary embodiment, the distal scoop facilitates retrieval of the morselized bone after removal of the bone graft collector from within the bone cutter.

(13) In another exemplary embodiment, the inner hub includes a proximal shank that is configured to be engaged with a rotary tool suitable for applying torque to the inner hub. In another exemplary embodiment, the inner hub and the outer hub are configured to cooperatively convey torque from the rotary tool to the bone graft collector and the bone cutter. In another exemplary embodiment, the distal cutting edge is configured to morselize bone during rotation of the bone cutter.

(14) In an exemplary embodiment, a method for a trephine bone graft harvester comprises: configuring a distal cutting edge of a bone cutter; affixing an outer hub to a proximal end of the bone cutter; disposing a bone graft collector within an interior of the bone cutter; affixing an inner hub to the bone graft collector; and coupling the inner hub to the outer hub.

(15) In another exemplary embodiment, a coupling includes causing the bone graft collector and the bone cutter rotate together upon applying torque to a proximal shank comprising the inner hub. In another exemplary embodiment, disposing the bone graft collector includes forming a distal scoop to retain morselized bone within an interior of the bone cutter. In another exemplary embodiment, configuring a distal cutting edge includes forming an angled wedge portion of the bone cutter to morselize bone upon rotating the bone cutter.

(16) In an exemplary embodiment, trephine bone graft harvester comprises: a bone cutter affixed to an outer hub; a bone graft collector sheathed within the bone cutter; and an inner hub affixed to the bone graft collector and coupled with the outer hub.

(17) In another exemplary embodiment, the bone cutter comprises a hollow tube having cylindrical wall and a distal cutting edge. In another exemplary embodiment, the distal cutting edge comprises an angled wedge portion of the cylindrical wall having sharpened edges and configured to

morselize bone during rotation of the bone cutter. In another exemplary embodiment, the bone graft collector includes a distal scoop adjacent to the distal cutting edge and is configured to migrate morselized bone into an interior of the bone graft collector. In another exemplary embodiment, the distal scoop retains the morselized bone within the interior during removal of the bone graft collector from the bone cutter.

(18) In another exemplary embodiment, the inner hub includes a proximal shank that is configured to be engaged with a rotary tool suitable for applying torque to the inner hub. In another exemplary embodiment, the inner hub is configured to rotate the bone graft collector and the bone cutter, the inner hub being coupled with the bone cutter by way of the outer hub. In another exemplary embodiment, the bone cutter is configured to morselize bone during rotation of the bone cutter. In another exemplary embodiment, the inner hub includes a fastener and a key whereby the inner hub may be removably coupled with the outer hub, the key being configured to convey torque from the inner hub to the outer hub. In another exemplary embodiment, the proximal shank is configured to be received by a chuck comprising the rotary tool.

(19) In another exemplary embodiment, the bone graft collector includes a distal scoop configured to be disposed adjacent to a distal cutting edge of the bone cutter, the distal scoop being configured to move morselized bone away from the distal cutting edge. In another exemplary embodiment, the distal scoop is configured to retain the morselized bone within the bone graft collector, such that the morselized bone may be retrieved upon removing the bone graft collector from an interior of the bone cutter. In another exemplary embodiment, the bone graft collector includes a half-tube portion adjacent to the distal scoop, the half-tube portion being configured to facilitate removal of the morselized bone upon removal of the bone graft collector from an interior of the bone cutter.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

(1) The drawings refer to embodiments of the present disclosure in which:

(2) FIG. 1 illustrates an isometric view of an exemplary embodiment of a trephine bone graft harvester, according to the present disclosure;

(3) FIG. 2 illustrates a cross-sectional view of the trephine bone graft harvester of FIG. 1, taken along a line 2-2;

(4) FIG. 3 illustrates an isometric view of an exemplary embodiment of a bone cutter comprising a trephine bone graft harvester, according to the present disclosure;

(5) FIG. 4 illustrates an isometric view of an exemplary embodiment of a bone graft collector comprising a trephine bone graft harvester in accordance with the present disclosure;

(6) FIG. 5 illustrates an isometric view of an exemplary embodiment of an outer hub comprising a trephine bone graft harvester in accordance with the present disclosure;

(7) FIG. 6 illustrates an isometric view of an exemplary embodiment of an inner hub comprising a trephine bone graft harvester, according to the present disclosure;

(8) FIG. 7 illustrates an exemplary embodiment of a trephine bone graft harvester in a bone drilling configuration, according to the present disclosure; and

(9) FIG. 8 illustrates an exploded view of the trephine bone graft harvester of FIG. 7 in a graft collection configuration according to the present disclosure.

(10) While the present disclosure is subject to various modifications and alternative forms, specific embodiments thereof have been shown by way of example in the drawings and will herein be described in detail. The invention should be understood to not be limited to the particular forms disclosed, but on the contrary, the intention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the present disclosure.

