

Product	Metals
Dental Bridges, Crowns, Partial Dentures, and Implants	<ul style="list-style-type: none"> • These items can contain aluminum, chromium, cobalt, copper, gallium, gold, indium, iridium, iron, manganese, nickel, palladium, platinum, silver, titanium, vanadium and more.^{1 2 3 4} • Items made of cobalt-chromium-molybdenum steel contain those elements in addition to aluminum, nickel, titanium, and others.⁵ • Research has found that some of these dental materials can contain lead.⁶
Dental Fillings	<ul style="list-style-type: none"> • Amalgam (silver) fillings contain about 50% mercury mixed with copper, silver, and tin, and they can also contain zinc⁷ and other metals,⁸ including lead and cadmium.⁹ • Some composite fillings, as well as dental cements and root-fillings, can contain titanium dioxide.¹⁰ • Dental gold alloys can also contain copper, gallium, indium, iridium, palladium, nickel, silver, tin, titanium, and zinc,¹¹ as well as beryllium.¹²
Gynecologic Devices	<ul style="list-style-type: none"> • Some intrauterine devices (IUDs) contain copper,¹³ and possible contaminants include manganese, nickel, and zinc.¹⁴ • Permanent contraceptive devices and clips (i.e. tubal ligation) can contain nickel and titanium.¹⁵
Intravascular Devices (i.e. coronary stents, perforated foramen occluders, pacemakers, and implantable defibrillators)	<ul style="list-style-type: none"> • Cardiac/intravascular devices can be made of stainless steel¹⁶¹⁷ (which can contain chromium, manganese, molybdenum, and nickel¹⁸). • They can also be made of chromium, cobalt, molybdenum, and/or nitinol (which is 45% nickel and 55% titanium).¹⁹ • Stents can be coated in gold.²⁰ • Pacemakers can contain aluminum, nickel, and titanium,²¹ and can be coated in gold.²²
Medication	<ul style="list-style-type: none"> • Pills can contain titanium dioxide and other metal oxides.²³ • Antacids can contain aluminum.²⁴

<p>Orthodontic Appliances (i.e. bands, braces, brackets, retainers, and wires)</p>	<ul style="list-style-type: none"> • These can contain nickel^{25 26 27 28} and titanium.^{29 30} • They can also contain aluminum, chromium, cobalt, copper, iron, molybdenum, niobium, and vanadium,³¹ as well as silicon and other elements.³²
<p>Orthopedic Implants (i.e. hip replacements, screws, nails, and clips)</p>	<ul style="list-style-type: none"> • These often contain chromium, cobalt, nickel, and/or titanium.³³ • Items made with stainless steel³⁴ contain a large amount of nickel³⁵ with chromium, manganese, and molybdenum,³⁶ in addition to other elements.³⁷ • Items made with cobalt-chromium molybdenum steel contain those elements in addition to aluminum, iron, manganese, nickel, titanium, and tungsten.³⁸ • Items made with titanium can also contain aluminum, vanadium, trace amounts of nickel,³⁹ and other elements.⁴⁰ • Items made with nitinol contain nickel and titanium.⁴¹ • Items made with Vitallium™ contain cobalt, chromium, manganese, molybdenum, iron, and other elements.⁴²
<p>Surgical Clips and Staples</p>	<ul style="list-style-type: none"> • Items made with stainless steel can contain chromium, manganese, molybdenum, nickel, and other elements.⁴³ • Items made with titanium alloy contain aluminum, nickel, titanium, and vanadium.⁴⁴
<p>Vaccines/Flu Shots/Immunoglobulin Preparations</p>	<ul style="list-style-type: none"> • These can contain aluminum^{45 46} and/or mercury (as thimerosal).^{47 48 49}

<p>Additional considerations for metal exposures:</p> <ul style="list-style-type: none"> • Cigarette smoke • Coins • Containers including beverage cans and canned food • Cookware and utensils • Cosmetic products • Detergents • Diet (i.e. fish containing mercury; foods high in nickel such as chocolate, nuts, oatmeal, soya beans, etc.) • Eye drops, contact lens solution, and eyeglass frames • Jewelry, belts, watches, accessories, etc. • Occupational exposures • Pipes for drinking water, etc. • Pollution • Sunscreen • Toothpaste • Well water • Other consumer products

-
- ¹ Muris J, Feilzer AJ. Micro analysis of metals in dental restorations as part of a diagnostic approach in metal allergies. *Neuroendocrinology Letters*. 2006 Dec 1;27(1):49-52. Available from https://pure.uva.nl/ws/files/2377838/155139_07_1_.pdf. Accessed April 11, 2018.
