DICOM Conformance Statement

Refractive Workplace

Version 1.1

Carl Zeiss Meditec AG

Goeschwitzer Strasse 51-52

07745 Jena

Germany

www.zeiss.com/med

1 Conformance Statement Overview

The Refractive Workplace Application is an advanced editor that accepts data from a data source (e.g. FORUM from ZEISS) intended to support an ophthalmic healthcare professional in assessing suitable treatment options for potential Laser Vision Correction (LVC) patients. It supports the pre-setting of planning parameters for the ZEISS refractive lasers. The application also uses the diagnostic data imported in for specific ZEISS refractive laser procedure types.

The Refractive Workplace Application Software consists of one application entity which allows to:

- query patients and studies
- import refractive surgery planning data
- archive refractive surgery planning data

This document is structured as suggested in the DICOM Standard (PS 3.2: Conformance).

Table 1-1 Network Services Supported

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Transfer		
Raw Data Storage	Yes	Yes
Workflow Management		
Verification	Yes	Yes
Storage Commitment Push Model SOP Class	Yes	No
Query / Retrieve		
Patient Root Query/Retrieve Information Model – FIND	Yes	No
Study Root Query/Retrieve Information Model – MOVE	Yes	No

The Refractive Workplace Application does not support Media Interchange.

2 Table of Contents

3 Introduction

3.1 Revision History

Document Version	Date	Changes
Software version 1.0		
1.0	2020-10-28	Initial revision
Software version 1.1		
1.0	2021-04-12	Initial revision

3.2 Audience

This document is written for the people that need to understand how Refractive Workplace will integrate into their healthcare facility. This includes both those responsible for overall imaging network policy and architecture, as well as integrators who need to have a detailed understanding of the DICOM features of the product. This document contains some basic DICOM definitions so that any reader may understand how this product implements DICOM features. However, integrators are expected to fully understand all the DICOM terminology, how the tables in this document relate to the product's functionality, and how that functionality integrates with other devices that support compatible DICOM features.

3.3 Remarks

The scope of this DICOM Conformance Statement is to facilitate integration between Refractive Workplace and other DICOM products. The Conformance Statement should be read and understood in conjunction with the DICOM Standard. DICOM by itself does not guarantee interoperability. The Conformance Statement does, however, facilitate a first-level comparison for interoperability between different applications supporting compatible DICOM functionality.

This Conformance Statement is not supposed to replace validation with other DICOM equipment to ensure proper exchange of intended information. In fact, the user should be aware of the following important issues:

- The comparison of different Conformance Statements is just the first step towards assessing interconnectivity and interoperability between the product and other DICOM conformant equipment.
- Test procedures should be defined and executed to validate the required level of interoperability with specific compatible DICOM equipment, as established by the healthcare facility.

3.4 Definitions and Terms

Informal definitions are provided for the following terms used in this Conformance Statement.

The DICOM Standard is the authoritative source for formal definitions of these terms.

Abstract Syntax
The information agreed to be exchanged between applications, generally equivalent to a Service/Object Pair (SOP) Class.

Examples: Verification SOP Class, Modality Worklist Information Model Find SOP Class, Computed Radiography Image Storage SOP Class.

Application Entity (AE)
An end point of a DICOM information exchange, including the DICOM network or media interface software; i.e., the software that sends or receives DICOM information objects or messages. A single device may have multiple Application Entities.

Application Entity Title
The externally known name of an Application Entity, used to identify a DICOM application to other DICOM applications on the network.

Application Context
The specification of the type of communication used between Application Entities.

Example: DICOM network protocol.

Association
A network communication channel set up between Application Entities.

Attribute
A unit of information in an object definition; a data element identified by a tag. The information may be a complex data structure (Sequence), itself composed of lower level data elements.

Examples: Patient ID (0010,0020), Accession Number (0008,0050), Photometric Interpretation (0028,0004), Procedure Code Sequence (0008,1032).

Information Object Definition (IOD)
The specified set of Attributes that comprise a type of data object; does not represent a specific instance of the data object, but rather a class of similar data objects that have the same properties. The Attributes may be specified as Mandatory (Type 1), Required but possibly unknown (Type 2), or Optional (Type 3), and there may be conditions associated with the use of an Attribute (Types 1C and 2C).

Examples: MR Image IOD, CT Image IOD, Print Job IOD.

Joint Photographic Experts Group (JPEG)
A set of standardized image compression techniques, available for use by DICOM applications.

Media Application Profile
The specification of DICOM information objects and encoding exchanged on removable media (e.g., CDs)

Module
A set of Attributes within an Information Object Definition that are logically related to each other.

Example: Patient Module includes Patient Name, Patient ID, Patient Birth Date, and Patient Sex.

Negotiation
First phase of Association establishment that allows Application Entities to agree on the types of data to be exchanged and how that data will be encoded.

Presentation Context
The set of DICOM network services used over an Association, as negotiated between Application Entities; includes Abstract Syntaxes and Transfer Syntaxes.

Protocol Data Unit (PDU)
A packet (piece) of a DICOM message sent across the network. Devices must specify the maximum size packet they can receive for DICOM messages.

Query Key
An input value for a query process. Query Keys denote the set of DICOM tags that are sent from the SCU to SCP and thus control the query result.

Security Profile
A set of mechanisms, such as encryption, user authentication, or digital signatures, used by an Application Entity to ensure confidentiality, integrity, and/or availability of exchanged DICOM data

Service Class Provider (SCP)
Role of an Application Entity that provides a DICOM network service; typically, a server that performs operations requested by another Application Entity (Service Class User).

Examples: Picture Archiving and Communication System (image storage SCP, and image query/retrieve SCP), Radiology Information System (modality worklist SCP).

Service Class User (SCU)
Role of an Application Entity that uses a DICOM network service; typically, a client.

Examples: imaging modality (image storage SCU, and modality worklist SCU), imaging workstation (image query/retrieve SCU)

Service/Object Pair (SOP) Class
The specification of the network or media transfer (service) of a particular type of data (object); the fundamental unit of DICOM interoperability specification.

Examples: Ultrasound Image Storage Service, Basic Grayscale Print Management.

Service/Object Pair (SOP) Instance
An information object; a specific occurrence of information exchanged in a SOP Class.

Examples: a specific x-ray image.

Tag
A 32-bit identifier for a data element, represented as a pair of four digit hexadecimal numbers, the “group” and the “element”. If the “group” number is odd, the tag is for a private (manufacturer-specific) data element.

Examples: (0010,0020) [Patient ID], (07FE,0010) [Pixel Data], (0019,0210) [private data element]

Transfer Syntax
The encoding used for exchange of DICOM information objects and messages.

Examples: JPEG compressed (images), little endian explicit value representation.

Unique Identifier (UID)
A globally unique “dotted decimal” string that identifies a specific object or a class of objects; an ISO-8824 Object Identifier.

Examples: Study Instance UID, SOP Class UID, SOP Instance UID.

Value Representation (VR)
The format type of an individual DICOM data element, such as text, an integer, a person’s name, or a code. DICOM information objects can be transmitted with either explicit identification of the type of each data element (Explicit VR), or without explicit identification (Implicit VR); with Implicit VR, the receiving application must use a DICOM data dictionary to look up the format of each data element.

