PROVISIONAL PATENT APPLICATION
FOR
JOINT STABILIZING BONE SCREW SYSTEM

FIELD

[0001] The present invention generally relates to medical devices and, more specifically, to a bone screw system configured to provide improved joint stabilization.

FEDERAL RESEARCH STATEMENT

[0002] This invention was made with government support under contract awarded by . The government may have certain rights in the invention.

BACKGROUND

[0003] Patients with neuromuscular conditions often have subluxation of their hip joints. Conventionally, this condition is treated with invasive surgical procedures that cut and realign the proximal femur (osteotomy) and the acetabulum (hip socket) to try to increase joint stability. While these osseous re-alignments are often successful, re-dislocation is not uncommon because the procedure cannot fix the underlying issues related to abnormal muscle tone, pull, and incompetent soft tissues.

[0004] Due to the invasive and morbid nature of the current treatments, guided growth, or using a screw to modify the growth of the proximal femur has been utilized in an attempt at changing the shape of the proximal femur and improve stability. However, like the osteotomies, these guided growth procedures only address the skeletal elements of the instability.

SUMMARY

[0005] This summary section is neither intended to be, nor should be, construed as being representative of the full extent and scope of the present disclosure. Additional benefits, features

and embodiments of the present disclosure are set forth in the attached figures and in the description hereinbelow, and as described by the claims. Accordingly, it should be understood that this Summary section may not contain all of the aspects and embodiments claimed herein.

[0006] Additionally, the disclosure herein is not meant to be limiting or restrictive in any manner. Moreover, the present disclosure is intended to provide an understanding to those of ordinary skill in the art of one or more representative embodiments supporting the claims. Thus, it is important that the claims be regarded as having a scope including constructions of various features of the present disclosure insofar as they do not depart from the scope of the methods and apparatuses consistent with the present disclosure (including the originally filed claims). Moreover, the present disclosure is intended to encompass and include obvious improvements and modifications of the present disclosure.

[0007] The present invention generally relates to a device comprising a cannulated screw configured to receive a spring into an interior volume of the cannulated screw, a first button sized to fit within the interior volume of the cannulated screw over the spring, and a second button. The device includes a flexible and inelastic material attached to the first button and the second button, wherein the flexible and inelastic material is threaded through the interior volume of the cannulated screw and the spring.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention.

[0009] In the drawings:

[0010] FIG. 1 is an exploded view of a joint stability implant device.

[0011] FIG. 2 is a diagram depicting a typical installation of the present joint stability implant device into a patient to provide joint stability.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

[0012] The present invention generally relates to medical devices and, more specifically, to a bone screw system configured to provide improved joint stabilization.

[0013] Patients with neuromuscular conditions often have subluxation of their hip joints. This condition involves a partial (or total) dislocation of the hip joint in which the femoral head is displaced out of the hip socket. This condition is often treated via surgical procedures that involve cutting and realigning the proximal femur (osteotomy) and the acetabulum to try to increase joint stability. Although these surgeries can be successful, re-dislocation is not uncommon due to the factors (e.g., abnormal muscle tone, pull, and incompetent soft tissues) that resulted in the condition in the first place.

[0014] The present disclosure, therefore, provides an implantable device that provides proximal femoral guided growth through the use of a cannulated screw that provides augmented stability through an incorporated flexible and inelastic material. Using the device, hip rotation is controlled by a compressible chamber (e.g., comprising a ball and spring) within the screw. Under such a scenario, the screw of the device acts to guide growth, improving the shape of the proximal femur, while the device provides joint stability utilizing the flexible material traversing the joint. Consequently, the present device allows, but can be configured to constrain rotatory motion of the hip joint through compression and relaxation of the incorporated spring.

[0015] The present implantable device, therefore, can provide growth control of the proximal femur, augment stability of the hip joint, and provide that stability while allowing hip motion. The device, therefore, may be utilized to repair coxofemoral luxation while maintaining sufficient degrees of freedom (e.g., allowing adequate flexion, extension, abduction, adduction, external rotation, internal rotation and circumduction).

[0016] In the present device, a flexible but generally inelastic material (e.g., a suture wire) passes through an entry port of a spherical button and then through the inner diameter of a compression spring that is housed/facilitated within the hollow body of the cannulated screw. The suture wire continues to pass through the remaining inner diameter of the cannulated screw body and out the femoral head where the wire then passes through the socket of the pelvis. The suture wire then passes through and double backs over another button returning through the screw, the spring, and the initial spherical button where a knot is tied to secure the mechanism and fix a loop in the suture wire. The compression spring allows for the maintaining the three degrees of freedom for

a ball and socket joint. The medial button becomes fixated due to compressive forces from the suture wire and spring. As the joint undergoes abduction/adduction and external/internal rotation, the spring compresses within the body of the cannulated screw allowing for joint mobility rather than a single point fixation.

[0017] FIG. 1 is an exploded view of joint stability device 100. Device 100 is made up of button 102, which can be a spherical button referred to as the lateral button, a compression spring 104 (e.g., a stainless steel compression spring), a hollow bodied cannulated screw 106 that is sized to receive and to house compression spring 104 in an interior volume of cannulated screw 106, and button 108 that may be shaped as a rectangular prism. Button 108 can operate as an anchoring mechanism within the pelvis. A loop of flexible but inelastic material 110 (e.g., heavy suture or metal cable) is threaded through device 100 and when forming a loop of fixed size operates to fix the maximum distance between button 102 and button 108.

