Digital Imaging and Communications in Medicine (DICOM)

Supplement 221: Dermoscopy

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VERSION: Final Text 15th November 2020

Developed pursuant to DICOM Work Item: 2019-04-C

Table of Contents

Scope and Field of Application

This Supplement to the DICOM Standard introduces a new IOD and a new storage SOP Class for encoding and storing dermoscopic images.

Dermoscopy is a diagnostic technique that enables visualization of the morphological structures of the skin. Dermoscopy (also known as dermatoscopy and epiluminescence microscopy) is a non-invasive, in vivo skin examination that has demonstrated to be an important aid in the early recognition of malignant melanoma and other skin tumors. Dermoscopy is also used for non-skin cancer disease conditions (e.g., inflammatory disease).

A dermoscope is hand-held device that consists of magnifier and light source. Emitted light can be polarized light or non-polarized. Dermoscopic examination can be by direct contact with skin or non-contact. Dermoscopy using non-polarized light require direct contact between the skin and the device. For direct contact dermoscopy an immersion medium is placed on the skin surface and a glass plate on the dermoscope is placed directly against the skin. Non-contact dermoscopy does not require the dermoscope to be in contact with the skin surface. Three techniques are used in dermoscopy: polarized non-contact dermoscopy, polarized contact dermoscopy, and non-polarized contact dermoscopy.

Changes to NEMA Standards Publication PS 3.2

Digital Imaging and Communications in Medicine (DICOM)

Part 2: Conformance

Item: Add to table A.1-2 categorizing SOP Classes:

The SOP Classes are categorized as follows:

Table A.1-2
UID VALUES

UID Value	UID NAME	Category
1.2.840.10008.5.1.4.1.1.77.1.7	Dermoscopic Photography Image Storage	Transfer

Changes to NEMA Standards Publication PS 3.3

Digital Imaging and Communications in Medicine (DICOM)

Part 3: Information Object Definitions
Part 3 Additions

Modify PS3.3

Modify PS3.3 Annex A

A.1.4 Overview of the Composite IOD Module Content

Table A.1-1c. Composite Information Object Modules Overview - More Images

IODs **Modules**	**VL PH**	**DMS PH**
Patient	M	**M**
Clinical Trial Subject	U	**U**
General Study	M	**M**
Patient Study	U	**U**
Clinical Trial Study	U	**U**
General Series	M	**M**
Clinical Trial Series	U	**U**
Segmentation Series		
Whole Slide Microscopy Series		
Intravascular OCT Series		
Frame of Reference		**U**
Synchronization		
Cardiac Synchronization		

IODs **Modules**	**VL PH**	**DMS PH**
General Equipment	M	**M**
Enhanced General Equipment		**M**
VL Photographic Equipment	**U**	**U**
General Image	M	**M**
General Reference	**U**	**U**
Image Pixel	M	**M**
Supplemental Palette Color Lookup Table		
Enhanced Contrast/Bolus		
Cine		
Multi-frame		
Multi-frame Functional Groups		
Multi-frame Dimension		
Device	U	**U**
Specimen	C	**C**
VL Image	M	**M**
VL Photographic Acquisition	**U**	**U**
Slide Coordinates		
Whole Slide Microscopy Image		
Optical Path		
Multi-Resolution Navigation		

IODs **Modules**	**VL PH**	**DMS PH**
Slide Label		
Dermoscopic Image		**U**
Intravascular OCT Image		
Intravascular OCT Acquisition Parameters		
Intravascular OCT Processing Parameters		
Intravascular Image Acquisition Parameters		
Segmentation Image		
Overlay Plane	U	
Common Instance Reference	U	**U**
Acquisition Context	M	**M**
ICC Profile	U	**U**
SOP Common	M	**M**
Frame Extraction		

A.32.11 Dermoscopic Photography Image IOD

A.32.11.1 Dermoscopic Photography Image IOD Description

The Dermoscopic Photography Image Information Object Definition (IOD) specifies an image that has been created using a dermoscope. The dermoscope may be a dedicated dermoscopic device, or a camera-attached or smart device-attached dermoscope.

A.32.11.2 Dermoscopic Photography Image IOD Description Entity-Relationship Model

The Dermoscopic Photography Image IOD uses the DICOM Composite Instance IOD Entity-Relationship Information Model defined in Section A.1.2, with only the Image IE below the Series IE.

A.32.11.3 Dermoscopic Photography Image IOD Modules

Table A.32.11-1 specifies the Modules of the Dermoscopic Photography Image IOD.

Table A.32.11-1
DERMOSCOPIC PHOTOGRAPHY IMAGE IOD MODULES

IE	Module	Reference	Usage
Patient	Patient	C.7.1.1	M
	Clinical Trial Subject	C.7.1.3	U
Study	General Study	C.7.2.1	M
	Patient Study	C.7.2.2	U
	Clinical Trial Study	C.7.2.3	U
Series	General Series	C.7.3.1	M
	Clinical Trial Series	C.7.3.2	U
Frame of Reference	Frame of Reference	C.7.4.1	U
Equipment	General Equipment	C.7.5.1	M
	Enhanced General Equipment	C.7.5.2	M
	VL Photographic Equipment	C.8.12.10	U
Image	General Image	C.7.6.1	M
	General Reference	C.12.4	U
	Image Pixel	C.7.6.3	M
	Acquisition Context	C.7.6.14	M
	VL Image	C.8.12.1	M
	VL Photographic Acquisition	C.8.12.11	U
	Dermoscopic Image	C.8.12.13	M
	ICC Profile	C.11.15	U
	SOP Common	C.12.1	M
	Common Instance Reference	C.12.2	U

A.32.11.4 Dermoscopic Photography Image IOD Content Constraints

A.32.11.4.1 Modality

The value of Modality (0008,0060) shall be DMS.

