

Review Article

Dental gold alloys and contact allergy

HALVOR MÖLLER

Department of Dermatology, Malmö University Hospital, Lund University, Sweden

Contact allergy to gold as demonstrated by patch testing is very common among patients with eczematous disease and seems to be even more frequent among patients with complaints from the oral cavity. There is a positive correlation between gold allergy and the presence of dental gold. Gold allergy is often found in patients with non-specific stomatitides as well as in those with lichenoid reactions or with only subjective symptoms from the oral cavity. The therapeutic effect of substituting other dental materials for gold alloys is conspicuous in casuistic reports but less impressive in larger patient materials. The amount of dental gold is correlated qualitatively and quantitatively to the blood level of gold and the effects if any of circulating blood gold are unknown. There is clearly a need for prospective studies in the field and gold sodium thiosulfate is considered an important item in the dental series for patch testing.

Key words: contact allergy; dental gold; gold alloy; lichenoid reaction, oral disease; stomatitis.

© Blackwell Munksgaard, 2002.

Accepted for publication 12 July 2002

Definitions

The term dental gold covers alloys containing gold as a component and included in the ISO standards (1, 2). Allergy to gold alloys implies contact allergy, i.e. the T-cell mediated, immunological state which is not expressed as a clinical reaction until a renewed contact with the hapten. A prerequisite for the induction as well as the elicitation of this allergy is dissolution and ionization of the metal followed by penetration of the hapten into the skin or mucous membrane. Dissolution of metallic gold is notoriously difficult but the process is facilitated by the presence of other metals in the alloy – the lower carat, the greater solubility of the gold (3) – but also by metals in the neighbourhood, e.g. amalgam through galvanism (4). Furthermore, dissolution and ionization are promoted by a high pH, an oxidative environment and the presence of amino acids, particularly sulfur-containing ones (3, 5).

Diagnosis

Contact allergy to gold is demonstrated by patch testing. Metallic gold (foil) and trivalent auric chloride were formerly used but are not recommended today. Instead, monovalent gold salts should be used, particularly gold sodium thiosulfate (GSTS) 0.5–2.0% in petrolatum (6). Since the

patch test reactions often are delayed (7), it is important to read the test not only 3 days after the application (D3), but also at least one more time thereafter, preferably at D7. Alternatively, the GSTS test may be performed intradermally with 55 mm in physiological saline (8). In most cases, the allergy may also be demonstrated *in vitro* by, e.g. lymphocyte transformation test (8, 9).

Gold allergy is very frequent in patch-tested patients with eczematous disease. In 2001, using 2.0% GSTS and two readings, 15% positivity was observed in Malmö, Sweden, i.e. the same figure as that for nickel sulfate (Möller, unpublished observation). The clinical relevance, however, is much lower than that for nickel allergy (10). Common frequencies in published materials are 5–15%, the latest figures being from the USA (11).

Gold allergy in relationship to dental gold

Questionnaire studies on patients with eczematous diseases have shown that contact allergy to gold is correlated to the presence of dental gold (10–12). A prospective, dermato-odontological study has recently confirmed this relationship and also demonstrated a quantitative correlation between the allergy and the number of gold surfaces in the oral cavity: the more gold in the mouth, the higher the risk of gold allergy (13).

Clinical and experimental studies have shown that metallic gold is released in saliva (14–16). Apparently, released gold is taken up into the circulation since the gold level in blood is correlated to the amount of dental gold in the individual (14, 17). Not surprisingly, contact allergy to gold has been demonstrated in dentists with hand eczema in 9% (18) which, however, is not a higher frequency than in other eczema patients.

Gold allergy and oral cavity problems

Case reports are usually mixed, with non-specific stomatitides, more specific ones such as lichenoid reactions, as well as prosthesis problems and other symptoms lacking objective signs like 'burning mouth syndrome'. In such mixed cases (9, 19–25), gold allergy has been demonstrated in 7–54% (mean 20%). Among patients with a non-specific stomatitis, gold allergy was found in 1–13% (23, 26, 27), with a lichenoid reaction in 9–30% (28–32). Contact allergy to gold as well as to mercury is frequent in connection with lichenoid reactions in the oral cavity (20, 28, 29). Patients with 'burning mouth syndrome' seem to have a higher frequency of contact allergy to gold than to mercury (20, 33, 34).

