CUSTOM MADE IMPLANT FROM BIORESORBABLE MATERIALS FOR INTERNAL FIXATION OF LONG BONE FRACTURES

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INTRODUCTION

The invention relates to a process for obtaining a unique, biodegradable, customized implant for the internal fixation of long bones, whose physical properties are predetermined by controlling the specific geometric parameters of the holes on its surface.

The implant meets the mechanical and biological requirements for bone regeneration and eliminates the need for secondary surgery, being a less invasive method for internal fixation of long bone fractures.

The technical problem is solved by obtaining a customized cylindrical bone fixation product, which can be made of polymeric, ceramic or bioresorbable composite materials, in a one-component or two-component way, with holes on the implant surface of different geometries and sizes and holes specific for screw fixing.

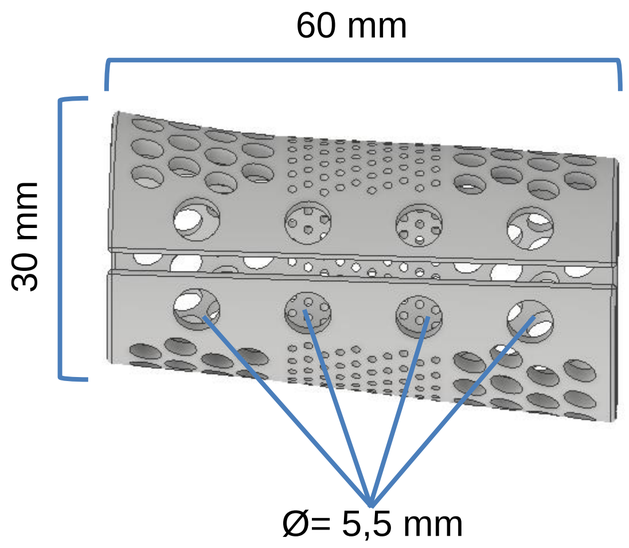
INTRODUCERE

Invenția se referă la un proces pentru obținerea unui implant unic biodegradabil, personalizat, pentru fixarea internă a oaselor lungi, ale cărui proprietăți fizice sunt predeterminate prin controlul parametrilor geometrici specifici ale gaurilor de pe suprafata acestuia.

Implantul îndeplinește cerințele mecanice și biologice necesare regenerării osoase și elimină necesitatea unei intervenții chirurgicale secundare, fiind o metodă mai puțin invazivă pentru fixarea internă a fracturilor osoase lungi.

Problema tehnică este rezolvată prin obținerea unui produs de fixare osoasă de formă cilindrică, personalizat, care poate fi realizat din materiale polimerice, ceramice sau compozite bioresorbabile, într-un mod monocomponent sau bicomponent, cu găuri pe suprafața implantului de diferite geometrii și dimensiuni și găuri specifice pentru fixarea cu șuruburi.

3D scanning through optical methods of an induced fractured animal bone



CONCEPTUAL DESIGN

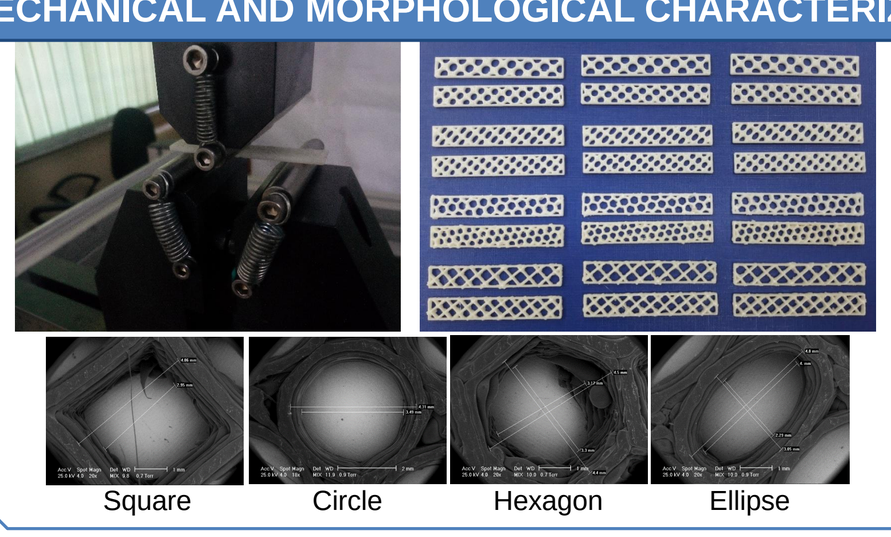
Cylindrical implant that mimics the natural profile of the bone, specific to each patient, designed to surround the bone and cover the fragmented section and an additional segment without defects that allows fixing with screws (providing adequate mechanical strength). Depending on the complexity of the structure, there are monocomponent and two-component types of implants.