A.32.11.4.2 Frame of Reference Module

The frame of reference module may be used if multiple successive images are acquired during a single acquisition. All images in a Series that share the same Frame of Reference UID will be spatially related to each other.

A.32.11.4.3 Acquisition Context Module

The Defined TID for Acquisition Context Sequence (0040,0555) is TID 8300 “Skin Cancer Acquisition Context.

It encodes patient level and lesion level information related to skin cancer.

Note: Any lesion level attributes apply to the single lesion seen in the acquired image.

A.32.11.4.4 VL Photographic Equipment Module

The VL Photographic Equipment Module may be used to encode Lens attributes. Some dermoscopes have interchangeable lenses.

A.32.11.4.5 VL Photographic Acquisition Module

The Digital Zoom Ratio (0016,0044) attribute may be used to encode the digital zoom ratio of the dermoscope when the image was acquired.

A.32.11.4.6 ICC Profile Module

The ICC Profile Module may be present for color images. If the color space to be used is not calibrated (i.e., a device-specific ICC Input Profile is not available), then an ICC Input Profile specifying a well-known space (such as sRGB) may be specified.

A.32.11.4.7 Series Organization

It is recommended that:

- All images of the same lesion within an imaging study are in the same series.
- Images of different lesions within the same imaging study are in different series.
- Regional images within an imaging study containing dermoscopy images are in a different series.

Add to PS3.3 C.7.3.1.1.1 Modality

C.7.3.1.1 General Series Attribute Descriptions

C.7.3.1.1.1 Modality

Defined Terms:

…

DMS Dermoscopy

…

Modify PS3.3 C.8 Modality Specific Modules

C.8.12.1 VL Image Module

Table C.8-77 specifies the Attributes that describe a VL Image produced by Endoscopy (ES), General Microscopy (GM), Automated-Stage Microscopy (SM), External-camera Photography (XC), **Dermoscopy (DMS),** or other VL imaging Modalities.

Table C.8-77. VL Image Module Attributes

Attribute Name	Tag	Type	Attribute Description
...			
Anatomic Region Sequence	(0008,2218)	1C	Sequence that identifies the anatomic region of interest in this image (i.e., external anatomy, surface anatomy, or general region of the body).

Attribute Name	Tag	Type	Attribute Description
			Only a single Item shall be included in this Sequence. Required if Number of Frames (0028,0008) is present and Specimen Description Sequence (0040,0560) is absent. May be present otherwise.
>Include Table 8.8-1 "Code Sequence Macro Attributes"			*DCID 4040 "Endoscopy Anatomic Regions" is defined for the Video Endoscopic IOD.* *BCID 4029 "Dermatology Anatomic Sites" is defined for the VL Photographic Image IOD **and Dermoscopic Photography Image IOD** for dermatology applications.* *BCID is CID 4031 "Common Anatomic Regions" for humans and CID 7483 "Common Anatomic Regions for Animals" for animals.*
>Anatomic Region Modifier Sequence	(0008,2220)	3	Sequence of Items that modifies the anatomic region of interest of this image One or more Items are permitted in this Sequence.
>>Include Table 8.8-1 "Code Sequence Macro Attributes"			*BCID 2 "Anatomic Modifier".* *BCID 245 "Laterality with Median" is defined for the VL Photographic Image IOD **and Dermoscopic Photography Image IOD** for dermatology applications.*
Include Table 10-8 "Primary Anatomic Structure Macro Attributes"			*No CID is defined. These Type 3 Attributes are not appropriate when Specimen Description Sequence (0040,0560) is present, as it includes the Primary Anatomic Structure Macro for each specimen in the image.*
...			

Add the following new subsection in PS3.3 C.8

C.8.12.13 Dermoscopic Image Module

Table C.8.12.13-1 specifies the Attributes that describe dermoscopic images.