[0018] In typical use cases, button 108 operates as a medial button that is placed on the inner surface of the pelvis and button 102 operates as a lateral button that is positioned inside hollow bodied cannulated screw 106 and against spring 104. With hollow bodied cannulated screw 106 placed within the femoral head, device 100 provides improved stability of soft tissue in the region. In particular, hollow bodied cannulated screw 106 is configured to house compression spring 104, but prevents spring 104 from passing through hollow bodied cannulated screw 106. In this configuration, compression of compression spring 104 allows for rotation (internal and external) not afforded by sutures that are fixed to the bone.

[0019] FIG. 2 is a diagram depicting a typical installation of device 100 into a patient to provide joint stability. The view of FIG. 2 is exploded to better illustrate the installation of device 100.

[0020] As shown, device 100 can be used to provide stability to a hip joint 200 that includes a femur 202 and pelvis 204. For installation, a hole is formed through the head of femur 202 and the pelvis 204. Hollow bodied cannulated screw 106 is screwed into the hole of femur 202. Button 108 is positioned over the hole formed in pelvis 204, on a surface of pelvis 204 opposite femur 202. Spring 104 is inserted into hollow bodied cannulated screw 106 and button 102 is positioned over compression spring 104 to form a cap on spring 104. Button 102 is sized to be able to enter hollow bodied cannulated screw 106, but cannot pass through compression spring

104. Flexible but inelastic material 110 is threaded through all of the components of device 100 and is tied off to form an inelastic loop of material.

[0021] With device 100 installed, the patient retains the ability to move femur 202 in a rotational movement with respect to pelvis 204. The flexible but inelastic material 110 limits the amount by which the patient can perform hip abduction (i.e., increasing the distance between the femoral head and the pelvis) thereby mitigating the risk of subluxation. However, some abduction is permitted through button 102 applying a compressive force on spring 104.

[0022] In an embodiment of the present disclosure, a device comprises a cannulated screw configured to receive a spring into an interior volume of the cannulated screw, a first button sized to fit within the interior volume of the cannulated screw over the spring, and a second button. The device includes a flexible and inelastic material attached to the first button and the second button, wherein the flexible and inelastic material is threaded through the interior volume of the cannulated screw and the spring.

[0023] The preceding detailed description is merely illustrative in nature and is not intended to limit the embodiments of the subject matter or the application and uses of such embodiments.

[0024] As used herein, the word “exemplary” means “serving as an example, instance, or illustration.” Any implementation described herein as exemplary is not necessarily to be construed as preferred or advantageous over other implementations. Furthermore, there is no intention to be bound by any expressed or implied theory presented in the preceding technical field, background, or detailed description.

[0025] The connecting lines shown in the various figures contained herein are intended to represent exemplary functional relationships and/or physical couplings between the various elements. It should be noted that many alternative or additional functional relationships or physical connections may be present in an embodiment of the subject matter. In addition, certain terminology may also be used herein for the purpose of reference only, and thus are not intended to be limiting, and the terms “first”, “second” and other such numerical terms referring to structures do not imply a sequence or order unless clearly indicated by the context.

[0026] As used herein, a “node” means any internal or external reference point, connection point, junction, signal line, conductive element, or the like, at which a given signal, logic level, voltage, data pattern, current, or quantity is present. Furthermore, two or more nodes may be

realized by one physical element (and two or more signals can be multiplexed, modulated, or otherwise distinguished even though received or output at a common node).

[0027] The foregoing description refers to elements or nodes or features being "connected" or "coupled" together. As used herein, unless expressly stated otherwise, "connected" means that one element is directly joined to (or directly communicates with) another element, and not necessarily mechanically. Likewise, unless expressly stated otherwise, "coupled" means that one element is directly or indirectly joined to (or directly or indirectly communicates with, electrically or otherwise) another element, and not necessarily mechanically. Thus, although the schematic shown in the figures depict one exemplary arrangement of elements, additional intervening elements, devices, features, or components may be present in an embodiment of the depicted subject matter.

[0028] While at least one exemplary embodiment has been presented in the foregoing detailed description, it should be appreciated that a vast number of variations exist. It should also be appreciated that the exemplary embodiment or embodiments described herein are not intended to limit the scope, applicability, or configuration of the claimed subject matter in any way. Rather, the foregoing detailed description will provide those skilled in the art with a convenient road map for implementing the described embodiment or embodiments. It should be understood that various changes can be made in the function and arrangement of elements without departing from the scope defined by the claims, which includes known equivalents and foreseeable equivalents at the time of filing this patent application.

CLAIMS

What is claimed:

1. A device, comprising:

a cannulated screw configured to receive a spring into an interior volume of the cannulated screw;

a first button sized to fit within the interior volume of the cannulated screw over the spring;

a second button; and

a flexible and inelastic material attached to the first button and the second button, wherein the flexible and inelastic material is threaded through the interior volume of the cannulated screw and the spring.

ABSTRACT

A device comprising a cannulated screw configured to receive a spring into an interior volume of the cannulated screw, a first button sized to fit within the interior volume of the cannulated screw over the spring, and a second button. The device includes a flexible and inelastic material attached to the first button and the second button, wherein the flexible and inelastic material is threaded through the interior volume of the cannulated screw and the spring.