DICOM Correction Proposal

STATUS	Draft Final Text
Date of Last Update	2024/11/05
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Correction Number CP-2346
Log Summary: Ocular Region Imaged Module in Ophthalmic Tomography
Name of Standard PS3.3, PS3.6 2024d
Rationale for Correction: Ocular Region Imaged Module is used widely in ophthalmic IODs. The mechanism of providing image coordinates for referenced anatomy was introduced with Ophthalmic Tomography En Faces images, which are 2D projections of the retina. In addition to 2D images, Ocular Region Imaged Module is used in multi-frame context with potentially 3D volumetric data. The mechanism for providing the anatomic reference point as X,Y coordinates is not sufficient for 3-dimensional data. Furthermore, a single image may have multiple anatomic landmarks present and localized. Ocular Region Imaged Module does not support providing coordinates for multiple anatomic structures, but Primary Anatomic Structure Sequence may contain one or more items. These issues can be addressed by moving Ophthalmic Anatomic Reference Points to a sequence and adding a third coordinate for frame number. As the implementation might be able to provide only 1 or 2 of the 3 coordinates, individual coordinates should remain type 2.
Correction Wording:

Move coordinate attributes to sequence and add frame number coordinate in Ocular Region Imaged Module (PS3.3)

C.8.17.5 Ocular Region Imaged Module

Table C.8.17.5-1 specifies the Attributes of the Ocular Region Imaged Module, which describe the anatomy imaged in an Ophthalmic Photography or Ophthalmic Tomography Image Storage SOP Instance.

Table C.8.17.5-1. Ocular Region Imaged Module Attributes

Attribute Name	Tag	Type	Attribute Description
Image Laterality	(0020,0062)	1	Laterality of object imaged (as described in Anatomic Region Sequence (0008,2218)) examined. Enumerated Values: **R** right eye

Attribute Name	Tag	Type	Attribute Description
			L left eye **B** both left and right eye Shall be consistent with any laterality information contained in Primary Anatomic Structure Modifier Sequence (0008,2230), if present. Note Laterality (0020,0060) is a Series level Attribute and must be the same for all Images in the Series, hence it must be absent if Image Laterality (0020,0062) has different values for Images in the same Series. Since most Ophthalmic Photographic Image Series contain images of both eyes, the Series level Attribute will rarely be present.
Relative Image Position Code Sequence	(0022,001D)	2C	The position of this image on the retina (as defined by a specified nomenclature; the nomenclature is implicit in the code used). Only a single Item is permitted in this Sequence. Required if Ophthalmic Volumetric Properties Flag (0022,1622) is set to YES and ~~**Attributes**~~ Ophthalmic Anatomic Reference Point X-Coordinate (0022,1624) and Ophthalmic Anatomic Reference Point Y-Coordinate (0022,1626) do not contain a value**, or Ophthalmic Anatomic Reference Point Sequence (0022,1632) is not present**. May be present otherwise. Note This Attribute is used to provide the user with a general reference point when viewing the image. If the implementation is able to identify ~~**a**~~ precise anatomic location**s**, it will convey that information in ~~**Attributes**~~ Ophthalmic Anatomic Reference Point X-Coordinate (0022,1624) and Ophthalmic Anatomic Reference Point Y-Coordinate (0022,1626)**, or Ophthalmic Anatomic Reference Point Sequence (0022,1632)**.
>Include Table 8.8-1 "Code Sequence Macro Attributes"			*BCID 4207 "Ophthalmic Image Position".*
Ophthalmic Anatomic Reference Point X-Coordinate	(0022,1624)	2C	The horizontal offset location (column) of the anatomic reference point identified by ~~**Attribute**~~ Primary Anatomic Region Sequence (0008,2228). See Section C.8.17.5.1 for further explanation. Image relative position specified with sub-pixel resolution such that the origin at the Top Left Hand Corner (TLHC) of the TLHC pixel is 0.0\0.0, the Bottom Right Hand Corner (BRHC) of the TLHC pixel is 1.0\1.0, and the BRHC of the BRHC pixel is Columns\Rows (see Figure C.10.5-1). The value ~~**must**~~ **shall** be within the range ~~**0\0**~~ **0.0** to Columns **(0028,0011)**. Required if **Ophthalmic Anatomic Reference Point Sequence (0022,1632) is not present and** Ophthalmic Volumetric Properties Flag (0022,1622) is set to YES. May be present otherwise.
Ophthalmic Anatomic Reference Point Y-Coordinate	(0022,1626)	2C	The vertical offset location (row) of the anatomic reference point identified by ~~**Attribute**~~ Primary Anatomic Region Sequence (0008,2228). See Section C.8.17.5.1 for further explanation.

