

Allergic Contact Dermatitis As a Complication of Lid Loading with Gold Implants

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Paralysis of the orbicularis oculi muscle in patients with a facial nerve injury causes functional and cosmetic disabilities including inability to close the eyelid. This complication is often treated by implanting a gold weight in the upper eyelid, which, however, is not without side effects. Four patients are described who, after lid loading with a gold implant, acquired an inflammatory reaction due to contact allergy to the metal inserted. The allergy was demonstrated by patch testing with gold sodium thiosulfate. The implant was removed and the dermatitis resolved. Contact allergy to gold occurs frequently and may explain many cases of complications to lid loading with the metal.

PATIENTS WITH FACIAL NERVE PARALYSIS have both functional and cosmetic impairments.¹ Ocular problems related to seventh-nerve palsy are an inability to close the eyelids (lagophthalmos), decreased tear production, and ectropion of the lower eyelid.² Since the musculus levator palpebrae superioris is overfunctioning without its paralytic antagonist (the musculus orbicularis oculi), the palpebral fissure stays open. Closure of the eyelids reduces evaporations of tears and prevents corneal dryness.³ Tarsorrhaphy has earlier been the preferred surgical option for the treatment of lagophthalmos. The implantation of foreign material in the paralyzed upper eyelid has been performed for more than 50 years.³ Sheehan⁴ was one of the first in the field who used tantalum wire and mesh implant. Other materials, such as stainless steel and lead, have also been used. Gold became the material of choice more than 40 years ago¹ because of its inertness, high density, and good color match for the skin.^{5,6} The gold implant can be custom made from dental gold by a local dental technician.⁶ Gold eyelid weights are also commercially available.⁷

The most common cause of facial nerve paralysis is excision of acoustic neurinoma and trauma.^{6,7} Patients with complete facial nerve paralysis are at risk for eye complications resulting from exposure of the cornea and loss of the blinking reflex. The failure of protection

predisposes the patient to exposure keratitis, corneal abrasion, and (in rare cases) blindness.⁸

The gold weight is inserted into a small pocket between the orbicularis oculi and the tarsal plate of the upper eyelid. The gold implant is curved to fit the curvature of the eye and contains holes for fixation to the tarsus with sutures.⁸ A lower-eyelid supporting procedure should be performed simultaneously in patients with lagophthalmos of a moderate or severe degree, to achieve complete closure of the eyelid.⁸

During the last 40 years, upper-lid gold weight insertions and lower-lid shortening procedures have been the standard surgical techniques used to restore eyelid function and protect the cornea in patients with facial nerve paralysis. Tarsorrhaphy, the former classic method,^{9,10} has many limitations, such as causing a narrow vision and sometimes permanent visual impairment.¹⁰

The implantation of a gold weight into the upper eyelid is not without complications (see below). The frequency of contact allergy to the inserted metal has not been systematically studied. We here present four cases of allergic contact dermatitis of the eyelid following gold lid loading. The four patients reported on here were patch-tested on the back with the Swedish standard series (cases 1, 2, and 3) or with the dental screening series (Chemotechnique Diagnostics, Vellinge, Sweden) (case 4) and, when indicated, with additional test series as well as patient-supplied materials. All patients were patch-tested with gold sodium thiosulfate (GST) 2% in petrolatum. In addition, GST 5% in petrolatum was added to the Swedish standard series (cases 2 and 3), and GST 0.5% in petrolatum was added to the dental screening series (case 4). The patients in cases 1, 2, and 4 were also patch-tested

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with ammonium hexachloroplatinate (AHP) 0.1% in water, a marker for platinum contact allergy. Finn Chambers (Epitest, Tuusula, Finland) were attached with Scanpor tape (Norgesplaster, Vennessla, Norway). The patches were removed after 2 days by the patients, and the reactions were read after a further day (day 3 [D3]) and on day 7 (D7), according to the criteria of the International Contact Dermatitis Research Group.¹¹

Case Reports

Case 1

A 51-year-old woman was operated on for an acoustic neurinoma on the right side, and the facial nerve could not be saved. Two months later, a lid loading with a gold implant was performed to correct her lagophthalmos. After the operation, she noted swelling and erythema of the eyelid, which became more intense during the following 8 months. No infection was evident. She had no history of atopy or dermatitis, and she had never had any problems with her dental gold or from wearing gold jewelry. To exclude a possible contact allergy, she was patch-tested with the Swedish standard series, including GST 2% in petrolatum, to which she had strongly positive reactions on D3 and D7. She was patch test negative to AHP.

