

The Platinum Chain

A New Upper-Lid Implant for Facial Palsy

Alexander Berghaus, MD; Kerstin Neumann, MD; Thomas Schrom, MD

Background: When using upper-lid gold implants in facial palsy, a certain percentage of undesired effects and complications are known to occur (eg, astigmatism, pseudoptosis, migration, bulging, and extrusion). Our flexible platinum chain implant adapts better to the changing radius of the tarsus with movement of the globe and reduces the complication rate. Platinum implants are smaller, owing to their higher density.

Objective: To compare the results with 33 gold and 30 platinum chain implantations.

Methods: Clinical follow-up study at a university otorhinolaryngology department. The mean follow-up was 11 months in the gold-implant group and 9 months in the platinum-implant group. The treatment consisted of pretarsal fixation of the metal weights to the upper lid.

Main Outcome Measures: Criteria for evaluation of results include reduction of lagophthalmos and kera-

topathy and gain of visual acuity. Complications that have been assessed include astigmatism, bulging, migration, pseudoptosis, and extrusion of implants. We evaluated histological samples of the implant bed and performed ultrasound measurements of the tarsal radius.

Results: The restoration of lid closure was a visual and aesthetic improvement for all patients. We found a tendency toward a higher rate of complications with gold implants compared with platinum chains, especially for astigmatism and bulging. Ultrasonographic measurements showed ongoing flexibility of the platinum chains after implantation, and histological findings confirmed their good biocompatibility.

Conclusions: Flexible platinum chain implants lead to better results with fewer complications compared with standard rigid gold implants.

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WHEN USING gold implants for treatment of eye-related symptoms in facial palsy, a certain percentage of undesired effects and complications are known to occur, including astigmatism, pseudoptosis, migration, bulging, and extrusion.¹⁻⁵ To reduce the complication rate in lid loading, we have developed a flexible platinum chain implant that adapts better to the changing radius of the tarsus with movement of the globe. Furthermore, platinum has a higher density than gold,⁶ so that smaller implants of the same weight can be used. In this study, we compared the results of 2 continuous series using gold and platinum chain implants.

In a clinical follow-up study at the Department of Otorhinolaryngology–Head and Neck Surgery at the Martin-Luther-University Halle-Wittenberg, Halle, Germany, we compared the results of 33 rigid

gold weight implantations and 30 flexible platinum chain implantations.

METHODS

IMPLANTS

The material used for rigid gold implants was 99.99% gold (Saxonia Edelmetall GmbH, Halsbrücke, Germany). The basic building block was a 20 × 5 × 1-mm gold leaf. The length of the implant varied with the weight required. Three drill holes were made for pretarsal attachment. The weight of the implant was determined preoperatively by placing various weights on the upper lid until satisfactory closure in an upright position was obtained. A slight overcorrection is tolerable, since the levator palpebral muscle becomes strengthened postoperatively.⁷ The implanted weights ranged from 0.9 to 2.8 g, with an average of 1.5 g. The mean diameter of the rigid gold implants was 29.3 mm. In each case, the radius was varied slightly for adaptation to the individual curvature of the patient's tarsus.

From the Department of Otorhinolaryngology–Head and Neck Surgery, Martin-Luther-University Halle-Wittenberg, Halle, Germany (Drs Berghaus and Neumann); and the Department of Otorhinolaryngology–Head and Neck Surgery, Charité at Humboldt–University, Berlin, Germany (Dr Schrom).



Figure 1. Different sizes of platinum chain implants used in this study.