3.5 Abbreviations

Table 3-1 Abbreviations used in this document

Abbreviation	Definition
ANAP	Attribute is not always present – Applicable for Type 3
AE	Application Entity
AET	Application Entity Title
APP	Application
ARTIM	Association Request/Reject/Release Timer
AUTO	Automatically generated, cannot be modified by the operator
BRQ	Broad Query mode of Modality Worklist Query
CONFIG	Configurable parameter
CZM	Carl Zeiss Meditec
DEF	Default value
DICOM	Digital Imaging and Communications in Medicine
ELE	Explicit Little Endian
ILE	Implicit Little Endian
IM	Information Model
IOD	Information Object Definition
JPG-1	JPEG Coding Process 1 transfer syntax; JPEG Baseline; ISO 10918-1
JPG-LL	JPEG Lossless
J2K	JPEG 2000 Image Compression
J2K-LL	JPEG 2000 Image Compression (Lossless Only)
RLE-LL	Run Length Encoding Lossless
MPPS	Modality Performed Procedure Step
MWL	Modality Worklist
MPG2	Motion Picture Expert Group 2; Abbreviation and synonym for video encoding and compression transfer syntax.
MPG2 – ML	MPEG2 Main Profile @ Main Level

MPG2 – HL	MPEG2 Main Profile @ High Level
OD	Oculus Dexter, the right eye
OS	Oculus Sinister, the left eye
OU	Oculus Uterque, both eyes
OP	Ophthalmic Photography
PBQ	Patient Based Query mode of Modality Worklist Query
PL	Pick list
PLD	Pick list item details
PRQ	Patient Root Query
RIS	Radiology Information System
RNG	Range of values
SCP	Service Class Provider
SCU	Service Class User
SEL	Selection from a list of values
SOP	Service Object Pair, union of a specific DICOM service and related IOD.
SRQ	Study Root Query
TCP/IP	Transmission Control Protocol / Internet Protocol
UID	Unique Identifier
USER	User input
VNAP	Value Not Always Present (attribute sent zero length if no value is present) – Applicable for Type 2, 2C.

3.6 References

NEMA PS3 / ISO 12052, Digital Imaging and Communications in Medicine (DICOM) Standard, National Electrical Manufacturers Association, Rosslyn, VA, USA (available free at http://medical.nema.org/)

Integrating the Healthcare Enterprise (IHE) EYECARE Technical Framework, rev 4.0, 2016 (available free at http://www.ihe.net/Technical_Framework/index.cfm).

4 Networking

4.1 Implementation Model

4.1.1 Application Data Flow

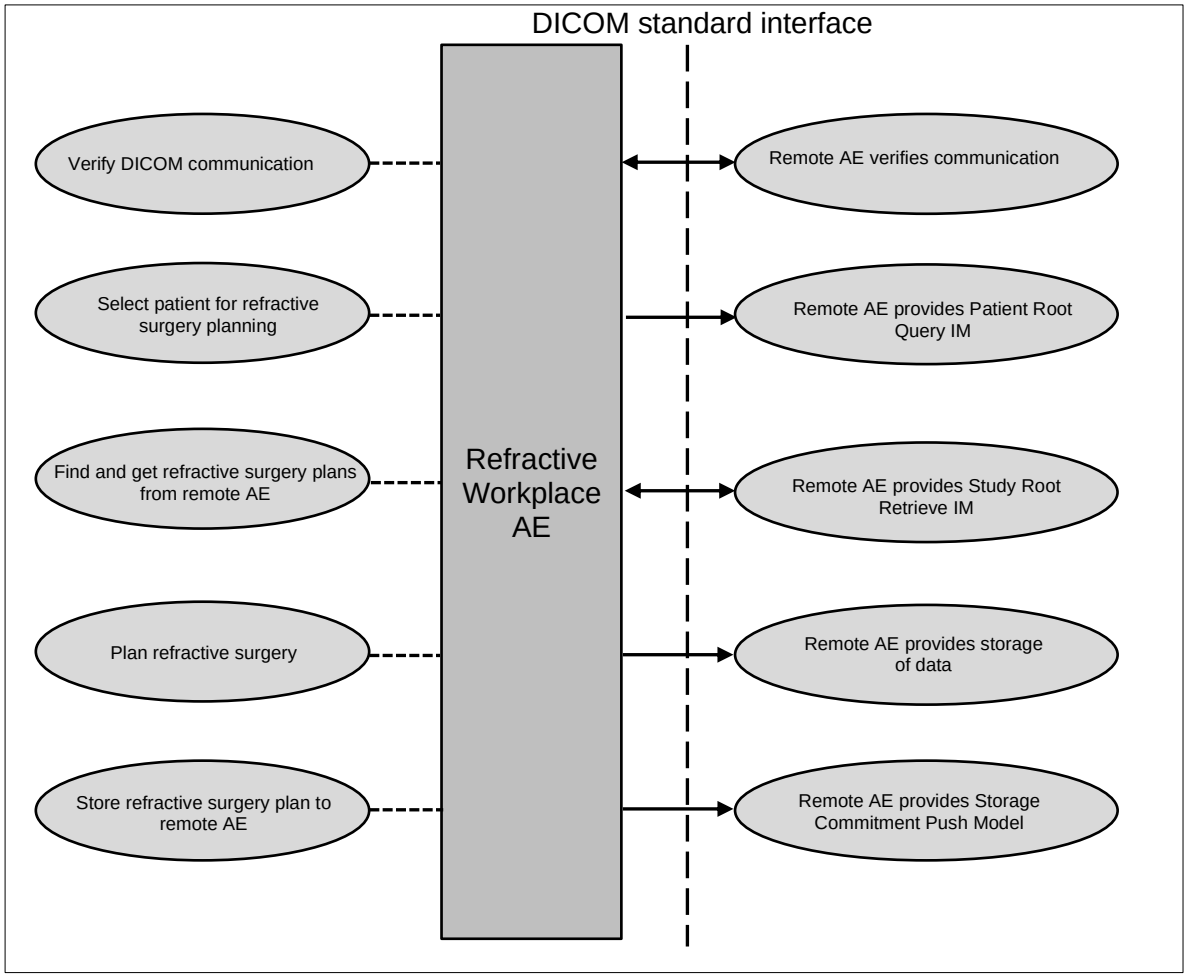


Figure 4-1 Refractive Workplace Application Data Flow

4.1.2 Functional Definition of AEs

4.1.2.1 Functional Definition of Refractive Workplace

The Refractive Workplace Application is an advanced editor that accepts data from a data source (e.g. FORUM from ZEISS) intended to support an ophthalmic healthcare professional in assessing suitable treatment options for potential Laser Vision Correction (LVC) patients. It supports the pre-setting of planning parameters for the ZEISS refractive lasers. The application also uses the diagnostic data imported in for specific ZEISS refractive laser procedure types.

The Refractive Workplace Application Software consists of one application entity which allows to:

- query patients and studies
- import refractive surgery planning data
- create new refractive surgery planning data
- archive refractive surgery planning data

Refractive Workplace implements a Service Class User (SCU) for the following DICOM Services:

- Verification
- Patient Root Query/Retrieve Information Model – FIND
- Study Root Query/Retrieve Information Model – MOVE
- Raw Data Storage
- Storage Commitment Push Model

Refractive Workplace implements a Service Class Provider (SCP) for the following DICOM Services:

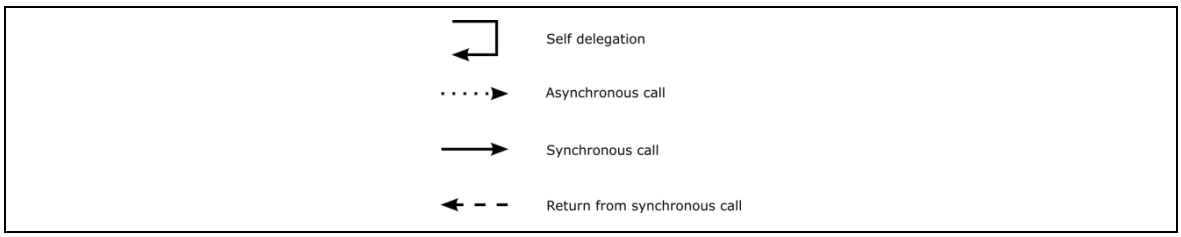
- Verification
- Raw Data Storage

All DICOM functionalities have been integrated into the application user interface and will not require any manual invoking of DICOM specific user interface.