Table C.8.12.13-1. Dermoscopic Image Module Attributes

Attribute Name	Tag	Type	Attribute Description

Recognizable Visual Features	(0028,0302)	1	Indicates whether or not the image contains sufficiently recognizable visual features to allow the image or a reconstruction from a set of images to identify the Patient. Enumerated Values: YES NO The value of Recognizable Visual Features (0028,0302) shall be YES if the image contains the patient's fingerprints
Light Source Polarization	(0016,1001)	2	Polarization of the dermoscope light source. Enumerated Values: POLARIZED NON_POLARIZED
Emitter Color Temperature	(0016,1002)	2	Color temperature of dermoscope light source in Kelvin.
Contact Method	(0016,1003)	2	Whether or not the image was acquired with the dermoscope in direct contact with the skin Enumerated Values: CONTACT NON_CONTACT
Immersion Media	(0016,1004)	2C	The interface between the dermoscope and the skin surface for images acquired with contact dermoscopy. Enumerated Values: ULTRASOUND_GEL ALCOHOL WATER MINERAL_OIL PLASTIC_CAP Required if Contact Method (0016,1003) is CONTACT
Optical Magnification Factor	(0016,1005)	2	Optical magnification factor when the image was acquired. Optical magnification is achieved using the optics of the dermoscope. The number indicates the magnification factor in times (X). The size of an object (e.g., a skin lesion) would appear on the sensor *n* times larger than the object when imaged with a dermoscope using *n* X optical magnification.
Partial View	(0028,1350)	3	Indicates whether this image is a partial view, that is a subset of a single view of a skin lesion. Enumerated Values: YES NO If this Attribute is absent, then the image may or may not be a partial view.
Partial View Description	(0028,1351)	3	Free text description of the portion of the skin lesion captured in a partial view image.

Tracking ID	(0062,0020)	1C	A text label used for tracking a finding or feature, potentially across multiple reporting objects, over time. This label shall be unique within the domain in which it is used. Required if Tracking UID (0062,0021) is present. Note: This Attribute allows linkage to Content Items in SR instances with observation context (112039, DCM, "Tracking Identifier") having the same value.
Tracking UID	(0062,0021)	1C	A unique identifier used for tracking a finding or feature, potentially across multiple reporting objects, over time. Required if Tracking ID (0062,0020) is present. Note: This Attribute allows linkage to Content Items in SR instances with observation context (112040, DCM, "Tracking Unique Identifier") having the same value.

Changes to NEMA Standards Publication PS 3.4

Digital Imaging and Communications in Medicine (DICOM)

Part 4: Service Class Specifications

Add to PS3.4 Annex B.5.

B.5 Standard SOP Classes

Table B.5-1
STANDARD SOP CLASSES

SOP Class Name	SOP Class UID	IOD (See PS 3.3)
Dermoscopic Photography Image Storage	1.2.840.10008.5.1.4.1.1.77.1.7	Dermoscopic Photography Image IOD

Changes to NEMA Standards Publication PS 3.6

Digital Imaging and Communications in Medicine (DICOM)

Part 6: Data Dictionary

Add to PS3.6 Annex A

UID Value	UID NAME	UID TYPE	Part
1.2.840.10008.5.1.4.1.1.77.1.7	Dermoscopic Photography Image Storage	SOP Class	PS 3.4

Add to PS3.6 the following Context Group UIDs:

Context UID	Context Identifier	Context Group Name	Comment
1.2.840.10008.6.1.1346	CID 4401	Fitzpatrick Skin Type	
1.2.840.10008.6.1.1347	CID 4402	History of Malignant Melanoma	
1.2.840.10008.6.1.1348	CID 4403	History of Melanoma in Situ	
1.2.840.10008.6.1.1349	CID 4404	History of Non-Melanoma Skin Cancer	
1.2.840.10008.6.1.1350	CID 4405	Skin Disorders	
1.2.840.10008.6.1.1351	CID 4406	Patient Reported Lesion Characteristics	
1.2.840.10008.6.1.1352	CID 4407	Lesion Palpation Findings	
1.2.840.10008.6.1.1353	CID 4408	Lesion Visual Findings	
1.2.840.10008.6.1.1354	CID 4409	Skin Procedures	

Add to PS3.6 the following Data Elements to Section 6, Registry of DICOM data elements:

Tag	Name	Keyword	VR	VM
(0016,1001)	Light Source Polarization	LightSourcePolarization	CS	1
(0016,1002)	Emitter Color Temperature	EmitterColorTemperature	DS	1
(0016,1003)	Contact Method	ContactMethod	CS	1
(0016,1004)	Immersion Media	ImmersionMedia	CS	1-n
(0016,1005)	Optical Magnification Factor	OpticalMagnificationFactor	DS	1

Changes to NEMA Standards Publication PS 3.16

Digital Imaging and Communications in Medicine (DICOM)

Part 16 Content Mapping Resource

Add to PS3.16 Annex B

Annex B DCMR Context Groups (Normative)

CID 4401 Fitzpatrick Skin Type

Resources: HTML| FHIR JSON|FHIR XML|IHE SVS XML

Type: Extensible
Version: 20201115
UID: 1.2.840.10008.6.1.1346

Table CID 4401 Fitzpatrick Skin Type

Coding Scheme Designator	Code Value	Code Meaning	SNOMED-RT ID	UMLS Concept Unique ID
NCIt	C74569	Fitzpatrick Skin Type I		C2700185
NCIt	C74570	Fitzpatrick Skin Type II		C2700186
NCIt	C74571	Fitzpatrick Skin Type III		C2700187
NCIt	C74572	Fitzpatrick Skin Type IV		C2700188
NCIt	C74573	Fitzpatrick Skin Type V		C2700189
NCIt	C74574	Fitzpatrick Skin Type VI		C2700190

CID 4402 History of Malignant Melanoma

Resources: HTML| FHIR JSON|FHIR XML|IHE SVS XML
Type: Extensible
Version: 20201115
UID: 1.2.840.10008.6.1.1347

