

# Histopathologic and Ultrastructural Features of Gold Thread Implanted in the Skin for Facial Rejuvenation

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**Abstract:** The authors report the histopathologic and ultrastructural features of gold threads, which were implanted in the cheek subcutis of a 77-year-old woman 10 years ago. These particles did not give rise to any adverse reactions and were fortuitously discovered by the surgeon during a facelift. Histopathology showed a nonpolarizing exogenous material consisting of black oval structures surrounded by a capsule of fibrosis and by a discrete inflammatory reaction with a few giant cells. In some cases, only a long fibrous tract surrounded by a moderate mononucleate infiltrate was observed. The wires were characterized with scanning electron microscopy, and X-ray microanalysis revealed a specific peak at 2.2 keV representative of gold that was absent in the control skin sample. As this value is specific for gold, it confirms the presence of the metal in the patient's skin. The histopathologic appearance of gold threads is particularly distinctive and easily recognizable by dermatopathologists.

**Key Words:** gold threads, fillers, soft tissue augmentation, histopathology

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## INTRODUCTION

Cosmetic dermatology has undergone rapid expansion over the last few decades with different techniques used for wrinkle correction and soft tissue augmentation by dermatologists and plastic surgeons. A common such technique involves the injection of several different fillers. Gold thread implantation may also be used during these “rejuvenation” procedures. We report here the histopathologic features of these gold threads in a 77-year-old woman who underwent gold thread implantation 10 years ago. These particles did not trigger any adverse reactions and were fortuitously discovered by the surgeon during a facelift. The gold nature of the threads was proved by X-ray microanalysis. The histopathologic appearance of gold threads described hereinafter will allow pathologists to recognize them if necessary.

## CASE REPORT

A 77-year-old woman underwent a facelift. She reported that she had already undergone gold thread implantation in her cheeks 10

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years previously. When the surgeon separated the skin from the deeper tissues, he found numerous threads in the deep part of the cutaneous flap and on the surface of the subcutaneous tissue (Fig. 1). He took a sample, which was fixed in 10% neutral-buffered formalin and embedded in paraffin. Small shining dots were observed on the paraffin block (Fig. 2). After routine processing, sections were stained with hematoxylin–eosin–safran. Light microscopic examination of the sections showed fibrosis, which was highlighted by Masson trichrome stain. Within this fibrous tissue, a nonpolarizing exogenous material made up of black oval structures was observed (Fig. 3). These particles were surrounded by a capsule of fibrosis and by a discrete inflammatory reaction with a few giant cells (Fig. 4). The oval particles were often grouped in clusters of 2 or 3 and measured about 0.1 mm in diameter. Some areas presented only a long fibrous tract surrounded by a moderate mononucleate infiltrate without any giant cells (Fig. 5).

## Electron Microscopy and X-ray Microanalysis

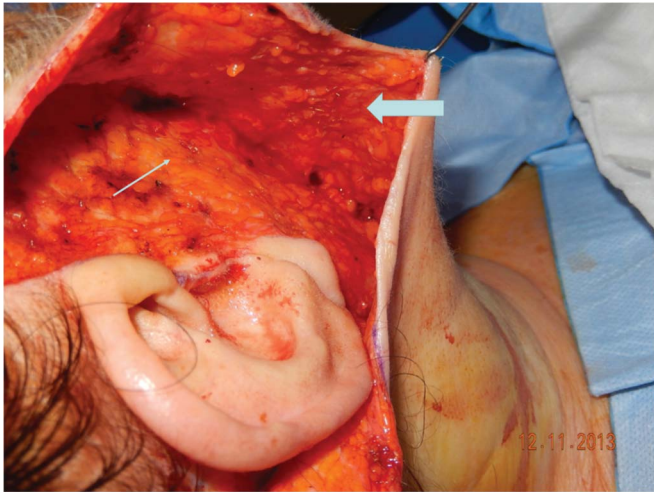
To confirm the nature of these structures, scanning electron microscopy and X-ray microanalysis were performed after deparaffinization of the block with xylene. The cut fragments or samples were air dried overnight at 40°C, fixed to the stubs with conductive carbon tape and coated with a 30-nm evaporated carbon film.

Imaging and qualitative microanalysis were performed with a Hitachi Su-70 scanning electron microscope equipped with an Oxford X-Max EDS detector. An acceleration voltage of 15 kV was applied.

