# Materiały z pamięcią kształtu

- **Medicine**
- Shape memory alloys are applied in medicine, for example, as fixation devices for osteotomies in orthopaedic surgery, in dental braces to exert constant tooth-moving forces on the teeth and in stent grafts where it gives the ability to adapt to the shape of certain blood vessels when exposed to body temperature.
- **Optometry**

- Eyeglass frames made from titanium-containing SMAs are marketed under the trademarks Flexon and TITANflex. These frames are usually made out of shape memory alloys that have their transition temperature set below the expected room temperature. This allows the frames to undergo large deformation under stress, yet regain their intended shape once the metal is unloaded again. The very large apparently elastic strains are due to the stress-induced martensitic effect, where the crystal structure can transform under loading, allowing the shape to change temporarily under load. This means that eyeglasses made of shape memory alloys are more robust against being accidentally damaged.
- **Orthopaedic surgery**

- This section **needs attention from an expert on the subject**. See the talk page for details. WikiProject Medicine or the Medicine Portal may be able to help recruit an expert. *(February 2009)* Memory metal has been utilised in orthopaedic surgery as a fixation device for osteotomies, typically around the foot and ankle. The device, usually a staple, is stored in a refrigerator in its malleable form and is implanted into pre-drilled holes in the bone across an osteotomy. As the staple warms it returns to its non-malleable state and compresses the bony surfaces together to promote union of the osteotomy.
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- **Dentistry**
- The range of applications for SMAs has grown over the years, a major area of development being dentistry. One example is the prevalence of dental braces using SMA technology to exert constant tooth-moving forces on the teeth; the nitinol archwire was developed in 1972 by orthodontist George Andreasen.[8] This revolutionized clinical orthodontics and has also had an effect on fiber optic development. Andreasen's alloy has a patterned shape memory, expanding and contracting within given temperature ranges because of its geometric programming.
- Harmeet D. Walia later utilized the alloy in the manufacture of root canal files for endodontics.
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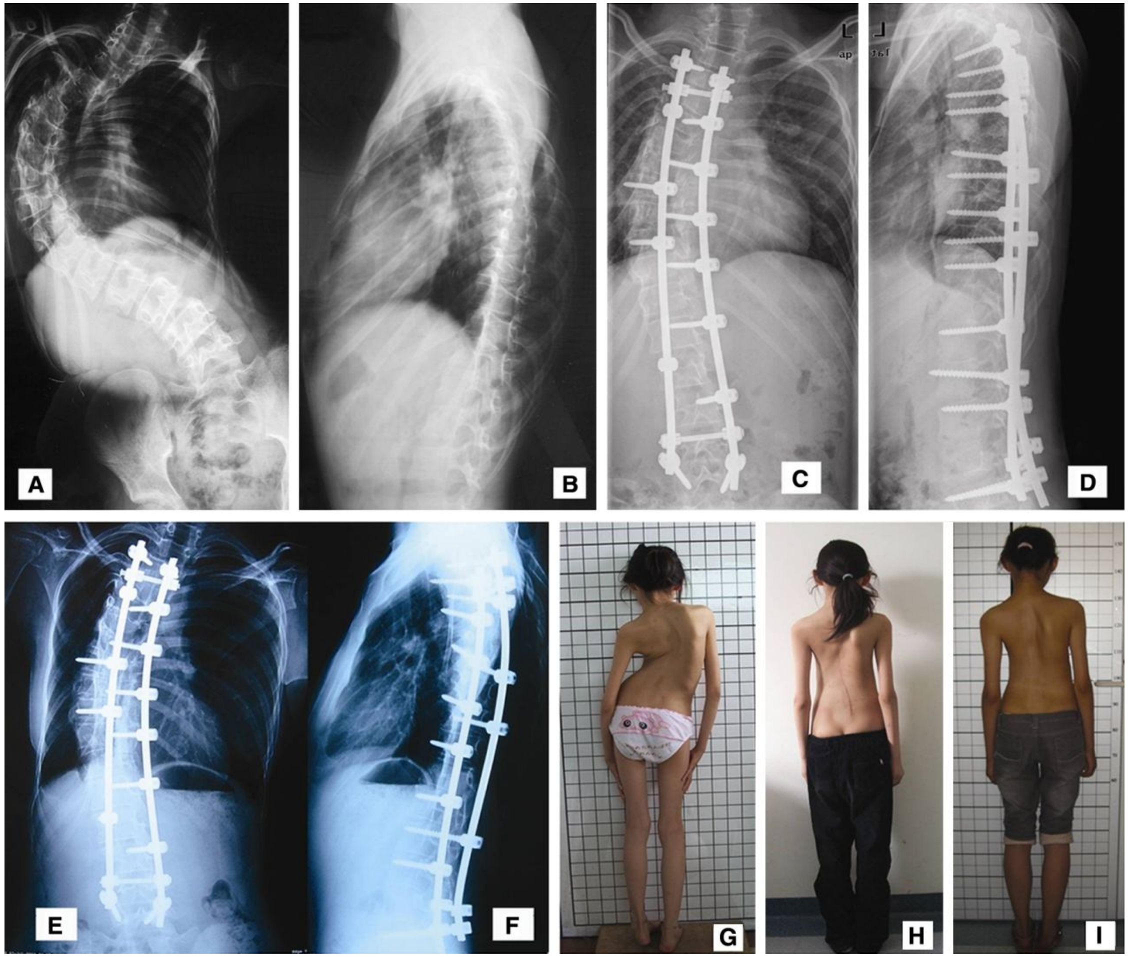
  Read more: http://www.answers.com/topic/shape-memory#ixzz1DBUG2kYp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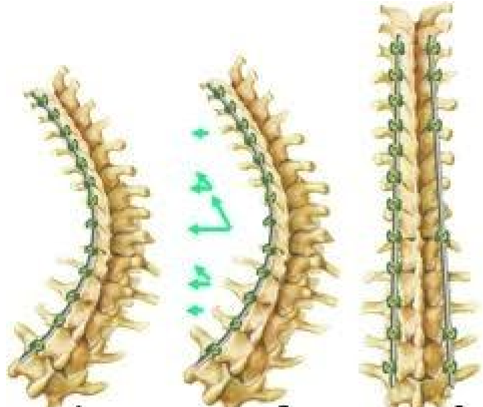

