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United States Patent	12383319
Kind Code	B2
Date of Patent	August 12, 2025
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Resorptive intramedullary implant between two bones or two bone fragments

Abstract

The invention relates to a resorptive intramedullary implant between two bones or two bone fragments. The implant includes a single-piece body (**1**) having a generally elongate shape and having, at each end, areas for anchoring to the bone portions in question, characterized in that one of said areas (A**1**) has a cylindrical cross-section while the other area (A**2**) has a flat cross-section.

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Appl. No.: **19/023889**

Filed: **January 16, 2025**

Prior Publication Data

Document Identifier	Publication Date
US 20250160913 A1	May. 22, 2025

Foreign Application Priority Data

FR	0856035	Sep. 09, 2008

Related U.S. Application Data

continuation parent-doc US 18770767 20240712 PENDING child-doc US 19023889
continuation parent-doc US 16506353 20190709 US 12059186 20240813 child-doc US 18770767

continuation parent-doc US 14858855 20150918 US 10383671 20190820 child-doc US 16506353
continuation parent-doc US 12918105 US 8414583 20130409 WO PCT/FR2009/051658 20090902 child-doc US 13795946
division parent-doc US 13795946 20130312 US 9168074 20151027 child-doc US 14858855

Publication Classification

Int. Cl.: **A61B17/68** (20060101); **A61B17/16** (20060101); **A61B17/72** (20060101); **A61B17/86** (20060101); **A61B17/88** (20060101); **A61F2/42** (20060101); A61B17/00 (20060101); A61F2/30 (20060101)

U.S. Cl.:

CPC **A61B17/8605** (20130101); **A61B17/1655** (20130101); **A61B17/68** (20130101); **A61B17/7233** (20130101); **A61B17/88** (20130101); **A61F2/4225** (20130101); **A61F2/4241** (20130101); A61B2017/00862 (20130101); A61B2017/681 (20130101); A61B17/7208 (20130101); A61B17/7225 (20130101); A61B17/7266 (20130101); A61B17/7283 (20130101); A61B2017/8655 (20130101); A61F2002/30062 (20130101); A61F2002/30563 (20130101); A61F2002/30622 (20130101); A61F2002/3085 (20130101); A61F2002/30878 (20130101); A61F2210/0004 (20130101)

Field of Classification Search

USPC: None

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS (1) This application is a continuation of U.S. patent application Ser. No. 18/770,767, filed on Jul. 12, 2024, which is a continuation of U.S. patent application Ser. No. 16/506,353, filed on Jul. 9, 2019, now U.S. Pat. No. 12,059,186, which is a continuation of U.S. patent application Ser. No. 14/858,855, filed Sep. 18, 2015, now U.S. Pat. No. 10,383,671, which is a divisional of U.S. patent application Ser. No. 13/795,946, filed Mar. 12, 2013, now U.S. Pat. No. 9,168,074, which is a continuation of U.S. patent application Ser. No. 12/918,105, filed Oct. 29, 2010, now U.S. Pat. No. 8,414,583, which application is a U.S. national phase entry under 35 U.S.C. § 371 of International Application No. PCT/FR2009/051658, filed Sep. 2, 2009, published as WO 2010/029246, which claims priority from French Patent Application No. 0856035, filed Sep. 9, 2008, whose entire disclosures are herewith incorporated by reference.

FIELD OF THE INVENTION
(1) The invention relates to the technical field of orthopedic implants, particularly for arthrodesis and osteosynthesis.
(2) More particularly, the invention relates to an intramedullary implant for arthrodesis between two bone parts or osteosynthesis between two bone fragments, particularly in the case of the hand or foot.
BACKGROUND OF THE INVENTION
(3) Different solutions have been proposed to achieve these functions.
(4) For example, a solution comes from the teaching of patent application FR 2,884,406 [US 2008/0177262], of which the applicant of the present application is also the applicant. This patent describes an intramedullary osteosynthesis device constituted of an elongated body whose ends constitute anchor zones cooperating with the bone parts to be immobilized. The anchor zones are shaped and made of a material selected to enable insertion into the bone parts, then to ensure an anchor in the bone parts by preventing any rotational movement by resisting traction and by maintaining a compression force.
(5) Another solution also comes from patent application FR 07.02003 [US 2010/0131014], also from the same applicant. This document describes an implant in the form of two anchor zones connected by a central zone and whose general shape is substantially inscribed in a very elongated rectangle of X-shape, so as to form in the anchor zones two legs adapted to move apart by elastic or shape-memory effect.
(6) From this design, different criteria have been established to make the implant easy to place and efficient in order to create a primary and secondary stability for the osteosynthesis or arthrodesis site.
(7) However, these solutions are not adapted for the case of an implant made of resorptive material.
BRIEF SUMMARY OF THE INVENTION
(8) From this state of the art, the object that the invention proposes to attain is further improving the anchor and the stability of the implant as well as its adaptation to the morphology of the implantation site when the implant is made of resorptive material.
(9) To solve such a problem, a resorptive intramedullary implant between two bones or two bone fragments has been designed and developed; it is constituted, in a known manner, of a single-piece