The platinum chain implants used in this series are devices newly developed by us (Spiggle & Theis GmbH, Dieburg, Germany).^{8,9} The design of these implants is characterized by platinum elements linked to each other like a chain (**Figure 1**). The pliable connection allows flexibility of the whole implant and adaptation of the radius to the individual curvature of the tarsus. We developed these implants expecting that this kind of flexibility, compared with the usual rigidity of the gold implants, must lead to a reduction of complications, especially astigmatism⁴ and extrusion. The 30 platinum implants had an average weight of 1.4 g (range, 1.0-2.0 g). The material consisted of a 97% platinum and 3% iridium alloy. The density of platinum is 21.5 g/cm³, which is higher than that of gold (19.4 g/cm³); thus, platinum implants with the same weight, owing to the reduction of volume, are approximately 10% smaller than gold implants. These platinum chain implants have several perforations for fixation using 6-0 polydioxanone sutures.

SURGICAL INTERVENTION

Treatment consisted of pretarsal fixation with a rigid gold or a flexible platinum chain weight to the upper lid using a standard surgical technique (**Figure 2**). The appropriate weight was defined by preoperative external fixation of a sample to the skin of the upper lid.

After inserting a lens for corneal protection, disinfection of the skin, and local injection of 1 to 2 mL of 1% articaine hydrochloride (Ultracaine) with epinephrine hydrochloride, the skin was incised at least 10 mm from the lid margin. A pocket was formed between the orbicularis oculi muscle and the levator aponeurosis. The weight was attached to the pretarsal tissues by means of three to six 6-0 absorbable sutures. The lower edge of the weight should be 1 to 2 mm above the superior eyelid margin. A standard skin suture completed the operation.

The patients underwent an ophthalmologic examination before and after the operation. The examination included refraction, visual acuity, eyelid position, lid closure, lacrimation, and corneal sensation.

PATIENTS

The study included 63 consecutive patients with facial palsy and eye-related symptoms. The main cause of the palsy was vestibular schwannoma. Other causes included trauma and surgery to the middle ear, apoplexy, and Bell palsy, among others. In the first 33 patients, rigid gold weights were used, whereas in the next 30 patients, flexible platinum chains were im-

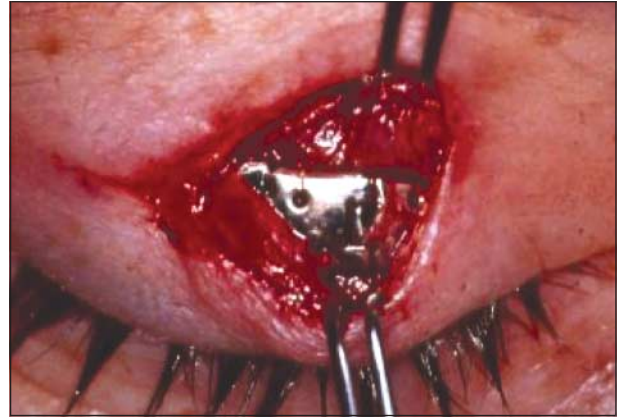


Figure 2. Intraoperative situation with the platinum chain implant sutured to the tarsus.

planted. The mean follow-up period in the gold-implant group was 11 months; in the platinum-implant group, 9 months.

MAIN OUTCOME MEASURES

Criteria for evaluation of results include reduction of lagophthalmos (narrowing of the palpebral fissure), reduction of keratopathy, and gain of visual acuity. For the grading of keratopathy, the findings of the patients' corneas were assigned various degrees (0 indicates normal; 3, ulcer of the cornea).

The following complications have been assessed: astigmatism, bulging, migration, pseudoptosis, and extrusion of implants. In some cases, we removed implants because of clinical improvement of facial palsy and evaluated histological samples of the implant bed. Six patients with gold implants and 4 patients with platinum chain implants underwent this procedure as soon as facial nerve function returned. As a later consequence, pseudoptosis may occur; this has also been described by Seiff et al.¹⁰

In addition, we performed ultrasonographic measurements to assess the radius of the tarsus in different visual directions in healthy subjects¹¹ and in some of those undergoing rigid gold and flexible platinum chain weight implantation.¹² Ultrasonographic measurements in 50 healthy subjects showed a mean upper-lid tarsus diameter of 19.3 mm with the straight view and 30.1 mm with the lateral view. The difference was statistically significant ($P = .008$).

