Standardized Nomenclature in
Ophthalmic Photography

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"When I use a word, it means what I choose it to mean... nothing more, nothing less."

Lewis Carroll
in Through the Looking Glass

Introduction

As our field expands, ophthalmic photographers are becoming responsible for performing an increasing number of patient oriented procedures. Physicians communicate imaging needs, third parties reimburse for photographic procedures, and clinical studies design their protocols based upon the vocabulary we use to describe clinical ophthalmic photography procedures. Terminology describing these procedures has not evolved in a standardized manner. It is incumbent upon us to adopt a vocabulary which will help us to communicate with others concerning the procedures we perform.

An example of how vocabulary problems may affect a clinical site is described in the following real life scenario. A local private ophthalmologist's office was recently informed by a third party payer that the procedures 92250* (fundus photography) and 92235 (fluorescein angiography) would be lumped together because of their similarity. As a result, fundus photography reimbursement was to be included in the reimbursement for fluorescein angiography. A letter of appeal explained the difference in application, instrumentation, technique, and result between these two procedures. The third party payer subsequently reversed their decision.

While this matter has been resolved, two potential scenarios could have arisen from this nomenclature miscue. First, the office may not have been reimbursed for fundus photography procedures fairly. Secondly, since these items had been lumped together, the third party may have been billed for a more expensive procedure (92235) when a less expensive procedure (92250) was performed. Clearly, standardization of ophthalmic photography vocabulary is important to everyone involved.

As the field of ophthalmic photography continues to evolve, it is important that we utilize clear terminology to effectively communicate with ophthalmic photographers and other health care professionals. Our terminology should be standardized and specific.

Issues

There are multiple issues concerning the terminology used to describe clinical ophthalmic photography which need to be resolved. For example: should a procedure's name describe the anatomy photographed (e.g. retinal photography), the instrumentation utilized to photograph it (e.g. slit-lamp biomicrography), or the technique involved (e.g. specular micrography)? (Table 1)

*Footnote: Procedure codes are obtained from the International Classification of Diseases, 9th Revision (ICD9) as established by the World Health Organization.
How context-sensitive should our vocabulary be? The word 'fundus' is a generalized medical term meaning the "bottom or lowest part of a sac or hollow organ." This term is used by multiple subspecialties including endocrinology, gynecology, ophthalmology, and urology. The generic term 'fundus photography' would designate quite different images in each instance.

Non-standardized vocabulary exists in our field. Multiple terms describing identical procedures are being utilized. There are now four synonyms for 'slit lamp photography' in current use. (Table 2)

Usage of the suffixes '-scopy' and '-graphy' is inconsistent. A prime example is the frequent misuse of the terms 'specular microscopy' and 'specular micrography'. The suffix -scopy describes the observation of an event and, in an ophthalmic setting, is usually performed by a physician. On the other hand, -graphy denotes the recording of an observation and is accomplished by the photographer.

The lines between certain ophthalmic photography procedures have become blurred to the point where no specificity between procedures exists. Differences between external photography and slit-lamp photography are evident to the experienced ophthalmic photographer. However, the ICD9 coding system refers to them as identical procedures (92285). This means that a very simple 35mm external photograph of two eyes is equated with the technically challenging gonio-photograph which documents intraocular anatomy utilizing far more complicated instrumentation.

As with all rapidly evolving fields, some ophthalmic photography terminology is new or is not yet widely recognized. A newer corneal imaging technique, corneal topography, has been developed over the last ten years. It is not presently included in the ICD9 code book. External ocular videography is utilized in a minority of offices and research centers, and so has had no specific nomenclature nor billing code.

Additionally, ophthalmic photography's imaging medium is evolving away from a silver based technology ('photography') and toward an electronic based technology ('videography'). How should this change be reflected in our vocabulary? Should electronically captured fluorescein angiograms be described as 'electronic imaging', 'digital imaging', or by just the term 'imaging'? Electronic imaging describes the difference between the use of film and magnetic or optical media, but may be too broad. Not all electronic imaging techniques utilize true digital technology. The term imaging can encompass both film and electronic technologies, as well as ultrasound and visualization by the physician.