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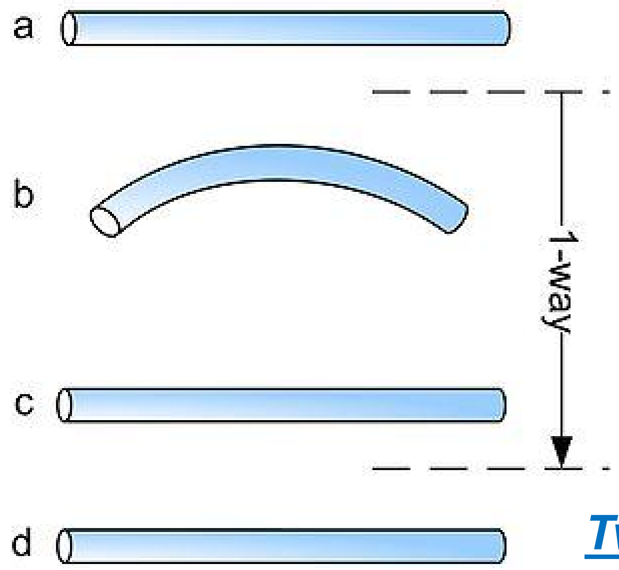
# Efekty pamięci kształtu



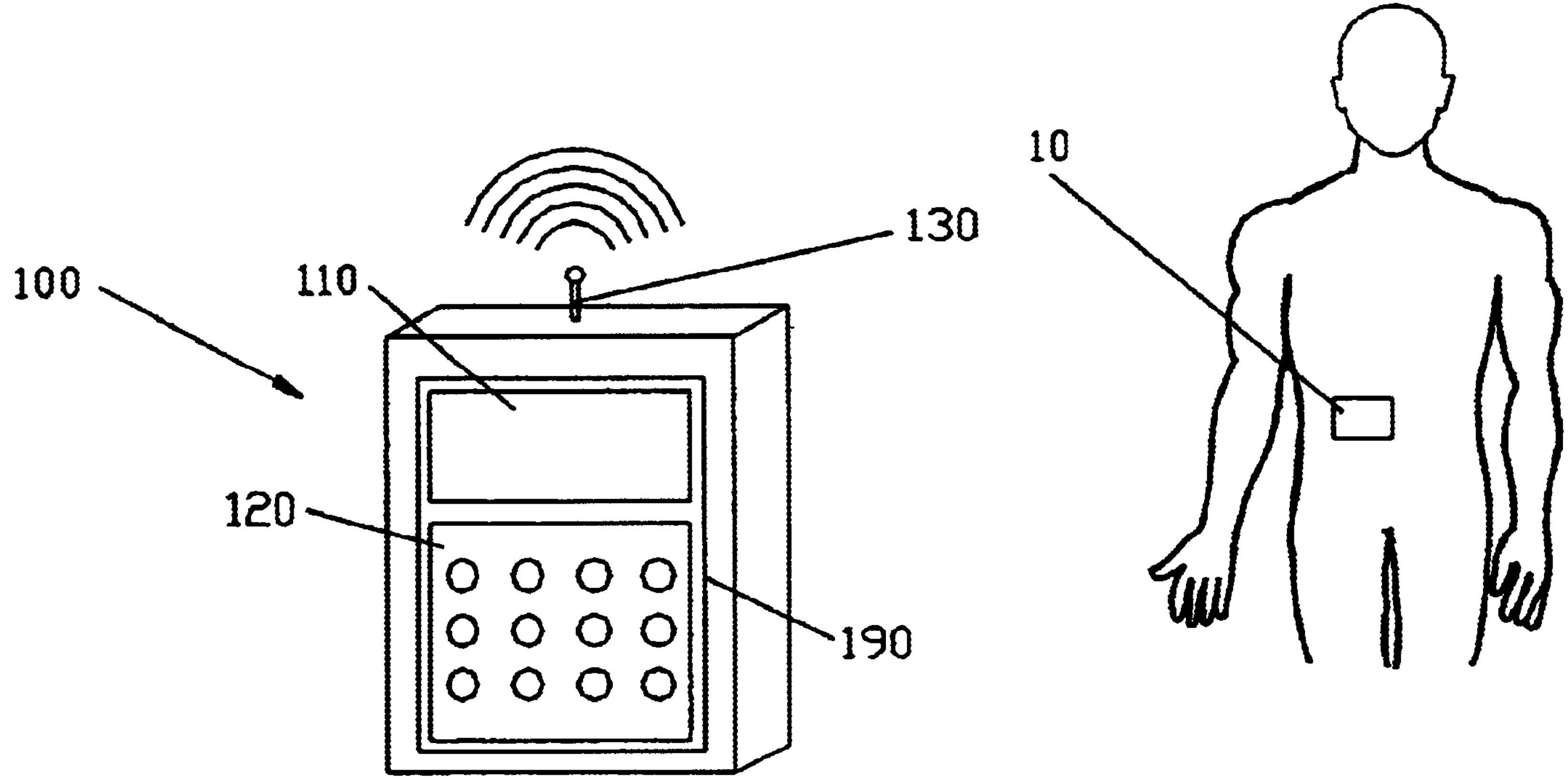

**One-way shape memory**

*When a shape memory alloy is in its cold state the metal can be bent or stretched and will hold those shapes until heated above the transition temperature. Upon heating, the shape changes to its original. When the metal cools again it will remain in the hot shape, until deformed again.*

**Two-way shape memory**

*The two-way shape memory effect is the effect that the material remembers two different shapes: one at low temperatures, and one at the high temperature shape. A material that shows a shape memory effect during both heating and cooling is called two-way shape memory.*

- *The three main types of shape memory alloys are :*
  - *1. copper-zinc-aluminium-nickel,*
  - *2. copper-aluminium-nickel, and*