Attribute Name	Tag	Type	Attribute Description
			Image relative position specified with sub-pixel resolution such that the origin at the Top Left Hand Corner (TLHC) of the TLHC pixel is 0.0\0.0, the Bottom Right Hand Corner (BRHC) of the TLHC pixel is 1.0\1.0, and the BRHC of the BRHC pixel is Columns\Rows (see Figure C.10.5-1). The value ~~must~~ **shall** be within the range ~~0\0~~ **0.0** to Rows **(0028,0010).** Required if **Ophthalmic Anatomic Reference Point Sequence (0022,1632) is not present and** Ophthalmic Volumetric Properties Flag (0022,1622) is set to YES. May be present otherwise.
Ophthalmic Anatomic Reference Point Sequence	**(0022,1632)**	**1C**	**Locations of the anatomic reference points identified by Items in Primary Anatomic Structure Sequence (0008,2228).** **Required if Ophthalmic Volumetric Properties Flag (0022,1622) is set to YES and SOP Instance is a Multi-frame Image, or if Primary Anatomic Structure Sequence (0008,2228) contains multiple Items. May be present otherwise.** **One or more Items shall be included in this Sequence**
>Primary Anatomic Structure Item Index	**(0022,1634)**	**1**	**Sequence Item index of the referenced Primary Anatomic Structure. Value shall be in the range 1 to number of Items in Primary Anatomic Structure Sequence (0028,2228).**
>Ophthalmic Anatomic Reference Point Localization Type	**(0022,1633)**	**2**	**Type of method used to localize the anatomic structure in the image.** **Enumerated Values:** **AUTOMATIC** **MANUAL**
>Ophthalmic Anatomic Reference Point X-Coordinate	**(0022,1624)**	**2**	**The horizontal offset location (column) of the anatomic reference point identified by Primary Anatomic Structure Sequence (0008,2228). See Section C.8.17.5.1 for further explanation.** **Image relative position specified with sub-pixel resolution such that the origin at the Top Left Hand Corner (TLHC) of the TLHC pixel is 0.0\0.0, the Bottom Right Hand Corner (BRHC) of the TLHC pixel is 1.0\1.0, and the BRHC of the BRHC pixel is Columns\Rows (see Figure C.10.5-1). The value shall be within the range 0.0 to Columns (0028,0011).**
>Ophthalmic Anatomic Reference Point Y-Coordinate	**(0022,1626)**	**2**	**The vertical offset location (row) of the anatomic reference point identified by Primary Anatomic Structure Sequence (0008,2228). See Section C.8.17.5.1 for further explanation.** **Image relative position specified with sub-pixel resolution such that the origin at the Top Left Hand Corner (TLHC) of the TLHC pixel is 0.0\0.0, the Bottom Right Hand Corner (BRHC) of the TLHC pixel is 1.0\1.0, and the BRHC of the BRHC pixel is Columns\Rows (see Figure C.10.5-1). The value shall be within the range 0.0 to Rows (0028,0010).**
>Ophthalmic Anatomic Reference Point Frame Coordinate	**(0022,1623)**	**2C**	**The frame number offset of the anatomic reference point identified by Primary Anatomic Structure Sequence (0008,2228).**