These data have to be interpreted with some caution as many reports can be criticised for lack of controls and questionable testing techniques. In one group of patients referred for different problems of the oral cavity, there was a positive correlation between contact allergy to gold and the presence of dental gold (25) which, as earlier mentioned, also holds true for patients investigated for eczematous disease (13). It has been confirmed that GSTS is the preferable test substance and that the allergy can be demonstrated *in vitro* (9, 35).

Casuistics

A local stomatitis close to dental gold and with a positive patch test to a gold salt has been reported in 13 patients (25, 36–45). In two cases (36, 45), the allergy was demonstrated also *in vitro*. The reports imply a crown, bridge or prosthesis causing a burning sense in the neighbourhood of the metal, later followed by erythema or even ulceration. In four cases, the patients had probably been sensitized through piercing of the earlobes or the wearing of jewellery, but in the other nine there were reasons to suspect a direct induction of contact allergy from the dental gold (25, 36, 38, 40–42, 45), i.e. after penetration of the hapten into the oral mucous membrane. In four patients (25, 37, 44), there was a concomitant dermatitis, probably with a causal connection to the dental gold.

Effect of elimination of dental gold

In some of the larger patient groups, results of removal of dental gold are given but not, however, if non-visible gold, such as that contained in posts, was also eliminated. Oral lichenoid reactions were reported healed or partly healed in five cases after removal of the metal; in addition, there was one case each of stomatitis and 'burning mouth syndrome' (22). Dental gold was eliminated in two of three patients with lichenoid reactions, which then healed (29). In a mixed number of oral cavity problems, gold was replaced in six cases but this led to healing in only two patients with stomatitis (9). In three cases with a local stomatitis, all healed upon removal of the metal (34, 42). In spite of 'an overrepresentation of gold allergies among those with dental restorations containing gold', removal of dental gold led to little success (25).

Casuistics with results from selected cases tell another story: in the eight patients with gold elimination (25, 36, 37, 40–44) all oral problems disappeared including, in some cases, a concomitant dermatitis. A case of pharyngo-laryngitis was even reported healed after such treatment (46).

Advice to the dentists and their patients

The amount of dental gold varies widely in different nations (in Sweden it is present in more than 25% of the population). The metal has become known as an inert material without any known serious adverse effects. A diagnosis of contact allergy to gold does not, of course, imply a disease and is not by itself an indication to remove the gold alloys in the patient's mouth. Such treatment should, however, be recommended in a patient with a local inflammatory reaction in close connection with dental gold and after a *lege artis* demonstrated gold allergy. In the case of stomatitides without direct contact with metallic gold, as well as in patients with subjective symptoms only, the possibility of healing is much less probable. It seems unwise to insert dental gold in patients in whom a contact allergy to gold has been demonstrated.

In summary, it is important that GSTS is included in the dental patch test series in order to disclose contact allergy to gold. In a patient with such an allergy and with a local stomatitis in close connection with metallic gold, elimination of the metal should be considered.

Acknowledgement

The review was originally commissioned by the Swedish National Board of Health and Welfare, which also gave permission for its publication.

