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Analysis of selenium and heavy metals by ICP-MS in patients with long-term dental titanium and/or amalgam fillings: does selenium deficiency increase the accumulation of mercury and aluminium in patients?

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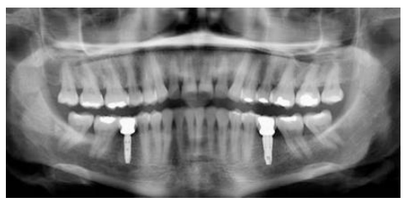
INTRODUCTION

- The release of mercury (Hg++) from dental amalgams can induce oxidative stress and contribute to cognitive impairments in patients with long-term dental Titanium (Ti) and/or amalgams.
- Selenium (Se) readily binds to heavy metals (especially mercury –Hg++- and Cd -cadmium) to create harmless, metabolically inert compounds.
- Heavy metal exposure triggers high levels of free radicals. Se is a key component of antioxidant enzymes like glutathione peroxidase (Gpx), which neutralize these free radicals and protect cells from degradation
- Selenium and SOD-1 are protect against oxidative stress and cellular damage
- Se and mercury have a strong affinity for one another. Mercury binds so strongly to selenium that it can sometimes deplete the body's natural selenium reserves, leading to deficiency symptoms.
- titanium alloys (Ti 6Al-4V) are biocompatible biomaterial in odontology. Although titanium is generally considered safe for patients, recent studies suggest certain adverse effects.
- However, the link between selenium deficiency and heavy metals (mercury and aluminium) accumulation and depression have not been evaluated in patients with long-term dental titanium implants and/or amalgam fillings (at least 15 years in their mouth).

AIM

- To determine whether a selenium deficit could increase mercury and aluminium accumulation in patients with long-term titanium and dental implants (**A + I group**, n = 57) as compared to their levels in participants with long-term dental amalgams alone (**A group, n = 55**), and control subjects (**without dental biomaterials, n = 30**).
- To achieve this, we compared Se/Hg++ and Se/Al ratios in hair samples by ICP-MS spectrophotometry (hair) between A+I, A, and control groups
- The Beck's test was performed to assess possible differences in depressive behaviour.

PROTOCOL. Study groups



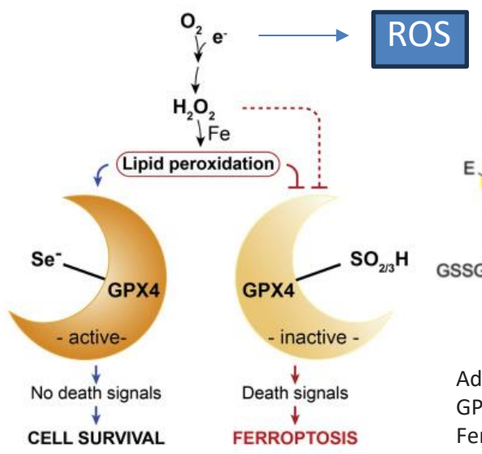
A + I group (n = 57): long-term titanium implants and dental amalgams

A group (n = 55):patients with Dental amalgams alone

Control subjects (**without dental biomaterials (n = 30**).