  - *3. nickel-titanium (NiTi) alloys*
- *SMA's can also be created by alloying zinc, copper, gold, and iron*

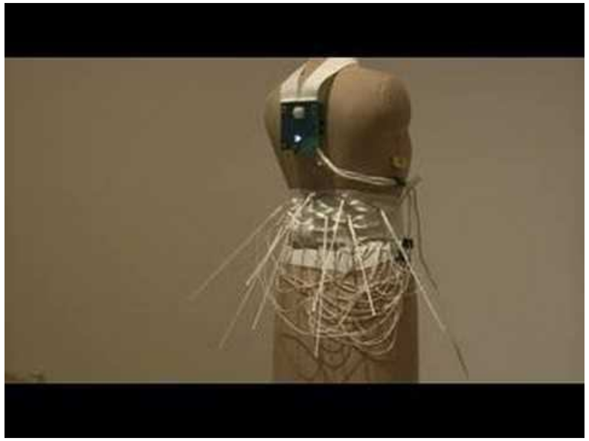



Urządzenie do dostarczania płynu do pacjenta, pozwalające na podłączenie urządzenia portu wyjścia do A device for delivering fluid to a patient including an exit port assembly adapted to connect to a transcutaneous patient access tool, and a dispenser including at least two laminated layers of material defining a passageway connected to the exit port assembly, and an expandable accumulator in fluid communication with the passageway for controlling fluid flow from a reservoir to the exit port assembly. The laminated construction provides many benefits including simplifying the design and manufacturing of the device, in order to further reduce the size, complexity and costs of the device so that the device lends itself to being small and disposable in nature.

