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PIN GUIDE AND DRILL GUIDE SYSTEMS AND METHODS

Abstract

Orthopedic systems and methods using a bone peg. In one example an orthopedic system includes a guide pin, a bone peg, a cutter, and a cutting guide. The bone peg may be used for guiding the guide pin through the cutting guide and into bone, with the guide pin used to guide the cutter for forming a hole in the bone. The bone peg may also be inserted into the hole after the hole is formed and used for additional beneficial purposes.

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Background/Summary

CROSS-REFERENCE TO RELATED PATENT APPLICATIONS [0001] This application claims priority from U.S. Provisional Patent Application No. 63/554,399, filed Feb. 16, 2024, incorporated herein by reference in its entirety.

BACKGROUND

[0002] Orthopedic methods and systems, including methods and systems using a bone peg positioned in a hole formed in a bone.

SUMMARY OF THE INVENTION

[0003] In one example, an orthopedic method uses an orthopedic system including a guide pin, a bone peg, a cutter, and a cutting guide. The method includes inserting the guide pin into a bone, with insertion of the guide pin being guided by and passing through a cannulation in the bone peg, with the bone peg in turn being inserted in the cannula of a cutting guide positioned on the bone. Next, after insertion of the guide pin into the bone, the bone peg may be removed from the cutting guide. Next, after removal of the bone peg, a cannulated cutter may be positioned over the guide pin and used to form a hole in the bone, with the guide pin guiding the formation of the hole in the bone by the cannulated cutter. Next, after forming the hole in the bone, the cannulated cutter may be removed from the hole. Next, after removing the cannulated cutter from the hole, the shaft of the bone peg may be inserted into the hole in the bone such that the head of the bone peg extends upwardly away from the hole in the bone.

[0004] After insertion of the bone peg into the hole in the bone, the bone peg may be used for a variety of beneficial purposes. For instance, the head of the bone peg may provide a visual indication of a trajectory of the hole in the bone. As another example, at least a portion of the bone peg may be of a radio-opaque material, and the bone peg may be used to provide a visual indication of the bone hole (such as its position, trajectory, and/or depth) when the bone is imaged using a surgical imaging system. As another example, the head of the bone peg may be used to resist soft tissue from moving over the bone hole. As additional examples, suture may be secured to and/or tensioned using the head of the bone peg.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] FIG. 1 shows an example of an orthopedic system.

[0006] FIG. 2 shows a guide pin from the orthopedic system of FIG. 1.

[0007] FIG. 3 shows a bone peg from the orthopedic system of FIG. 1.

[0008] FIG. 4 shows a cutter from the orthopedic system of FIG. 1.

[0009] FIG. 5 shows a cutting guide from the orthopedic system of FIG. 1.

[0010] FIGS. 6-13 show an example of an orthopedic method.

[0011] FIG. 14 shows the guide pin, bone peg, and cutting guide from the system of FIG. 1 in cross-section, with the guide pin inserted in the bone peg and the bone peg inserted in the cutting guide.

[0012] FIGS. 15-19 are additional images of the orthopedic method of FIGS. 6-13.

[0013] FIG. 20 shows an example of the use of three bone pegs to provide visual indications of bone hole trajectory and to resist soft tissue from moving over the bone holes.

[0014] FIG. 21 shows an example of the use of a bone peg to temporarily secure a suture.

[0015] FIG. 22 shows an example of the use of a bone peg to tension a suture.

DETAILED DESCRIPTION

[0016] FIG. 1 shows an example of an orthopedic system including a guide pin 10, a bone peg 20,

a cutter **30**, and a cutting guide **40**. The bone peg **20**, cutter **30**, and cutting guide **40** are all cannulated, with the cannulas of the bone peg **20** and cutter **30** both configured (in size and shape) to receive the guide pin **10**, and the cannula of the cutting guide **40** configured (in size and shape) to alternatively receive either the bone peg **20** or the cutter **30**.

[0017] FIG. **2** shows the guide pin **10** of the orthopedic system of FIG. **1**.

[0018] FIG. **3** shows the bone peg **20** of the orthopedic system of FIG. **1**. The bone peg **20** in this example includes a head **22**, a shaft **24**, and a cannula **26** extending through the head **22** and shaft **24**. The cannula **26** is configured to receive and guide the guide pin **10**. The head **22**, shaft **24**, and cannula **26** are all aligned along a longitudinal axis **28** of the bone peg **20**. The shaft **24** is configured (in size and shape) to be inserted into a cannula of the cutting guide **40**, and is also configured (in size and shape) to be inserted into a bone hole formed by cutter **30**. When the shaft **24** is inserted into a bone hole, the head **22** of the bone peg **20** will extend upwardly and away from the hole in the bone. In the examples shown in the figures, the head **22** is a concave cylinder, which may make it easier to handle in the operating environment and facilitate some of the other functions discussed below (such as acting as a soft tissue dam or securing/tensioning suture).

