BASE-METAL RESTORATIONS SEEM SAFE

Base-metal alloys have in many instances replaced noble alloys for crown and bridge frameworks. The high cost of noble alloys and new methods for the fabrication of the frameworks like CAD-CAM, are possible explanations for this shift. However, does this shift have an implication on patient safety?

The aspect of patient safety has been addressed in a research project conducted by a Swedish visiting scientist at NIOM, Charlotta Holm, DDS. The aims of her study were to investigate the release of elements from, and the biological response in vitro to, cobalt-chromium alloys and other base-metal alloys used for the fabrication of metal-ceramic restorations.

Eighteen different alloys were investigated; nine cobalt-chromium alloys, three nickel-chromium alloys and two cobalt-chromium-iron alloys served as base metal products; a palladium-silver alloy, a high-noble gold alloy and a titanium grade II were used for comparison.

Leaching of elements was measured in cell culture media and in a highly corrosive media (pH=2.3) to simulate different oral conditions. These media were also used to investigate possible toxic effects on cells and mucosal irritation.

All alloys showed similar and low release of elements in cell culture media; approximately 0.1 µg/cm² surface after 7 days. In the highly corrosive solution, the element release from base-metal alloys was somewhat higher than that of the noble alloys (2-50 times) but the release was for all tested products far below the limit set in the international standard for dental alloys (200 µg/cm² surface after 7 days).

Cell culture testing using the cell culture media or the highly corrosive media revealed no increased cell death for any of the base-metal alloys compared to noble alloys and titanium. Signs of mucosal damage were not observed for any products in the irritation testing.

It was concluded that base-metal alloys performed comparable to the high-gold alloy and the silver-palladium-based alloys in regard to release of elements, cytotoxicity and mucosal irritation.

Clinical implications: The laboratory is never a mirror of the clinical situation, but laboratory data are good estimates of what could be expected in the clinic. The present study suggests that replacing noble alloys with base-metal alloys for prosthetic frameworks represents no additional harm to the patient.

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Free full text: http://dx.doi.org/10.3109/23337931.2015.1069714
Resin-based dental restorative materials polymerize in situ and are complex mixtures of monomers and filler particles, along with initiators, activators, stabilizers and other additives. However, the polymerization reaction is never complete and several studies have reported unreacted components leaching into the oral cavity. This has been shown to cause allergies and eczema in both patients and dental personnel.

Gas chromatography/mass spectrometry (GC/MS) and liquid chromatography/mass spectrometry (LC/MS) are versatile analytical techniques used in a range of scientific disciplines. They are also useful tools towards assessing the biocompatibility of different dental materials and therefore important for improving patient safety. The leaching components, e.g. methacrylate monomers, can be identified and quantified from a solution exposed to resin-based dental materials (i.e. water, ethanol or saliva). The analysis techniques work by first separating the leaching components in the solution according to size and polarity, either in the gas phase (GC/MS) or liquid phase (LC/MS), before they are injected into the mass spectrometer (MS). In the mass spectrometer the components of interest are ionized to charged particles and are separated in the gas phase according to their mass to charge (m/z) ratio. This allows for quantification of the individual components. GC/MS and LC/MS are used for analysis volatile molecules (e.g. HEMA) and non-volatile molecules (e.g. Bis-GMA), respectively. As a result, the whole spectrum of leaching components can be analysed when the two techniques are combined.

Assessing the extent of leaching from different materials is an essential part of NIOM’s activities. In 2016, NIOM will acquire a new high sensitivity LC/MS to enable quantification when the concentrations of the leaching components are very low.

Recently, the methacrylate-based monomers in dental materials have been shown to affect cells in vitro by reducing cell growth. However, little is known about the mechanism through which this process occurs. Research projects at NIOM are currently focused on elucidating this mechanism through the use of LC/MS to study interactions between the methacrylate monomers and proteins in cells. This will further provide the possibility of improving the biocompatibility of resin-based dental restorative materials.