

## NEW TECHNOLOGIES IN HEALING BONES

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The article is about Biomaterial Science, the new frontier in biodegradable devices for assisting bone healing and a bioabsorbable implant as an innovation that is worth speaking about.

The worst part of breaking a bone (besides the pain) is the healing process. Wearing an uncomfortable cast can be irritating and aggravating, making it harder to move around for months at a time. After a bone is broken, there is a fast inflammatory response where blood clots and specialized cells are quickly attracted to the fracture site. These cells encourage a cascade of proteins, hormones and other cells to create new bone. The key to the biomaterial is its surface structure, which is coated by a special arrangement of polymers that attract the right proteins to the wounded bone. There are polymers that attract proteins and those that repel them. By getting the right balance we can attract and repel the right proteins to create bones. Under laboratory conditions the biomaterial induces the proteins and hormones needed for the initial inflammatory response. If you fracture your ankle, you might need pins to fasten the bones together while they mend, you have options available to you in the material that can be implanted. Some of the instances where you may want to consider options are allergies to metal components, already fragile health or other medical issues that might make a metal implant less suitable for you. It is something you might want to discuss with your surgeon.

For decades now, besides metal pins and screws, there is the option of having bioabsorbable devices implanted that are gradually replaced by your own bone as the implants are absorbed by your own body and eliminated from your system by normal body functions. No surgical removal required. It is like a high tech heavy-duty dissolving suture. Prior to 1984, the only option was to use metal pins that could be surgically implanted to hold the bone fragments together until the fracture was healed. They are still in use; the new bioabsorbable implant technology has not replaced them, but has created options

where none existed before. A metal implant stays permanently in place. Once you have one, it will always be there unless there is a problem with the implant. In such cases, the metal implant would have to be surgically removed. That changed when in 1984, the first bioabsorbable implant created after years of research at Tampere University of Technology was successfully implanted into a human bone fracture. A female patient at the Helsinki University Hospital was the world's first recipient. Since that time, this technology has been part of an alternative approach for repairing bone fractures.

Metal implants are made with cobalt, chrome, stainless steel and titanium. These metals contain traces of other metals as part of the alloys they are made of. Alloys are needed to give certain characteristics to the metal. It is rare; however, there is a slight risk that allergies could develop in sensitive patients. Two of the metals that can be used as alloys are aluminum and nickel. As noted, allergies are rare, but can occur.

Many different types of bioabsorbable implants have been developed, but the originators of this innovative technology are still researching and innovating their product. The original team is now a company called Biorectec, still based in Tampere. Biorectec's ActivaNail is manufactured with lactic/glycolic acid copolymer. The implant degrades over time by hydrolysis into alpha-hydroxy acids, which are metabolized and eliminated by the body. When the degradation is complete, the body will have provided new bone growth in the area of the implant, completely replacing it.

Biorectec has just recently developed a new generation of bioabsorbable implant that incorporates antibiotic in the implant material in manufacture. The antibiotic is gradually released over a long period of time. This innovation called "CiproScrew", is helpful in patients who are at risk for infection at the site of the implant. Diabetics would be one class of patients where this is beneficial since diabetics are generally slow to heal and infection is a definite risk in any surgical procedure. Others that would benefit are those patients with the following conditions: the elderly, smokers and those with immune compromised conditions.

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