Increasing the Osseoinduction of Ti6Al7Nb Tibia Implant by Surface Treatment and “in vivo” Application

Julia C. Mirza Rosca[1] , Pedro P. Socorro Perdomo[1],Nestor R. Florido Suarez[2],Tomás Gil López[3]

[1]*Mechanical Engineering Department, University of Las Palmas de Gran Canaria, Julia.mirza@ulpgc.es*

[2]*Processing Engineering Department, University of Las Palmas de Gran Canaria,*

[3]*Mechanical Engineering Department, Polytechnic University of Madrid.*

Keywords:

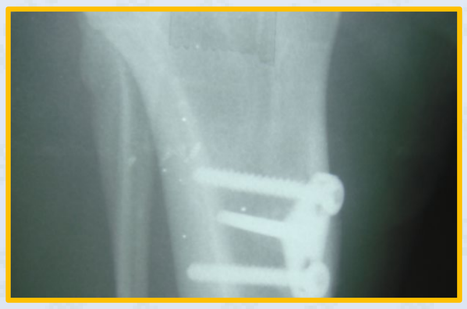
Biomaterials, corrosion, electrochemical, orthopedic

ABSTRACT

Animals such as rats, guinea pigs, rabbits, dogs, sheep, goats, pigs and others with a relatively long life expectancy are suitable for long-term testing of subcutaneous tissues, bones and muscles. Pigs are one of the preferred species as they have organs and osseointegration times similar to humans and this is one of the main reasons why the minipig has been chosen as an experimental animal in our study, mainly focused on analyzing the behavior "in vivo" of a titanium alloy plate Ti6Al7Nb with nanostructured surface, from the point of view of its osseointegration and its toxicity.

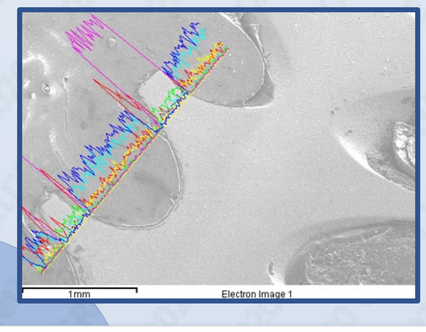
EQUIPMENT

Radiography of the implant



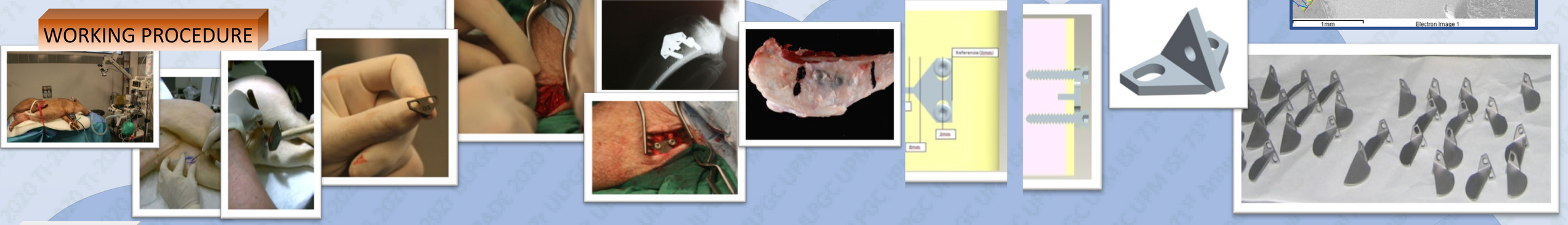
In this study, the implant was designed so that implantation is simple and as minimally invasive as possible, in the tibia, ensuring optimal bone-implant contact as well as load transmission (bone growth induction).