The Refractive Workplace Application Software logs extensive information about the DICOM operations to its log file.

4.1.3 Sequencing of Real-World Activities

To realize the real world activities, the different entities work together. The sequence diagrams shall depict the intended workflow.



The diagrams use slightly modified UML symbols. The asynchronous call is not depicted as suggested in UML. Some objects do have more than one dashed line. It symbolizes more than one thread.

4.1.3.1 Refractive Workplace Activities

Select patient for refractive surgery planning
The operator can search patients stored at a remote AE and select a specific single patient for usage with Refractive Workplace. Patient selection is not part of the Refractive Workplace AE and is performed in the ZEISS FORUM Viewer application which is not in scope of this document.

When a patient is selected the operator can launch the Refractive Workplace application by pressing “Save and plan surgery” in the ZEISS FORUM Viewer application. Any patient identifying information is provided to the application accordingly.

The Refractive Workplace application then queries the remote AE for patient details to ensure valid selection.

The operator can then start planning a refractive surgery.

Find and get refractive surgery plans from remote AE
Once a patient is selected for Refractive Workplace the application searches remote AE for any existing refractive surgery planning and summary data associated with the selected patient. Based on the query responses the Refractive Workplace application tries to identify the most recent planning

that has no related surgery summary for each eye side. If such surgery planning instance exists, these will be loaded automatically from the remote AE by performing a DICOM retrieve operation.

The UI for surgery planning is then pre-loaded with the retrieved planning data.

Plan refractive surgery

Once a patient is selected the operator can start planning a refractive surgery for each eye of the patient. In case, previous surgery planning data is loaded and the planning is resumed, the operator can manipulate already set planning parameters. This is denoted as the “follow-up case”. Otherwise, the operator can start a new surgery plan from the scratch. The Refractive Workplace application software supports the operator by instantly validating the clinical correctness of any surgery parameter. If done, the operator can either choose to store the plan or to discard the entered parameters.

This activity creates a refractive surgery plan for each edited eye side which might become subjects of the activity "Store refractive surgery plan to remote AE".

Store refractive surgery plan to remote AE

This activity can be invoked manually by the operator by pressing “Save” from the planning screen. The application software transfers for each eye side planned for refractive surgery one single Raw Data SOP instance to the configured remote Storage AE.

After successful storage these instances become subject of a subsequent request to the configured Storage Commitment Provider to take over responsibility on data persistence.

Depending on the type of surgery such planning SOP instance might have a direct relationship to another planning SOP instance. The application software keeps track of these relationships by utilizing Study, Series, Referenced Instances and Related Series attributes as follows.

a) Planning predecessors are referenced by using the same Study and Series information and a Referenced Instance Sequence Item with the Purpose of Reference Code “REPLACEDPLAN” (see Figure 4-2 Single eye planning with predecessor)
b) Combined plans (both eye sides have a strong relationship in terms of surgery parameters) are referenced by using the same Study information and a Referenced Instance Sequence Item with the Purpose of Reference Code “COMBINEDPLAN” (see Figure 4-3 Combined eye planning)
c) In case a patient’s eye is undergoing multiple types of surgery all planning instances using the same study information and referencing each other with a Related Series Sequence Item with the Purpose of Reference Code “COMBINEDSERIES” (see Figure 4-4 Multi-type surgery planning)