body having a general elongated shape with, at each end, zones for anchoring to the bone parts being considered. According to the invention, one of the zones has a cylindrical shape, whereas the other zone is flat.
(10) Advantageously, the implant is made of a resorptive material whose mechanical properties are determined to last the time necessary for the consolidation, so that the implant is resorbed after six months. For example, the implant is composed of lactic acid polymer or copolymer (PLA, PGA . . .).
(11) Considering the specific mechanical characteristics of resorptive materials, and to solve the given problem of improving anchor and stability, the cylindrical cross-section is threaded and tapers in the direction of its free end.
(12) To solve the given problem of enabling a deformation by elasticity, thus causing an expansion adapted to the geometry of the site and to the properties of the material, the flat cross-section zone has, substantially in its median portion, an opening adapted to enable elastic deformation of the zone. The opening defines at least two anchor arms.
(13) It therefore appears that the combination of a cylindrical and threaded anchor zone and a flat-sectioned anchor zone is particularly advantageous considering the problem to be solved.
(14) To solve the given problem of resisting the shear and flexion forces susceptible of occurring in the area of the bone site, between the two anchor zones, the body has a central zone of transition adapted to resist the shear and flexion forces occurring in the area of the bone site and adapted to serve as an abutment.
(15) From this basic design of the implant, the anchor zones are either coaxial or angularly offset by between about 1° and 30° and, advantageously, by 10°. The bend between the anchor zones is located so as to substantially correspond to an arthrodesis line of the bones being considered.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
(1) The invention is explained in more detail hereinafter with reference to the attached drawings, in which:
(2) FIG. **1** is a perspective view of the implant;
(3) FIG. **2** is a front view of the implant before insertion into the bone part in question;
(4) FIG. **3** is a side view corresponding to FIG. **2**;
(5) FIG. **4** is a view like FIG. **2** showing the position of the anchor arms of the flat section after insertion;
(6) FIG. **5** is a perspective view of another advantageous embodiment of the implant;
(7) FIGS. **6** and **7** show the installation of the implant into two bone parts.
DETAILED DESCRIPTION
(8) The implant according to the invention has a one-piece body **1** of elongated shape and having a first proximal zone A**1** and a second distal zone A**2**. The entire implant body is made of a resorptive material whose mechanical properties are determined for the implant to be resorbed in no less than about 6 months. In one embodiment, the implant is composed of lactic acid polymer or copolymer (PLA, PGA . . .).
(9) As will be described later in the description, the zones A**1** and A**2** have anchor formations for the respective bone parts. Taking into account the specific characteristics of the resorptive material and to attain the given object of anchor and stability, the zone A**1** is of a cylindrical shape section whereas the other zone A**2** is flat.
(10) The zone A**1** has a generally cylindrical outer surface **1***a* with a limited taper toward its free end. The surface **1***a* has a helical rib forming a screwthread **1***a***1**.
(11) The zone A**2** is flat and has substantially in its center, an opening **1***b* adapted to enable elastic