Attribute Name	Tag	Type	Attribute Description
			Required if SOP Instance is a Multi-frame Image, and frames are parallel and equally spaced. **Image relative position specified with sub-voxel resolution such that the middle position of the image plane of the first frame is 0.5 and the middle position of the image plane of the last frame is Number of Frames (0028,0008) - 0.5.** **The value shall be within the range 0.0 to Number of Frames (0028,0008).**
Include Table 10-5 "General Anatomy Mandatory Macro Attributes"			*DCID 4209 "Ophthalmic Anatomic Structure Imaged" for Anatomic Region Sequence.* *DCID 4266 "Ophthalmic Anatomic Structure Reference Point" for Primary Anatomic Structure Sequence.* *In this Module, Primary Anatomic Structure Sequence (0008,2228) is specialized to be Type 1C; required if* ***~~Attributes~~*** *Ophthalmic Anatomic Reference Point X-Coordinate (0022,0024) and Ophthalmic Anatomic Reference Point Y-Coordinate (0022,0026) contain a value****, or Ophthalmic Anatomic Reference Point Sequence (0022,1632) is present****; may be present otherwise.*

C.8.17.5.1 Ocular Region Imaged Module Attribute Descriptions

C.8.17.5.1.1 Ophthalmic Anatomic Reference Point Location

The ***~~Attributes~~*** Ophthalmic Anatomic Reference Point X-Coordinate (0022,1624)**,** ***~~and~~*** Ophthalmic Anatomic Reference Point Y-Coordinate (0022,1626)**, and Ophthalmic Anatomic Reference Point Frame Coordinate (0022,1623)** are used when an Ophthalmic Tomography Image Storage SOP Instance contains Attributes to convey volumetric properties (such as when using the Ophthalmic Tomography image for angiography). These Attributes identify the location of the anatomic ***~~region~~*** **structures** conveyed in ***~~Attribute~~*** Primary Anatomic Region Sequence (0008,2228). The most common anatomic ***~~regions~~*** **structures** identified for an OCT angiography are the fovea centralis and optic nerve head.

Individual coordinate values are Type 2 Attributes. If the implementation is not able to provide all three coordinates, unknown coordinates shall be conveyed as empty values. Ophthalmic Anatomic Reference Point Frame Coordinate (0022,1623) is required only for volumetric multi-frame Images.

Note

The Anatomic Region Sequence (0008,2218) is typically set to (81745001, SCT, "Eye").

Figure C.8.17.5-1 shows an Ophthalmic Tomography **En Face** image displaying the fovea centralis. The image Row/Column is defined as 245 x 245 and the location of the fovea centralis is horizontal row = 194 and vertical row = 132. Therefore, ***~~Attribute~~*** Ophthalmic Anatomic Reference Point X-Coordinate (0022,0024) is equal to 194 and ***~~Attribute~~*** Ophthalmic Anatomic Reference Point Y-Coordinate (0022,0026) is equal to 132. **Because the Image is two-dimensional, Ophthalmic Anatomic Reference Point Frame Coordinate (0022,1623) is not present.**

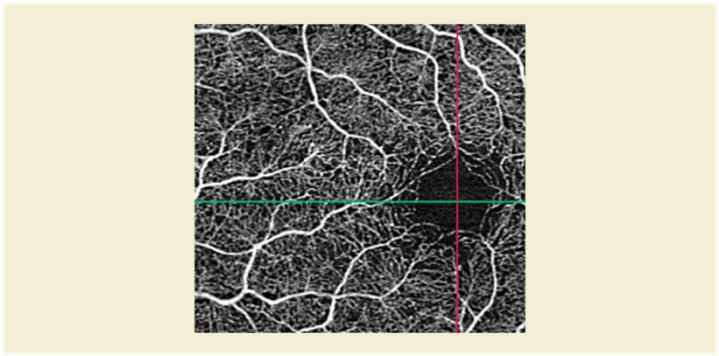

Figure C.8.17.5-1. En face Image - Ophthalmic Anatomic Reference Point Location Example

Add new Data Elements to Registry of Data Elements in PS3.6

Table 6-1. Registry of Data Elements

Tag	Name	Keyword	VR	VM	
(0022,1632)	Ophthalmic Anatomic Reference Point Sequence	OphthalmicAnatomicReferencePointSequence	SQ	1	
(0022,1633)	Ophthalmic Anatomic Reference Point Localization Type	OphthalmicAnatomicReferencePointLocalizationType	CS	1	
(0022,1634)	Primary Anatomic Structure Item Index	PrimaryAnatomicStructureItemIndex	IS	1	
(0022,1623)	Ophthalmic Anatomic Reference Point Frame Coordinate	OphthalmicAnatomicReferencePointFrameCoordinate	FL	1	