RESULTS

Rigid gold and flexible platinum chain implants improved lagophthalmos, keratopathy, and visual acuity comparatively well (**Table 1** and **Figure 3**). All patients felt that restoring lid closure was a visual and aesthetic improvement. Fifty-six (89%) of the 63 patients graded the postoperative result as good or very good in a questionnaire. Postoperative closure of the upper lid was satisfactory in all patients, and the lids covered the cornea completely. Lagophthalmos decreased on average from 5.0 to 0.3 mm with gold and from 4.2 to 0.4 mm with platinum. The keratopathy index improved on average from 1.3 to 0.3 for the gold-implant group and to 0.4 for the platinum-implant group. These results are statistically significant (t test for paired spot checks, $P < .05$). As for the cornea, visual acuity increased on average from 0.5 to 0.7 with both implant types. Figure 3 compares the

Table 1. Results of Lid Loading*

	Rigid Gold Weights (n = 33)		Flexible Platinum Chains (n = 30)	
	Preoperative	Postoperative	Preoperative	Postoperative
Lagophthalmos, mm	5.0	0.3	4.2	0.4
Keratopathy index	1.3	0.3	1.3	0.4
Visual acuity	0.5	0.7	0.5	0.7

*Data are expressed as mean values. Patients receiving rigid gold weight implants underwent an average follow-up of 11 months; those receiving flexible platinum chain implants, 9 months.

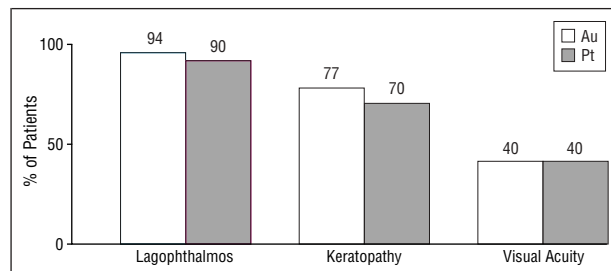


Figure 3. Percentage of improvement after lid loading using rigid gold (Au; n=33) or flexible platinum chain (Pt; n=30) implants with lagophthalmos, keratopathy, and visual acuity.

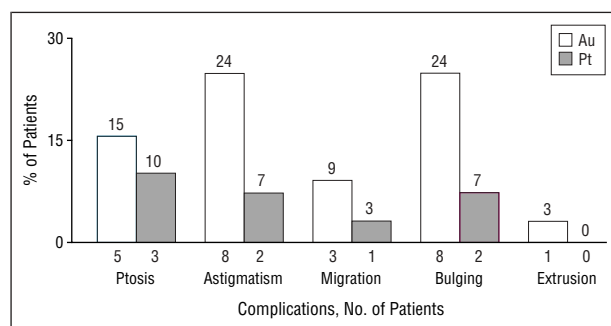


Figure 4. Comparison of the percentage of complications after lid loading with rigid gold (Au; n=33) and platinum chain (Pt; n=30) implants. For astigmatism and bulging, $P < .10$ (χ^2 test) between groups.

percentage of improvement after lid loading between the gold- and platinum-implant groups with regard to lagophthalmos, keratopathy, and visual acuity.