DETAILED DESCRIPTION

(11) In the following description, numerous specific details are set forth in order to provide a thorough understanding of the present disclosure. It will be apparent, however, to one of ordinary skill in the art that the invention disclosed herein may be practiced without these specific details. In other instances, specific numeric references such as “first bone graft,” may be made. However, the specific numeric reference should not be interpreted as a literal sequential order but rather interpreted that the “first bone graft” is different than a “second bone graft.” Thus, the specific details set forth are merely exemplary. The specific details may be varied from and still be contemplated to be within the spirit and scope of the present disclosure. The term “coupled” is defined as meaning connected either directly to the component or indirectly to the component through another component. Further, as used herein, the terms “about,” “approximately,” or “substantially” for any numerical values or ranges indicate a suitable dimensional tolerance that allows the part or collection of components to function for its intended purpose as described herein.

(12) In general, the present disclosure describes an apparatus and methods for a trephine bone graft harvester for extracting morselized bone from patients. The trephine bone graft harvester includes a bone graft collector sheathed within a bone cutter. The bone cutter comprises a hollow tube having a distal cutting edge and a proximal outer hub. The bone graft collector includes a distal scoop adjacent to the distal cutting edge of the bone cutter and an inner hub that engages with the outer hub of the bone cutter. The distal scoop is configured to move morselized bone away from the distal cutting edge. The inner hub includes a proximal shank configured to be engaged with a rotary tool suitable for applying torque to the inner hub.

(13) FIG. 1 illustrates an exemplary embodiment of a trephine bone graft harvester **100**, according to the present disclosure. The harvester **100** is a generally elongate assembly that includes a bone graft collector **104** that is sheathed within a bone cutter **108**, as best shown in FIG. 2. In the illustrated embodiment of FIG. 1, the bone cutter **108** is affixed to an outer hub **112**, while the bone graft collector **104** is affixed to an inner hub **116**. As described herein, the outer hub **112** is engaged with the inner hub **116**, such that disengaging of the outer and inner hubs **112**, **116** enables a practitioner to remove the bone graft collector **104** from an interior of the bone cutter **108**. The harvester **100** includes a distal cutting edge **120** and a distal scoop **124**, as well as a proximal shank **128** that may be engaged with a suitable rotary tool capable of rotating the harvester **100** for the purpose of extracting bone from an autograft site.

(14) FIG. 3 illustrates an exemplary embodiment of the bone cutter **108** comprising the trephine bone graft harvester **100**, according to the present disclosure. The bone cutter **108** comprises a generally hollow tube having a cylindrical wall **132** that includes a proximal portion **136** and the distal cutting edge **120**. The distal cutting edge **120** comprises an angled wedge portion of the cylindrical wall **132** and includes sharpened edges **140** that are configured to morselize bone during rotation of the bone cutter **108**. The proximal portion **136** comprises a relatively thicker portion of the cylindrical wall **132** and is configured to be affixedly received into a distal opening **144** (see FIG. 5) of the outer hub **112**, as discussed herein. The proximal portion **136** includes a keyed opening **148** that facilitates mechanically affixing the bone cutter **108** to the outer hub **112**, such as by way of a key **152** as shown in FIG. 2.

(15) FIG. 4 illustrates an exemplary embodiment of the bone graft collector **104** comprising the trephine bone graft harvester **100** in accordance with the present disclosure. The bone graft collector **104** comprises a generally hollow tube having a proximal portion **156** and an open-tube portion **160** that includes the distal scoop **124**. The proximal portion **156** is configured to be affixed within a central opening **164** disposed in the inner hub **116**, as shown in FIG. 2. In the embodiment illustrated in FIG. 4, the proximal portion **156** includes a keyed opening **168** that is configured to receive a lock pin **166** comprising the inner hub **116**, as shown in FIG. 2. As will be appreciated, inserting the lock pin **166** into the keyed opening **168** affixes the bone graft collector **104** and the inner hub **116**.

(16) With continuing reference to FIG. 4, the bone graft collector **104** is configured to position the

distal scoop **124** adjacent to the distal cutting edge **120**. The distal scoop **124** is configured to move morselized bone away from the distal cutting edge **120** during extracting bone from a patient. Further, the distal scoop **124** is configured to retain the morselized bone within the bone graft collector **104**, such that the morselized bone may be retrieved upon removing the bone graft collector **104** from the interior of the bone cutter **108**. In the embodiment illustrated in FIG. **4**, the open-tube portion **160** adjacent to the distal scoop **124** facilitates retrieving the morselized bone upon removal of the bone graft collector **104** from the interior of the bone cutter **108**.