The author's hope is that this paper will initiate a dialogue within the ophthalmic community and encourage an open debate concerning the above and other nomenclature issues.

Methods

Current nomenclature was elicited by a survey of experienced ophthalmic photographers (85 surveys sent, 21 returned). Results were listed and reviewed. Terminology which was judged to be simple, straightforward, specific, and widely used was designated as standardized vocabulary and is printed in bold. The instrumentation, procedure, and results denoted by each term is briefly described. Traditional and common synonyms, as well as specific ICD9 codes are noted (Tables 1 and 2).

Authors suggesting standardized vocabulary must at some point wrestle with the issue of common usage. Should simple, everyday terms for procedures be validated? Or should long, rarely used - but descriptively complete terms be championed (eg. slit-lamp photog-raphy vs. slit-lamp biomicrography)? This paper navigates the middle road between these two extremes, choosing vocabulary which is communicative and sensible.

All clinical ophthalmic photographs require medical diagnostic evaluation and interpretation by a physician. These photographs may be classified into two groups: documentary photography and diagnostic photography.

Documentary ophthalmic photographs are visual records of information which can be directly observed by the physician during a patient exam. They allow the physician to further study a patient's condition, to identify changes on follow-up, to re-examine patient anatomy in the operating room, or to review a patient's findings with a colleague. Documentary photographs may be used for lectures and publication, for insurance pre-authorization, or for legal purposes.

Diagnostic ophthalmic photographs, on the other hand, present unique information which is not available through direct examination. The resulting images are interpreted by a physician who makes diagnostic and therapeutic decisions based upon the test results.

Although there are multiple photographic procedures an ophthalmic photographer may perform which fall outside of the standard patient procedures outlined in the ICD9 *codes* this paper addresses only the nomenclature which describes clinical ophthalmic photography procedures. Specific terms and meanings for standard darkroom and photographic procedures (for example to 'develop', 'contact print', or 'duplicate') are well known throughout the photographic community and are not discussed herein.

Footnote: Research photography, portrait photography, public relations photography, and studio photography may be found in many ophthalmic photographers' job descriptions. Many ophthalmic photographers also participate in the preparation of speaker support slides including title slide generation, copy stand photography, and small object photography.
Terminology

**Fundus photography** (also known as ‘retinal photography’) refers to the documentation of the retina and choroid utilizing color film and a specialized instrument called a fundus camera. Fundus photography was first described by Jackman and Webster in 1886. Modern fundus photography began with the introduction of commercially available fundus cameras in 1926.3

A small portion (e.g. just the disc and macula - fields 1&2) or an extended portion (a ‘diabetic series’ - fields 1 through 7) of the retina may be documented. Fundus photographs may be taken at different magnifications ranging from wide angle (45° - 90°) to normal (30°) to high magnification (10° - 20°). Auxiliary lenses and specialized cameras may extend the field of view to 180°.4,5

The fundus camera may be focused on different areas of the ocular anatomy, for example the vitreous. Single or stereo color slides are routinely the product of this documentary procedure.

Fundus photographs are routinely ordered in a wide variety of retinal conditions. Retinal details may be easier to visualize in stereoscopic fundus photographs as opposed to direct examination.6

The ICD9 description of fundus photography is code 92250. It should be noted that fundus photography (92250) is almost always performed at the same time as fluorescein angiography (92235). Fundus photographs are useful when interpreting fluorescein angiograms because certain retinal landmarks visible in fundus photographs are not visible on the fluorescein angiogram.

The retina may be imaged utilizing a photo slit-lamp biomicroscope and auxiliary contact lenses, or with portable hand held fundus cameras, although these techniques are not routine.

**Optic disc photographs** (‘disc photos’ or ‘nerve photos’) are color fundus photographs which concentrate on the optic nerve head. These are usually shot in stereo and may include narrow angle (2x) color fundus photographs.

