

White or Grey? Ceramic or Metal?

“For the moment titanium is still the golden standard as material for the fabrication of dental implants, but since it gets obvious that titanium is not a harmless material for intra-oral use, research focuses more and more on ceramic implant materials”



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COLUMN ARTICLE

Implantology is in evolution. What was groundbreaking yesterday, is maybe evidence based today. Researchers look for better, stronger, faster and “healthier” materials. This search sometimes leads to unexpected changes in treatment paradigms.

25 years ago, dentists were trained to restore caries with amalgam fillings. Today cavities are filled with composite materials. With this evolution, not only the toxic mercury was banned out of the mouth, also the aesthetic aspect was tackled. Now a days we feature of a maximum of options to fill cavities or replace old fillings in an utmost acceptable aesthetic way: for every cavity there is an appropriate color!

Dentists are often considered to be conservative, so it was believed that amalgam would remain the golden standard as filling material. But amalgam is today almost a “no go” in restorative dentistry and is completely replaced by all kinds of composite materials.

The same evolution is taking place in implant dentistry. For the moment titanium is still the golden standard as material for the fabrication of dental implants. Brånemark [1] was one the first to develop a commercially pure titanium screw for dental purpose on large scale. Schroeder [2] confirmed his findings with another screw design but with the same material: titanium. In those early days, only the group

around Sandhaus [3] experimented with another material: aluminium oxide.



But it gets more and more obvious that titanium is not a harmless material for intra-oral use at all. Several studies show multiple disadvantages when using titanium in human:

- immunomodulation and auto-immune diseases (e.g. multiple sclerosis);
- allergic reactions;
- due to corrosion, titanium particles are found in lymph nodes;
- the color doesn't aesthetically match with intra-oral/dental structures.

Due to these adverse characteristics, research focuses more and more on ceramic implant materials. The new material of choice is zirconia. The advantages proven for zirconia as a prosthetic material were also applicable for zirconia as implant material:

- highly biocompatible;
- highosseointegration-capacity;
- Osseo conductive;
- bio-inert;
- no allergic reactions;
- excellent tissue response (less bacterial plaque adhesion);
- aesthetical.

There are also some disadvantages and adverse effects coupled to zirconia:

- there are almost no long term random clinical trials proving the success and survival rates;
- the production cost of zirconia implants is high;
- most available zirconia implants are one-piece implants. This was historically because of the lower tensile strength of zirconia. One-piece implants give less options for application, since zirconia implants may not be grinded (this causes cracks). So correct implant placement is critical;
- over time, zirconia shows (minimal) biodegradation if in contact with fluids on a high(er) temperature;
- potential radioactivity of zirconium-dioxide: this radioactivity can be considered lower than many hazardous radioactive appliances.

Will titanium soon be discarded as implant material? No, because this material has too many advantages to be replaced. Therefore, titanium will surely remain the golden standard as implant material for the next decade(s).

Is zirconia just a temporary “ecological” hype? No, since there is a clear niche for zirconia implants that will grow when the material is completely established.

But two main topics need further and profound research:

- how “undesirable” is the use of titanium as dental implant material for our general health?
- what is the long(er) term clinical result of zirconia as implant material in the oral cavity?

For answering both questions, randomized clinical trials are needed to come to significant conclusions. So for the moment, titanium remains probably the material of choice for tooth replacement; but zirconia will surely get more applications in the mouth over time.

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