DICOM Correction Proposal

STATUS	Final Text
Date of Last Update	2024/03/24
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Correction Number CP-2324
Log Summary: Add information about Vertex Distance to refraction correction parameters
Name of Standard PS3.3, PS3.6, PS3.16, PS3.17 2024a
Rationale for Correction: Several modules in PS3.3 and a template specification in PS3.16 define attributes or content items to encode the refractive correction of a patient's eye that is needed to achieve best vision. Although the effect of vertex distance (i.e., the distance from the corneal vertex of the eye to the back of the corrective lens) on optical correction is well known, it is not covered by these modules nor templates when specifying the refractive correction. As long as patient's vision correction was based on ophthalmic lenses offered in increments by not less than 0.25 diopters, the lack of vertex distance has only low influence. But nowadays, with correction specified in down to 0.01 diopter precision for either ophthalmic lenses or refractive laser vision correction, vertex distance becomes an important factor of refractive correction data. (see Sebag/Meslin, 2020)[1] It is proposed to add attributes and content items to specify the corneal vertex to all occurrences where refractive correction of a patient's eye is conveyed. [1] Sebag M, Meslin D. Refraction: Vertex Distance Matters! Points de Vue - International Review of Ophthalmic Optics. 09/2020. https://www.pointsdevue.com/sites/default/files/refraction_vertex_distance_matters.pdf *[Ed.Note: SNOMED CRS ID#783795 for 415813002]*
Correction Wording:

In PS3.3, section C.8.17.8 Ophthalmic Tomography Acquisition Parameters Module add following attributes

Table C.8.17.8-2. Ophthalmic Acquisition Parameters Macro Attributes

Attribute Name	Tag	Type	Attribute Description
Refractive State Sequence	(0022,001B)	2	Refractive state of the imaged eye at the time of acquisition. Zero or one Item shall be included in this Sequence.
>Spherical Lens Power	(0022,0007)	1	Sphere value in diopters.
>Cylinder Lens Power	(0022,0008)	1	Cylinder value in diopters.
>Cylinder Axis	(0022,0009)	1	Axis value in degrees.

>Vertex Distance	**(0022,000F)**	**3**	**The distance from the corneal vertex of the eye to the back of the corrective lens, in mm.**
Emmetropic Magnification	(0022,000A)	2	Emmetropic magnification value (dimensionless). Zero length means the emmetropic magnification was not measured.
…			

In PS3.3, section C.8.25.9 Autorefraction Measurements Module add following attributes

Table C.8.25.9-1. Autorefraction Measurements Module Attributes

Attribute Name	Tag	Type	Attribute Description
Autorefraction Right Eye Sequence	(0046,0050)	1C	A Sequence that specifies refractive measurements of a patient's right eye. Only a single Item shall be included in this Sequence. Required if the right eye is measured. ***Note*** *If Autorefraction Right Eye Sequence (0046,0050) is present, Measurement Laterality (0024,0113), if present, will have a value of R or B as appropriate.*
>Sphere Power	(0046,0146)	1	Refractive power of the eye that is the same in all meridians, measured at distance (optical infinity), in diopters.
>Include Table C.8.25.6.1-1 "Cylinder Sequence Macro Attributes"			
>Pupil Size	(0046,0044)	3	The horizontal diameter measurement of the pupil, in mm.
>Corneal Size	(0046,0046)	3	The horizontal diameter measurement of the cornea, in mm.
>Vertex Distance	**(0022,000F)**	**3**	**The distance from the corneal vertex of the eye to the back of the corrective lens, in mm.**
Autorefraction Left Eye Sequence	(0046,0052)	1C	A Sequence that specifies refractive measurements of a patient's left eye. Only a single Item shall be included in this Sequence. Required if the left eye is measured. ***Note*** *If Autorefraction Left Eye Sequence (0046,0052) is present, Measurement Laterality (0024,0113), if present, will have a value of L or B as appropriate.*
>Sphere Power	(0046,0146)	1	Refractive power of the eye that is the same in all meridians, measured at distance (optical infinity), in diopters.
>Include Table C.8.25.6.1-1 "Cylinder Sequence Macro Attributes"			
>Pupil Size	(0046,0044)	3	The horizontal diameter measurement of the pupil, in mm.
>Corneal Size	(0046,0046)	3	The horizontal diameter measurement of the cornea, in