- ² Knosp H, Holliday RJ, Corti CW. Gold in dentistry: alloys, uses and performance. *Gold Bulletin*. 2003 Sep 1;36(3):93-102. Available from <https://link.springer.com/content/pdf/10.1007/bf03215496.pdf>. Accessed February 23, 2018.
- ³ MELISA. Metal exposure. Available from <http://www.melisa.org/metal-exposure-2/>. Accessed February 23, 2018.
- ⁴ Wood MM, Warshaw EM. Hypersensitivity reactions to titanium: diagnosis and management. *Dermatitis*. 2015 Jan 1;26(1):7-25. Available from <https://ceramic-implantology.com/wp-content/uploads/2015/07/documento003.pdf>. Accessed April 11, 2018.
- ⁵ Schalock PC, Menné T, Johansen JD, Taylor JS, Maibach HI, Lidén C, Bruze M, Thyssen JP. Hypersensitivity reactions to metallic implants—diagnostic algorithm and suggested patch test series for clinical use. *Contact Dermatitis*. 2012 Jan 1;66(1):4-19. Available from <https://onlinelibrary.wiley.com/doi/full/10.1111/j.1600-0536.2011.01971.x>. Accessed April 11, 2018.
- ⁶ Nikolić RS, Kalićanin BM, Nikolić GM. Potentiometric stripping analysis of lead and cadmium leaching from dental prosthetic materials and teeth. *Journal of the Serbian Chemical Society*. 2004;69(7):575-80. Available from <http://www.doiserbia.nb.rs/img/doi/0352-5139/2004/0352-51390407575N.pdf>. Accessed February 23, 2018.
- ⁷ MELISA. Metal exposure. Available from <http://www.melisa.org/metal-exposure-2/>. Accessed February 23, 2018.
- ⁸ Kern JK, Geier DA, Björklund G, King PG, Homme KG, Haley BE, Sykes LK, Geier MR. Evidence supporting a link between dental amalgams and chronic illness, fatigue, depression, anxiety, and suicide. *Neuro Endocrinol Lett*. 2014; 35(7): 537-52. Available from: http://www.nel.edu/archive_issues/o/35_7/NEL35_7_Kern_537-552.pdf. Accessed December 16, 2015.
- ⁹ Nikolić RS, Kalićanin BM, Nikolić GM. Potentiometric stripping analysis of lead and cadmium leaching from dental prosthetic materials and teeth. *Journal of the Serbian Chemical Society*. 2004;69(7):575-80. Available from <http://www.doiserbia.nb.rs/img/doi/0352-5139/2004/0352-51390407575N.pdf>. Accessed February 23, 2018.
- ¹⁰ Stejskal VD. Human hapten-specific lymphocytes: biomarkers of allergy in man. *Drug Information Journal*. 1997 Oct;31(4):1379-82. Available from <http://www.melisa.org/pdf/dij063.pdf>. Accessed April 11, 2018.
- ¹¹ Knosp H, Holliday RJ, Corti CW. Gold in dentistry: alloys, uses and performance. *Gold Bulletin*. 2003 Sep 1;36(3):93-102. Available from: <https://link.springer.com/content/pdf/10.1007/bf03215496.pdf>. Accessed February 23, 2018
- ¹² Stejskal V. Metals as a common trigger of inflammation resulting in non-specific symptoms: diagnosis and treatment. *The Israel Medical Association Journal: IMAJ*. 2014 Dec;16(12):753-8. Available from <http://www.melisa.org/wp-content/uploads/2015/01/Metals-as-a-Common-Trigger-of-Inflammation.pdf>. Accessed April 11, 2018.
- ¹³ Teo ZW, Schalock PC. Hypersensitivity reactions to implanted metal devices: facts and fictions. *J Investig Allergol Clin Immunol*. 2016 Jan 1;26(5):279-94. Available from <https://pdfs.semanticscholar.org/698e/e81a0e73f24113646ef6e9d0ec9f34b7e135.pdf>. Accessed April 11, 2018.