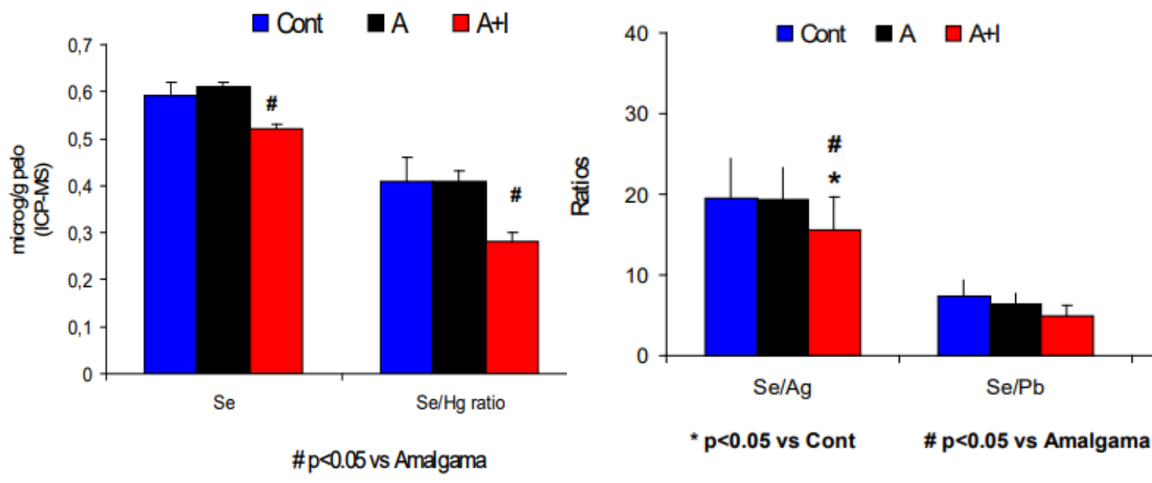
- Selenium (Se) and heavy metals (Hg++, Ag, Pb, Ag) were quantified by ICP-MSC in hair samples of patients with long-term dental titanium implant (A+I)
- In addition, their systemic proinflammatory cytokines (IL-1 beta and MCP-1) were measured by ELISA (pg/mL)levels

Selenium is nececesary for Glutation peroxidase and SOD-1 activity

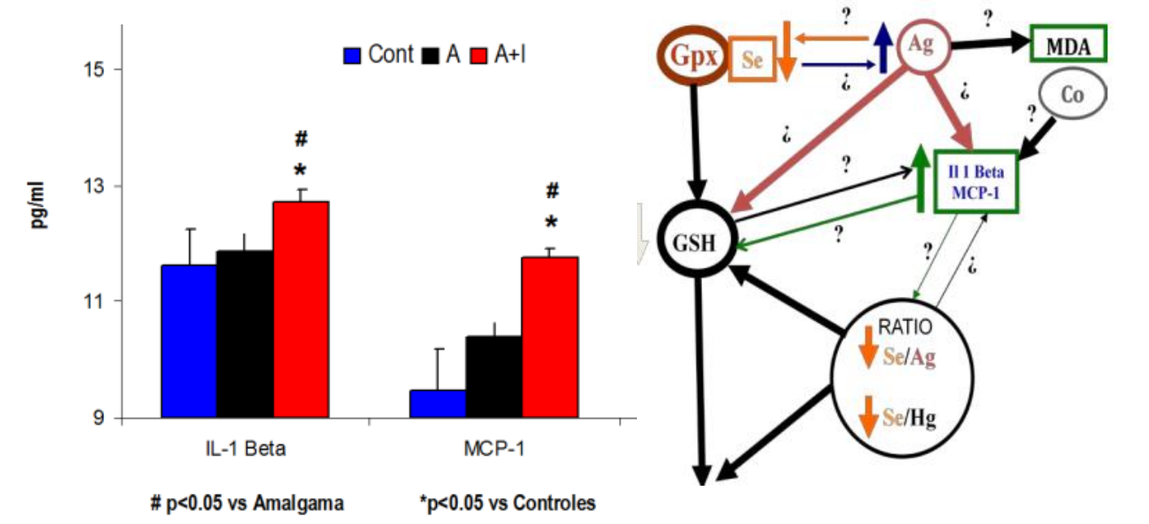


Adapted from Ingold I, et al. Selenium Utilization by GPX4 Is Required to Prevent Hydroperoxide-Induced Ferroptosis. Cell. 2018 Jan 25;172(3):409-422.e21.

DECREASED Se/Hg++ and REDUCED Se/Ag ratios in patients with long-term dental titanium implants (A+I) as compared to patients with long-term dental amalgams alone (A)



Increased IL-1 beta and MCP-1 production in plasma of patients with long-term dental titanium implants (A+I) as compared to those with long-term dental amalgams alone (A)



CONCLUSION

- Increased plasma IL-1 beta and MCP-1 levels were observed in patients with long-term dental titanium implants (A+I)
- Patients with long-term titanium implants have low selenium levels that contribute to mercury and aluminium accumulation
- Depression scores did not differ between patients with long-term dental titanium implants and/or dental amalgams in the Becks scale