**Post-laser fundus photography** is fundus photography which documents a recent laser treatment.7 Since this procedure usually occurs immediately following the treatment, the patient’s eye is rinsed with eyewash to improve corneal clarity.

**Torsion photography** refers specifically to fundus photographs which objectively document the rotation of the eye.8 The patient is carefully aligned in the headrest and the fundus camera’s internal fixation device is utilized to illustrate the relative positions of the fovea and the optic nerve.

**Single wavelength or monochromatic fundus photography** takes multiple forms and is usually recorded on black and white film.9,10 **Nerve fiber layer photography** (NFL photos) utilizes a blue filter (490 nm), careful focusing, and specialized processing techniques to enhance the retinal nerve fiber layer.11

**Red free fundus photographs** are exposed using a green filter (540 - 570 nm) over the light source. These photographs are usually included in a fluorescein angiogram to help orient the interpreting physician. **Choroidal photographs** are exposed with a red filter (650 nm) over the light source.

**Fluorescein angiography** is a diagnostic test which involves the rapid sequential photography of sodium fluorescein dye as it passes through the patient’s retinal blood vessels. Fluorescein angiography was first described by Novotny and Alvis in 1961.3

A fundus camera with appropriate filtration and black and white film is commonly used, although images may be also be captured electronically. Fluorescein dye is injected into the patient’s arm vein (by a physician or nurse) while the photographer documents the flow of the dye in multiple photographs. Early (10-30 seconds), mid-phase (1-3 minutes), and late (5-20 minute) photographs are taken. Either a small portion (e.g. just the disc or macula) or an extended portion of the retina may be documented. A contact sheet on transparency film, a video image stored in a computer file, or a set of mounted stereo negatives may be the product of this diagnostic test.

Fluorescein angiograms help the physician diagnose a wide variety of retinal conditions, and may also provide a guide to therapy.12

The ICD9 description of fluorescein angiography is code 92235. It should be noted that both color fundus photography and red free fundus photography are almost always performed at the same time as fluorescein...
angiography. The ICD9 code for fluorescein angiography includes routine red free fundus photography but does not include color fundus photography (92250).

During routine fluorescein angiography, the photographer images the retina. If the test is not performed on the retina, it is referred to by another name. Consequently, a physician may request iris angiography, scleral angiography, or corneal angiography. The ICD9 code 92287 includes all anterior segment angiography procedures.

**Indocyanine green angiography** (‘IR angiography’ or ICG angiography) is a relatively new test which involves the sequential photography of indocyanine green dye as it travels through a patient’s choroidal blood vessels. ICG angiography was originally described by Hocheimer in 1971, and ICG videoangiography was described by Yannuzzi, et al in 1992.13,14

A modified fundus camera with infrared filtration and electronic imaging capabilities must be used for ICG angiography. Indocyanine green dye is injected into a vein in the patient’s arm (by a physician or nurse) while the photographer documents the flow of the dye in multiple images. Early, mid-phase, and late (40 minutes) images are produced. An electronic image stored in a computer file, or a black and white printout of multiple video images may be the product of this diagnostic test.

Currently, there is no ICD9 description specifically for ICG angiography. Indocyanine green dye is significantly different from sodium fluorescein in chemical composition and cost. Differences in the anatomy photographed, the instrumentation, technique, and patient reaction rate make ICG angiography and fluorescein angiography unique tests. It should be noted that fundus photographs (92250) and fluorescein angiography (92235) are usually performed at the same time as ICG angiography because ICG angiography test results can more easily be interpreted when viewed with these additional images.

**Slit-lamp photography** (‘slit-lamp biomicrography’ or ‘photo slit-lamp biomicroscopy’) refers to the documentation of the structures exterior to and contained within the anterior chamber of a patient’s eye utilizing a photo slit-lamp biomicroscope. Theil was the first to describe slit-lamp photography in 1930.15

The illumination system of the photo slit-lamp allows multiple variations in lighting while the optics provide multiple linear magnifications, usually from about 1x to 10x. A single slit-lamp photograph rarely tells the same story as a complete slit-lamp exam, so multiple exposures may be made, taking advantage of different angles, magnifications and lighting. Slit-lamp photography may be requested in conjunction with the topical administration of sodium fluorescein or rose bengal dye. Stereoscopic or singular color slides are routinely the product of this documentary procedure.