- ¹⁴ Schalock PC, Menné T, Johansen JD, Taylor JS, Maibach HI, Lidén C, Bruze M, Thyssen JP. Hypersensitivity reactions to metallic implants—diagnostic algorithm and suggested patch test series for clinical use. *Contact Dermatitis*. 2012 Jan 1;66(1):8. Available from <https://onlinelibrary.wiley.com/doi/full/10.1111/j.1600-0536.2011.01971.x>. Accessed April 11, 2018.
- ¹⁵ Teo ZW, Schalock PC. Hypersensitivity reactions to implanted metal devices: facts and fictions. *J Investig Allergol Clin Immunol*. 2016 Jan 1;26(5):283. Available from <https://pdfs.semanticscholar.org/698e/e81a0e73f24113646ef6e9d0ec9f34b7e135.pdf>. Accessed April 11, 2018.
- ¹⁶ Teo ZW, Schalock PC. Hypersensitivity reactions to implanted metal devices: facts and fictions. *J Investig Allergol Clin Immunol*. 2016 Jan 1;26(5):279-94. Available from <https://pdfs.semanticscholar.org/698e/e81a0e73f24113646ef6e9d0ec9f34b7e135.pdf>. Accessed April 11, 2018.
- ¹⁷ Schalock PC, Menné T, Johansen JD, Taylor JS, Maibach HI, Lidén C, Bruze M, Thyssen JP. Hypersensitivity reactions to metallic implants—diagnostic algorithm and suggested patch test series for clinical use. *Contact Dermatitis*. 2012 Jan 1;66(1):4-19. Available from <https://onlinelibrary.wiley.com/doi/full/10.1111/j.1600-0536.2011.01971.x>. Accessed April 11, 2018.
- ¹⁸ MELISA. Metal exposure. Available from <http://www.melisa.org/metal-exposure-2/>. Accessed February 23, 2018.
- ¹⁹ Schalock PC, Menné T, Johansen JD, Taylor JS, Maibach HI, Lidén C, Bruze M, Thyssen JP. Hypersensitivity reactions to metallic implants—diagnostic algorithm and suggested patch test series for clinical use. *Contact Dermatitis*. 2012 Jan 1;66(1):4-19. Available from <https://onlinelibrary.wiley.com/doi/full/10.1111/j.1600-0536.2011.01971.x>. Accessed April 11, 2018.
- ²⁰ Teo ZW, Schalock PC. Hypersensitivity reactions to implanted metal devices: facts and fictions. *J Investig Allergol Clin Immunol*. 2016 Jan 1;26(5):279-94. Available from <https://pdfs.semanticscholar.org/698e/e81a0e73f24113646ef6e9d0ec9f34b7e135.pdf>. Accessed April 11, 2018.

- ²¹ Schalock PC, Menné T, Johansen JD, Taylor JS, Maibach HI, Lidén C, Bruze M, Thyssen JP. Hypersensitivity reactions to metallic implants—diagnostic algorithm and suggested patch test series for clinical use. *Contact Dermatitis*. 2012 Jan 1;66(1):4-19. Available from <https://onlinelibrary.wiley.com/doi/full/10.1111/j.1600-0536.2011.01971.x>. Accessed April 11, 2018.
- ²² Teo ZW, Schalock PC. Hypersensitivity reactions to implanted metal devices: facts and fictions. *J Investig Allergol Clin Immunol*. 2016 Jan 1;26(5):279-94. Available from <https://pdfs.semanticscholar.org/698e/e81a0e73f24113646ef6e9d0ec9f34b7e135.pdf>. Accessed April 11, 2018.
- ²³ MELISA. Metal exposure. Available from <http://www.melisa.org/metal-exposure-2/>. Accessed February 23, 2018.
- ²⁴ MELISA. Metal exposure. Available from <http://www.melisa.org/metal-exposure-2/>. Accessed February 23, 2018.
- ²⁵ Muris J, Feilzer AJ. Micro analysis of metals in dental restorations as part of a diagnostic approach in metal allergies. *Neuroendocrinology Letters*. 2006 Dec 1;27(1):49-52. Available from https://pure.uva.nl/ws/files/2377838/155139_07_1_.pdf. Accessed April 11, 2018.