[0019] In some implementations, when the shaft **24** of the bone peg **20** is inserted into a hole in a bone, the head **22** of the bone peg may provide a visual indication of a trajectory of the hole in the bone. For example, FIG. **20** shows three bone pegs inserted into three bone holes, providing a clear visualization to the surgeon and other operating room personnel of the trajectories of the three bone holes, which may otherwise not be easy to visually determine from just viewing the holes themselves.

[0020] In some implementations, when the bone peg **20** is inserted into a hole in a bone, the head **22** of the bone peg **20** may function as a soft tissue dam surface that resists soft tissue from moving over the hole in the bone. For example, FIG. **20** shows three bone pegs inserted into bone holes, with the heads of the bone pegs helping to prevent soft tissue from moving over and covering the bone holes.

[0021] In some implementations, at least a portion of the bone peg **20** may be formed of a radio-opaque material. For instance, the shaft **24** may be formed of a radio-opaque material. In these instances, when the bone peg **20** is inserted in a hole in a bone, the bone peg **20** can provide a visual indication of the hole in the bone (such as the holes position, trajectory, and depth) when the bone is imaged using a surgical imaging system such as a CT scanner or other x-ray device.

[0022] In some implementations, the head **22** of the bone peg may be used to temporarily secure suture during an operation. The head **22** of the bone peg may include one or more suture retention sites such as the suture cleats shown in FIG. **21** for securing suture or may include other features for accomplishing the same or similar functions, such as o-rings or push button based mechanisms that temporarily retain suture on the head **22**. In some implementations, the head **22** of the bone peg **20** may be used to tension suture. For instance, the suture may be wrapped around the head **22** of the bone peg **20** and the bone peg **20** may be rotated in the bone hole **52** such that the suture winds around the head **22** of the bone peg **20**, thereby tensioning the suture.

[0023] FIG. **4** shows the cutter **30** of the orthopedic system of FIG. **1**. In this example the cutter **30** is a drill bit including a shank **32** and a cutting portion **34**, with cutting flutes **36** spiraling around the cutting portion **34**. The outer diameter of the cutting portion **34** is approximately the same as the outer diameter of the shaft **24** of the bone peg **20**. In this context, “approximately the same” means 10% or less difference. The cutter **30** in this example has a cannula **38** that is configured to receive and be guided by the guide pin **10**.

[0024] FIG. **5** shows the cutting guide **40** of the orthopedic system of FIG. **1**. The cutting guide **40** in this example includes a cannula **42** configured to alternatively receive and guide the bone peg **20** and the cutter **30**. The cannula **42** of the cutting guide **40** extends through a body **44** including a toothed end **46** that facilitates maintaining the position of the cutting guide **40** on a bone surface. The cutting guide **40** in this example also includes a handle **48**.

[0025] Although not shown in the figures, the bone peg 20 may be secured in the cannula 42 of the cutting guide 40 in a variety of fashions. Non-limiting examples include: superficial threads on the bone peg 20 and/or the cutting guide 40; an o-ring on the bone peg 20; a locking pin and mating feature; a clip on the cutting guide 40; a ball detent; and/or a push button.

[0026] FIGS. 6-13 show an example of an orthopedic method using the orthopedic system of FIGS. 1-5. In FIG. 6, the cutting guide 40 is shown positioned on a bone 50, with the bone peg 20 inserted in the cannula of cutting guide 40. In FIG. 7, the guide pin 10 is inserted into the bone 50. Insertion of the guide pin 10 is guided by and passes through the cannulation in bone peg 20. FIG. 8 shows the bone peg 20 removed from the cutting guide 40 after insertion of the guide pin 10 into the bone 50. Next, as shown in FIG. 9, the cannulated cutter 30 may be positioned over the guide pin 10 and be used to form a hole 52 in the bone 50. Both the guide pin 10 and the cannula 42 of the cutting guide 40 guide the formation of the hole 52 in the bone 50 by guiding the cannulated cutter 30. Next, as shown in FIG. 10, the cannulated cutter 30 may be removed from the bone hole 52 and from the cutting guide 40. Note that although the figures show the guide pin 10 remaining in the bone hole 52 after removal of the cutter 30, in other implementations the guide pin 10 may be removed along with the cutter 30. Next, as shown in FIG. 11, the cutting guide 40 may be removed from the bone 50, leaving just the guide pin 10 in the bone hole 52. Next, as shown in FIG. 12, the shaft 24 of the bone peg 20 may be inserted into the bone hole 52 such that the head 22 of the bone peg 20 extends upwardly away from the bone hole 52. As shown in FIG. 12, the outer diameter of the shaft 24 of the bone peg 20 is approximately the same as the inner diameter of the hole 52 in the bone 50. In this context, “approximately the same” means 10% or less difference. As shown in FIG. 13, the bone peg 20 may remain in the bone hole 52 after the guide pin 10 is removed from the bone 50.