Table CID 4402 History of Malignant Melanoma

Coding Scheme Designator	Code Value	Code Meaning	SNOMED-RT ID	UMLS Concept Unique ID
SCT	161432005	History of malignant melanoma	G-0239	C0457969
SCT	321000119108	History of malignant melanoma of the skin	R-FAC46	C3266389

CID 4403 History of Melanoma in Situ

Resources: HTML| FHIR JSON|FHIR XML|IHE SVS XML

Type: **Extensible**
Version: **20201115**
UID: **1.2.840.10008.6.1.1348**

Table CID 4403 History of Melanoma in Situ

Coding Scheme Designator	Code Value	Code Meaning	SNOMED-RT ID	UMLS Concept Unique ID
SCT	1251000119106	History of melanoma in situ of the skin	R-FAC47	C3266774

CID 4404 History of Non-Melanoma Skin Cancer

Resources: **HTML| FHIR JSON|FHIR XML|IHE SVS XML**
Type: **Extensible**
Version: **20201115**
UID: **1.2.840.10008.6.1.1349**

Table CID 4404 History of Non-Melanoma Skin Cancer

Coding Scheme Designator	Code Value	Code Meaning	SNOMED-RT ID	UMLS Concept Unique ID
SCT	428053000	History of malignant basal cell neoplasm of skin	G-0416	C1997258
SCT	429024007	History of squamous cell carcinoma of skin	G-0477	C1998384
SCT	443895001	History of malignant neoplasm of skin excluding melanoma	G-0584	C2732359

CID 4405 Skin Disorders

Resources: **HTML| FHIR JSON|FHIR XML|IHE SVS XML**
Type: **Extensible**
Version: **20201115**
UID: **1.2.840.10008.6.1.1350**

Table CID 4405 Skin Disorders

Coding Scheme Designator	Code Value	Code Meaning	SNOMED-RT ID	UMLS Concept Unique ID
SCT	43982006	Solar degeneration	D0-40100	C0546380
SCT	254819008	Atypical mole syndrome	D0-F1017	C0013403
SCT	782823001	Telangiectasia, cutaneous, cancer syndrome, familial		C5190630
SCT	69408002	Gorlin syndrome	D4-01046	C0004779

SCT	722859001	PTEN hamartoma tumor syndrome		C1959582
SCT	721904001	Rombo syndrome		C1867147

CID 4406 Patient Reported Lesion Characteristics

Resources: HTML| FHIR JSON|FHIR XML|IHE SVS XML
Type: Extensible
Version: 20201115
UID: 1.2.840.10008.6.1.1351

Table CID 4406 Patient Reported Lesion Characteristics

Coding Scheme Designator	Code Value	Code Meaning	SNOMED-RT ID	UMLS Concept Unique ID
SCT	418363000	Itching	F-A21A7	C0033774
SCT	247441003	Erythema	F-4410C	C4552417
SCT	162499001	Symptom has changed	R-20A12	C0436317

CID 4407 Lesion Palpation Findings

Resources: HTML| FHIR JSON|FHIR XML|IHE SVS XML
Type: Extensible
Version: 20201115
UID: 1.2.840.10008.6.1.1352

Table CID 4407 Lesion Palpation Findings

Coding Scheme Designator	Code Value	Code Meaning	SNOMED-RT ID	UMLS Concept Unique ID
DCM	130485	Firm skin lesion		
DCM	130486	Raised skin lesion		C0748816

CID 4408 Lesion Visual Findings

Resources: HTML| FHIR JSON|FHIR XML|IHE SVS XML
Type: Extensible
Version: 20201115
UID: 1.2.840.10008.6.1.1353

Table CID 4408 Lesion Visual Findings

Coding Scheme Designator	Code Value	Code Meaning	SNOMED-RT ID	UMLS Concept Unique ID
SCT	297968009	Bleeding skin	F-40031	C0574741
SCT	247441003	Erythema	F-4410C	C4552417

CID 4409 Skin Procedures

Resources: HTML| FHIR JSON|FHIR XML|IHE SVS XML
Type: Extensible
Version: 20201115
UID: 1.2.840.10008.6.1.1354

Table CID 4409 Skin Procedures

Coding Scheme Designator	Code Value	Code Meaning	SNOMED-RT ID	UMLS Concept Unique ID
SCT	302396003	Cryotherapy to skin lesion	P1-40C19	C0411410
SCT	240977001	Biopsy of skin	P1-031C8	C0150866
SCT	428604001	Photodynamic therapy of skin	P0-05E3D	C1998192
SCT	24977001	Topical chemotherapy for malignant neoplasm	P2-67017	C0199946

Modify tables in PS3.16 Annex B

CID 29 Acquisition Modality

Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML

Type: Extensible

Version: ~~20200623~~20201115

UID: 1.2.840.10008.6.1.19

Table CID 29. Acquisition Modality

Coding Scheme Designator	Code Value	Code Meaning
…		
DCM	**DMS**	**Dermoscopy**

CID 6099 Racial Group

Resources: HTML| FHIR JSON|FHIR XML|IHE SVS XML
Type: Extensible
Version: ~~20190125~~20201115
UID: 1.2.840.10008.6.1.1278