- ²⁶ Schalock PC, Menné T, Johansen JD, Taylor JS, Maibach HI, Lidén C, Bruze M, Thyssen JP. Hypersensitivity reactions to metallic implants—diagnostic algorithm and suggested patch test series for clinical use. *Contact Dermatitis*. 2012 Jan 1;66(1):4-19. Available from <https://onlinelibrary.wiley.com/doi/full/10.1111/j.1600-0536.2011.01971.x>. Accessed April 11, 2018.
- ²⁷ Schiff N, Boinet M, Morgon L, Lissac M, Dalard F, Grosogeat B. Galvanic corrosion between orthodontic wires and brackets in fluoride mouthwashes. *The European Journal of Orthodontics*. 2006 Jan 20;28(3):298-304. Available from <https://academic.oup.com/ejo/article/28/3/298/405288>. Accessed April 10, 2018.
- ²⁸ Mikulewicz M, Chojnacka K. Release of metal ions from orthodontic appliances by in vitro studies: a systematic literature review. *Biological Trace Element Research*. 2011 Mar 1;139(3):241-56. Available from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3310133/pdf/12011_2011_Article_9233.pdf. Accessed April 10, 2018.
- ²⁹ Schalock PC, Menné T, Johansen JD, Taylor JS, Maibach HI, Lidén C, Bruze M, Thyssen JP. Hypersensitivity reactions to metallic implants—diagnostic algorithm and suggested patch test series for clinical use. *Contact Dermatitis*. 2012 Jan 1;66(1):4-19. Available from <https://onlinelibrary.wiley.com/doi/full/10.1111/j.1600-0536.2011.01971.x>. Accessed April 11, 2018.
- ³⁰ Schiff N, Boinet M, Morgon L, Lissac M, Dalard F, Grosogeat B. Galvanic corrosion between orthodontic wires and brackets in fluoride mouthwashes. *The European Journal of Orthodontics*. 2006 Jan 20;28(3):298-304. Available from <https://academic.oup.com/ejo/article/28/3/298/405288>. Accessed April 10, 2018.
- ³¹ Schiff N, Boinet M, Morgon L, Lissac M, Dalard F, Grosogeat B. Galvanic corrosion between orthodontic wires and brackets in fluoride mouthwashes. *The European Journal of Orthodontics*. 2006 Jan 20;28(3):298-304. Available from <https://academic.oup.com/ejo/article/28/3/298/405288>. Accessed April 10, 2018.
- ³² Mikulewicz M, Chojnacka K. Release of metal ions from orthodontic appliances by in vitro studies: a systematic literature review. *Biological Trace Element Research*. 2011 Mar 1;139(3):241-56. Available from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3310133/pdf/12011_2011_Article_9233.pdf. Accessed April 10, 2018.
- ³³ Teo ZW, Schalock PC. Hypersensitivity reactions to implanted metal devices: facts and fictions. *J Investig Allergol Clin Immunol*. 2016 Jan 1;26(5):279-94. Available from <https://pdfs.semanticscholar.org/698e/e81a0e73f24113646ef6e9d0ec9f34b7e135.pdf>. Accessed April 11, 2018.
- ³⁴ Schalock PC, Menné T, Johansen JD, Taylor JS, Maibach HI, Lidén C, Bruze M, Thyssen JP. Hypersensitivity reactions to metallic implants—diagnostic algorithm and suggested patch test series for clinical use. *Contact Dermatitis*. 2012 Jan 1;66(1):4-19. Available from <https://onlinelibrary.wiley.com/doi/full/10.1111/j.1600-0536.2011.01971.x>. Accessed April 11, 2018.
- ³⁵ Teo ZW, Schalock PC. Hypersensitivity reactions to implanted metal devices: facts and fictions. *J Investig Allergol Clin Immunol*. 2016 Jan 1;26(5):279-94. Available from <https://pdfs.semanticscholar.org/698e/e81a0e73f24113646ef6e9d0ec9f34b7e135.pdf>. Accessed April 11, 2018.
- ³⁶ MELISA. Metal exposure. Available from <http://www.melisa.org/metal-exposure-2/>. Accessed February 23, 2018.