COMPLICATIONS

All complications encountered with gold and platinum implants are summarized in **Figure 4**. A low-grade astigmatism of the cornea developed between 1 and 2 diopters (D). The lesions in the cornea were seen in cornea topographic photographs in the approximately vertical cut corresponding to the pressure of the implant from above, especially with gold weights. Astigmatism was not noticed by any of the patients and was corrected in all cases by the fitting of glasses with cylindrical lenses, thus preserving preoperative visual acuity. In 3 patients, migration of a gold weight occurred, and in 1, migration of a platinum weight. The functional results in these cases were good, and further treatment was declined. In 8 patients with gold implants and 2 patients with platinum implants, an unsightly bulge of

Table 2. Diameter of Upper-Lid Tarsus by Ultrasonographic Measurement*

	Mean Diameter, mm	
	Straight View	Lateral View
Healthy subjects (n = 50)	19.3	30.1
Rigid gold-implant group (n = 15)		
Preoperative	24.5	31.6
Postoperative	29.3	29.4
Flexible platinum chain implant group (n = 17)		
Preoperative	25.9	32.0
Postoperative	24.4	30.8

*Measurements are not available for all patients, because the special ultrasonographic instrument used to obtain these measurements was not available for the entire study period. Values expressed in boldface type are significant ($P < .05$).

the weight was visible under thin skin. In an 80-year-old patient, a 1.5-g gold weight extruded after 2½ years and was removed. Five patients with gold implants and 3 with platinum implants had a pseudoptosis of 2 mm at most, without restriction of visual fields.

Comparison of gold and platinum implants showed a tendency to a higher rate of complications with gold implants ($P < .1$ for astigmatism and bulging; χ^2 test).

ULTRASONOGRAPHIC MEASUREMENTS

After platinum chain implantation, the tarsal radius, as in healthy subjects, changed when varying the visual direction from straight to lateral. On the other hand, after implantation of rigid gold weights, the tarsus radius stayed abnormally constant (**Table 2**). The rigidity of gold weights does not allow the implant to change its radius according to the physiologic modification of the tarsal radius. In contrast, flexible platinum chains are able to follow the tarsus radius, which is confirmed by ultrasonographic measurements of the straight and lateral views. To our knowledge, this is the first time that ultrasonographic data concerning the tarsus diameter of normal and implanted lids have been published.

HISTOLOGICAL FINDINGS

Whenever an implant was removed owing to extrusion, return of facial nerve function, or, in the case of gold implants, exchange for platinum chain implants, histological specimens were taken and examined.

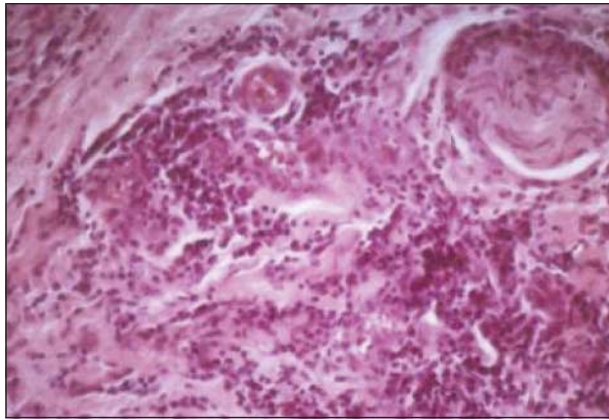


Figure 5. Granulomatous reaction in the gold-implant bed (hematoxylin-eosin, original magnification $\times 150$).

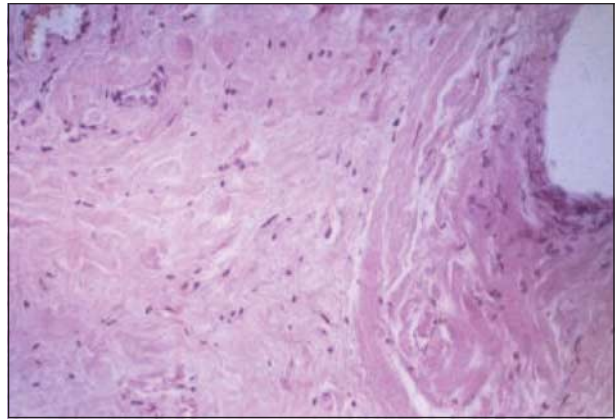


Figure 6. No signs of chronic infection in a specimen after platinum chain lid loading (hematoxylin-eosin, original magnification $\times 120$).