Coding Scheme Designator	Code Value	Code Meaning	SNOMED-RT ID	UMLS Concept Unique ID
SCT	413464008	African race	S-0004E	C0027567
SCT	413582008	Asian race	S-00051	C0078988
SCT	413773004	Caucasian race	S-0003D	C0007457
SCT	413490006	American Indian or Alaska native	S-0004B	C1515945
NCIt	C41219	Native Hawaiian or other Pacific Islander		C1513907
SCT	**413581001**	**Asian or Pacific Islander race**	**S-0004C**	**C1531604**
SCT	**413600007**	**Australian aborigine race**	**S-00052**	**C0337948**
SCT	**414481008**	**Indian race**	**S-0003E**	**C1524069**

SCT	**414752008**	**Mixed racial group**	**S-00043**	**C0682081**

Add to PS3.16 Annex C

Annex C Acquisition Context Module, Protocol and Workflow Context Templates (Normative)

TID 8300 Skin Cancer Acquisition Context

This Template provides defines an Acquisition Context Template for Skin Cancer. The attributes in this template represent values known at the time of image acquisition. Hence, these values may subsequently change.

Type: **Extensible**
Order: **Non-Significant**
Root: **No**

Table TID 8300. Skin Cancer Acquisition Context

Row Number	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1	CODE	DT (443635002, SCT, “Fitzpatrick Skin Type”)	1	U		BCID 4401 “Fitzpatrick Skin Type”
2	CODE	DT (415229000, SCT, “Racial group”)	1	U		BCID 6099 “Racial Group”
3	CODE	DT (161432005, SCT, "History of malignant melanoma")	1-n	U		BCID 4402 “History of Malignant Melanoma”
4	NUMERIC	DT (130483, DCM, “Number of malignant melanomas”)	1	UC	IFF Row 3 is present	
5	CODE	DT (1251000119106, SCT, "History of melanoma in situ of skin")	1-n	U		BCID 4403 “History of Melanoma in Situ”
6	NUMERIC	DT (130484, DCM, “Number of melanomas in situ”)	1	UC	IFF Row 5 is present	
7	CODE	DT (130482, DCM, "History of non-melanoma skin cancer")	1-n	U		BCID 4404 “History of Non-Melanoma Skin Cancer“

8	CODE	DT (64572001, SCT, "Disease")	1-n	U		BCID 4405 “Skin Disorders”
9	CODE	DT (427858005, SCT, "Family history of malignant melanoma")	1-n	U		BCID 4402 “History of Malignant Melanoma”
10	NUMERIC	DT (130487, DCM, “Number of first-degree relatives affected by malignant melanoma”)	1	UC	IFF Row 9 is present	
11	CODE	DT (130481, DCM, "Family history of melanoma in situ")	1-n	U		BCID 4403 “History of Melanoma in Situ”
12	CODE	DT (130480, DCM, "Family history of non-melanoma skin cancer")	1-n	U		BCID 4404 “History of Non-Melanoma Skin Cancer”
13	CODE	DT (418799008, SCT, “Findings reported by patient/informant”)	1-n	U		BCID 4406 “Patient Reported Lesion Characteristics”
14	CODE	DT (118242002, SCT, “Finding by palpation”).	1-n	U		BCID 4407 “Lesion Palpation Findings”
15	CODE	DT (118243007, SCT, “Finding by inspection”)	1-n	U		BCID 4408 “Lesion Visual Findings”
16	CODE	DT (416940007, SCT, “Past history of procedure”)	1-n	U		BCID 4409 “Skin Procedures”

Add the following definitions to Part 16 Annex D DICOM Controlled Terminology Definitions (Normative) – Modify Table D-1

Annex D DICOM Controlled Terminology Definitions (Normative)

Table D-1. DICOM Controlled Terminology Definitions (Coding Scheme Designator “DCM” Coding Scheme Version “01”)

Code Value	Code meaning	Definition	Notes

...			
DMS	Dermoscopy	An acquisition device, process or method that performs imaging of the surface of the skin using epiluminescence microscopy	
130480	Family history of non-melanoma skin cancer	Information about non-melanoma skin cancers in blood relatives of the patient	
130481	Family history of melanoma in situ	Information about in situ melanoma in blood relatives of the patient	
130482	History of non-melanoma skin cancer	Information about non-melanoma skin cancers in the patient	
130483	Number of malignant melanomas	The number of malignant melanomas the patient has had diagnosed	
130484	Number of melanomas in situ	The number of in situ melanomas the patient has had diagnosed	
130485	Firm skin lesion	A skin lesion that is firm on palpation	
130486	Raised skin lesion	A lesion that is raised from the skin surface on palpation	
130487	Number of first-degree relatives affected by malignant melanoma	The number of direct relatives (i.e., parent, sibling, offspring) who have malignant melanoma	

Changes to NEMA Standards Publication PS 3.17

Digital Imaging and Communications in Medicine (DICOM)
Part 17: Explanatory Information

Add to PS3.17 Annex TTTT

Annex TTTT Dermoscopy (Informative)

TTTT.1 Measurements

Dermoscopic images can be acquired with the dermoscope in direct contact with the patient's skin or not. Contact dermoscopes have a glass plate which contacts the skin via a liquid interface (immersion media). Some vendors include a millimeter measurement scale which is etched or imprinted onto the glass contact plate. Resultant images include the scale as shown in Figure TTTT.1-1. This scale can be used to calibrate measurement tools in display software.