(17) FIGS. **5-6** respectively illustrate exemplary embodiments of the outer hub **112** and the inner hub **116** comprising the trephine bone graft harvester **100** in accordance with the present disclosure. The outer hub **112** comprises a cylindrical member **176** that includes a proximal opening **180** and the distal opening **144**. As mentioned above, the distal opening **144** is configured to receive the proximal portion **136** of the bone cutter **108**. Although not shown in FIG. **5**, the distal opening **144** preferably includes a key that is received by the keyed opening **148** (see FIG. **3**) so as to mechanically fixate the bone cutter **108** to the outer hub **112**.

(18) With continuing reference to FIGS. **5-6**, the proximal opening **180** is configured to slidably receive a distal portion **184** of the inner hub **116**. The proximal opening **180** includes a keyed opening **188** that receives a keyed portion **172** of the inner hub **116**. The outer hub **112** includes an opening **192** and an actuator **196** disposed in the side of the cylindrical member **176**. The opening **192** is configured to receive a flexible protrusion **200** disposed on the inner hub **116** whereby the outer hub **112** and the inner hub **116** may be removably locked together. The actuator **196** is configured to enable a practitioner to remove the flexible protrusion **200** from the opening **192**, thereby allowing the practitioner to disengage the outer and inner hubs **112**, **116**.

(19) As will be appreciated, engaging the keyed portion **172** within the keyed opening **188** effectively fixates the outer hub **112** to the inner hub **116**, such that torque applied to the proximal shank **128** is conveyed to both the outer hub **112** and the inner hub **116**. In some embodiments, the proximal shank **128** is configured to be received by a chuck comprising a suitable rotary tool. As such, the rotary tool may be engagedly coupled with the proximal shank **128** to rotate both the bone cutter **108** and the bone graft collector **104** for the purpose of extracting bone from a patient. Once a desired quantity of morselized bone has been extracted, the actuator **196** may be used to disengage the outer and inner hubs **112**, **116** and allow the bone graft collector **104** to be removed from the interior of the bone cutter **108**. As described hereinabove, removal of the bone graft collector **104** from the bone cutter **108** reveals the open-tube portion **160** and allows for retrieval of the extracted quantity of morselized bone.

(20) FIGS. **7-8** illustrate an exemplary embodiment of a trephine bone graft harvester **220**, according to the present disclosure. The harvester **220** is a generally elongate assembly that includes a bone graft collector **224** that is sheathed within a bone cutter **228**, as best shown in FIG. **8**. The bone cutter **228** includes a proximal handle **232** configured to facilitate a practitioner grasping the harvester **200** during extracting bone. The handle **232** includes an outer hub **236** that engages with an inner hub **240** comprising the bone graft collector **224**. As described herein, disengaging the outer and inner hubs **236**, **240** enables the practitioner to remove the bone graft collector **224** from an interior of the bone cutter **228**. The harvester **200** includes a distal cutting edge **244** and a distal scoop **248**, as well as a proximal shank **252** that may be engaged with a suitable rotary tool capable of rotating the harvester **200** for the purpose of extracting bone from an autograft site.

(21) As best shown in FIG. **8**, the bone cutter **228** comprises a generally hollow tube having a cylindrical wall **256** that is joined with a proximal body **260**. The cylindrical wall **256** includes a distal cutting edge **264** that comprises an angled wedge portion of the cylindrical wall **256** and includes sharpened edges **268** configured to morselize bone during rotation of the bone cutter **228**. The body **260** generally comprises a portion of the handle **232** that is configured to be grasped in a hand of the practitioner during operation of the harvester **200**. As described herein, the body **260**

includes substantially similar levers **272** disposed on opposite sides of the body **260** that are configured to engage with the inner hub **240** of the bone graft collector **224**.

(22) With continuing reference to FIG. **8**, the bone graft collector **224** comprises a generally hollow tube having an open-tube portion **276** that includes the distal scoop **248**. The open-tube portion **276** is joined with the proximal shank **252** by way of the inner hub **240**. The bone graft collector **224** is configured to position the distal scoop **248** adjacent to the distal cutting edge **244** when the bone graft collector **224** is sheathed within the bone cutter **228**. The distal scoop **248** is configured to move morselized bone away from the distal cutting edge **244** during extracting bone from a patient, as well as retain the morselized bone within the bone graft collector **104** until retrieval by the practitioner. As will be appreciated, the morselized bone may be retrieved upon removing the bone graft collector **224** from the interior of the bone cutter **228** to expose the morselized bone within the open-tube portion **276** adjacent to the distal scoop **248**.