Two weeks after patch testing, she underwent another lid-loading operation in which the gold weight was removed and replaced with a platinum implant, and the symptoms subsided gradually during 10 months (Figs 1 and 2). This patient was described in an earlier report.¹²

Case 2

A 71-year-old woman had an acoustic neurinoma on her right side. During the operation, both her facial nerve and trigeminal nerve on that side could not be saved. Afterwards, she was unable to close her eyelids and had ectropion of the lower eyelid. She also developed a hemianopia to the right. Six months later, a lid-loading operation with a gold implant was performed to correct her lagophthalmos. However, only a few days later, the patient noted swelling and erythema of the eyelid. Subsequent removal of the weight resulted in resolution of the inflammation. She was referred to our department to exclude a contact allergy to gold before another operation with a new gold implant was performed. Because of her hemianopia, tarsorrhaphy was not the method of choice. The patient was patch-tested with the



Figure 1. Swelling and erythema of the upper-right eyelid in case 1 patient with a gold implant.

Swedish standard series including GST 2% and 5% in petrolatum, to which she had strongly positive reactions on D3 and D7. The result of a patch test with AHP was



Figure 2. After 10 months, the swelling and erythema gradually subsided after the gold implant was replaced with a platinum implant.

negative. She has had dental gold for more than 50 years without any oral symptoms. She had no problems wearing gold jewelry. Implantation with a platinum weight made her free of symptoms.

Case 3

A 68-year-old woman was operated on three times for an acoustic neurinoma on her left side. The tumor was not successfully removed the first two times. After the third operation, she developed a facial nerve paralysis. One month later, a lid-loading operation with a gold implant was done. After a week, she noted erythema and swelling not only of her eyelid but also of her left forehead and cheek. The gold implant was removed after an additional week and was replaced by a platinum weight. The dermatitis slowly subsided and healed after 4 months. The platinum implant was later also removed because she spontaneously recovered from the facial pareses. The patient was patch-tested with the Swedish standard series including GST 2% and 5% in petrolatum, to which she had strongly positive reactions on D3 and D7. She was also patch test positive to nickel, chromium, cobalt, palladium, and two preservatives. When newly married, she developed an eczema under the gold rings worn on her finger. Since then, she has never been able to wear red gold jewelry, but white gold gave her no symptoms in spite of her being allergic to nickel. She has never had problems with her dental gold.

Case 4

A 77-year-old woman was operated on in 1981 for an acoustic neurinoma on her left side, which resulted in a facial paralysis. A lid gold weight implant was therefore installed. She had many problems with the eye in the following years, including erythema, swelling, and spontaneous extrusion of the implant. The gold weight was finally removed. Six months later, she was referred to us for patch testing under the suspicion of a gold allergy. During this time, her symptoms gradually abated. She was patch-tested with our dental screening series, including GST 2% and 0.5% in petrolatum. She had positive reactions to both concentrations on D3 and D7. She was patch test negative to AHP. She had no oral symptoms from dental gold. She could not tell if she ever had had any dermatitis from gold jewelry. A new operation with a platinum implant is planned.

Discussion

A number of reports from around the world in the last decade have shown that the prevalence of gold allergy in

patch-test studies among dermatitis patients varies between 0.8% to as high as 13.0%.^{13–15} By patch-testing with GST 0.5%, we earlier found a frequency of contact allergy to gold of 8.3% in consecutively tested dermatitis patients,¹⁶ very similar to the result of a North American study.¹⁷ The latest figure (ie, for 2006) from the Malmö department (testing with GST 2.0%) was 14.5%. By far the majority of those sensitized to gold are women.^{16–19} We have reported on four women who developed allergic contact dermatitis from gold as a complication after upper-lid loading with a gold implant for postoperative facial palsy. Most authors who have studied the morbidity after gold weight insertion into the upper eyelid in facial palsy did not divide the patients into gender, but among those who had, there was a slight predominance of women.^{6,20,21}

It is difficult to explain the source of sensitization and to see any clinical relevance in most people who are allergic to gold.²² Many patients are skeptical about their being patch test positive to gold; they had never had any problems with metallic gold. None of our patients have had any oral symptoms from dental gold, and only one has a problem wearing gold jewelry.