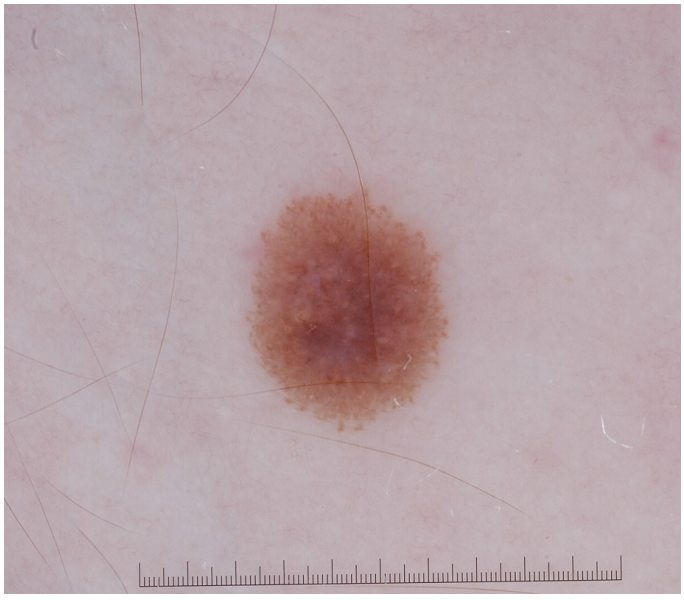

Figure TTTT.1-1 Dermoscopy image including scale.

An alternative way to support distance measurements is when the vendor encodes the Pixel Spacing (0028,0030) attribute with the physical distance between the center of adjacent pixels as defined in PS3.3 10.7.1.3. If Pixel Spacing contains values then measurements tools in the display software do not need to calibrate against an object of known size (e.g., millimeter measurement scale) to be able to provide a distance measurement. Pixel Spacing can be geometrically calculated when there is a known source-to-object distance as would occur with contact dermoscopy. Some non-contact dermoscopes also have fixed distance lens cones which also make it possible to geometrically calculate pixel spacing. It is difficult to accurately calculate pixel spacing when the source-to-object distance is not fixed.

TTTT.2 Frame of Reference

Some dermoscopes record multiple images during a single acquisition with each acquisition using a different lighting mode. The dermoscope does not move during acquisition therefore the corresponding pixel in each image is of exactly the same region of skin. In this scenario a vendor generated unique

identifier can be encoded in the (0020,0052) Frame of Reference UID attribute for all images acquired during the acquisition.

TTTT.3 Use Cases

TTTT.3.1 Use Case 1: Linking dermoscopic images to a regional image

A regional or contextual image is a clinical photograph that includes anatomic reference points (e.g., joint or navel) in the field of view. Dermoscopic images are typically of a single skin lesion (e.g., mole). Linking dermoscopic images to a regional image can give the anatomical location of skin lesion. Further, the linkage may help with the consistent identification of individual skin lesions in sequential dermoscopy.

A regional image may include one or more skin lesions. A skin lesion may be seen in one or more regional images. Therefore, the relationship between the regional image and the linked dermoscopy images is many-to-many.

An example of a regional image shown in Figure TTTT.3-1.

Figure TTTT.3-1 Regional image

Potential acquisition workflow. The aim of this workflow is to create a link between the regional image(s) and the dermoscopic image(s).

Steps:

1. A regional image is acquired and displayed on the acquisition modality.
2. A skin lesion requiring dermoscopy is identified (e.g., by mouse click).
3. The user is prompted to input a skin lesion label (e.g., Lesion 1) or the acquisition modality actor automatically generates a label. The mouse click generates X and Y co-ordinates to encode in the metadata of the regional image.
4. A dermoscopy image is acquired and linked to the lesion identified in Step 2.

Considerations:

- The skin lesion identifier could be used as the series descriptor for the dermoscopic images of this skin lesion.
- The metadata of the regional images contains all referenced dermoscopy images (SOP Instance UID) (see Figure TTTT.3-2).
- The metadata of the dermoscopy image contains referenced regional images (SOP Instance UID) (see Figure TTTT.3-2).

- The metadata of the regional image contains the X and Y co-ordinate of the lesion (see Figure TTTT.3-2).
- The metadata of the regional image optionally contains the skin lesion identifier.
- The dermatology imaging study consists one or more regional images and one or more dermoscopic images.
- Tracking Identifier (0062,0020) is used to store the skin lesion label.
- Tracking Unique Identifier (0062,0021) is used to store a vendor generated skin lesion UID.
- A new regional image for each dermatology imaging study or re-use of the original image from a different imaging study are possible.

