THE INFLUENCE OF THE DEGRADATION PROCESS ON THE PLA/TCP LOCKING BOLT THREAD STRENGTH AS A PART OF INTRAMEDULLARY LOCKING NAIL SYSTEM

K.Gryń*, B.Szaraniec, M.Ziąbka, A.Morawska-Chochół, J.Chłopek

AGH-University of Science and Technology,
Faculty of Material Sciences and Ceramics,
30 Mickiewicza Ave, 30-059 Krakow, Poland
*MAILTO: kgryn@agh.edu.pl

Abstract

Intramedullary nailing has received increased attention for the treatment of distal femoral fractures. There are many types of nailing systems commonly used. Among them there is locked intramedullary nailing, which combines closed nailing with a special locking piece (bolt), which expands distal part of a nail and anchoring it when a central screw is tightened. Compared to other interlocking nail systems it is very effective and not so invasive way of fractured long bone treatment. However, it is not perfect and has one major disadvantage related to material (metal) and necessity of removing all parts of the system after the bone is recovered. The biggest issue is connected with the locking piece removal. That is why there was a need to find a material for this piece which is biodegradable and strong enough to maintain its mechanical function at the same time.

Poly-L-lactide (PLA) is nowadays one of the most used bioabsorbable materials. Unfortunately, this polymer may not meet some application requirements due to inadequate mechanical properties and its degradation characteristics. One of the easiest ways to overcome these obstacles is to introduce an inorganic phase into the polymer matrix to create a composite.

In this article a production method of a biodegradable composite (PLA/TCP, 90/10) locking piece of an interlocking intramedullary nail called "OLIVE" and the influence of degradation process in simulated physiological conditions (H2O, PBS) on its mechanical properties is shown. Main stress was placed on the inner thread strength to discover how it changes with time. A special device for mechanical testing machine imitating working conditions was fabricated.

Based on SEM observations, pH and electric conductivity monitoring after 14 days no degradation was found. However, mechanical testing shown, that after incubation for such period of time the material was more ductile. Instead of cracking, what was observed for not incubated samples, they changed their shape during the testing process. Nevertheless, it didn't radically influence on the inner thread strength and didn't change mechanical function of the olive. No inner thread destruction was discovered contrary to a metallic screws which in all cases were broken. Preliminary results indicate that proposed composite and an implant made of this material might be used as a locking piece in a locked intramedullary nailing system.

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INFLUENCE OF THIN FILMS OF BIOGLASS AND HYDROXYAPATITE MIXTURE DEPOSITED BY PLD METHOD ON BIOACTIVITY OF FOAM TITANIUM IMPLANTS

W.Mróz[1], B.Budner[1], R.Załęczny[1], A.Bombalska[1], K.Niedzielski[2], M.Łączka[3], A.Ślósarczyk[3], K.Cholewa-Kowalska[3], T.E.L.Douglas[4], D.Schwarze[5]

[1] Military University of Technology,
Institute of Optoelectronics,
2 Gen.S.Kaliskiego Str., 00-908 Warsaw, Poland
[2] Medical University, Department of Orthopaedics,
Polish Mother Memorial Hospital,
281/289 Rzgowska Str., 93-338 Lodz, Poland
[3]AGH– University of Science and Technology
Faculty of Material Science and Ceramics,
30 Mickiewicza Ave, 30-059 Kraków, Poland
[4] Ghent University,
Polymer Chemistry and Biomaterials (PBM) group,
Campus Sterre, building S4,
Krijgslaan 281, 9000 Gent, Belgium
[5] SLM Solutions GmbH, Roggenhorster Strasse 9c,
23556 Lübeck, Germany

Abstract

The introduction of different bioelements into the structure of hydroxyapatite exerts a positive influence on the growth of new bone tissue. One such useful bioelement is silica, which possesses antibacterial properties and also acts as a factor regulating bone mineralization through stimulation of DNA to synthesize osteoblasts.

Results of investigations into integration of foam titanium implants (FTI), with rabbit bone are presented. Two groups of implants were investigated: clean titanium implants produced by selective laser melting and FTI coated with a thin film of hydroxyapatite (HA) mixed with 10 wt. % of bioglass (BG) of A2 type (CaO-P_2P_5-SiO_2). Analysis of histopathology of implants' integration with bone were performed by staining using the triple chromatographic method of Masson - Goldner, planimetric analysis using the Kruskal - Wallis test, an ANOVA test and microtomography. Application of layers of the type HA+GH showed superior integration with bone than uncoated titanium implants.

Key words: *PLD, foam titanium implants, in vivo, HA, bioglass*

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