- ³⁷ Schalock PC, Menné T, Johansen JD, Taylor JS, Maibach HI, Lidén C, Bruze M, Thyssen JP. Hypersensitivity reactions to metallic implants—diagnostic algorithm and suggested patch test series for clinical use. *Contact Dermatitis*. 2012 Jan 1;66(1):4-19. Available from <https://onlinelibrary.wiley.com/doi/full/10.1111/j.1600-0536.2011.01971.x>. Accessed April 11, 2018.
- ³⁸ MELISA. Metal exposure. Available from <http://www.melisa.org/metal-exposure-2/>. Accessed February 23, 2018.
- ³⁹ MELISA. Metal exposure. Available from <http://www.melisa.org/metal-exposure-2/>. Accessed February 23, 2018.
- ⁴⁰ Schalock PC, Menné T, Johansen JD, Taylor JS, Maibach HI, Lidén C, Bruze M, Thyssen JP. Hypersensitivity reactions to metallic implants—diagnostic algorithm and suggested patch test series for clinical use. *Contact Dermatitis*. 2012 Jan 1;66(1):4-19. Available from <https://onlinelibrary.wiley.com/doi/full/10.1111/j.1600-0536.2011.01971.x>. Accessed April 11, 2018.
- ⁴¹ MELISA. Metal exposure. Available from <http://www.melisa.org/metal-exposure-2/>. Accessed February 23, 2018.

-
- ⁴² Schalock PC, Menné T, Johansen JD, Taylor JS, Maibach HI, Lidén C, Bruze M, Thyssen JP. Hypersensitivity reactions to metallic implants—diagnostic algorithm and suggested patch test series for clinical use. *Contact Dermatitis*. 2012 Jan 1;66(1):4-19. Available from <https://onlinelibrary.wiley.com/doi/full/10.1111/j.1600-0536.2011.01971.x>. Accessed April 11, 2018.
- ⁴³ Schalock PC, Menné T, Johansen JD, Taylor JS, Maibach HI, Lidén C, Bruze M, Thyssen JP. Hypersensitivity reactions to metallic implants—diagnostic algorithm and suggested patch test series for clinical use. *Contact Dermatitis*. 2012 Jan 1;66(1):4-19. Available from <https://onlinelibrary.wiley.com/doi/full/10.1111/j.1600-0536.2011.01971.x>. Accessed April 11, 2018.
- ⁴⁴ Schalock PC, Menné T, Johansen JD, Taylor JS, Maibach HI, Lidén C, Bruze M, Thyssen JP. Hypersensitivity reactions to metallic implants—diagnostic algorithm and suggested patch test series for clinical use. *Contact Dermatitis*. 2012 Jan 1;66(1):4-19. Available from <https://onlinelibrary.wiley.com/doi/full/10.1111/j.1600-0536.2011.01971.x>. Accessed April 11, 2018.
- ⁴⁵ Tomljenovic L, Shaw CA. Mechanisms of aluminum adjuvant toxicity and autoimmunity in pediatric populations. *Lupus*. 2012 Feb;21(2):223. Available from <http://www.vaccineliberationarmy.com/wp-content/uploads/2012/01/LTShaw-Lupus-2012-Mechanism-of-adjuvant-toxicity-in-pediatric-populations.pdf>. Accessed April 11, 2018.
- ⁴⁶ MELISA. Metal exposure. Available from <http://www.melisa.org/metal-exposure-2/>. Accessed February 23, 2018.
- ⁴⁷ MELISA. Metal exposure. Available from <http://www.melisa.org/metal-exposure-2/>. Accessed February 23, 2018.
- ⁴⁸ Stejskal VD, Forsbeck M, Cederbrant KE, Asteman O. Mercury-specific lymphocytes: an indication of mercury allergy in man. *Journal of Clinical Immunology*. 1996 Jan 1;16(1):31-40. Available from <http://www.melisa.org/pdf/hg-specific-lymph.pdf>. Accessed April 11, 2018.
- ⁴⁹ Yaqob A, Danersund A, Stejskal VD, Lindvall A, Hudecek R, Lindh U. Metal-specific lymphocyte reactivity is down-regulated after dental metal replacement. *Neuroendocrinology Letters*. 2006 Feb 1;27(1-2):189-97. Available from http://www.melisa.org/pdf/Yaqob_2006.pdf. Accessed April 11, 2018.