The current ICD9 description for slit-lamp photography is 92285. This code also includes external photography. It is the author’s opinion that, because anatomy (external pathology vs. corneal and anterior chamber pathology), instrumentation (35mm camera with macro lens vs. photo-slit-lamp), and technique and difficulty differences (static vs. adjustable light source), external photography and slit-lamp photography should be coded as two separate and distinct procedures.

**Diagnostic lens photography** utilizes a photo slit-lamp and auxiliary lenses to photograph various intraocular anatomy which cannot be directly observed utilizing a slit-lamp (including but not limited to the posterior chamber, lens, ciliary body and vitreous). Both extremely wide angle retinal photographs and peripheral retina photographs may also be imaged in this manner.16 **Goniography** (also known as goniophotography) describes the documentation of the filtering angle of the anterior chamber utilizing auxiliary diagnostic contact lenses.17

**Scheimpflug lens photography** (‘slits for density measurement’) utilizes a uniquely designed photo slit-lamp which images a sharply focused cross section of the lens utilizing the Scheimpflug principle. Cataractous changes may be examined in detail and graded utilizing these images.18 **Meibography** describes the documentation of the meibomian gland utilizing an infrared transilluminator and photo slit-lamp.19

**Lens retro-illumination photography** (‘Neitz photos’ or ‘B&W cataract photos’) utilizes a camera with axial illumination and cross polarization to image lens changes.20

**Specular micrography** refers to the photographic documentation of the different layers of the cornea utilizing a specular microscope. Specular micrography was first described by Maurice in 1968.21 Although the endothelial cell layer is most often photographed, other layers may also be imaged. Black and white images (prints, 35mm slides, or instant prints from a video screen) are generated. Both morphologic and quantitative data are recovered from these images.

This procedure is useful for examining disease-related changes in the corneal endothelium, evaluating the health of a patient’s cornea before surgery, and examining corneal donor eyes.22

The ICD9 description of specular micrography is code 92286. Slit-lamp photography (92285) may be performed at the same time as specular micrography because of the complementary nature of the information they provide.

**Photokeratoscopy** is the photographic documentation of the keratoscopic reflection of a placido disc using a photokeratoscope. Gullstrand first described photokeratoscopy in 1896.23

This visual record documents the current keratoscopic appearance of the patient’s cornea in print form with a 35mm camera or on instant film.
Currently, there is no ICD9 description specifically for photokeratoscopy.

Corneal topography is a relatively new way to objectively analyze the surface of the cornea. A video image of a keratoscopic reflection of a placido disc is captured. A computer then analyzes thousands of different points on the image and constructs a color-coded topographic map of the cornea. Corneal topography covers a larger portion of the corneal surface area and is more precise than keratometry. It provides more objective information than photokeratoscopy.

The resulting color print of a corneal topographic map is interpreted by the physician, who then makes decisions involving the patient's diagnosis and treatment.

Corneal topography is useful in determining the diagnosis and extent of disease presenting with epithelial abnormalities, stromal thinning disorders, and corneal topographic alterations associated with external compression. Corneal topography also plays an important role in the evaluation of corneas before and after surgical procedures ranging from laceration repair to radial keratotomy.

External ocular photography ("external photography") utilizes a still camera, color film, and a generally non-adjustable electronic flash to document the external aspects of a patient's eye and ocular adnexa. Magnification for external photography generally falls between 1:10 (full face) and 1:1 (single eye). The resulting slides are static visual records which document the patient's eye at a specific moment in time. External photographs are frequently used to document strabismus and ophthalmic plastics cases.

The current ICD9 description for external photography is 92285.

Surgical photography documents procedures in the operating room and may use the same instrumentation as external photography. Photographs may also be made directly through the operating microscope utilizing a beam splitter.