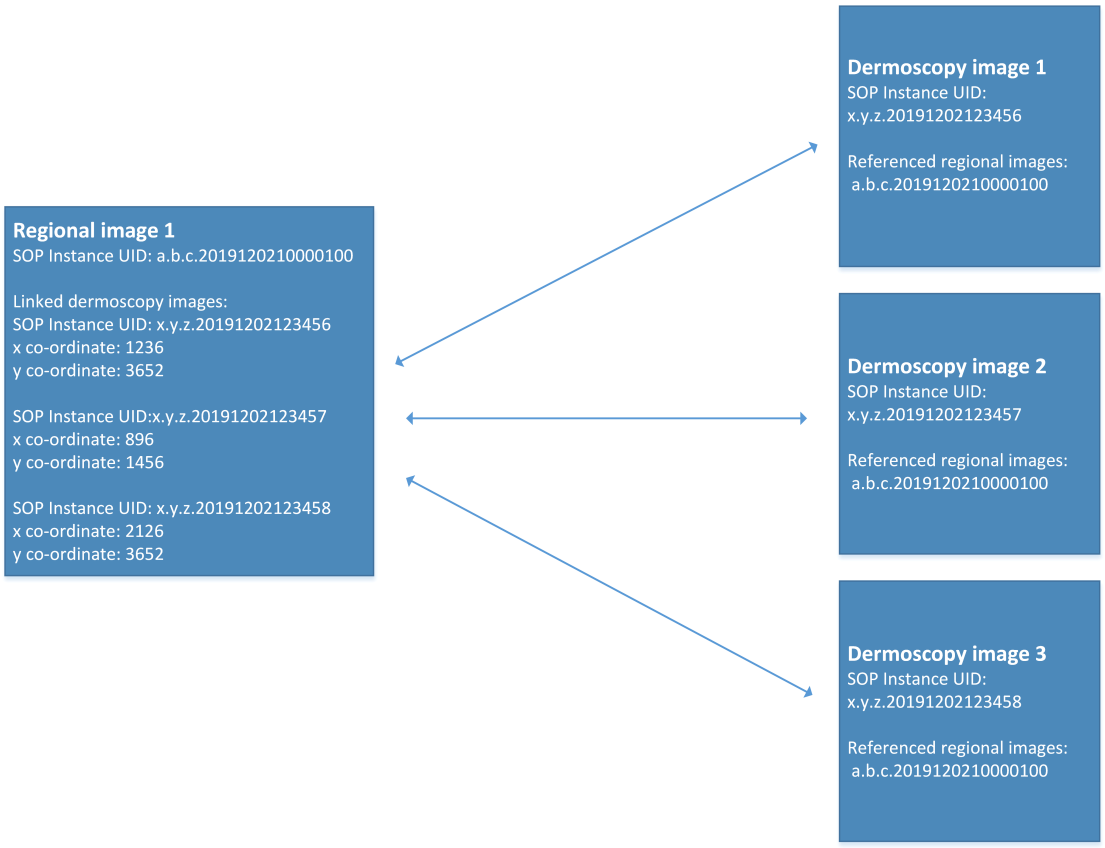

Figure TTTT.3-2 Linkage between regional image/s and dermoscopy image/s within a dermatology imaging study

Potential display functionality. When displaying a dermatology imaging study, a user can click a skin lesion in a regional image, which hyperlinks to display the appropriate dermoscopic image.

Notes:

1. The Referenced Image Sequence (0008,1140) may provide a method for relating dermoscopy and regional images.

2. A DICOM Structured Report object may be used to retrospectively encode the link between skin lesion on a regional image and a dermoscopic image. The use of a DICOM Structured Report object could be extended for longitudinal lesion tracking, see Use Case 2.

TTTT.3.2 Use Case 2: Longitudinal lesion tracking

This use case proposes a workflow, and the use of a DICOM Structured Report for longitudinal lesion tracking of dermoscopic images.

In dermatology, successive images of a skin lesion at different time points are compared to detect suspicious lesions. Monitoring of lesions may be short-term or long-term. Clinical photography and dermoscopy can both be used for longitudinal lesion tracking. However, comparison requires images from the same modality. The longitudinal tracking of images using dermoscopy is often termed sequential digital dermoscopy.

Potential workflow for the acquisition of lesion tracking information

Steps:

1. The user displays a dermoscopic image that requires longitudinal tracking on an image display / evidence creator actor and invokes a lesion tracking reporting window (see Figure TTTT.3-3).
2. The user invokes a lesion tracking dialogue box (e.g., by right mouse click) and selects:
    a. *New Lesion* when there is no existing skin lesion label and will input a unique skin lesion label (e.g., Lesion_1, L1) for the patient.
    b. *New reporting on existing lesion* when there is an existing skin lesion label from a previous imaging study or a skin lesion label has been assigned when linking dermoscopic images to regional image. The lesion tracking dialogue box will contain a software generated list of skin lesion labels (e.g., New report on Lesion 1, New report on Lesion 2, New report on Lesion 3, etc.).
3. The user inputs information via the lesion tracking reporting window (see Figure TTTT.3-3) for the currently displayed dermoscopic image. This information may include time point descriptor (e.g., baseline/follow-up), long diameter of lesion, and short diameter lesion. Other information may be derived (e.g., sum of diameters). Other information may auto populate (e.g., study date).
4. The user inputs information for one or more lesions (Steps 2 and 3).
5. After completion of data entry, the user will save the data entry which will invoke the creation of a DICOM Structured Report object for the study.