			mm.
>Vertex Distance	**(0022,000F)**	**3**	**The distance from the corneal vertex of the eye to the back of the corrective lens, in mm.**
Distance Pupillary Distance	(0046,0060)	3	Distance in mm between the pupils when the patient's object of regard is in the distance, as measured by an autorefractor.
Near Pupillary Distance	(0046,0062)	3	Distance in mm between the pupils when the patient's object of regard is at near, as measured by an autorefractor.

In PS3.3, section C.8.25.11 Subjective Refraction Measurements Module add following attributes

Table C.8.25.11-2. Subjective Refraction Measurements Macro Attributes

Attribute Name	Tag	Type	Attribute Description
Sphere Power	(0046,0146)	1	Refractive power of the eye that is the same in all meridians, measured at distance (optical infinity), in diopters.
Include Table C.8.25.6.1-1 "Cylinder Sequence Macro Attributes"			
Include Table C.8.25.6.2-1 "Prism Sequence Macro Attributes"			
Vertex Distance	**(0022,000F)**	**3**	**The distance from the corneal vertex of the eye to the back of the corrective lens, in mm.**
Add Near Sequence	(0046,0100)	1C	A Sequence that specifies refractive measurements of the eye to correct for inability to focus at near while wearing the distance prescription. Only a single Item shall be included in this Sequence. Required if near point refraction is done.
…			

In PS3.3, section C.8.25.16.2 Intraocular Lens Calculations Macro add following attributes

Table C.8.25.16-2. Intraocular Lens Calculations Macro Attributes

Attribute Name	Tag	Type	Attribute Description
…			
Refractive State Sequence	(0022,001B)	2	Refractive state of the imaged eye at the time of acquisition. Zero or one Item shall be included in this Sequence.
>Spherical Lens Power	(0022,0007)	1	Sphere value in diopters.
>Cylinder Lens Power	(0022,0008)	1	Cylinder value in diopters.
>Cylinder Axis	(0022,0009)	1	Axis value in degrees.
>Vertex Distance	**(0022,000F)**	**3**	**The distance from the corneal vertex of the eye to the back of the corrective lens, in mm.**
>Source of Refractive Measurements Sequence	(0022,1134)	1	Refractive measurements source.

			Only a single Item shall be included in this Sequence.
…			

In PS3.3, section C.8.26.6.1 Ophthalmic Patient Clinical Information and Test Lens Parameters Macro ad following attributes

Table C.8.26.6-2. Ophthalmic Patient Clinical Information and Test Lens Parameters Macro Attributes

Attribute Name	Tag	Type	Attribute Description
Refractive Parameters Used on Patient Sequence	(0024,0112)	2	Refractive parameters used when performing visual field test. Zero or one Item shall be included in this Sequence.
>Spherical Lens Power	(0022,0007)	1	Sphere value in diopters.
>Cylinder Lens Power	(0022,0008)	1	Cylinder value in diopters.
>Cylinder Axis	(0022,0009)	1	Axis value in degrees.
>Vertex Distance	**(0022,000F)**	**3**	**The distance from the corneal vertex of the eye to the back of the corrective lens, in mm.**
Pupil Size	(0046,0044)	2	The horizontal diameter measurement of the pupil, in mm.
…			

In PS 3.6, Section 6 add following attributes to Table 6-1. Registry of DICOM Data Elements

Tag	Name	Keyword	VR	VM
(0022,000F)	**Vertex Distance**	**VertexDistance**	**FD**	**1**

In PS3.16, Annex A, TID 2021 Template for Spectacle Prescription Details add following content item to Table TID 2021. Spectacle Prescription Details