Donaldson stereo photography specifically describes external documentation of the eye utilizing the Donaldson Simultaneous Stereo Camera.

External ocular videography refers to the documentation of the motion of the face and eye utilizing a video camera and videotape recorder. External ocular videography documents not just the endpoints of the process (as external ocular photography does), but the actual pathway the eye takes as it travels toward those endpoints. A videotape recording is the product of this dynamic documentary procedure.

External ocular videography is useful whenever the actual motion of the eye needs to be documented. Some ocular conditions for which this procedure may be requested include nystagmus, blepharospasm, strabismus, Marcus-Gunn jaw-wink ptosis, and various neurologic conditions.

Currently, there is no ICD9 description for external ocular videography. External photography and external ocular videography may be performed on the same patient on the same day as they complement each other. Each procedure, however, provides the physician with a different type of information.

Infrared ocular videography or 'IR videography' utilizes infrared sensitive video equipment. It documents pupillary phenomena and iris transillumination defects.

Surgical videography describes the video documentation of surgeries. This is usually accomplished with a beam splitter and video camera which is directly attached to the operating microscope.

Conclusion

This paper raises several issues concerning currently utilized ophthalmic photographic terminology. Current nomenclature is tabulated and defined. The author hopes that this paper will initiate dialogue concerning nomenclature issues within the community of ophthalmic photographers.

Keywords: terminology, ophthalmic photography, ICD9

About the Author: Patrick J. Same has been photographing eyes for 13 years and has published several previous papers on ophthalmic photography. He supervises the Ophthalmic Photography Department at Davis Dueher Eye Associates and teaches both ophthalmic and fine art photography. Active in professional organizations, he currently serves as the President of the Ophthalmic Photographers' Society.

REFERENCE

Table 1: Summary of common ophthalmic photography patient procedures.

<table>
<thead>
<tr>
<th>PROCEDURE</th>
<th>ANATOMY</th>
<th>INSTRUMENTATION</th>
<th>ICD9 CODE</th>
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</thead>
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<td>Retina &amp; Choroid</td>
<td>Fundus Camera</td>
<td>92250</td>
</tr>
<tr>
<td>Fluorescein Angiography</td>
<td>Retina</td>
<td>Fundus Camera w/ Filters</td>
<td>92235</td>
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<td>Anterior Segment Angiography</td>
<td>Cornea &amp; Anterior Segment</td>
<td>Fundus or Slit-lamp Camera w/ Filters</td>
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<tr>
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<td>Choroid</td>
<td>Fundus Camera w/ Electronic Imaging &amp; IR Filtration</td>
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<tr>
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<td>Filtering Angle</td>
<td>Photo Slit-lamp w/ Accessory Lenses</td>
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<td>Corneal Endothelium</td>
<td>Specular Microscope</td>
<td>92286</td>
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<td>Corneal Surface</td>
<td>Photokeratoscope</td>
<td>92249*</td>
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<tr>
<td>Corneal Topography</td>
<td>Corneal Surface</td>
<td>Corneal Topography Unit</td>
<td>92249*</td>
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<tr>
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<td>35mm Camera w/ Macro Lens</td>
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<tr>
<td>External Ocular Videography</td>
<td>Eye &amp; Ocular Adnexa Movements</td>
<td>Video Camera</td>
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*The code 92249 (Unlisted Ophthalmological Service or Procedure) is used to describe procedures which have not been assigned specific ICD9 codes.
Table 2: Some synonyms for common ophthalmic photography patient procedures

<table>
<thead>
<tr>
<th>PROCEDURE</th>
<th>SYNONYMS</th>
<th>COLLOQUIAL NOMENCLATURE</th>
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<td>Retinal Angiography</td>
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<td>Indocyanine Green Angiography</td>
<td>ICG Angiography, IR Angiography, ICG Chorioangiography</td>
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<td>Slit-lamp Photography</td>
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<td>Goniophotography</td>
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<td>CT's</td>
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