References

- ISO 1563: 1990: Dental alginate impression material.
- ISO 9693: 1999: Metal-ceramic dental restorative systems.
- Brown DH, Smith W E, Fox P, Sturrock R D. The reactions of gold(0) with amino acids and the significance of these reactions in the biochemistry of gold. *Inorganica Chimica Acta* 1982; 67: 27–30.
- Holland R I. Galvanic currents between gold and amalgam. *Scand J Dent Res* 1980; 88: 269–272.
- Flint G N. A metallurgical approach to metal contact dermatitis. *Contact Dermatitis* 1998; 39: 213–221.
- Bruze M, Björkner B, Möller H. Patch testing with gold sodium thiosulfate. Jadassohn Centenary Congress, London, 9–12 October, 1996: Abstract 49.
- Bruze M, Hedman H, Björkner B, Möller H. The development and course of test reactions to gold sodium thiosulfate. *Contact Dermatitis* 1995; 33: 386–391.
- Björkner B, Bruze M, Möller H. High frequency of contact allergy to gold sodium thiosulfate. An indication of gold allergy? *Contact Dermatitis* 1994; 30: 144–151.
- Räsänen L, Kalimo K, Laine J, Vainio O, Kotiranta J, Pesola I. Contact allergy to gold in dental patients. *Br J Dermatol* 1996; 134: 673–677.
- Bruze M, Edman B, Björkner B, Möller H. Clinical relevance of contact allergy to gold sodium thiosulfate. *J Am Acad Dermatol* 1994; 31: 579–583.
- Fowler J Jr, Taylor J, Storrs F et al. Gold allergy in North America. *Am J Contact Dermatitis* 2001; 12: 3–5.
- Schaffran R M, Storrs F J, Schalock P. Prevalence of gold sensitivity in asymptomatic individuals with gold dental restorations. *Am J Contact Dermatitis* 1999; 10: 201–206.
- Ahlgren C, Ahnlide I, Björkner B et al. Contact allergy to gold is correlated to dental gold. *Acta Derm Venereol* 2002; 82: 41–44.
- Drasch G, Muss C, Roider G. Gold and palladium burden from dental restoration materials. *J Trace Elements Med Biol* 2000; 14: 71–75.
- Björkman L, Ekstrand J, Lind B. Determination of gold released from dental alloys into saliva. IADR abstract. *J Dent Res* 1998; 77: 1068.
- Christidis R, Ringvall J, Björkman L. Gold in saliva following experimental exposure to dental gold. *IADR Scand Div Abstr* 2000; 99.
- Ahnlide I, Ahlgren C, Björkner B, Bruze M, Lundh T, Möller H, Nilner K, Schütz A. Gold concentration in blood in relation to the number of gold restorations and contact allergy to gold. *Acta Odontol Scand*, in press.
- Wallenhammar L-M, Örtengren U, Andreasson H, et al. Contact allergy and hand eczema in Swedish dentists. *Contact Dermatitis* 2000; 43: 192–199.
- Stenman E, Bergman M. Hypersensitivity reactions to dental materials in a referred group of patients. *Scand J Dent Res* 1989; 97: 76–83.
- Laeijendecker R, van Joost T. Oral manifestations of gold allergy. *J Am Acad Dermatol* 1994; 30: 205–209.
- Alanko K, Kanerva L, Jolanki R, Kannas L, Estlander T. Oral mucosal diseases investigated by patch testing with a dental screening series. *Contact Dermatitis* 1996; 34: 263–267.
- Marcusson J A. Contact allergies to nickel sulfate, gold sodium thiosulfate and palladium chloride in patients claiming side-effects from dental alloy components. *Contact Dermatitis* 1996; 34: 320–323.
- Richter G, Geier J. Dentalwerkstoffe – Problemsubstanzen in der allergologischen Diagnostik? Teil I. Analyse der Testergebnisse bei Patienten mit Mundschleimhaut/Dentalwerkstoff-Problemen. *Hautarzt* 1996; 47: 839–843.
- Heise H, Beyer H, Rauschenbach D. Ergebnisse der Epikutantestung auf Goldsalze versus Amalgam. *Ztschr Dermatol* 1997; 183: 68–73.