Table TID 2021. Spectacle Prescription Details

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1		CONTAINS	NUM	EV (251795007, SCT, "Sphere")	1	M		UNITS = EV ([diop], UCUM, "diopters")
2		CONTAINS	NUM	EV (251797004, SCT, "Cylinder Power")	1	UC	IF Cylinder is prescribed	UNITS = EV ([diop], UCUM, "diopters")
3		CONTAINS	NUM	EV (251799001, SCT, "Axis")	1	MC	IF Row 2 is present	UNITS = EV (deg, UCUM, "degrees")
4		CONTAINS	NUM	EV (111672, DCM,	1	UC	IF Add Near	UNITS = EV

				"Add Near")			is prescribed	([diop], UCUM, "diopters")
5		CONTAINS	NUM	EV (111673, DCM, "Add Intermediate")	1	UC	IF Add Intermediate is prescribed	UNITS = EV ([diop], UCUM, "diopters")
6		CONTAINS	NUM	EV (111674, DCM, "Add Other")	1	UC	IF Add Other is prescribed	UNITS = EV ([diop], UCUM, "diopters")
7		CONTAINS	NUM	EV (111675, DCM, "Horizontal Prism Power")	1	UC	IF Horizontal Prism is prescribed	UNITS = EV ([p'diop], UCUM, "prism diopters")
8		CONTAINS	CODE	EV (111676, DCM, “Horizontal Prism Base”)	1	MC	IF Row 7 is present	DCID 4214 “Ophthalmic Horizontal Direction”
9		CONTAINS	NUM	EV (111677, DCM, "Vertical Prism Power")	1	UC	IF Vertical Prism is prescribed	UNITS = EV ([p'diop], UCUM, "prism diopters")
10		CONTAINS	CODE	EV (111678, DCM, "Vertical Prism Base")	1	MC	IF Row 9 is present	DCID 4215 “Ophthalmic Vertical Direction”
11		**CONTAINS**	**NUM**	**EV (415813002, SCT, "Vertex distance")**	**1**	**U**		**UNITS = EV (mm, UCUM, "mm")**

In PS 3.17, Section RR Ophthalmic Refractive Reports Use Cases (Informative) add following statement

RR.1 Introduction

Refractive instruments are the most commonly used instruments in eye care. At present many of them have the capability for digital output, but their data is most often addressed by manual input into a paper or electronic record.

Refractive instruments address the power of a lens or of a patient's eye to bend light. In order for a patient to see well light must be focused on the retina in the back of the eye. If the natural optics of a patient's eye do not accomplish this, corrective lenses can bend incident light so that it will be focused on the retina after passing through the optics of the eye. The power of an optical system such as a spectacle lens or the eye is measured by its ability to bend light, and is measured in diopters (D). In practical clinical applications, this is measured to 3 decimal points, in increments of 0.125 D. The power of a lens is measured in at least two major meridians. A spherical lens power occurs when the power is the same in all meridians (0-180 degrees). A cylindrical lens power occurs when there is a difference in lens power across the various meridians. The shape of the anterior surface of the eye largely determines what type of correcting lens is needed. An eye that requires only spherical lens power is usually shaped spherically, more like a ball, while an eye that requires cylindrical lens power is ellipsoid and shaped more like a football.

Lenses can also bend light without changing its focal distance. This type of refraction simply displaces the position of the image laterally. The power of a prism to bend light is measured in prism diopters. In practical clinical applications this is measured to 1 decimal point, in increments of 0.5 prism diopters.

Prism power is required in a pair of spectacles most commonly when both eyes are not properly aligned with the object of regard. Clinical prisms are considered to bend all light coming in from the lens either up, down, in toward the nose, or out away from the nose, in order to compensate for ocular misalignment.

In either case of refractive examination, the distance between the back of corrective lenses and the front of the eye (corneal vertex) has an impact on the result of correction, and thus to the vision of the patient. This distance is called Vertex Distance and is measured in millimeters.

Visual acuity is measured in various scales, all of which indicate a patient's vision as a fraction of what a reference standard patient would see at any given distance. For example, if a patient has 20/30 vision it means that he sees from a distance of 20 feet what a reference standard patient would see from a distance of 30 feet. These measurements are determined by presentation of standardized objects or symbols (optotypes) of varying sizes calibrated to reference standard vision (20/20). The smallest discernible optotype defines the patient's visual acuity expressed in a variety of formats (letters, numbers, pictures, tumbling E, Landolt C, etc).