(23) As shown in FIG. **8**, the bone graft collector **224** includes pins **280** that are disposed on opposite sides of the inner hub **240**. The pins **280** are configured to be received into slots **284** disposed on opposite sides of the outer hub **236** of the bone cutter **228**. The pins **280** and the slots **284** are respectively positioned on the bone graft collector **224** and the bone cutter **228** such that the distal scoop **248** is optimally positioned with respect to the distal cutting edge **244** when the bone graft collector **224** is sheathed within the bone cutter **228** as shown in FIG. **7**. The pins **280** are configured to be retained within the slots **284** by way of a snap lock portion **288** comprising each of the levers **272**, as shown in FIG. **7**. The snap lock portions **288** are biased toward the outer hub **236** by flexible portions **292** that attach the levers **272** to the body **260**. The flexible portions **292** allow the snap lock portions **288** to pivot the levers **272** slightly as the pins **280** are pushed into the slots **284** during insertion of the bone graft collector **224** into the bone cutter **228**. As will be recognized, the snap lock portions **288** allow the pins **280** to be removed from the slots **284** upon the practitioner squeezing the levers **272** together.

(24) Methods for a trephine bone graft harvester **100** include, in some embodiments, configuring a distal cutting edge **120** of a bone cutter **108**, affixing an outer hub **112** to a proximal end of the bone cutter **108**, disposing a bone graft collector **104** within an interior of the bone cutter **108**, affixing an inner hub **116** to the bone graft collector **104**, and coupling the inner hub **116** to the outer hub **112**.

(25) In some embodiments, methods for a trephine bone graft harvester **100** include coupling an inner hub **116** to an outer hub **112**. In some embodiments, coupling the inner hub **116** to the outer hub **112** further includes causing the bone graft collector **104** and the bone cutter **104** to rotate together upon applying torque to a proximal shank **128** comprising the inner hub **116**.

(26) In some embodiments, methods for a trephine bone graft harvester **100** include disposing a bone graft collector **104** within an interior of the bone cutter **108**. The methods may further include, in some embodiments, forming a distal scoop **124** to retain morselized bone within an interior of the bone cutter **108**.

(27) In some embodiments, methods for a trephine bone graft harvester **100** include configuring a distal cutting edge **120** of a bone cutter **108**. Further, in some embodiments, the methods for configuring the distal cutting edge **120** may include forming an angled wedge portion of the bone cutter **108** having sharpened edges **140** to morselize bone upon rotating the bone cutter **108**.

(28) While the invention has been described in terms of particular variations and illustrative figures, those of ordinary skill in the art will recognize that the invention is not limited to the variations or figures described. In addition, where methods and steps described above indicate certain events occurring in certain order, those of ordinary skill in the art will recognize that the ordering of certain steps may be modified and that such modifications are in accordance with the variations of the invention. Additionally, certain of the steps may be performed concurrently in a parallel process when possible, as well as performed sequentially as described above. To the extent there are variations of the invention, which are within the spirit of the disclosure or equivalent to

the inventions found in the claims, it is the intent that this patent will cover those variations as well. Therefore, the present disclosure is to be understood as not limited by the specific embodiments described herein, but only by scope of the appended claims.

Claims

1. A trephine bone graft harvester, comprising: a bone cutter for morselizing bone wherein the bone cutter comprises a hollow tube having a cylindrical wall; the bone cutter includes a proximal portion configured to be received into the outer hub wherein the proximal portion includes an opening configured to receive a key comprising the outer hub; a bone graft collector for retaining the morselized bone; a proximal shank for engaging with a rotary tool; an outer hub coupled with the bone cutter; and an inner hub coupled with the bone graft collector.
 2. The bone graft harvester of claim 1, wherein the outer hub engages with the inner hub such that the bone graft collector is sheathed within the bone cutter.
 3. The bone graft harvester of claim 1, wherein the outer hub and the inner hub are disengageable to enable removal of the bone graft collector from an interior of the bone cutter.
 4. The bone graft harvester of claim 1, wherein the bone cutter includes a distal cutting edge configured for morselizing bone during rotation of the bone cutter.
 5. The bone graft harvester of claim 4, wherein the distal cutting edge comprises an angled wedge portion of the cylindrical wall that includes sharpened edges.
 6. The bone graft harvester of claim 1, wherein the bone graft collector comprises a hollow tube configured to be sheathed within the bone cutter.
 7. The bone graft harvester of claim 6, wherein the bone graft collector includes a distal scoop configured to receive the morselized bone from the bone cutter.
 8. The bone graft harvester of claim 7, wherein the distal scoop is configured to move the morselized bone into the bone graft collector.
 9. The bone graft harvester of claim 8, wherein the distal scoop is configured to retain the morselized bone within the bone graft collector during removal of the bone graft collector from the bone cutter.
 10. The bone graft harvester of claim 6, wherein the bone graft collector includes a proximal portion configured to engage within a central opening of the inner hub.
 11. The bone graft harvester of claim 10, wherein the proximal portion includes a keyed opening for receiving a lock pin comprising the inner hub.
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