deformation of the zone A**2**. More particularly, the opening **1***b* defines at least two anchor arms **1***c* and **1***d*, each having at least one outwardly projecting tooth **1***c***1**, **1***d***1**.
(12) Advantageously, between the two zones A**1** and A**2** the body **1** has a central zone C for transition adapted to resist shear and flexion forces that can occur at the end of a bone. By way of nonlimiting example, this median zone C can have a length of about 3.5 mm and a thickness of about 2 mm, for an overall implant length comprised between about 15 and 25 mm and a diameter of about 2 or 3 mm at the zone A**1**.
(13) In the embodiment shown in FIG. **1**, the two zones A**1** and A**2** are coaxial.
(14) To solve the problem of adaptation to the shape of the implantation site, the anchor zones A**1** and A**2** can be offset at an angle α adapted to the geometry of the bone site. This angle α is comprised between about 1° and 30° and, advantageously, on the order of 10° when the implant is for foot arthrodesis (FIG. **5**).
(15) In this embodiment in which the two anchor zones are angularly offset, the bend is located so as to correspond substantially to the arthrodesis line of the bone parts being fused.
(16) FIGS. **6** and **7** schematically show the positioning of the implant according to the invention between two bone parts O**1** and O**2**. After suitable holes have been made in the bone by a rasp-type tool, the operator screws the thread **1***a* into the bone part O**1** substantially up to the median zone C that serves as abutment preventing the implant from sinking too deeply into the bone (FIG. **6**). The operator then fits the second bone part O**2** back onto the anchor arms **1***d* and **1***c* of the zone A**2**, the anchor arms then spread and tighten by elasticity (FIG. **7**).
(17) The operative technique can be the following: Drilling of the two holes with a conventional drill; Preparation of the holes with a rasp for the flat side and a bone tap to form the inner screw thread on the cylindrical side; Use of a screwdriver with a gripper end; Screwing in the cylindrical side P**1** [A**1**] for an arthrodesis IPP of the foot; Fitting of the bone back onto the flat side [A**2**] of the implant.
(18) The advantages are readily apparent from the description; in particular, it is to be emphasized and understood that the combination of the two anchor zones A**1** and A**2** of cylindrical and a flat shape, respectively, significantly enhances anchor and stability of the implant adapted to the geometry of the bone site and to the material properties, namely, a resorptive material.

Claims

1. A method for fixing first and second bone parts, the method comprising the steps of: drilling a first hole in a first bone part; drilling a second hole in a second bone part; tapping the first hole; threading a first end of a monolithic implant into the first hole until a step abuts the first bone part; moving first and second anchor arms of a second end of the implant towards one another, the first anchor arm including first and second teeth extending in a first direction and the second anchor arm including third and fourth teeth extending in a second direction different from the first direction; and fitting the second end into the second bone part.
2. The method of claim 1, wherein during the fitting step, the first and second anchor arms move away from one another.
3. The method of claim 1, further comprising the step of preparing the second bone part with a rasp prior to fitting the second end of the implant into the second bone part.
4. The method of claim 1, wherein the second end has an opening in a median portion thereof adapted to enable elastic deformation of the first and second anchor arms, and wherein the first and second anchor arms are in a compressed state while the second end is being fitted into the second bone part, the first and second anchor arms move away from each other once fitted within the second bone part.
5. The method of claim 1, wherein the intramedullary implant includes a longitudinal axis and the step defines a plane substantially perpendicular to the longitudinal axis.

6. The method of claim 1, wherein the fitting step includes fitting a first flat portion of the first tooth, a second flat portion of the second tooth, a third flat portion of the third tooth and a fourth flat portion of the fourth tooth within the second bone part.
7. The method of claim 6, wherein the first, second, third and fourth flat portions are coplanar.
8. The method of claim 1, wherein the first end tapers in a direction away from the second end.
9. The method of claim 1, wherein an opening is formed between the first and second anchor arms to permit the first and second anchor arms to move with respect to each other.
10. The method of claim 1, wherein the moving step includes elastically deforming the first and second anchor arms.
11. The method of claim 1, wherein the first and second ends are offset from each other.
12. A method for fixing first and second bone parts, the method comprising the steps of: drilling a first hole in a first bone part; drilling a second hole in a second bone part; tapping the first hole; rasping the second hole; rotating a first end of a monolithic implant to thread the first end into the first hole until a step abuts the first bone part; elastically deforming first and second anchor arms of a second end of the implant towards one another, the first anchor arm including first and second teeth extending in a first direction and the second anchor arm including third and fourth teeth extending in a second direction different from the first direction; and fitting the second end into the second bone part.
13. The method of claim 12, wherein during the fitting step, the first and second anchor arms move away from one another.
14. The method of claim 12, wherein the second end has an opening in a median portion thereof adapted to enable elastic deformation of the first and second anchor arms, and wherein the first and second anchor arms are in a compressed state while the second end is being fitted into the second bone part, the first and second anchor arms move away from each other once fitted within the second bone part.
15. The method of claim 12, wherein the intramedullary implant includes a longitudinal axis and the step defines a plane substantially perpendicular to the longitudinal axis.
16. The method of claim 12, wherein the first tooth includes a first flat portion, the second tooth includes a second flat portion, the third tooth includes a third flat portion and the fourth tooth includes a fourth flat portion.
17. The method of claim 16, wherein the first, second, third and fourth flat portions are coplanar.
18. The method of claim 12, wherein the first end tapers in a direction away from the second end.
19. The method of claim 12, wherein the elastically deforming step includes moving the first and second anchor arms with respect to each other about an opening formed therebetween.
20. The method of claim 12, wherein the first and second ends are offset from each other.