First attempts at analysis of the wire structures were inconclusive because the electron probe can only analyze to a depth of a few micrometers. The tissues in which the wires were embedded were removed with a scalpel and the samples analyzed again. The wires could then be seen clearly as a dense gray material on scanning electron microscopy images (Fig. 6A). X-ray spectra of the center of these wires showed peaks of C, N, and Au only (Fig. 6B). Thus, the only metal on the surface of the wire was pure gold. The focus was then moved to a region where a wire was sticking out from the tissue creating a round image (Fig. 7A). In this case, microanalysis evidenced the gold without need for scratching (Fig. 7B). Control spectra were also taken in other regions where no gold wires were seen and none of the metal was found. The electron microscopy image was also used to measure the diameter of the threads, which was found to be 95  $\mu\text{m}$  with a 5- $\mu\text{m}$  uncertainty.

## DISCUSSION

Facial rejuvenation procedures (wrinkle reduction and skin defect correction) using injectable materials are now widely performed by dermatologists and plastic surgeons, and their histopathologic side effects are well known.<sup>1</sup> The technique of gold thread implantation for wrinkle treatment was developed about 30 years ago but is poorly documented in the

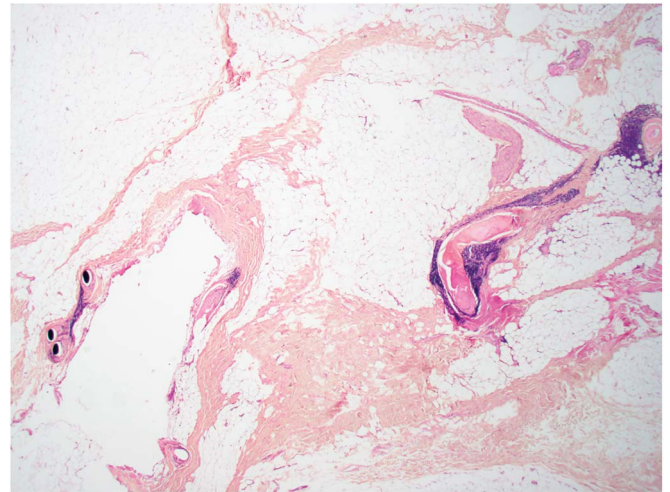


**FIGURE 1.** Numerous threads in the deep part of the cutaneous flap and on the surface of the subcutaneous tissue during the surgical facelift procedure.

medical literature. The 0.1-mm diameter gold threads are implanted into the anesthetized area and threaded into the subdermal layer of the skin. The aim is to create a net-like structure that will provide a mechanical support for the overlying skin.<sup>2</sup> The implanted gold thread may be seen if



**FIGURE 2.** Shining dots in the paraffin block.

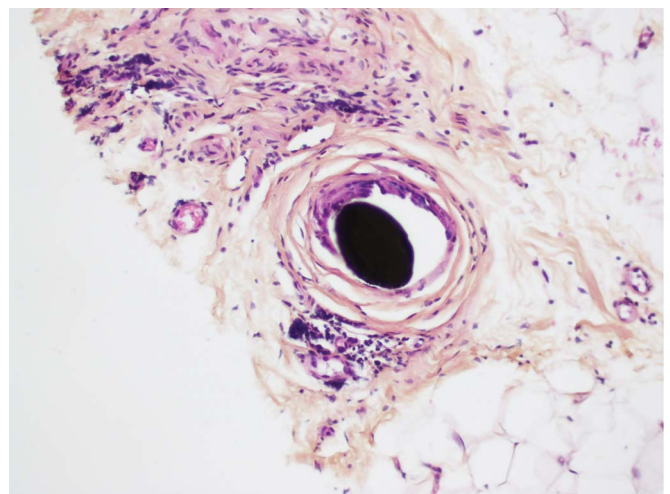


**FIGURE 3.** Fibrosis of the subcutaneous tissue with 3 black ovoid particles on the left and a fibrous tract on the right (hematoxylin–eosin–safran  $\times 20$ ).

radiological investigations are required for other reasons, for example, they appear as irregular strings and curved lines of dense radiopaque material on panoramic radiographs in a 60-year-old woman<sup>3</sup> and as curvilinear hyperattenuating filaments with metallic density in a 54-year-old woman who underwent a CT after a traffic accident.<sup>4</sup>