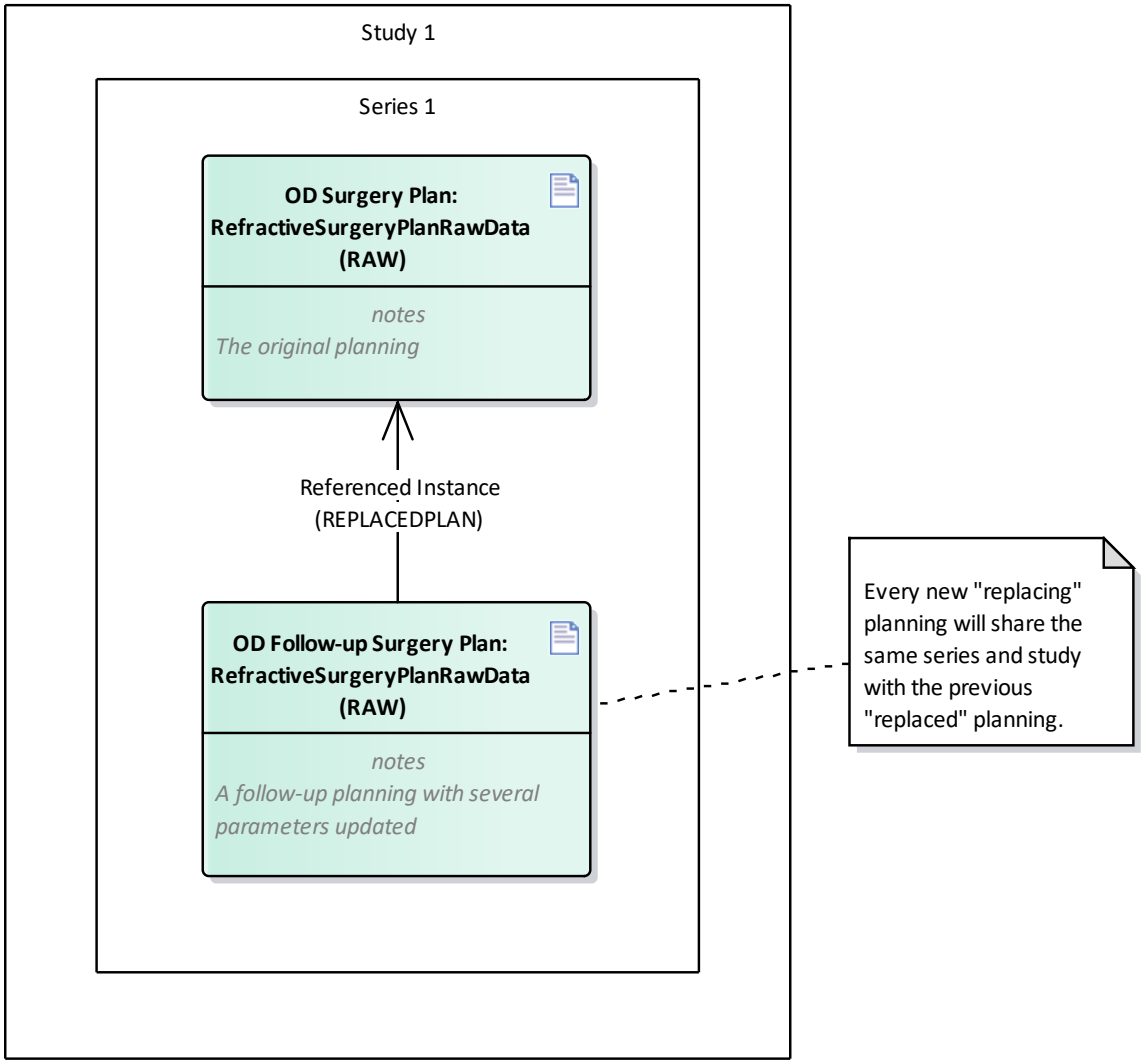


Figure 4-2 Single eye planning with predecessor

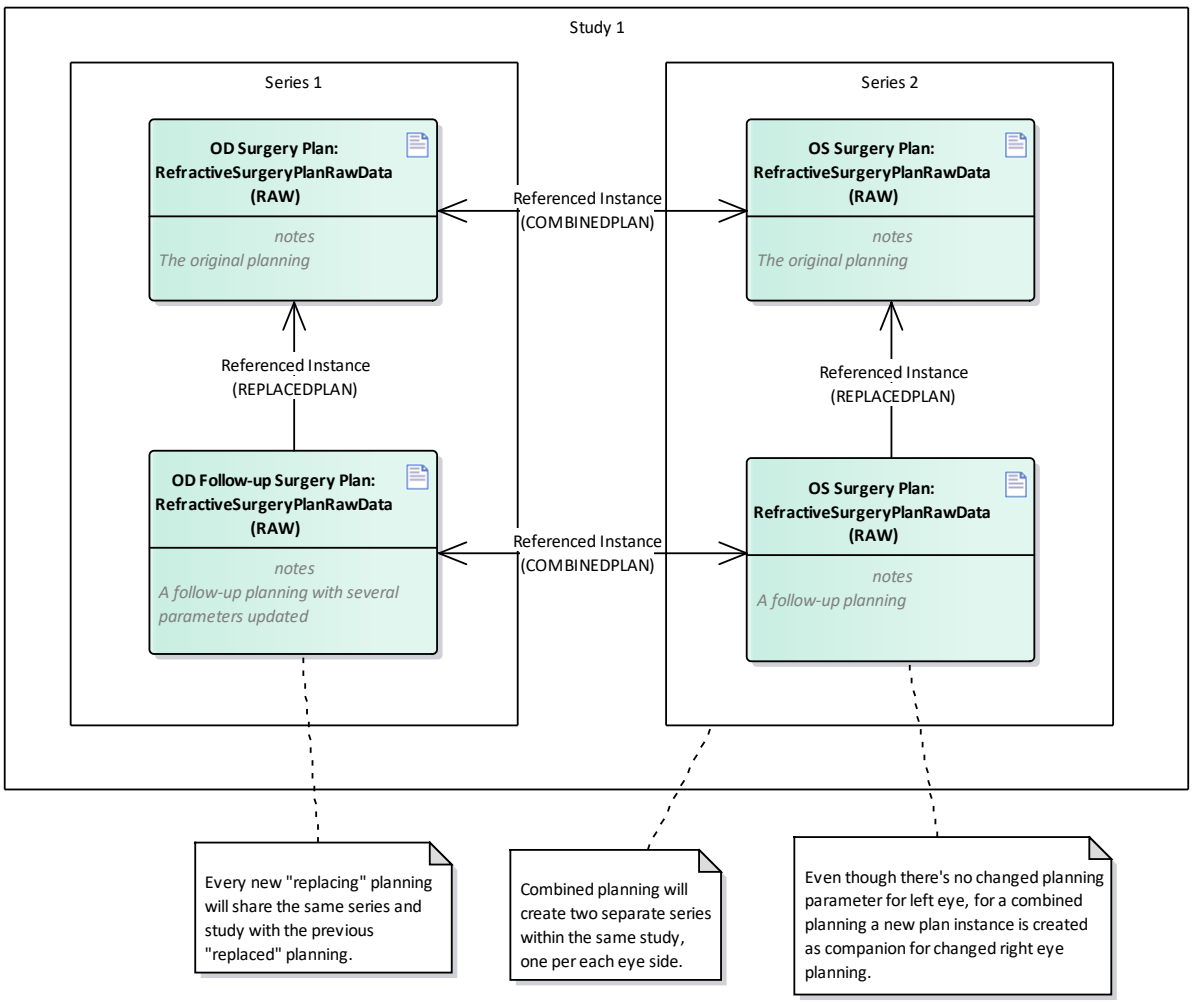


Figure 4-3 Combined eye planning

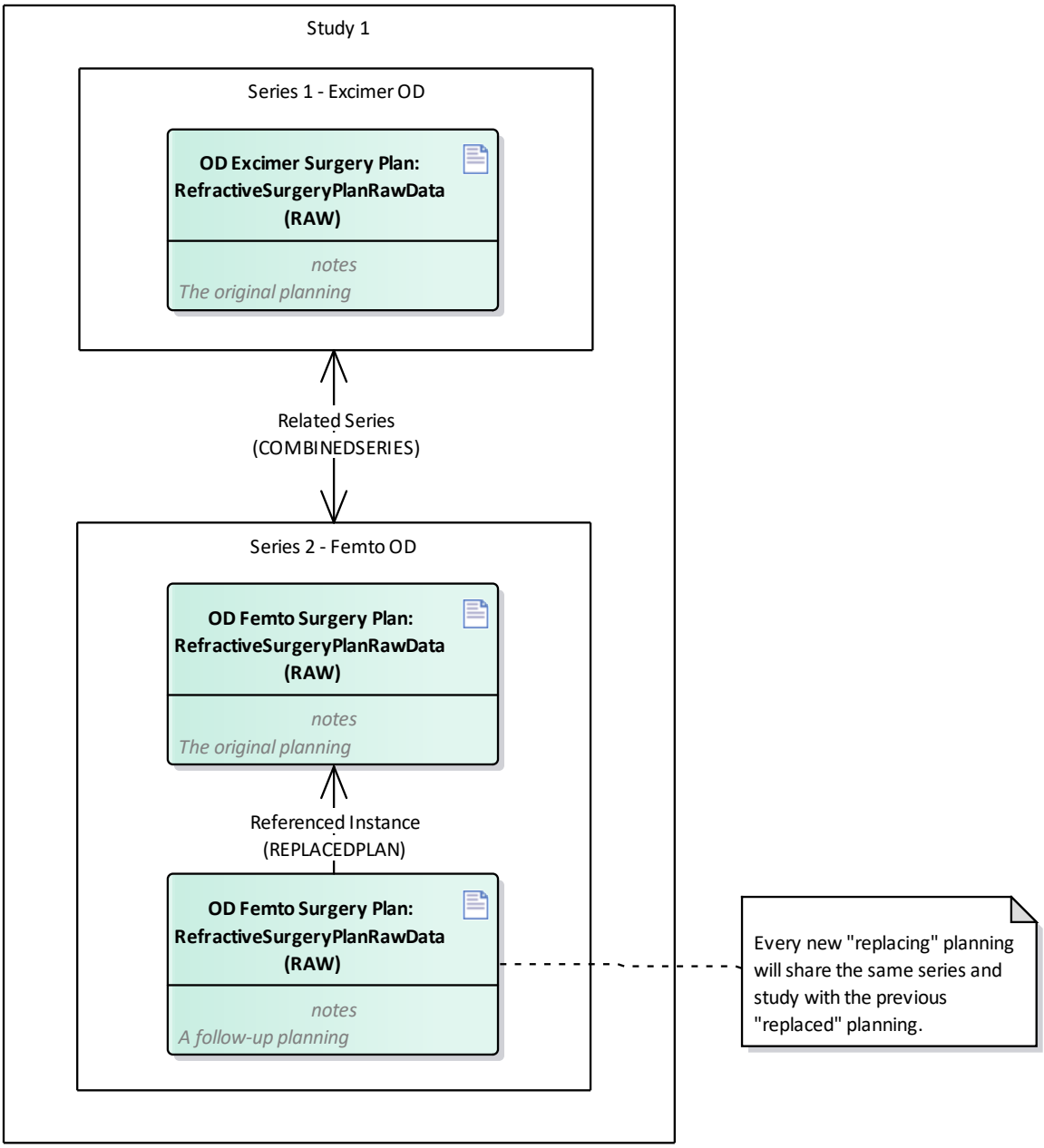


Figure 4-4 Multi-type surgery planning

4.1.3.2 Standard workflow

In the standard workflow the patient arrives at the Refractive Workplace with no scheduled order in the DICOM Modality Worklist. Patient has to be picked from patient list manually by the operator and patient demographics needs to be queried from the remote Query AE. All study specific information has to be generated by Refractive Workplace application software itself

This is the standard case for Refractive Workplace.

