

White is the new grey!

Curd ML Bollen DDS, PhD, MSc, MclinDent*

Department of Clinical Dental, International Academy of Ceramic Implantology, Netherlands

***Corresponding Author:** Curd ML Bollen, Department of Clinical Dental, International Academy of Ceramic Implantology, Netherlands.

Received: May 22, 2016; **Published:** October 01, 2016

Volume 1 Issue 1 October 2016

© All Rights Reserved by Curd ML Bollen.

Dentistry is continuously in evolution. What was groundbreaking yesterday, can be evidence based today or maybe tomorrow. Researchers and scientists all over the globe are looking for better, stronger, faster and “healthier” restorative materials. This search sometimes leads to complete changes in treatment paradigms.

Pure superficially, these changes can even be correlated to a shift in dental material colors. Whereas 25 years ago, dentists were still trained and used to restore caries with amalgam fillings, today cavities are filled with all types of composite materials. With this evolution, not only the toxic mercury was banned out of the patients mouth, also the aesthetic aspect of the ugly silverish fillings was tackled. At the early times of composite materials, only a limited number of different white shades were available, whereas now we have a seemingly unlimited differentiation between all kinds of “white”. Aesthetically we feature of a maximum of options to fill cavities or replace old fillings in an utmost acceptable aesthetic way. Compromises are not ubiquitous anymore: for every cavity there is an appropriate color!

At the early age of composites as a restorative material, there were as always supporters and opponents of this novelty. Since dentists are considered to be often a bit conservative, a majority believed that amalgam would remain the golden standard as filling material. Only sustained scientific reports and extensive publicity from the different composite manufacturers could change the prevailing opinion. And so nowadays, amalgam is almost a “no go” in restorative dentistry and is completely replaced by a fast evolving market of all kinds of excellent composite materials.

The same evolution will maybe take place in implant dentistry during the next decade. Today, titanium is the golden standard as material for the fabrication of dental implants. Brånemark¹, the godfather of Osseo integration was the first to develop a commercially pure titanium screw for dental purpose on large scale. Afterwards Schroeder² confirmed his findings with another screw design but with the same material: titanium. In these early days of dental implantology only a small group around Sami Sandhaus³ experimented with another implant material: aluminium oxide. But due to the insufficient tensile strength, this material was early abandoned for intra-oral use, although its high biocompatibility and clear aesthetic advantages.

Today it gets obvious that titanium is not such a harmless material for intra-oral use, as it seemed for decades. Several studies showed multiple disadvantages when using titanium in the human mouth/body:

1. Titanium can cause immunomodulation and several auto-immune diseases (e.g. multiple sclerosis and rheumatoid arthritis);
2. Allergic reactions to titanium are widely detected;
3. Due to corrosion, titanium particles are found in lymph nodes all over the body;

4. The grey/silverish colour doesn't aesthetically match with intra-oral/dental structures as dentine, enamel, composite or porcelain, especially in an era that aesthetics are of utmost importance.

Due to these adverse characteristics, several research groups started to focus on ceramic implant materials. The actual material of choice became zirconia (yttria-tetragonal-zirconia-polycrystal). This material was already applied as (aesthetic) implant abutment material. The advantages proven for zirconia as a prosthetic material were also applicable for zirconia as implant material:

- a. The material is highly biocompatible;
- b. Moreover it shows an high Osseo integration-capacity;
- c. Zirconia is also Osseo conductive;
- d. This ceramic is bio-inert: the biological stability is excellent;
- e. There are no allergic reactions reported (yet);
- f. Zirconia offers an excellent tissue response: on the surface there is much less bacterial plaque adhesion than on titanium surfaces;
- g. Aesthetically, zirconia outdoes titanium because of it's whitish color.

But of course there are also some disadvantages and adverse effects coupled to this implant material:

- a. Most important, there are not many/enough (long term) random clinical trials that prove the success and survival rates of zirconia implants in humans;
- b. The production cost of zirconia implants is much higher than the production cost of titanium implants. This factor will surely slow down the acceptance and spread of these implants;
- c. Until now, most of the commercially 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. Grinding of zirconia can cause after all cracks. So the correct placement of these implants is very critical!
- d. Actually some companies started the production of two-piece zirconia implants. But on this new concept, no research outcomes are available yet;
- e. Over time, zirconia shows (minimal) biodegradation if in contact with fluids on a high(er) temperature. The mouth offers of course enough humidity because of the presence of saliva, but the regular body temperature is too low to start a significant biodegradation process;
- f. Some studies showed the potential radioactivity of zirconium-dioxide. But this radioactivity can be considered lower than many hazardous radioactive appliances in our close environment.

Will titanium soon be discarded as implant material? Definitely not! The material has too many advantages to be replaced: cheap and easy production which makes the implants economically "affordable", enormous amount of significant clinical data, two-piece product offering all versatile applications, a large offer of different types – lengths – diameters – designs of screws. Therefore, titanium will surely remain the golden standard as implant material for the next decade(s).

Is zirconia just a temporary "ecological" hype? Surely not! There is a clear niche for zirconia implants that probably will grow when the material is completely established:

- a. Aesthetic reconstructions in the front area, specifically in patients with a thin biotype. A white or enamel colored implant is a great advantage in case of upcoming gingival recessions;
- b. Patients with titanium allergy;
- c. Patients preferring a bio-holistic/metal-free dental approach.

Future wise, two main topics need further and profound research:

- a. How "undesirable" is the use of titanium as dental implant material for the overall general health?
- b. What is the long(er) term clinical result of zirconia as implant material in the oral cavity?

For answering both questions, much more 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. The preservation of own teeth however, will always remain the cheapest, safest and healthiest solution on long term!

References

1. Brånemark PI, *et al.* "Intra-osseous anchorage of dental prostheses. I. Experimental studies". *Scandinavian Journal of Plastic and Reconstructive Surgery* 3.2 (1969): 81-100.
2. Schroeder A, *et al.* "Tissue reaction to an implant of a titanium hollow cylinder with a titanium surface spray layer". *SSO Schweiz Monatsschr Zahnheilkd* 86.7 (1976): 713-727.
3. Sandhaus S. "Oral rehabilitation using implantation method C.B.S". *ZWR* 80.13 (1971): 597-604.