Clifford Consulting & Research, Inc. CLIA 06D0669295

4775 Centennial Blvd., Suite 112; Colorado Springs, CO 80919-3309 U.S.A.
(719) 550-0008 (Office) (719) 550-0009 (Fax)
Web Site: www.ccrlab.com

Should I Demand Metal-Free Dentistry For Safety?

The questions about "metal-free" dentistry are frequent and ubiquitous. We have all seen signs and advertising offering to provide "metal-free" dentistry. Patients are scared out of their wits by some practitioner telling them that the metals in composites or other restoratives are going to destroy their health if not outrightly causing their death. In the most basic of chemistry terms, there is no such entity as a "metal-free" restorative. NONE! This statement applies to composites, glass ionomers, ceramics, porcelains, compomers, ceromers, denture acrylic, mouth guards, splints, bonding agents, cements and so on and so forth.

From the concepts and laws of nature as taught in any competent freshman chemistry class, we learn that whenever there is an anion in nature, there must, of necessity, be a balancing cation. Cations are nearly always metals or metalloids. Some of them will be relatively light and so-called 'simple' metals, such as sodium, potassium, calcium, lithium and magnesium. Others will be heavier and more complex, but they are always present with a non-ionized or dissociated anion.

Perhaps the confusion in materials science comes in understanding the state in which metals are found. The commonly identified metals, such as those in a precious bridge alloy or in the steel used to structure a building or in kitchen utensils or in a foil, are present in a fully 'reduced' state. These are the hard, shiny metallic forms normally referred to as "metals".

But metals can also be present in an 'oxidized' state. They will no longer look like hard, shiny metals, but will be a powder (as in common oxides such as rust) or will combine with other chemicals to form a salt (as in the example of sodium metal combining with chlorine to form common table salt). Being in an oxidized form means simply that the metal is present in a different state of being. By various means, we can take common iron rust and convert it back to its 'reduced' state to look like a piece of hard shiny metal.

When we look at the metals used in dentistry, they may be in either 'reduced' state (bridge or gold crown) or 'oxidized' state (composites or ceramics or porcelains). By the laws of chemistry and physics, these metals must be present in one state or the other or there cannot be a dental material (or any other material for that matter). There will certainly be differences between a gold crown versus ceramic versus composite versus prophy paste. However, these differences do not mean that the metals have been taken away from any of these products, but rather, they have been placed in a number of variations of either the 'reduced' or the 'oxidized' state. The metals are present in any substance you might wish to discuss.

Parties who advertise "metal-free" dental products have overlooked the fact that the materials which lack the hard, shiny metallic nature of "metals" still have those metals present, but the metals are in an 'oxidized' state and are combined with other components. With proper chemistry and methods, we can

take any porcelain or ceramic or composite and convert the metals found therein back into the reduced hard, shiny form. They were there all along.

The presence of metals does not mean that a product is either safe or harmful. A good example of a metal which has both harmful and beneficial effects (depending on its state of being) can be found with aluminum. I will not repeat the senario here, but refer you to the communication I have exchanged with you regarding aluminum. Some forms are desirable, while others may need to be avoided. The issue of how they might become toxic is also covered in the aluminum communication we have exchanged.

Thus, the question to ask when considering the desirability of restorative materials is clearly not whether they contain metals. Simply, they do. All of them. Rather, we would want to ask what state, forms and structures the metals take. Do the metals readily separate from the other chemistries present and do they take any forms which are not desirable. To simplify several hours of lectures from a chemistry class, do the metals dissociate, ionize or become bioavailable when placed into the body?

Frankly reduced metals may be very slow to oxidize or to become ionized. Gold, titanium and platinum, placed in the oral cavity, do not rapidly dissociate to an ionized form. However, silver, copper, palladium and indium may more readily oxidize, separate from a crown or bridge structure, and become attachable (bioavailable) to various organic compounds found in the tissues. Once attached or bound, these metals may take on qualities which can participate in a number of pathologies. They may become toxic in some senarios.

Oxidized metals can also be induced to separate from restorative materials under certain circumstances. They may have been placed into the restorative for purposes of pigmenting (cadmium chloride, cobalt chloride, iron oxide), or they may have been placed to facilitate fusing (silver, tin, zinc) or to give various qualities of luster, lucence and finish to things like ceramics, porcelains or composites. These forms of the metals can be as dangerous as their reduced forms can be. Arsenic, mercury and lead, whether introduced to the tissues as reduced metals or as oxidized salts, are going to be poisonous. Others may have little or no detectable effect on the patient.

Without wanting to complete an entire course in chemistry and materials science within this communication, may I say simply that form, state of being and ability to separate from chemical associations are the more important issues when looking at the metals. Taking all of these qualities into consideration, may I turn to your inquiry about zirconia ceramics.

By their nature, porcelain and ceramic materials have some shared qualities which tend to keep most of their components intact for long periods of time, and they present some very useful qualities of strength, durability and esthetics which make they very desirable for many patients. A ceramic material will usually have a predictable structure and nature which revolves around a combination of aluminum, silicon and oxygen (alumina and aluminosilicate) or zirconium, silicon and oxygen (zirconium silicate or zirconia). The elements in these combinations tend to bind with covalent bonds and with certain crystalline lattice structures which may also involve ionic bonds. The crystalline lattice structure is far stronger and more likely to stay together that compounds of other chemicals. In some cases, manufacturers may use these structures, finely ground, to serve as durable fillers in composites and the like. In ceramics, the lattice structures are bound into sizeable masses of repeating lattices with firing and high heat. Whether the principle metal is aluminum or zirconium, the end product will have strong

similarities.

Aluminum and zirconium are not identical metals. Each has some peculiarities that permit a manufacturer to obtain somewhat different qualities by selecting one or the other. In the case of zirconium, it is commonly felt that strength and esthetics are superior to that found in aluminum based ceramics. However, zirconium may exit the lattice structure a bit faster than aluminum does. Thus, a zirconia crown or bridge may be stronger than an aluminosilicate unit, but the patient who happens to have a zirconium sensitivity may receive a little more separated zirconium exposure than would have been seen with aluminum and aluminosilicate units. There are differing circumstances where one or the other may both find good use. Some zirconia advocates will claim that no one ever has a problem with zirconia, but that is simply contrary to the data.

In selecting zirconia for a patient, there will be metal in the ceramic. There is no need to hide that fact. We still are bound by the same laws of chemistry and physics in dentistry as is the rest of the world around us. If it were not zirconium, it would be aluminum. The metal will be in an oxidized state and will have peculiar qualities within its lattice structure. However, if the patient does not have a zirconium sensitivity, there should be no issue at all with the metal. For the patient who faces sensitivity to metals such as palladium, silver, copper or tin, the zirconia's strength without need for a metal substructure in making a multi-unit span will be highly prized. For the patient who can be spared multiple trips to the dental office and repeated insult to tissue and patience by using CEREC or similar zirconia blocks for milling, there is a tremendous advantage. For the patient who has anterior reconstruction needs and needs to be exceptionally careful with esthetics, zirconia will be the odds-on favorite. Could an aluminosilicate ceramic be made to work? In the hands of a skilled dentist, of course it could. But zirconia is a wonderful ceramic, and is often the right choice in terms of time in chair, cost / value ratio and wonderful esthetics.

Is zirconium safer than aluminum? No, but the issues for each are different. Would I be afraid to have either alumina or zirconia in my own mouth? No. I currently wear a well-known zirconia-filled composite in my teeth, and it seems to be doing very well. My wife has aluminosilicate-filled composite and an aluminosilicate crown, and they seem to be doing very well.

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