

Design and Realization of Semi-Manual Beads Template System to Produce Antibiotic-Loaded PMMA Beads

Hermawan N. Rasyid¹, Soegijardjo Soegijoko²

¹Department of Orthopaedic and Traumatology, Faculty of Medicine Universitas Padjadjaran / Hasan Sadikin General Hospital, Bandung, Indonesia

²Biomedical Engineering Program, School of Electrical Engineering and Informatics, Institut Teknologi Bandung, Indonesia

Email: hermawan_nr@yahoo.com

Abstract. This article describes the design and realization of a relatively simple template system for antibiotic-loaded polymethylmethacrylate (PMMA) beads to provide good antibiotic release. The template system has been designed to semi-manually produce antibiotic-loaded PMMA beads in almost spherical shape and regular diameter of 8 mm. All 30 beads will be tied together by a flexible stainless steel wire 0.8 mm in diameter. The technique and extent of mixing of antibiotic with cement base greatly affects the distribution of drug throughout the cured cement and likely to cause major variations in the amount of drug subsequently released. Mixing of the polymer and antibiotic powder components should be meticulous and in similar light pressure inside the beads. The system consists of a Polytetrafluoroethylene (PTFE) ring as a beads template and a stainless steel ring part as a compression structure. There are 30 holes with a spherical shape inside the PTFE part, to produce 30 almost regular shapes of antibiotic beads. This system should be heated during sterilization in the autoclave and hardening process of polymerization. The experimental results show that this system is able to produce 30 pieces of 8 mm antibiotic beads and connected to each other by a flexible stainless steel wire. In conclusion, by adjusting the PTFE rings and compressed by stainless steel rings can produce good spherical shape beads. Therefore, it is expected that the beads template system will be able to yield good antibiotic-loaded beads with higher porosity and better antibiotic release.

Keywords: antibiotic-loaded PMMA beads, beads template, higher porosity, spherical shape

1. Introduction

The concept of local antibiotic therapy in the form of antibiotics impregnated in bone cement to treat infected arthroplasties was introduced in the 1970s.[1] On the basis of the success in using this method to reduce arthroplasty infections, interest developed in applying antibiotic-impregnated cement as a therapy for osteomyelitis.[2-4] Osteomyelitis is characterized by progressive inflammatory bone destruction. [5] In general, chronic osteomyelitis is unable to be eradicated solely by intravenous administration of antibiotics. [6] In 1979, gentamicin-loaded cement beads were first used to fill the dead space created by debridement of infected bone.[1] **The invention of antibiotic-loaded PMMA beads for local delivery of antibiotics made an enormous impact on the treatment of chronic osteomyelitis.** [7],[8] Since then it has been used routinely in clinical practice to treat chronic osteomyelitis.

Up to now, orthopedic surgeon makes the beads himself by mixing PMMA-components with antibiotics, hand-rolling them during surgery, targeting on beads with a spherical shape and diameter of 7 mm, similar to the commercial beads. Using of these beads is an established method to deliver antibiotics into a wound in a well defined way, in a dosage that is high enough concentration to sterilize the cavity. The disadvantage of this method is the variation