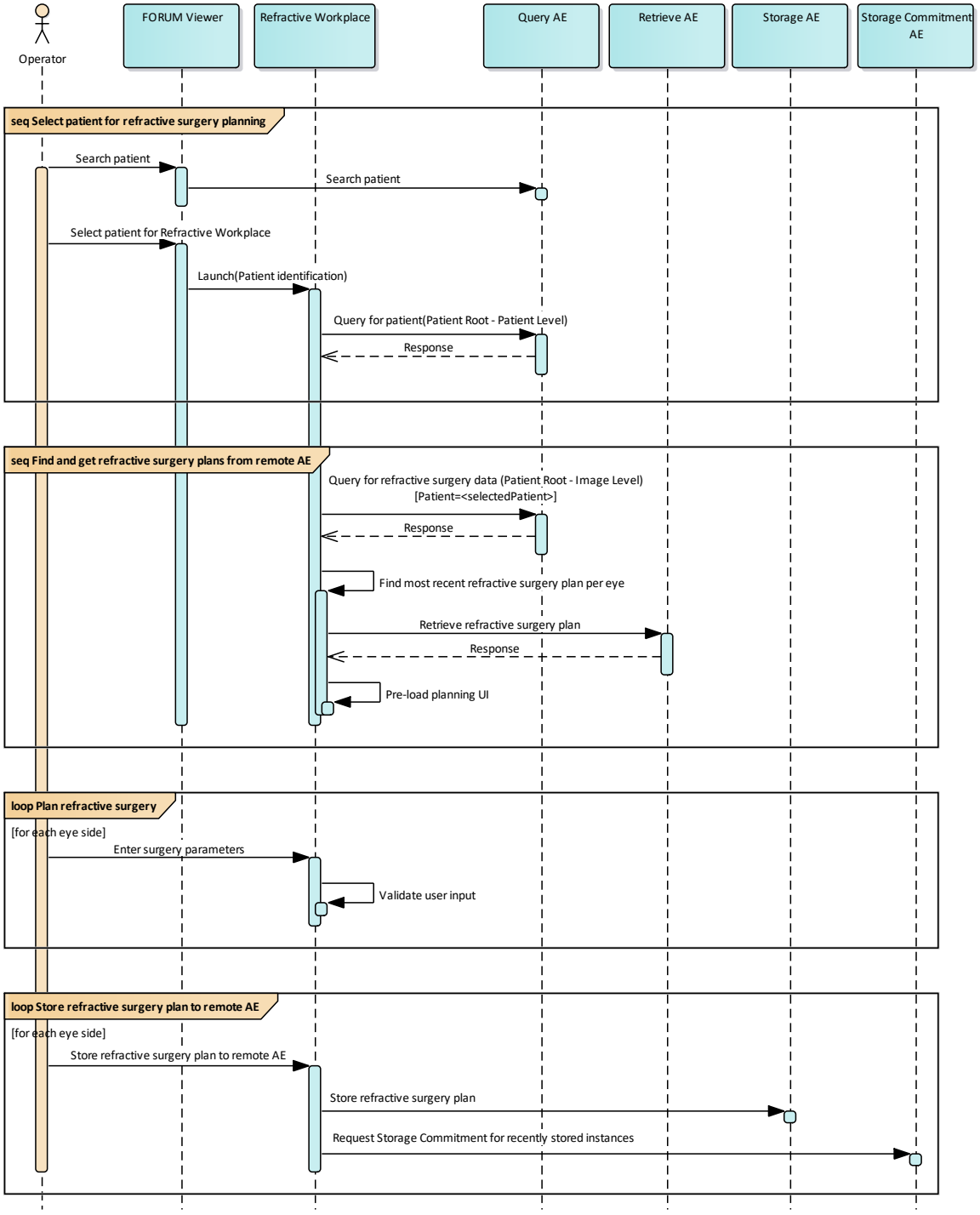


Figure 4-5 Standard workflow

4.2 AE Specifications

4.2.1 Refractive Workplace AE Specification

4.2.1.1 SOP Classes

Table 4-1 SOP Classes for Refractive Workplace AE

SOP Class Name	SOP Class UID	SCU	SCP
Verification	1.2.840.10008.1.1	Yes	Yes

Storage Commitment Push Model SOP Class	1.2.840.10008.1.20.1	Yes	No
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	Yes	Yes
Patient Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.1.1	Yes	No
Study Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	Yes	No

4.2.1.2 Associations Policies

4.2.1.2.1 General

The DICOM standard Application Context Name for DICOM 3.0 is always proposed:

Table 4-2 DICOM Application Context

Application Context Name	1.2.840.10008.3.1.1.1

4.2.1.2.2 Number of Associations

The number of simultaneous associations depends on the usage profile. At a certain point of time there might be active simultaneously:

- 1 association for Verification
- 1 association for Storage
- 1 association for Storage Commitment
- 1 association for Query/Retrieve – FIND
- 1 association for Query/Retrieve – MOVE

Table 4-3 Number of associations

Maximum number of simultaneous associations	50

4.2.1.2.3 Asynchronous Nature

Refractive Workplace Application Software does not support asynchronous communication (multiple outstanding transactions over a single Association).

4.2.1.2.4 Implementation Identifying Information

Table 4-4 DICOM implementation class and version

Implementation Class UID	1.2.276.0.75.2.5.20
Implementation Version Name	NIM-2.12.0

4.2.1.3 Association Initiation Policy

4.2.1.3.1 Activity - Verify Communication

4.2.1.3.1.1 Description and Sequencing of Activities

This activity is available during the configuration phase. It facilitates the setup and management of the DICOM Application Entities.

The user can test the application level communication between instrument's software Application Entity and its peer DICOM Application Entities. During one test call, all configured peer DICOM Application Entities are contacted.

In the association request Refractive Workplace Application Software proposes not only Verification SOP Class, but also all other SOP Classes as supported by the instrument's DICOM interface.

The association is established when the peer DICOM entity accepts the verification related presentation context. In a sub-sequent step a C-ECHO message is exchanged.

The results of the "Verify Communication" activity are shown to the user as success or failure. For e. g. a Storage Provider not only the Verification information is evaluated, but also the acceptance of the proposed presentation context comprising the respective Storage SOP Classes.

4.2.1.3.1.2 Proposed Presentation Contexts

Following presentation contexts are offered for each initiated association. During this activity the Application Software uses only

Verification with Transfer Syntax ILE as SCU

Table 4-5 Proposed Presentation Contexts for Activity Verify Communication

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID 1.2.840.10008. ...**	**Name List**	**UID List 1.2.840.10008. ...**		
Verification	1.1	ILE	1.2	BOTH	None
Storage Commitment Push Model	1.20.1	ILE	1.2	SCU	None
Raw Data Storage	5.1.4.1.1.66	ILE	1.2	BOTH[2]	None
		ELE	1.2.1	BOTH[2]	None
Patient Root Query/Retrieve IM – FIND	5.1.4.1.2.1.1	ILE	1.2	SCU	Yes[1]
Study Root Query/Retrieve IM – MOVE	5.1.4.1.2.2.2	ILE	1.2	SCU	No

Note 1: C-FIND extended negotiation is offered. Relational-query support is required by the SCP.

Note 2: Only acts as SCP when a C-Move-RQ was initiated first and this association is still open.

Table 4-6 Extended Negotiation as a SCU

SOP Class Name	SOP Class UID	Extended Negotiation
Patient Root Query/Retrieve IM – FIND	1.2.840.10008.5.1.4.1.2.1.1	See Note 1

Note 1: Extended negotiation for relational queries is offered. Relational-query support by the SCP is required for successful Patient Root Queries issued by the Refractive Workplace AE.

4.2.1.3.1.3 SOP Specific Conformance for Verification SOP Class

The Refractive Workplace Application Software provides standard conformance.

4.2.1.3.2 Activity – Select patient for refractive surgery planning

The operator can search patients stored at a remote AE and select a specific single patient for usage with Refractive Workplace. Patient selection is not part of the Refractive Workplace AE and is performed in the ZEISS FORUM Viewer application which is not in scope of this document.