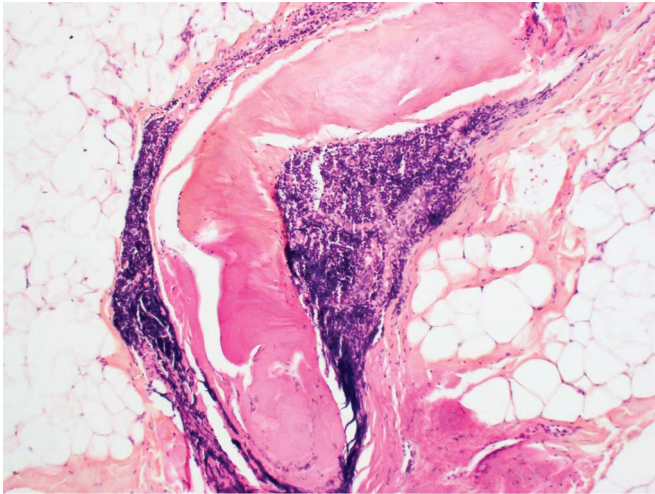
Implantation of gold weights into the upper eyelid is a technique used in facial palsy to provide adequate coverage for the cornea. Gold is considered the material of choice because of its inertness, high density, malleability, and nonallergic properties. The rate of complications is low with a few cases of migration or extrusion of the weight, and in rare cases, infection.<sup>5</sup>

Histopathologic studies of gold thread implantation are rare in the literature. By contrast, the histopathologic features of chrysiasis, which is caused by gold deposits in the skin after gold injections for the treatment of rheumatoid arthritis and



**FIGURE 4.** Black longitudinal structure surrounded by a few multinucleated giant cells (hematoxylin–eosin–safran  $\times 200$ ).



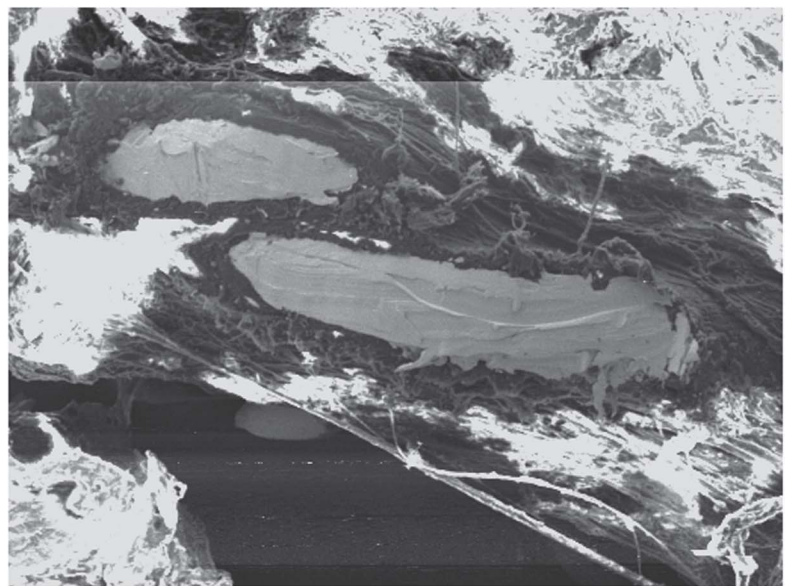


**FIGURE 5.** Fibrous tract surrounded by a moderate inflammatory reaction (hematoxylin–eosin–safran  $\times 100$ ).

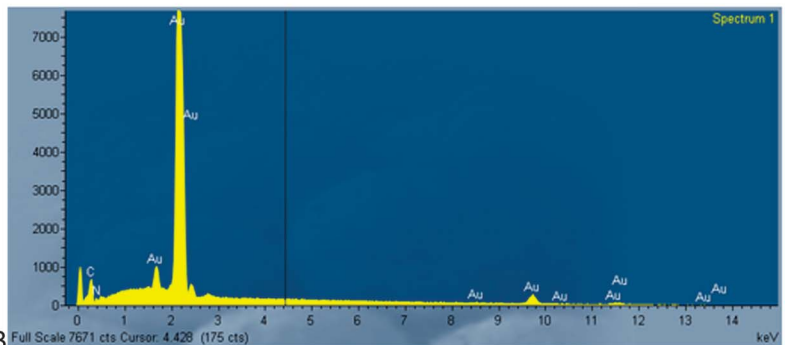
pemphigus, are well known. It causes permanent blue-gray pigmentation of the skin, especially in sun-exposed areas.<sup>6–9</sup> The pathogenesis of chrysiasis is uncertain. It is probably related to an effect of UV radiation on tissue-bound gold