Exposure to gold jewelry,²³ ear piercing,^{24,25} and dental gold^{17,22,25–28} is of importance in the sensitization to gold. We earlier showed that there is a positive relationship between contact allergy to gold and the presence of dental gold alloys²²; this was later confirmed by Schaffran and colleagues²⁸ and Vamnes and colleagues.²⁵ The positive correlation between dental gold and gold allergy was even quantitative.²⁶ Gold apparently is released from dental gold restorations and taken up into the circulation.²⁷

An interesting feature of gold allergy is the propensity for facial and eyelid dermatitis to occur. We have reported a statistically more frequent occurrence of eyelid dermatitis among patients who are allergic to gold.²² Eyelid skin is particularly prone to allergic reactions and may be the site where contact dermatitis is manifested even if the site of exposure is elsewhere.^{29,30} However, among patients with upper-lid gold weight implants, the eyelid dermatitis was only noticed on the same side on which the operation was performed. Fowler²⁹ described two women with eyelid dermatitis and gold allergy, and Ehrlich and Belsito³⁰ reported that 7 of 17 patients (43.8%) with gold allergy had eyelid dermatitis. When contact with gold jewelry was discontinued, 46.7% of the gold-allergic patients reported that their dermatitis cleared. None of the patients required the removal of dental gold.

As early as the 1940s, Forster and Dickey³¹ reported a case of sensitivity to a gold-ball implant in a 29-year-old

woman. She had had bilateral congenital dislocated lenses since the age of six years, with uveitis and secondary glaucoma. The left eye had become blind and painful. Enucleation was performed, and a 14-carat gold ball was implanted. Five years after the implantation of the gold ball, the patient presented with an erythematous, oozing, and vesiculopapular dermatitis of her left eyelids and adjoining malar region. She was patch-tested with GST 0.5% in water, pure gold leaf, and the gold ball, all with positive results.

For some years, metallic gold implants have been used as a paramedical remedy for the treatment of rheumatism and pain. However, this method has been considered irrational because a scientific explanation of the postulated beneficial effect is lacking. The use of gold implants originates from acupuncture, in which gold needles seem to have been used quite often. In the early 1970s, some US veterinarians started to use gold implants to treat dogs suffering from hip dysplasia.^{32,33}

Mulherin and colleagues³⁴ reported that gold molecules from a gold ring protect the adjacent joints against articular erosion in rheumatoid arthritis cases. But for gold to be considered to have a healing effect as well as be a contact allergen, it has to be shown that gold ions are released from the implanted gold and diffuse out into the surrounding tissue.

Danscher³² implanted pure gold threads in the bodies of adult rats. The study showed that the gold implants released gold ions, most likely by surface oxidation caused by macrophages that bind to sulfhydryl groups in tissue adjacent to the implant. The gold-loaded molecules are then phagocytosed by cells close to the gold implants and are finally accumulated in the lysosomes, where gold inhibits the antigen processing.³⁵ The bigger the surface of the gold implants, the more gold ions are released and the farther away cells loaded with gold can be found.³² Danscher hypothesized that the surface of the gold implant stimulates a reaction from the immune system, causing an oxidative liberation of gold ions that bind to the above-mentioned molecules. The released gold ions, possibly Au(I), either may exert their inhibitory effect on inflammation directly (by harming peptides or proteins by reacting chemically with them) or may have to be converted to aurocyanide ions first.^{32,36}

Before gold can act as an allergen, it must thus first be converted into a soluble form. In aqueous solutions of various amino acids, particularly cysteine or glutathione, which contain a thiol group generally known to complex electropositive metals, gold is solubilized. The simple metal salts or complexes thus formed can reach the epidermis

and react with native protein, a prerequisite for immune system activation.^{36,37}