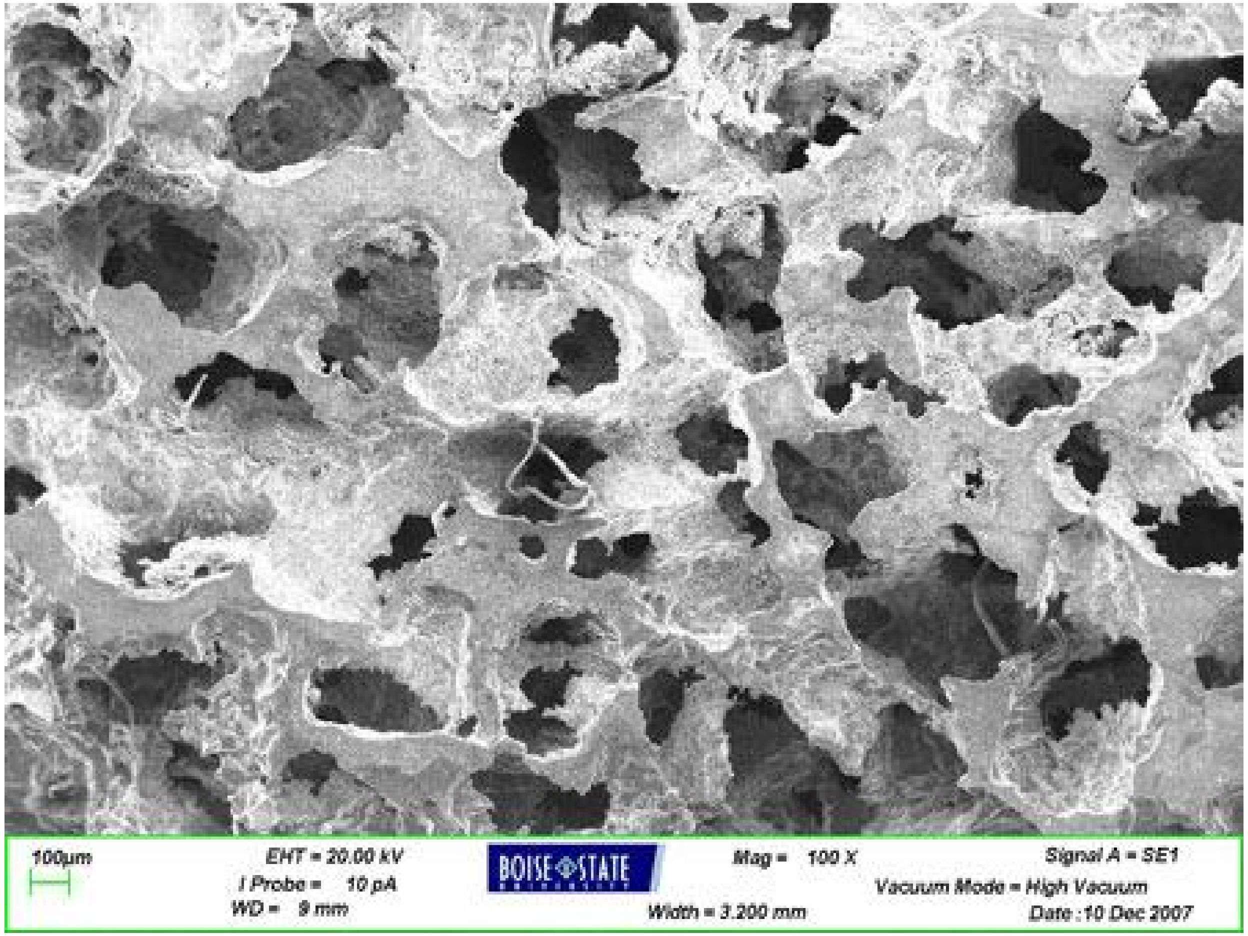
# Zastosowanie SMA w technice



# Zastosowanie SMA w wytwarzaniu odzieży

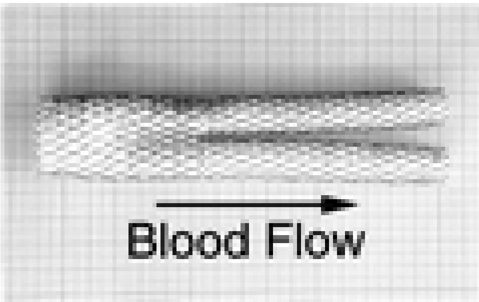


# SAM w wytwarzaniu stentów


100µm
EHT = 20.00 kV
I Probe = 10 pA
WD = 9 mm
BOISE STATE
Mag = 100 X
Width = 3.200 mm
Signal A = SE1
Vacuum Mode = High Vacuum
Date :10 Dec 2007

- The foam consists of a nickel-manganese-gallium alloy whose structure resembles a piece of Swiss cheese with small voids of space between thin, curvy "struts" of material. The struts have a bamboo-like grain structure that can lengthen, or strain, up to 10 percent when a magnetic field is applied. Strain is the degree to which a material deforms under load. In this instance, the force came from a magnetic field rather a physical load. Force from magnetic fields can be exerted over long range, making them advantageous for many applications. The alloy material retains its new shape when the field is turned off, but the magnetically sensitive atomic structure returns to its original structure if the field is rotated 90 degrees--a phenomenon called "magnetic shape-memory." Making large single crystals of the alloy material is too slow and expensive to be commercially viable -- one of the reasons why gems are so costly -- so the researchers make polycrystalline alloys, which contain many small crystals or grains. Traditional polycrystalline materials are not porous and exhibit near zero strains due to mechanical constraints at the boundaries between each grain. In contrast, a single crystal exhibits a large strain as there are no internal boundaries. By introducing voids into the polycrystalline alloy, the researchers have made a porous material that has less internal mechanical constraint and exhibits a reasonably large degree of strain.

- The researchers created the new material by pouring molten alloy into a piece of porous sodium aluminate salt. Once the material cooled, they leached out the salt with acid, leaving behind large voids. The researchers then exposed the porous alloy to a rotating magnetic field. The level of strain achieved after each of the over 10 million rotations is consistent with the best currently used magnetic actuators, and Müllner and Dunand expect to significantly improve the strain when they have further optimized the foam's architecture.
- "The base alloy material was previously known, but it wasn't very effective for shape-memory applications," Dunand said. "The porous nature of the material amplifies the shape-change effect, making it a good candidate for tiny motion control devices or biomedical pumps without moving parts."