When a patient is selected the operator can launch the Refractive Workplace application by pressing “Save and plan surgery” in the ZEISS FORUM Viewer application. Any patient identifying information is provided to the application accordingly.

The Refractive Workplace application then queries the remote AE for patient details to ensure valid selection.

The operator can then start planning a refractive surgery.

4.2.1.3.2.1 Description and Sequencing of Activities

When launched with patient identification provided (Patient ID, Issuer of Patient ID) the Refractive Workplace application will automatically perform a Patient Root Query based DICOM C-FIND request to validate the correctness of the provided patient identification.

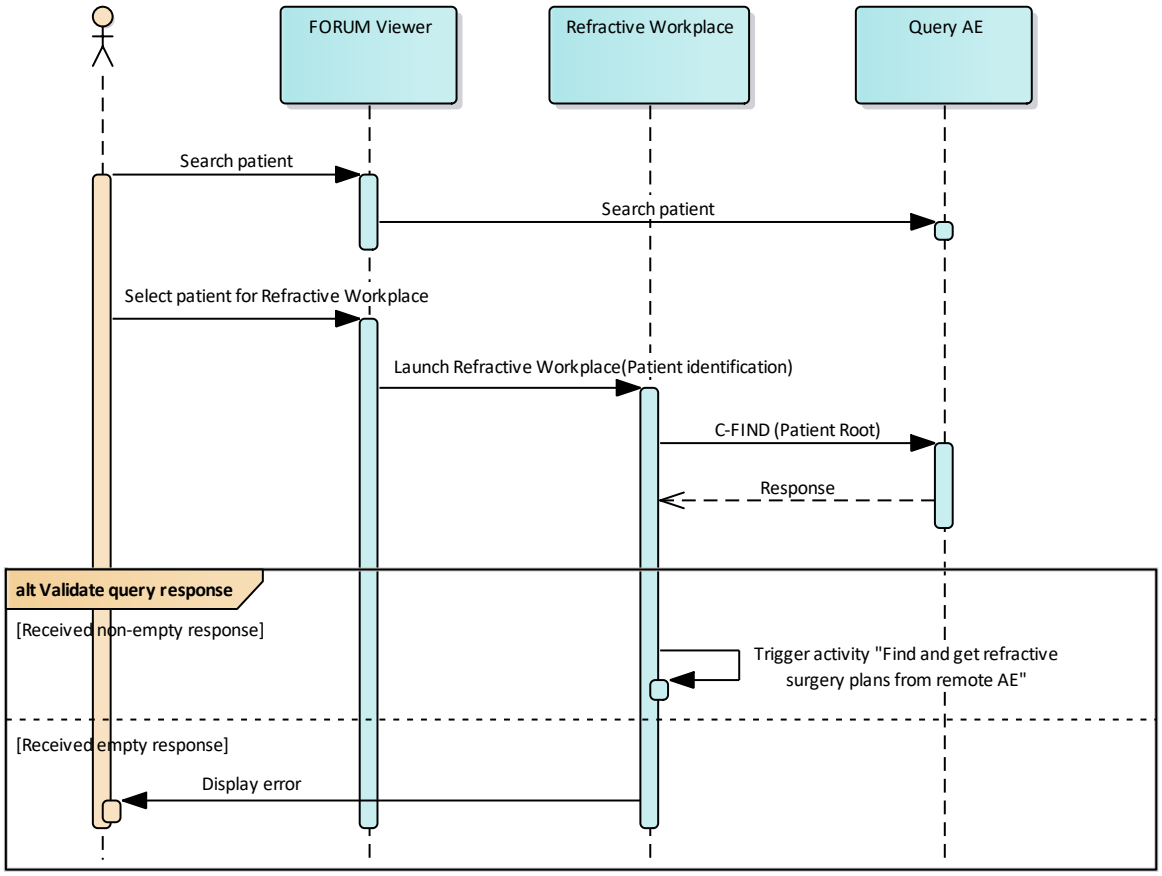


Figure 4-6 Select patient for refractive surgery planning

Search patient

This activity is handled by the external software application ZEISS FORUM Viewer and not in scope of this document.

Select patient for Refractive Workplace

The Refractive Workplace is launched by an external software application which is not in scope of this document. When launched, patient identification information (Patient ID, Issuer of Patient ID) shall be provided to the Refractive Workplace application.

Once launched, Refractive Workplace application tries to verify the given patient information and sends a Patient Root based DICOM C-FIND request at Patient level with the given information applied to the following query keys

- (0010,0010) Patient's Name [as provided with launch parameters]
- (0010,0020) Patient ID [as provided with launch parameters]
- (0010,0021) Issuer of Patient ID [as provided with launch parameters]
- (0010,0030) Patient's Birth Date [as provided with launch parameters]
- (0010,0040) Patient's Sex [as provided with launch parameters]

The Application Software waits for the response from the Query AE and checks whether the number of received items is at least one.

If response contains at least one item, the application automatically triggers activity "Find and get refractive surgery plans from remote AE". The Refractive Workplace application displays an error to the operator in case no items were responded.

4.2.1.3.2.2 Proposed Presentation Contexts

Following presentation contexts are offered for each initiated association. During this activity the Application Software uses only

- "Patient Root Query/Retrieve Information Model - FIND" with Transfer Syntax ILE as SCU

Important note: For this activity it is required that the SCP supports the Relational query model since Application Software does not use the Hierarchical model.

Table 4-7 Proposed Presentation Contexts for Activity Select patient for refractive surgery planning

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID 1.2.840.10008. ...**	**Name List**	**UID List 1.2.840.10008. ...**		
Verification	1.1	ILE	1.2	BOTH	None
Storage Commitment Push Model	1.20.1	ILE	1.2	SCU	None
Raw Data Storage	5.1.4.1.1.66	ILE	1.2	BOTH[2]	None
		ELE	1.2.1	BOTH[2]	None
Patient Root Query/Retrieve IM – FIND	5.1.4.1.2.1.1	ILE	1.2	SCU	Yes[1]
Study Root Query/Retrieve IM – MOVE	5.1.4.1.2.2.2	ILE	1.2	SCU	No

Note 1: C-FIND extended negotiation is offered. Relational-query support is required by the SCP.

Note 2: Only acts as SCP when a C-Move-RQ was initiated first and this association is still open.

Table 4-8 Extended Negotiation as a SCU

SOP Class Name	SOP Class UID	Extended Negotiation
Patient Root Query/Retrieve IM – FIND	1.2.840.10008.5.1.4.1.2.1.1	See Note 1

Note 1: Extended negotiation for relational queries is offered. Relational-query support by the SCP is required for successful Patient Root Queries issued by the Refractive Workplace AE.

4.2.1.3.2.3 SOP Specific Conformance for Patient Root Query/Retrieve SOP Class as SCU

Table 4-9 Query C-FIND Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Failure	Refused: Out of Resources	A700	Log message and display user alert.
Failure	Identifier does not match SOP Class	A900-A9FF	Log message and display user alert.
Failure	Unable to process	C000-CFFF	Log message and display user alert.
Failure	Refused: SOP class not supported	0122	Log message and display user alert
Cancel	Matching terminated due to Cancel request	FE00	None
Success	Matching is complete – No final Identifier is supplied	0000	The Software Application stops receiving worklist items. It finally updates the pick list.
Pending	Matches are continuing – Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys	FF00	Log message. The Application Software checks whether the number of received worklist items overstepped the configurable limit. If the number of received worklist items overstepped the limit, then the Application Software sends a C-CANCEL-RQ, then an A-RELEASE-RQ to the

			service provider and a message is displayed.
Pending	Matches are continuing – Warning that one or more Optional Keys were not supported for existence and / or matching for this Identifier.	FF01	Log message. The Application Software checks whether the number of received worklist items overstepped the configurable limit. If the number of received worklist items overstepped the limit, then the Application Software sends a C-CANCEL-RQ, then an A-RELEASE-RQ to the service provider and a message is displayed.
Unknown	All other responses with unknown code meaning	xxxx	Log message and display user alert

Table 4-10 Query C-FIND Communication Failure Behavior

Exception	Behavior
DIMSE response timeout	The Association is aborted using A-ABORT. The reason is written to the log file. A user alert message is displayed.
Network Timeout	The Application Software is unable to connect to the remote Application Entity. The reason is written to the log file. A user alert message is displayed.
Maximum Association Idle Time exceeded	The Artim timer expires and the socket is closed. The reason is written to the log file.