particles. Its histopathologic features include small round or oval black granules, irregular in size, located in dermal macrophages, which tend to cluster around blood vessels in the upper and mid dermis and sometimes around the sweat gland coils.<sup>8</sup> A similar pigment may be found in elongated fibroblast-like cells in the upper dermis.<sup>6</sup> Transmission electron microscopy evidences dense filaments and numerous melanosomes within the upper dermal macrophages. Radiographic microanalysis proves that the phagolysosomes contain gold and are aurosomes.<sup>6,8,9</sup>

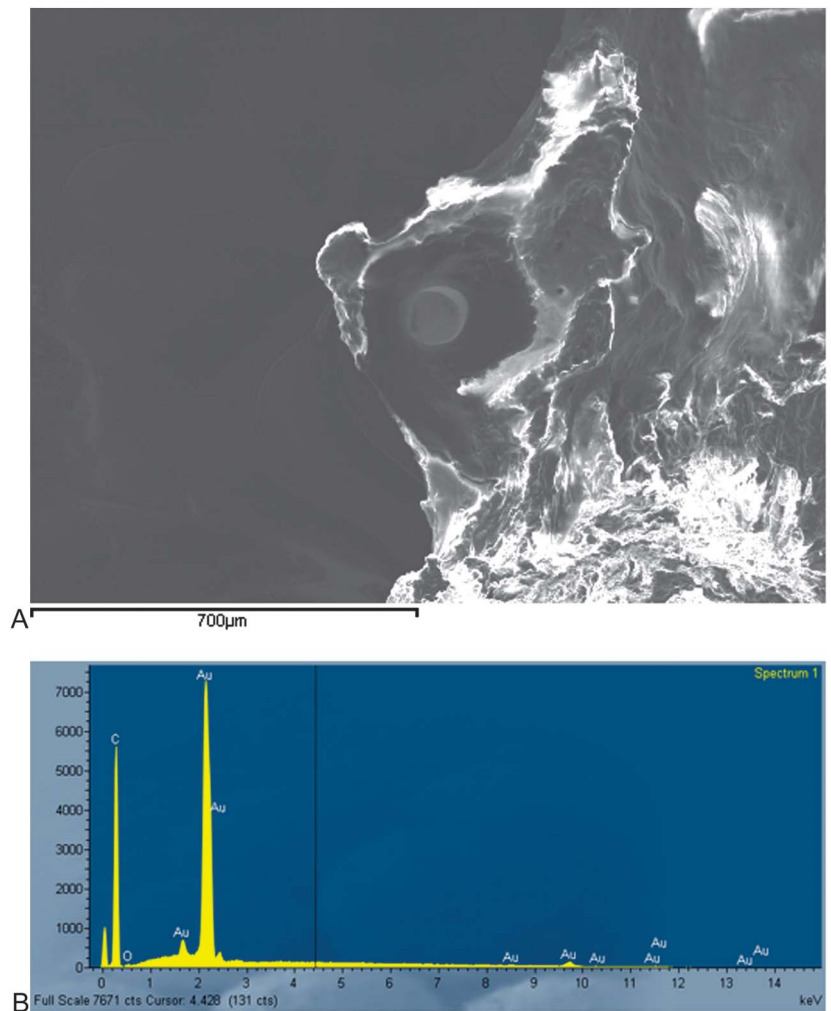
Kurita et al<sup>10</sup> investigated the effects of rejuvenation threads in a rat model by implanting 3 types of thread: non-absorbable monofilament cog, pure gold with no cog, and pure gold-coated cog on the dorsal skin of rats. Six animals were used for each thread. Tissue samples were submitted to histological examination at 1, 3, and 7 months after thread implantation. All the threads were surrounded by a capsule-like structure, whose thickness and composition were evaluated as was the number of  $\alpha$ -SMA-positive myofibroblasts. The collagenous area and the cellular areas were measured separately with image-processing software on van Gieson-stained sections. The capsule around the gold thread was thin at 1 month and gradually thickened up to 7 months. It was composed primarily of cellular components at 1 month



**A** 500 $\mu$ m



**FIGURE 6.** A, Electron microscope view of a wire. We can see the wires in light gray with the scratches performed by the scalpel. B, X-ray microanalysis spectrum showing the peaks of C, N, and Au elements. Presence of biological elements is the consequence of fluorescence of the tissues.



