NEW MODELS OF BIOABSORBABLE IMPLANTS USED IN ORTHOPAEDIC AND MAXILO-FACIAL SURGERY

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Abstract - In the last years, at European and international level, there is an important increase in the interest for patient protection and quality of life. The use of bioabsorbable implants in orthopaedic surgical procedures is becoming more frequent. Advances in polymer science have allowed the production of implants with the mechanical strength necessary for such procedures. Bioabsorbable materials have been utilized for the fixation of fractures as well as for soft-tissue fixation. These implants offer the advantages of gradual load transfer to the healing tissue, reduced need for hardware removal, and radiolucency, which facilitates postoperative radiographic evaluation.

Keywords – orthopaedic, maxillo-facial surgery

Introduction:

By definition, bioabsorbable implants are degraded in a biologic environment, and their breakdown products are incorporated into normal cellular physiologic and biochemical processes. These materials must also be biocompatible, with degradation products that are well tolerated by the host with no immunogenic or mutagenic tendency. In addition, for musculoskeletal applications, these materials must maintain adequate strength and not degrade too rapidly, so that fixation is not lost before adequate healing can occur.

The perfect bioabsorbable material for orthopaedic use would initially have mechanical characteristics equal to those of standard stainless steel implants. It would degrade with the healing process so that load is gradually transferred to the healing tissue. The currently available polymers still do not have mechanical characteristics equal to those of metal implants, but improvements continue to be made, particularly with the use of reinforcing techniques.

In Orthopaedics bioabsorbable materials are used for:

- Bone cements,
- Bone defect fillers,
- Fracture fixation plates,
- Artificial tendons and ligaments.

Bioabsorbable Implants

In the project was proposed implant models for ankle, for Ulna and Radius and interference screws. Ankle plates allow the fixing of fibula to tibia. The shapes of implant plate are design to allow 6 or 8 holes for screws fixation. The holes arrangement is made to obtain the best fixation and strength of the fixture.

![Fig. 1. Ankle implant plate](image)

The fixing screws can be mono cortical, with diameter of 2.8mm and lengths of 8mm, or bi cortical with diameter of 2.8mm-3.1mm and lengths of 10 to 40mm. The fixing screws are made also from bioabsorbable materials. Radius implants (fig.2.) are design in 2 kinds of dimensions.
New models of bioabsorbable implants used in orthopaedic surgery

The big implant plate has 60mm length and 28 mm large. The small implant plate has 48mm length and 23mm large.
The selection of which kind of implant plate will be made according to patient anatomic dimensions. The shape of the implant plate can be performed to the bone shape using worm solutions during the surgery. In this way the firm contact of bone fragments had been assured.
The implant plate allows threw 11 holes (or 9 holes in the smallest plate) the fixing of bone fragments. One of the holes is design with lengthened shape which allow the approach until the contact is firm and lock in that position. (Fig. 3)

After fracture reduction the other screws are introduced to assure a firm final position (fig. 4)

The ulna plates (fig. 5) are design for the left and right side and allow the fixture with 6 screws.

The pre shape and fixing style is the same with the radius implant plates. The material allows making supplementary holes if it is necessary for a good fixing.
For ligaments restore surgery was design a set of interference screws. (Fig. 6).
The diameter of design interferential screws is between 7mm and 10mm and depends of anatomical patients dimensions. The lengths can be 23mm, 25mm or 30mm.

The interferential screws are design with 12mm depth recessed hexagonal hole for screws / unscrews. This depth allows the guidance of the screws with the insert instrument. The screws shape is conical with round edge and the propeller pitch of the screw is 1.9mm.

Triangulate thread with an angle of 75\(^\circ\) is placed different from the perpendicular screw axe. This allows being easily place in the desire position and preventing his pullout.

The materials from witch are design the bioabsorbable implants a biocompatible bioabsorbable polymers obtains by Politechnica University, Chemistry Department, partner in the project.

Conclusions

It is not uncommon to remove metal implants during a second surgery as a result of implant breakage, migration, palpability, or tissue irritation. Also, metal implants are very stiff and tend to off-load the bone near the implant, causing local osteoporosis. Even if a long-term metal implant is relatively benign, the presence of metal can complicate tumor treatment, obscure radiographs, and make future revision surgeries more difficult. While metal implants continue to serve a valuable and necessary purpose, resorbable implants can be a useful addition to your armamentarium. A resorbable implant that is eliminated by the body after healing has occurred should preclude implant removal surgery.

Resorbable implants offer a temporary solution to a temporary problem! Moreover, the benefits offered by bioresorbable implants over their metal counterparts are expected to boost their use among surgeons. Among the perceived advantages is the averting of a second surgery to remove screws as well as obviating the problems caused by metal implants during post-operative radiological examinations such as MRI/CT.

Orthopaedic surgeons are increasingly transferring their allegiance from allograft and autograft bone grafts to synthetic bone graft substitutes. Accordingly, the fastest growing sub-segment is likely to be the application of absorbable and erodible biomaterials as synthetic bone graft alternatives.

Another sub-segment poised to register significant growth is likely to be absorbable fracture fixation devices. Herein, growing sales of absorbable plates and screws for use in traumatology and craniomaxillofacial surgery are expected to provide the principal thrust to expansion.

References