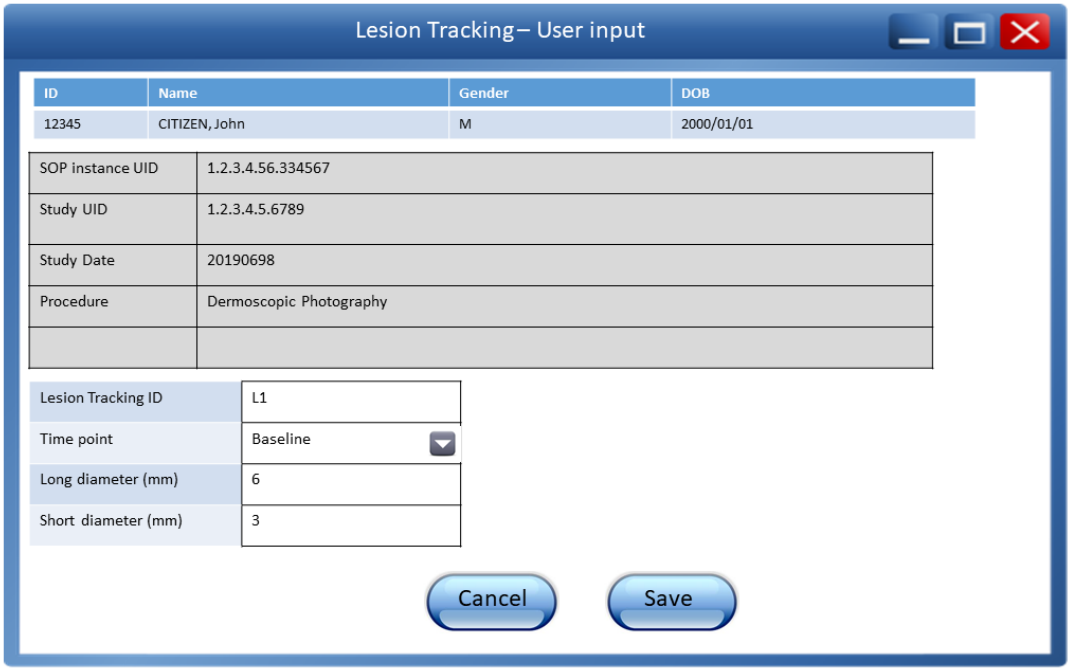

Figure TTTT.3-3 Potential Lesion Tracking Reporting Window

Considerations

- Tracking Identifier (0062,0020) is used to store the skin lesion label.
- Tracking Unique Identifier (0062,0021) is used to store a vendor generated skin lesion UID.
- Lesion identifier label is auto-generated by the image display / evidence creator actor.
- Measurements in the lesion tracking reporting windows are auto-populated from measurement tools in the image display /evidence creator actor.
- Procedure reported is auto-populated e.g., (121058, DCM, "Procedure reported") = (446078004, SCT, "Dermoscopic photograph").
- There is potential to use the DICOM Structured Report Template TID 1500 Measurement Report for skin lesion tracking.
- The DICOM Structured Report object would contain the SOP Instance UID of the dermoscopic image as it is unlikely a segmentation object would be required given that dermoscopy field of view is a single lesion.

Potential workflow for the display of lesion tracking

Steps:

1. A user displays a dermoscopic study on image display / evidence creator actor, and invokes the opening of the lesion tracking reporting window, which invokes a DICOM query / retrieve of all individual DICOM Structured Report Measurement Reports for that patient that meet a criterion (e.g., (121058, DCM, "Procedure reported") = (446078004, SCT, "Dermoscopic photograph")).
2. The lesion tracking reporting window displays images and measurements and derived measurements from one or more DICOM Structured Report objects in the lesion tracking reporting window (see Figure TTTT.3-4).
3. The lesion tracking reporting windows may display summary information (e.g., change in size tables or graphs).

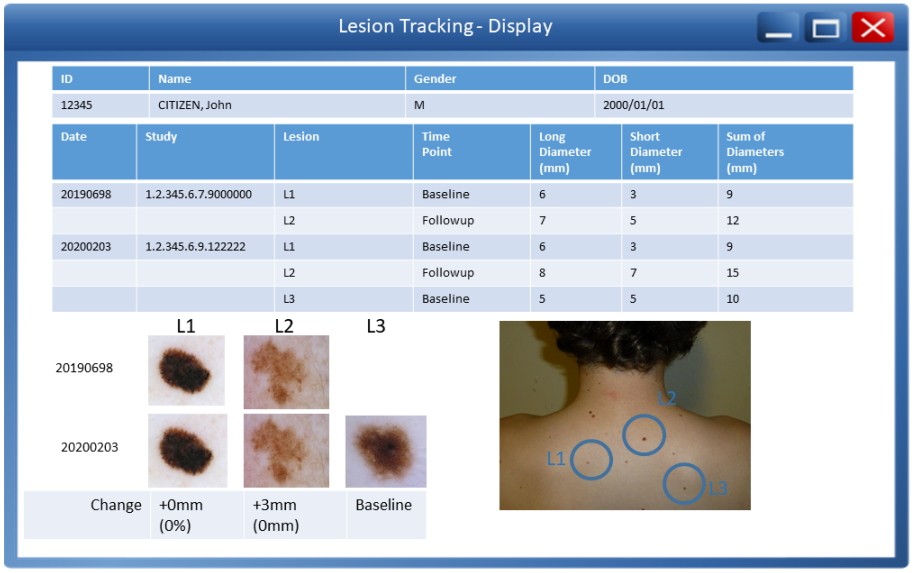

Figure TTTT.3-4 Potential Lesion Tracking Reporting Window Display