The following tables lists attributes, which are in use during this activity. The tables also explains how the attributes are involved.

Table 4-11 PATIENT level keys for the Patient Root Query/Retrieve Information Model (request and response)

Tag	Tag Name	Query Key Matching	Query Key Return	Imported	Displayed	Copied into SOP Instance
(0010,0010)	Patient's Name[1]	X	X	X	X	X
(0010,0020)	Patient ID	X	X	X	X	X
(0010,0021)	Issuer of Patient ID	X		X		X
(0010,0030)	Patient's Birth Date	X		X	X	X
(0010,0040)	Patient's Sex	X		X	X	X
(0010,1000)	Other Patient IDs			X		X
(0010,4000)	Patient Comments			X		X

Note 1: The Refractive Workplace application does not support multicomponent group name representation and only use the Alphabetic representation group.

No query keys from neither STUDY level, SERIES level nor INSTANCE level are involved in Patient Root Query/Retrieve Information Model request and response.

Values of column "Query Key Matching":

RNG

The operator can apply a range as value for the query key.

SEL

The operator can select a value from a given list of values.

X
The value is included in the query request if not empty.
AUTO
The value cannot be modified by the operator.

Values of column “Query Keys Return”:
X
The tag shall be present in the Patient Root Query/Retrieve C-FIND response. If any required tag is missing the relevant Patient Root Query/Retrieve C-FIND response item will be ignored and not imported by the application software.

Values of column "Imported":
X
The value gets imported in the application. Thus this value may have influence in Information Objects which will be created as a result of the performed examination.

Values of column "Displayed":
X
Values of this tag are instantly visible in the pick list.

Values of column “Copied into SOP Instance”:
X
Values of marked tags will be stored in created SOP Instances. See section "mapping of attributes" in 8.1.3 Attribute Mapping.

4.2.1.3.3 Activity – Find and get refractive surgery plans from remote AE

This activity is triggered automatically after a patient is successfully selected for Refractive Workplace.

The application searches remote AE for any existing refractive surgery planning and summary data associated with the selected patient. Based on the query responses the Refractive Workplace application tries to identify the most recent planning that has no related surgery summary for each eye side. If such surgery planning instance exists, these will be loaded automatically from the remote AE by performing a DICOM retrieve operation.

The UI for surgery planning is then pre-loaded with the retrieved planning data.

4.2.1.3.3.1 Description and Sequencing of Activities

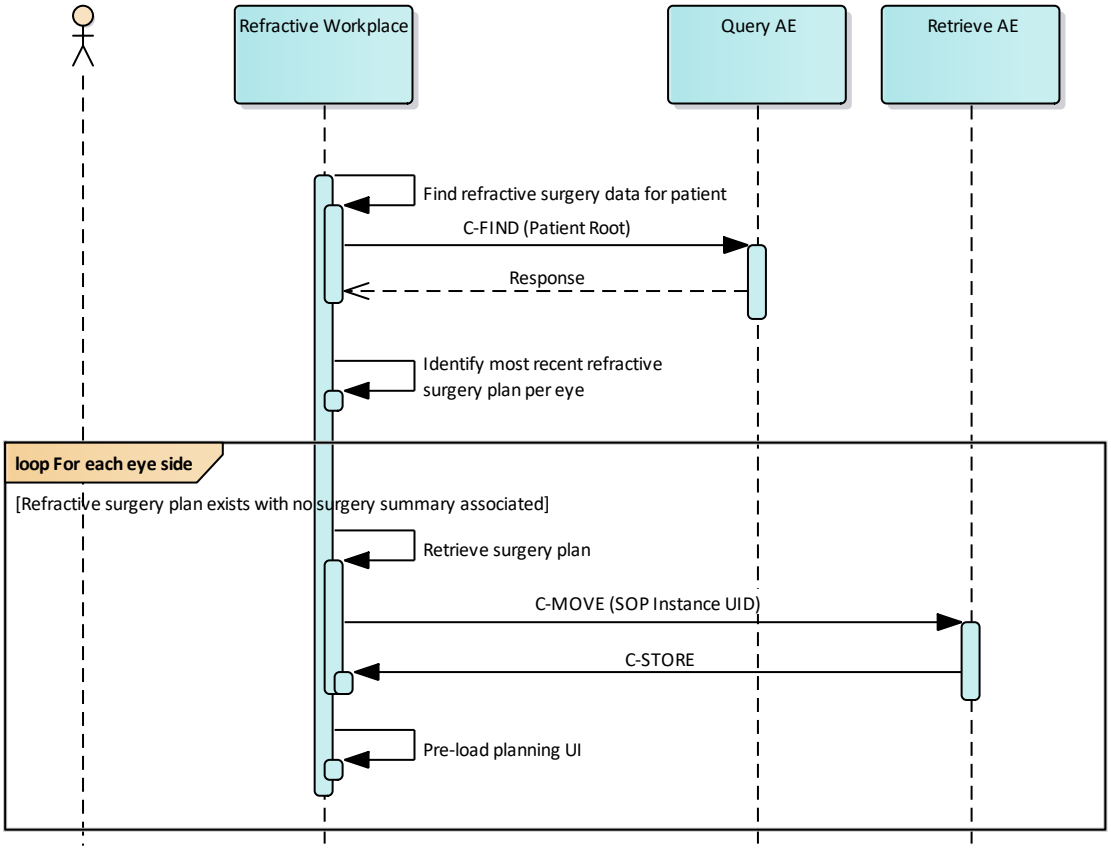


Figure 4-7 Find and get refractive surgery plans from remote AE

Find refractive surgery data for patient
The Refractive Workplace application searches for any refractive surgery data at the remote AE. Therefore, it sends a Patient Root based DICOM C-FIND request at Image level with the given information applied to the following query keys

- (0008,0016) SOP Class UID [=”1.2.840.10008.5.1.4.1.1.66”]
- (0010,0010) Patient’s Name [=as provided by activity “Select patient”]
- (0010,0020) Patient ID [=as provided by activity “Select patient”]
- (0010,0021) Issuer of Patient ID [=as provided by activity “Select patient”]
- (0010,0030) Patient’s Birth Date [=as provided by activity “Select patient”]
- (0010,0040) Patient’s Sex [=as provided by activity “Select patient”]

In case of returned instances belong to combined series (see Figure 4-4 Multi-type surgery planning) the Refractive Workplace application sends additional C-FIND requests with also following query keys

- (0020,000E) Series Instance UID [=as provided by previous C-FIND response)

Identify most recent refractive surgery plan per eye
The Application Software waits for the response from the Query AE and tries to identify for each eye side the most recent refractive surgery planning instance which has no associated surgery summary instance. This identification is based on following return keys

- (0008,002A) Acquisition DateTime
- (0008,0060) Modality
- (0008,114A) Referenced Instance Sequence
- (0020,0013) Instance Number

- (0020,0062) Image Laterality

Retrieve surgery plan

In case such planning instances have been identified these will become subject of a subsequent retrieve request and the respective SOP instances are retrieved from the remote AE. The surgery planning UI is pre-populated with the retrieved surgery planning parameters.