CAD DESIGN OF THE IMPLANT

The surface of the implant is provided with holes of different sizes (between 1 mm and 5 mm) and various geometries (square, hexagon, ellipse or circle), at an angle of inclination between 20˚ and 40˚ from the vertical, with a distance between the holes from 0.5 mm to 1 mm.

The middle area of 30 mm, corresponding to the fracture area of the bone, may be compact or with small circular holes (1 mm), at a distance of 0,5 mm and an inclination of 20˚, opposite the direction of the large holes.

MECHANICAL AND MORPHOLOGICAL CHARACTERIZATION



Square
L_{holes} = 4 mm

Hexagon
L_{holes} = 4 mm

Ellipse
$Ø_{1\ holes}$ = 4 mm
$Ø_{2\ holes}$ = 3 mm

Circle
$Ø_{holes}$ = 4 mm

Monocomponent implants

Ellipse
$Ø_{1\ holes}$ = 3 mm
$Ø_{2\ holes}$ = 4 mm

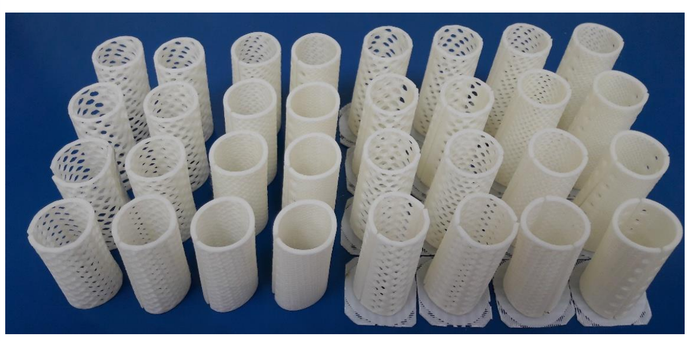
Circle
$Ø_{holes}$ = 2 mm

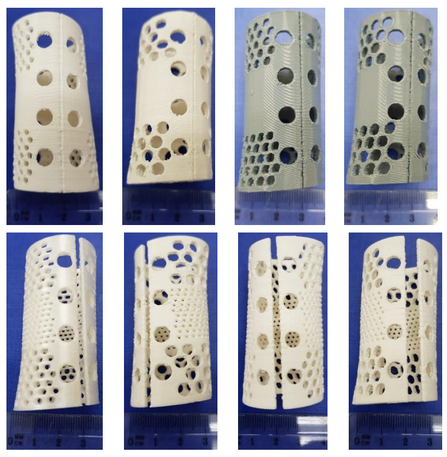
Ellipse
$Ø_{1\ holes}$ = 2 mm
$Ø_{2\ holes}$ = 3 mm
$Ø_{middle\ holes}$ = 1 mm

Circle
$Ø_{holes}$ = 4 mm
$Ø_{middle\ holes}$ = 1 mm

Bicomponent implants

FDM 3D PRINTING OF DIFFERENT MODELS





Finite Element Simulation and numerical modeling of mechanical stresses applicable to long bone fixators.

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