[0027] As shown in FIG. 13 and in FIG. 20, when the bone peg 20 is inserted in the hole 52 in the bone 50, the head 22 of the bone peg 20 provides a visual indication of a trajectory of the hole 52 in the bone 50. For instance, since the head 22 of the bone peg 20 extends along the same longitudinal axis as the shaft 24 of the bone peg 20, the head 22 can provide a visual indication of the trajectory of the shaft 24 of the bone peg 20 (which will be the same as the trajectory of the bone hole 52 since the outer diameter of the shaft 24 is approximately the same as the inner diameter of the hole 52).

[0028] Although not shown in the figures, the bone peg 20 may be subsequently removed from the bone hole 52 and a fastener may be installed into the bone hole 52 (along with a suture, a surgical mesh, or other construct for fixation to the bone).

Claims

1. An orthopedic method comprising: (a) inserting a guide pin into a bone, wherein insertion of the guide pin is guided by and passes through a cannulation in a bone peg that is inserted in the cannula of a cutting guide positioned on the bone, the bone peg comprising a shaft and a head; (b) after insertion of the guide pin into the bone, removing the bone peg from the cutting guide; (c) after removal of the bone peg, positioning a cannulated cutter over the guide pin, and using the cannulated cutter to form a hole in the bone, wherein the guide pin guides the formation of the hole in the bone by the cannulated cutter; (d) after forming the hole in the bone, removing the cannulated cutter from the hole; (e) after removing the cannulated cutter from the hole, inserting the shaft of the bone peg into the hole in the bone such that the head of the bone peg extends upwardly away from the hole in the bone.
2. The orthopedic method of claim 1 wherein an outer diameter of the shaft of the bone peg is approximately the same as an inner diameter of the hole in the bone.
3. The orthopedic method of claim 2 wherein both the cutting guide and the guide pin guides the formation of the hole in the bone by the cannulated cutter.

- 4.** The orthopedic method of claim 2 wherein the shaft of the bone peg is inserted into the hole in the bone after the cutting guide is removed from the bone.
 - 5.** The orthopedic method of claim 2 wherein the bone peg remains inserted in the hole in the bone after the guide pin is removed from the bone.
 - 6.** The orthopedic method of claim 1 wherein, when the bone peg is inserted in the hole in the bone, the head of the bone peg provides a visual indication of a trajectory of the hole in the bone.
 - 7.** The orthopedic method of claim 1 wherein, when the bone peg is inserted in the hole in the bone, the bone peg provides a visual indication of the hole in the bone when the bone is imaged using a surgical imaging system.
 - 8.** The orthopedic method of claim 7 wherein, when the bone peg is inserted in the hole in the bone, the bone peg provides a visual indication of a position, a trajectory, and a depth of the hole in the bone when the bone is imaged using the surgical imaging system.
 - 9.** The orthopedic method of claim 1 wherein, when the bone peg is inserted in the hole in the bone, the head of the bone peg resists soft tissue from moving over the hole in the bone.
 - 10.** The orthopedic method of claim 1 wherein, after inserting the bone peg in the hole in the bone, temporarily securing at least one suture to the head of the bone peg.
 - 11.** The orthopedic method of claim 1 wherein, after inserting the bone peg in the hole in the bone, using the head of the bone peg to tension at least one suture.
 - 12.** The orthopedic method of claim 11 wherein using the head of the bone peg to tension the at least one suture comprises rotating the bone peg while it is inserted in the hole in the bone such that the at least one suture winds around the head of the bone peg.
 - 13.** The orthopedic method of claim 1 wherein, after inserting the bone peg in the hole in the bone, removing the bone peg from the hole in the bone and installing a fastener in the hole in the bone.
 - 14.** An orthopedic method comprising: (a) inserting a shaft of a bone peg into a hole in a bone such that a head of the bone peg extends upwardly away from the hole in the bone; (b) wherein the bone peg is cannulated to receive and guide a guide pin.
 - 15.** The orthopedic method of claim 14 wherein, when the shaft of the bone peg is inserted in the hole in the bone, the head of the bone peg provides a visual indication of a trajectory of the hole in the bone.
 - 16.** The orthopedic method of claim 14 wherein, when the bone peg is inserted in the hole in the bone, the bone peg provides a visual indication of the hole in the bone when the bone is imaged using a surgical imaging system.
 - 17.** The orthopedic method of claim 14 wherein, after inserting the bone peg in the hole in the bone, temporarily securing at least one suture to the head of the bone peg.
 - 18.** The orthopedic method of claim 14 wherein, after inserting the bone peg in the hole in the bone, using the head of the bone peg to tension at least one suture.
 - 19.** The orthopedic method of claim 18 wherein using the head of the bone peg to tension the at least one suture comprises rotating the bone peg while it is inserted in the hole in the bone such that the at least one suture winds around the head of the bone peg.
 - 20.** The orthopedic method of claim 14 wherein, after inserting the bone peg in the hole in the bone, removing the bone peg from the hole in the bone and installing a fastener into the hole in the bone.
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