Figure 7. A, Bulging after lid loading using a rigid gold implant. B, Almost invisible contour after replacement of gold implant by a platinum chain implant in the same patient.

In these cases, the surrounding tissue of gold implants consistently showed disseminated lymphoid infiltrates and fibrous connective tissue as a granulomatous reaction (**Figure 5**). With platinum chain implants, however, a pseudocapsule surrounding the implant without any chronic infection reaction was seen regularly (**Figure 6**).

COSMETIC RESULTS

In 4 patients, for the correction of bulging or prevention of extrusion, a gold implant was replaced by a platinum chain (**Figure 7**). After exchange in all of these patients, the cosmetic result was much better than before, mainly because platinum implants resulted in less bulging and contouring. Also, all patients with primary platinum chain implantations have been very pleased with the cosmetic result.

COMMENT

Tarsorrhaphy has been the classic method used to narrow the separation of the lids, but it involves reduction of the visual fields and is aesthetically displeasing.^{7,13-15} As an alternative, the upper-lid gold weight implant was proposed by Illig¹⁶ as early as in 1958. With gold weights, complete lid closure can be achieved in about 80% of the

patients, and complete covering of the cornea in up to 100%.⁵ On the other hand, our follow-up study shows that a number of complications can be seen when following up a larger group of patients for a longer time.

The most important complications are astigmatism, bulging, pseudoptosis, migration, and extrusion. Corneal astigmatism has rarely been reported.^{4,7,14,17} Increased lid pressure is known to cause corneal astigmatism, as is also seen with upper-lid swelling and tumors.¹⁸ The same mechanism is probably active with rigid lid implants.

Corneal astigmatism usually develops after an interval of 1 to 18 months.⁷ This low-grade astigmatism ranging from 1 to 2 D is seen in the approximately vertical cut corresponding to the pressure of the gold implant from above, as can be shown by means of corneal topographic photographs. Astigmatism is usually not noticed by the patient, and according to our experience can be corrected in all cases by the fitting of glasses with cylindrical lenses, thus preserving the preoperative visual acuity. The fact that platinum chain implants lead to a reduced percentage of astigmatism is certainly due to the reduction of pressure exerted on the cornea by the flexible implant compared with the rigid gold implant. The reduced number of patients with bulging and extrusion in the platinum-implant group is partly due to the flexibility of the platinum chain implant, but may in part also

be the consequence of the lower volume of these implants at the same weight.

Large implants and thin, scarred, or irradiated skin can predispose to extrusion,^{18,19} as can poor or absent fixation in a small pocket.^{5,20} Jobe¹⁷ reported a 2.6% extrusion rate in 2000 gold implants.

Apart from the flexibility of the chainlike platinum implants, other advantages include the higher density of platinum (21.5 g/cm³) compared with that in gold (19.4 g/cm³), which reduces the volume and the surface by more than 10%, and the higher biocompatibility of platinum compared with gold. We have not found any reports of foreign body reactions to the use of platinum as implant material in the literature. According to our own studies in cooperation with the Institute of Radiology at Martin-Luther-University Halle-Wittenberg, platinum and gold do not affect magnetic resonance imaging findings (T.S. and Dirk Pickuth, MD, unpublished data, April 2001).

CONCLUSIONS

In cases of facial palsy with eye-related symptoms, upper-lid loading is an effective, helpful procedure. The results of our study have shown that newly developed flexible platinum chain implants lead to better results with fewer complications compared with standard rigid gold implants. We therefore decided to discontinue the use of gold implants in favor of the new platinum weights.

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Corresponding author and reprints: Alexander Berghaus, MD, Department of Otorhinolaryngology–Head and Neck Surgery, Martin-Luther-University Halle-Wittenberg, Magdeburger Strasse 12, Halle D-06097, Germany (e-mail: alexander.berghaus@medizin.uni-halle.de).

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