Determination of the nature and origin of the metallic foreign particles appearing on the iris after phacoemulsification

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PURPOSE: To determine the nature and the origin of metallic foreign particles appearing on the iris after phacoemulsification surgery.

SETTING: P.D. Hinduja Hospital and Medical Research Centre, Mumbai, Maharashtra, India.

DESIGN: Case series.

METHODS: Metallic foreign particles were observed on the iris surface and the pupillary border on the first postoperative visit after phacoemulsification. One metallic particle, which was stuck to the iris surface, was removed intraoperatively and sent for metal analysis along with the phaco needle, the wrench used to tighten the phaco needle to the phaco handpiece, and the anterior chamber maintainer used during phacoemulsification. The composition of the elements was studied by scanning electron microscopy (SEM) to determine the origin of the metallic particle.

RESULTS: Foreign particles were seen in 11 eyes. On SEM, 3 elements (carbon, magnesium, and silicone) were common in the metal particle and 4 elements (carbon, magnesium, silicone, and titanium) on the wrench. The elements in the phaco needle (titanium) and anterior chamber maintainer (manganese, iron, and nickel) did not match those in the metal particle.

CONCLUSION: The metal contents of the metallic particle extracted from the eye matched some of the constituent metals of the wrench that was used to tighten the phaco needle on the handpiece just before surgery.

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Phacoemulsification is a widely used technique for cataract extraction today. Intraocular metallic foreign particles after phacoemulsification that had no clinically significant effect on the visual function have been observed.\(^1\)–\(^3\) The origin of these metal particles, which embed on the iris surface, remains unknown with varied results. Some have concluded that these particles were shed from the phaco needle due to its ultrasonic activation,\(^4\) from instrument touch during phacoemulsification,\(^5\) or from the irrigation/aspiration tubing of the phaco handpiece.\(^2\)

We encountered a few shiny metal particles on the iris surface and the pupillary borders in a group of patients after phacoemulsification. Origins cited in previous studies in the literature were ruled out. Despite the precautions taken to eliminate their source, the metallic foreign particles continued to appear in eyes having phacoemulsification. This study was performed to determine whether there was another source of these metallic foreign particles.
PATIENTS AND METHODS

Cases of intraocular metallic foreign bodies were seen postoperatively from June 2010 to March 2012 at P.D. Hinduja Hospital. Slitlamp examination was performed 2 days postoperatively when these metal particles were identified on the iris stroma and the pupillary margin (Figure 1). The particles were small, irregular, and shiny.

The cataract surgery was performed by the 2-handed phacoemulsification technique using the Infiniti phacoemulsification machine and phaco handpiece with torsional properties (both Alcon Laboratories, Inc.). The phacoemulsification needles were used an average of 10 times until their appearance or their performance was altered.

The metallic foreign bodies were observed on the immediate postoperative follow-up day. The visual acuity and intraocular pressure were normal, and there was no sign of postoperative inflammation on the postoperative visits at 2 and 8 days and 3 weeks. One metal particle that was deposited on the iris surface during phacoemulsification was removed intraoperatively and sent for metal analysis by scanning electron microscopy (SEM). The phaco needle, the wrench used to tighten the needle, and the anterior chamber maintainer (ACM) used during the same surgery were sent for analysis to determine their metal constituents; all were observed under high magnification.

RESULTS

Intraocular metallic foreign bodies were encountered postoperatively in 11 cases. Irregularities were seen on the tip of the phaco needle and the inner surface of the wrench (Figure 2). Figure 3 shows an unused wrench with a smooth inner surface. On SEM, 3 elements (carbon, magnesium, and silicone) were common in the metal particle and 4 elements (carbon, magnesium, silicone, and titanium) in the wrench. The elements in the phaco needle (titanium) and the ACM (manganese, iron, and nickel) did not match those in the metal particle obtained intraoperatively. Therefore, it was inferred that these particles must have shred from the wrench that was used to tighten the phaco needle preoperatively because most of the constituents of the metal particles matched those of the wrench.

Thereafter, the metallic wrenches used to tighten the phaco needles were replaced by plastic ones. Since then, no metallic particles have been encountered intraocularly after phacoemulsification. The change in the material of the wrench supported this conclusion.
DISCUSSION

Although phacoemulsification is considered a safe and a convenient technique for cataract extraction, complications, such as the appearance of small reflective metallic particles embedded on the iris surface, have been observed in many patients postoperatively over the past 2 decades. Some surgeons have tried to determine the nature and origin of these particles. Some concluded that the foreign particles were composed of iron, chromium, and nickel, indicating that they came from the phaco handpiece after frequent use. They analyzed the phaco tip and the Sinskey hook used as a second instrument during phacoemulsification because it was thought that the metal particles must have shred from the Sinskey hook due to the inadvertent touch with the phaco tip during surgery. However, it was finally concluded that the metal particles came from the irrigation or aspiration ducts of the phacoemulsifier handpiece after prolonged use and vibration. Others observed that the metal particles came from the cavitation erosion of the area under the plastic irrigating sleeve of the phaco handpiece. One study applied ultrasonic energy with the phacoemulsification handpiece to a cyclodialysis spatula and concluded that instrument touch during surgery resulted in the release of particles. Another study showed that the metal particles were derived from the phaco tip. Our SEM analysis showed that the metal particles were the wrench used to tighten the phaco needle. We did not see adverse reactions or signs of inflammation in our 11 cases, which were followed regularly. However, a case report describes a metallic foreign body on the iris surface that resulted in chronic recalcitrant postoperative inflammation. Hence, the appearance of foreign bodies that do not cause inflammation cannot be neglected. Such complications must be prevented in the future.

In conclusion, after using the metallic wrench to tighten the phaco needle, the phaco needle and the phaco handpiece should always be thoroughly checked for metallic fragments on the surface that could have shred from the irregular surfaces of the wrench. The alternative is the use of plastic wrenches. Such precautions will help prevent the occurrence of metallic particles in the eye and the complications caused by them.

WHAT WAS KNOWN

- After phacoemulsification, metallic foreign particles have often been seen on the iris surface. Their source was thought to be the phaco needle, instrument touch during phacoemulsification, or irrigation aspiration tubing.

WHAT THIS PAPER ADDS

- Despite the precautions taken to eliminate the previously cited sources, metal particles appeared on the iris surface after phacoemulsification surgery.
- The metallic wrench used to tighten the phaco needle to the handpiece was found to be the source of the metallic particles.

REFERENCES


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