**FIGURE 7.** A, View of tissue in an area where a wire is seen transversally sticking out. B, X-ray microanalysis of the wire: only the peak of the gold is seen (the carbon peak is the result of the contamination of the surface).

and was gradually replaced by collagen fibers thereafter. Multinucleated giant cells were found in the capsules of the gold and gold-coated cog threads but not in the capsules surrounding the propylene glycol thread. Few  $\alpha$ -SMA–positive cells identified as myofibroblasts were present around the gold threads. A small picture of each thread with its capsule is provided in the paper. The structural features of the threads were measured with electron microscopy and found to have a diameter of 100  $\mu$ m for the gold thread and of 540  $\mu$ m for the gold-coated cog thread. The concentric fibrous zone we observed around each thread and the fibrous tract could be later forms of this capsule, as the threads were in place for 10 years.

In an apparently experimental study, Rondo et al<sup>11</sup> performed biopsies on the anterior region of the arm of 10 female patients aged between 34 and 53 years old after implantation of gold threads. They described an inflammatory reaction around the gold threads with epithelioid cells without any giant multinucleated cells. The pictures show a dense black structure identified as a gold thread, which shares the histopathologic features of our case surrounded by epithelioid cells. In our case, the inflammatory reaction is moderate with a few giant cells

surrounding the threads and has no clinical consequence as the threads were fortuitously discovered by the surgeon.

In summary, we report the histopathologic appearance of gold threads whose nature was demonstrated by X-ray microanalysis. Our aim is to illustrate and list its distinctive features to help dermatologists and dermatopathologists recognize it. Histopathologic findings characteristic of gold threads are the presence of black ovoid particles surrounded by fibrosis and a moderate inflammatory reaction, which may contain a few giant cells. The presence of gold threads should also be suspected when fibrous tracts are detected. Recuts should then be performed to look for the black structures characteristic of gold threads. It is of interest to note that these particles did not give rise to any adverse reactions and were fortuitously discovered by the surgeon.

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#### REFERENCES

1. Requena L, Requena C, Christensen L, et al. Adverse reactions to injectable soft tissue fillers. *J Am Acad Dermatol*. 2011;64:1–34.
2. Shin KC, Bae TH, Kim WS, et al. Usefulness of gold thread implantation for Crow's feet. *Arch Plast Surg*. 2012;39:42–45.
3. Alsaadi G, Jacobs R, Quiryne M, et al. Soft tissue augmentation of the cheeks detected on intra- and extraoral radiographs: a case report. *Dentomaxillofac Radiol*. 2008;37:117–120.
4. Wang YF, Wang CC, Liu KL. A woman's secret. Filler rhinoplasty with Radiesse and gold thread implantation. *Ann Emerg Med*. 2013;62:224–234.
5. Pickford M. Morbidity after gold weight insertion. *Br J Plast Surg*. 1992;45:460–464.
6. Cox AJ, Marich KW. Gold in the dermis following gold therapy for rheumatoid arthritis. *Arch Dermatol*. 1973;108:655–657.
7. Fleming CJ, Salisbury EL, Kirwan P, et al. Chrysiasis after low-dose gold and UV light exposure. *J Am Acad Dermatol*. 1996;34:349–351.
8. Smith RW, Leppard B, Barnett NL, et al. Chrysiasis revisited: a clinical and pathological study. *Br J Dermatol*. 1995;133:671–678.
9. Schultz Larsen F, Boye H, Hage E. Chrysiasis: electron microscopic studies and x-ray microanalysis. *Clin Exp Dermatol*. 1984;9:174–180.
10. Kurita M, Matsumoto D, Kato H, et al. Tissue reactions to cog structure and pure gold in lifting threads: a histological study in rats. *Aesthet Surg J*. 2011;31:347–351.
11. Rondo Junior W, Vidarte G, Michalany N. Histologic study of the skin with gold thread implantation. *Plast Reconstr Surg*. 1996;97:256–258.