- Vamnes J S, Morken T, Helland S, Gjerdet N R. Dental gold alloys and contact hypersensitivity. *Contact Dermatitis* 2000; 42: 128–133.
- van Loon L A J, van Elsas P W, van Joost T, Davidson C L. Test battery for metal allergy in dentistry. *Contact Dermatitis* 1986; 14: 158–161.
- Vilaplana J, Romaguera C. Contact dermatitis and adverse oral mucous membrane reactions related to the use of dental prostheses. *Contact Dermatitis* 2000; 43: 183–185.
- Nordlind K, Lidén S. Patch test reactions to metal salts in patients with mucosal lesions associated with amalgam restorations. *Contact Dermatitis* 1992; 27: 157–160.
- Koch P, Bahmer F A. Oral lichenoid lesions, mercury hypersensitivity and combined hypersensitivity to mercury and other metals: histologically-proven reproduction of the reaction by patch testing with metal salts. *Contact Dermatitis* 1995; 33: 323–328.
- Laine J, Kalimo K, Happonen R-P. Contact allergy to dental restorative materials in patients with oral lichenoid lesions. *Contact Dermatitis* 1997; 36: 141–146.
- Yannias J A, el-Azhary R A, Hand JH, Pakzad S Y, Rogers R S III. Relevant contact sensitivities in patients with the diagnosis of oral lichen planus. *J Am Acad Dermatol* 2000; 42: 177–182.
- Scalf L A, Fowler JF Jr, Morgan KW, Looney SW. Dental metal allergy in patients with oral, cutaneous, and genital lichenoid reactions. *Am J Contact Dermatitis* 2001; 12: 146–150.
- Dutrée-Meulenberg R O G M, Kozel M M A, van Joost T. Burning mouth syndrome: a possible etiologic role for local contact hypersensitivity. *J Am Acad Dermatol* 1992; 26: 935–940.
- Koch P, Bahmer F A. Oral lesions and symptoms related to metals used in dental restorations. A clinical, allergological and histologic study. *J Am Acad Dermatol* 1999; 41: 422–430.
- Cederbrant K, Hultman P, Marcusson J A, Tibblin L. In vitro lymphocyte proliferation as compared to patch test using gold, palladium and nickel. *Int Arch Allergy Immunol* 1997; 112: 212–217.
- Schöpf E, Wex O, Schulz KH. Allergische Kontaktstomatitis mit spezifischer Lymphocytenstimulation durch Gold. *Hautarzt* 1970; 21: 422–424.
- Elgart M L, Higdon R C. Allergic contact dermatitis to gold. *Arch Dermatol* 1971; 103: 649–653.
- Young E. Contact hypersensitivity to metallic gold. *Dermatologica* 1974; 149: 294–298.
- Klaschka F. Contact allergy to gold. *Contact Dermatitis* 1975; 1: 264–265.
- Fregert S, Kollander M, Poulsen J. Allergic contact stomatitis from gold dentures. *Contact Dermatitis* 1979; 5: 63–64.
- Holland-Moritz R, Rimpler M, Rudolph P-O. Allergie gegenüber Gold in der Mundhöhle? *Dtsch Zahnärztl Z* 1980; 35: 963–967.
- Izumi A. Allergic contact gingivostomatitis due to gold. *Arch Dermatol Res* 1982; 272: 387–391.
- Shepard F E, Moon P C, Grant G C, Fretwell L D. Allergic contact stomatitis from a gold alloy-fixed partial denture. *J Am Dent Assoc* 1983; 106: 198–199.
- Wiesenfeld D, Ferguson M M, Forsyth A, MacDonald D G. Allergy to dental gold. *Oral Surg* 1984; 57: 158–160.
- Aro T, Kanerva L, Häyrynen-Immonen R et al. Long-lasting allergic patch test reaction caused by gold. *Contact Dermatitis* 1993; 28: 276–281.
- Kilpikari I. Contact allergy to gold with pharyngeal and laryngeal disorders. *Contact Dermatitis* 1997; 37: 130–131.

Address:

*Halvor Möller**Department of Dermatology**Malmö University Hospital**S-20502 Malmö**Sweden*e-mail: halvor.moller@derm.mas.lu.se

Tel: 4640 331752

Fax: 4640 336213