Doyle and colleagues³⁸ reported on two patients who had suffered noninfectious inflammatory reactions to upper-eyelid gold weight implants after facial nerve palsy. The first patient developed an inflammatory reaction 2 weeks after implantation. The patient was patch test positive to GST 2% in a standard dental series. The second patient, who developed an inflammation 1 week after implantation, refused patch testing. Histologic examination of the fibrous capsule from this patient revealed a chronic inflammatory infiltrate with mostly lymphocytes and a few macrophages. B-cells, as well as CD4⁺ and CD8⁺ T cells, were also detected. The reaction was nongranulomatous and therefore not typical of a foreign-body reaction. The authors concluded that the histology therefore supported a diagnosis of delayed-type hypersensitivity. However, histopathologic findings without a positive patch-test result do not support a diagnosis of contact allergy to gold in the second patient.

Doyle and colleagues³⁸ also pointed out that a personal and family history of gold allergy should be looked for before upper-eyelid gold weight implantation. Patch testing should be performed on a patient when there is suspicion about whether gold has been the specific cause of previous allergic reactions, when the patient has undergone previous dental restoration involving gold, or if there is a positive family history of gold allergy. However, as gold is a contact allergen, a family history of gold allergy has no significance.

Gold contact dermatitis, which on the other hand is often persistent and granulomatous, might be explained by the fact that Langerhans cells avidly bind even minute amounts of gold rather than degrading or excreting it as with other allergens.³² Gold particles, once deposited in the dermis, remain in place permanently and have also been located around blood vessels and in dermal macrophages.^{39,40} The rather late appearance of a gold dermatitis may thus be ascribed to the antiinflammatory properties of gold compounds that makes them effective antirheumatic agents, as well as the slow release of gold ions from solid gold.

A gold implant from dental gold, custom-made by a local dental technician, usually consists of 70% gold, 16% copper, 10% silver, and 2% platinum.⁶ Most complications from implants with dental gold have been blamed on the gold alloy used, which might be significant for the rate of dissolution. For example, the higher the copper content in the gold alloy, the more gold is dissolved.³⁵ This is probably due to the increased surface area exposed by the

dissolving copper.⁴¹ To minimize tissue reaction, 24-carat gold weights are now preferred to dental gold weights.⁶

Gold weight lid-loading procedures have shown satisfactory results in most follow-up reports, but the method is not without error or complications.^{20,42–45} Specific complications that have been mentioned are bulging of the load,^{7,46,47} extrusion of the gold weight,^{9,46,47} ptosis,^{46,48} astigmatism,⁴⁶ infections,^{9,48} and noninfectious inflammation.^{21,49}

In cases with a noninfectious inflammatory complication, as well as in those cases in which infection was presumed but not verified, it seems reasonable to consider a contact allergy to the implanted material to be responsible for the postsurgical dermatitis. Consequently, investigation in such cases should include patch testing to demonstrate a causative allergen (in this case, gold, which is a common contact allergen).

An alternative load material also might be considered. Platinum implants lead to better results with fewer complications as compared to standard rigid gold implants. A flexible platinum chain implant adapts better to the changing radius of the tarsus with movements of the eyeball and therefore reduces the complication rate. Platinum implants are smaller owing to their higher density.⁵⁰ Our patients were patch test negative to AHP, and contact allergy to platinum and platinum salts seems to be extremely rare.

Conclusion

Gold is a relatively common allergen in spite of the fact that only a few people suspect gold sensitivity. Therefore, it is quite possible that gold allergy was present in some of our patients before the metal was implanted. Consequently, to reduce the risk of possible postoperative complications, patch testing with gold sodium thiosulfate *lege artis* should be performed before gold implants are installed in patients with lagophthalmos. Endogenous implant infection without extrusion of the gold weight may be distinguished from presumed inflammation due to gold allergy by the clinical response to antibiotics in the former and by the requirement of steroids or removal of the implant in the latter.⁵¹ Implantation with a platinum weight could be considered as an alternative to a gold weight in such circumstances.

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