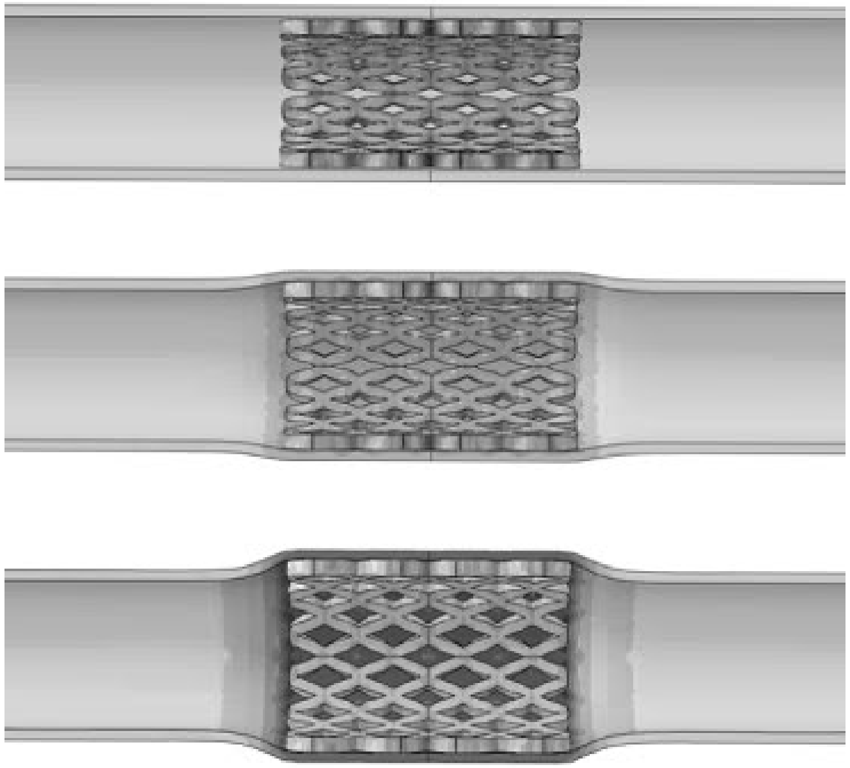

# Pomiar …

Information that can be obtained by magnetic resonance imaging (MRI) of explanted endovascular devices must be validated as this method is non-destructive. Histology of such a device together with its encroached tissues can be elegantly performed after polymethymethacrylate (PMMA) embedding, but this approach requires destruction of the specimen. The issue is therefore to determine if the MRI is sufficient to fully validate an explanted device based upon the characterization of an explanted specimen.

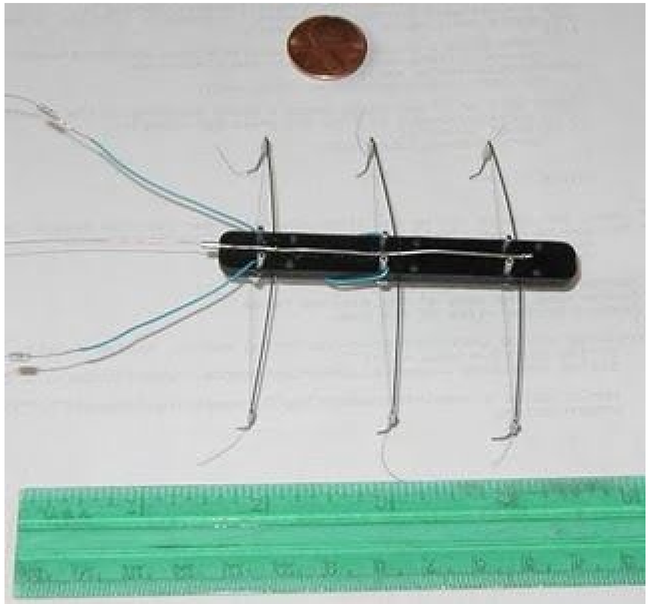
An AneuRx device deployed percutaneously 25 months earlier in a 75-year-old patient was removed en bloc at autopsy together with the surrounding aneurysmal sac and segments of the upstream and downstream arteries. Macroscopic pictures were taken and a slice of the cross-section was processed for histology after polymethylmethacrylate (PMMA) embedding. For the magnetic resonance imaging investigation, the device was inserted in a Biospec 4.7 T MRI system with a 20 mm diameter birdcage resonator used for both emission and reception. A Spin-Echo (SE) was used to acquire both T1 proton density (PD) and T2 weighted images. A gradient-echo (GE) sampling of a free induction decay (GESFID) was used to generate multiple GE images using a single excitation pulse so that four images at different TE were obtained in the same acquisition.

The selected explanted device was outstandingly well-healed compared to most devices harvested from humans. No inflammatory process was observed in contact or at distance of the materials. In MRI T1 images display no specific contrast and were homogeneous in the different tissues. The contrast was improved on proton density weighed images. On the T2 weighed images, the different areas were well indentified. The diffusion images displayed in the surrounding B region had the greatest diffusion coefficient and the greatest anisotropy.

The MRI analysis of the explanted AneuRx device illustrates the possibilities of this technique to characterize the interaction of the endovascular graft with the surrounding tissues. MRI is a breakthrough to investigate explanted medical devices but it also can be advantageously used in vivo to obtain virtual biopsies, because real biopsies to determine the 3 Bs (biocompatibility, biofunctionality and bioresilience) cannot be carried out as they could obviously initiate infection.



Shape-memory polymers are not a new discovery, as anyone who has played with Shrinky-Dinks or who has used heat-shrink tubing for wires in an electronic circuit can testify.



*In aircrafts they are developed a gadget called Variable Geometry Chevron using shape memory alloy that reduces aircraft's engine noise.*

- *in oil line pipes for industrial application.*

- *Nitinol is the name of a light weight Shape Memory Alloy having a content of Titanium of 45% and characterized by their extraordinary ability to recover any shape pre-programmed, upon heating.*
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