Metal-implant interface analysis



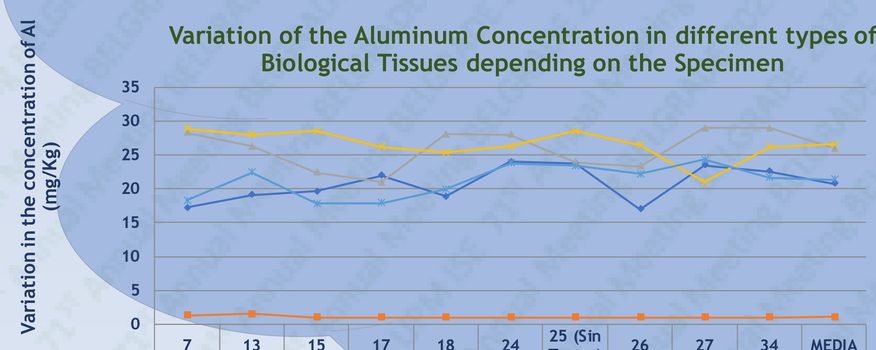
The study of the bone-implant interface of the samples from the experimental animals shows that elements belonging to the mineral part of the bone tissue (calcium, phosphorus) have been found. The average of the results obtained from the Ca/P ratio that have been analyzed for each animal allow us to confirm that there is bone growth.

WORKING PROCEDURE

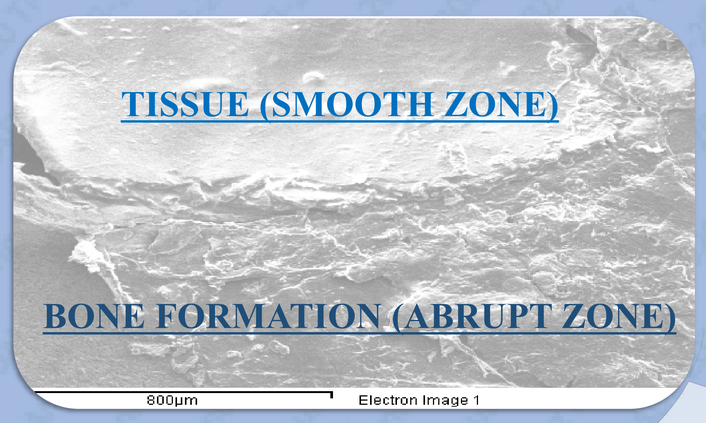


RESULTS

Variation of the Aluminum Concentration in different types of Biological Tissues depending on the Specimen

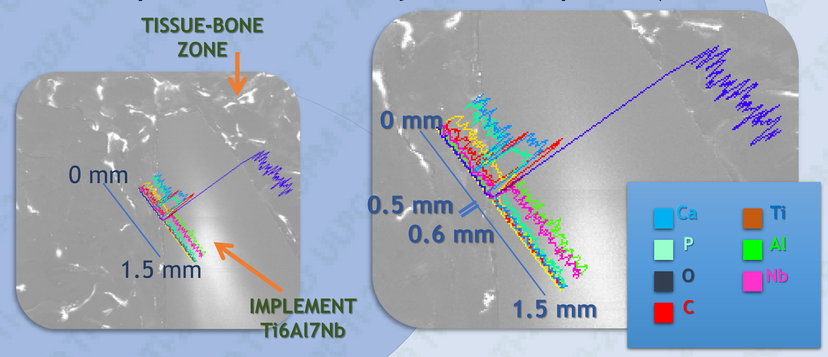


	7	13	15	17	18	24	25 (Sin Tratar)	26	27	34	MEDIA
BRAIN (mg/kg)	17,2	19,1	19,6	22	18,9	24	23,8	17	23,5	22,6	20,77
FAT (mg/kg)	1,3	1,5	1	1	1	1	1	1	1	1	1,085
KIDNEY (mg/kg)	28,3	26,3	22,4	21	28,1	28	23,9	23,3	29	29	25,93
BAZO (mg/kg)	28,9	28	28,5	26,2	25,4	26,3	28,5	26,5	21	26,2	26,55
LIVER (mg/kg)	18,3	22,4	17,8	17,9	19,9	23,8	23,4	22,2	24,3	21,7	21,37



CHEMICAL MICROANALYSIS

Bone to implant interface analysis in the tip area (1.5 mm scan)



ZONA 1: BONE FPORMATION, Ca, P, O y C (0 mm-0.5 mm)

ZONA 2: INTERPHASE, C y O (0.5 mm-0.6 mm)

ZONA 3: IMPLANTE, Ti, Al, Nb (0.6 mm- 1.4 mm)

Studies using the atomic absorption spectropy technique indicate that the proportion of aluminium that can affect humans due to the diffusion of this element when wearing an implant is insignificant and cannot be considered harmful compared to daily consumption through food intake or other factors.