4.2.1.3.3.2 Proposed Presentation Contexts

Following presentation contexts are offered for each initiated association. During this activity the Application Software uses only

- "Patient Root Query/Retrieve Information Model - FIND" with Transfer Syntax ILE as SCU
- "Study Root Query/Retrieve Information Model - MOVE" with Transfer Syntax ILE as SCU
- “Raw Data Storage” with Transfer Syntax ELE or ILE as SCP

Important note: For this activity it is required that the SCP supports the Relational query model since Application Software does not use the Hierarchical model.

Table 4-12 Proposed Presentation Contexts for Activity Find and get refractive surgery plans from remote AE

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID 1.2.840.10008. ...**	**Name List**	**UID List 1.2.840.10008. ...**		
Verification	1.1	ILE	1.2	BOTH	None
Storage Commitment Push Model	1.20.1	ILE	1.2	SCU	None
Raw Data Storage	5.1.4.1.1.66	ILE	1.2	BOTH[2]	None
		ELE	1.2.1	BOTH[2]	None
Patient Root Query/Retrieve IM – FIND	5.1.4.1.2.1.1	ILE	1.2	SCU	Yes[1]
Study Root Query/Retrieve IM – MOVE	5.1.4.1.2.2.2	ILE	1.2	SCU	No

Note 1: C-FIND extended negotiation is offered. Relational-query support is required by the SCP.

Note 2: Only acts as SCP when a C-Move-RQ was initiated first and this association is still open.

Table 4-13 Extended Negotiation as a SCU

SOP Class Name	SOP Class UID	Extended Negotiation
Patient Root Query/Retrieve IM – FIND	1.2.840.10008.5.1.4.1.2.1.1	See Note 1

Note 1: Extended negotiation for relational queries is offered. Relational-query support by the SCP is required for successful Patient Root Queries issued by the Refractive Workplace AE.

4.2.1.3.3.3 SOP Specific Conformance for Patient Root Query/Retrieve SOP Class as SCU

Table 4-14 Query C-FIND Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Failure	Refused: Out of Resources	A700	Log message and display user alert.
Failure	Identifier does not match SOP Class	A900-A9FF	Log message and display user alert.
Failure	Unable to process	C000-CFFF	Log message and display user alert.
Failure	Refused: SOP class not supported	0122	Log message and display user alert
Cancel	Matching terminated due to Cancel request	FE00	None

Success	Matching is complete – No final Identifier is supplied	0000	The Software Application stops receiving worklist items. It finally updates the pick list.
Pending	Matches are continuing – Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys	FF00	Log message. The Application Software checks whether the number of received worklist items overstepped the configurable limit. If the number of received worklist items overstepped the limit, then the Application Software sends a C-CANCEL-RQ, then an A-RELEASE-RQ to the service provider and a message is displayed.
Pending	Matches are continuing – Warning that one or more Optional Keys were not supported for existence and / or matching for this Identifier.	FF01	Log message. The Application Software checks whether the number of received worklist items overstepped the configurable limit. If the number of received worklist items overstepped the limit, then the Application Software sends a C-CANCEL-RQ, then an A-RELEASE-RQ to the service provider and a message is displayed.
Unknown	All other responses with unknown code meaning	xxxx	Log message and display user alert

Table 4-15 Query C-FIND Communication Failure Behavior

Exception	Behavior
DIMSE response timeout	The Association is aborted using A-ABORT. The reason is written to the log file. A user alert message is displayed.
Network Timeout	The Application Software is unable to connect to the remote Application Entity. The reason is written to the log file. A user alert message is displayed.
Maximum Association Idle Time exceeded	The Artim timer expires and the socket is closed. The reason is written to the log file.

Table 4-16 Retrieve C-MOVE Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Sub-operations Complete No Failures	0000	The Application Software returns from this activity.
Pending	Sub-operations are continuing	FF00	This is not expected since the Application Software calls C-MOVE instance by instance.
Refused	Out of Resources Unable to calculate number of matches	A701	An error message is shown to the operator. The Application Software logs this event and continues with processing next C-MOVE operation.
Refused	Out of Resources Unable to perform sub-operations	A702	
Refused	Move Destination unknown	A801	
Failure	Identifier does not match SOP Class	A900	

Failure	Unable to process	C000 - CFFF	
Success	Sub-operations Complete One or more Failures	B000	
Cancel	Sub-operations terminated due to Cancel Indication	FE00	
*	*	Any other status code	

The following tables lists attributes, which are in use during this activity. The tables also explains how the attributes are involved.

Table 4-17 PATIENT level keys for the Patient Root Query/Retrieve Information Model (request and response)

Tag	Tag Name	Query Key Matching	Query Key Return	Imported	Displayed	Copied into SOP Instance
(0010,0010)	Patient's Name[1]	X		X	X	X
(0010,0020)	Patient ID	X	X	X	X	X
(0010,0021)	Issuer of Patient ID	X		X		X
(0010,0030)	Patient's Birth Date	X		X	X	X
(0010,0040)	Patient's Sex	X		X	X	X
(0010,1000)	Other Patient IDs			X		X
(0010,4000)	Patient Comments			X		X

Note 1: The Refractive Workplace application does not support multicomponent group name representation and only use the Alphabetic representation group.

Table 4-18 STUDY level keys for the Patient Root Query/Retrieve Information Model (request and response)

Tag	Tag Name	Query Keys Matching	Query Keys Return	Imported	Displayed	Copied into SOP Instance
(0008,0020)	Study Date					
(0008,0030)	Study Time					
(0008,0050)	Accession Number					
(0008,0090)	Referring Physician's Name					
(0008,1030)	Study Description					
(0020,0010)	Study ID					
(0020,000D)	Study Instance UID		X	X		

Table 4-19 SERIES level keys for the Patient Root Query/Retrieve Information Model (request and response)

Tag	Tag Name	Query Keys Matching	Query Keys Return	Imported	Displayed	Copied into SOP Instance
(0008,0021)	Series Date					
(0008,0031)	Series Time					
(0008,0060)	Modality		X	X		
(0008,103E)	Series Description					
(0008,1050)	Performing Physician's Name					
(0008,1090)	Manufacturer's Model Name					
(0020,000E)	Series Instance UID		X	X		
(0020,0011)	Series Number		X	X		

Table 4-20 INSTANCE level keys for the Patient Root Query/Retrieve Information Model (request and response)

Tag	Tag Name	Query Keys Matching	Query Keys Return	Imported	Displayed	Copied into SOP Instance
(0008,0016)	SOP Class UID	X	X	X		
(0008,0018)	SOP Instance UID		X	X		
(0008,002A)	Acquisition DateTime		X	X		
(0008,114A)	Referenced Instance Sequence		X	X		
>(0008,1150)	Referenced SOP Class UID		X*	X		
>(0008,1155)	Referenced SOP Instance UID		X*	X		
>(0040,A170)	Purpose of Reference Code Sequence		X*	X		
>>(0008,0100)	Code Value		X*	X		
>>(0008,0102)	Coding Scheme Designator		X*	X		
(0008,9123)	Creator-Version UID		X	X		
(0020,0013)	Instance Number		X	X		
(0020,0062)	Image Laterality		X	X		

Values of column "Query Key Matching":

RNG
The operator can apply a range as value for the query key.

SEL
The operator can select a value from a given list of values.

X
The value is included in the query request if not empty.

AUTO
The value cannot be modified by the operator.

Values of column “Query Keys Return”:

X
The tag shall be present in the Patient Root Query/Retrieve C-FIND response. If any required tag is missing the relevant Patient Root Query/Retrieve C-FIND response item will be ignored and not imported by the application software.

X*
The tag shall be present in the Patient Root Query/Retrieve C-FIND response if its enclosing sequence is present. If any required tag is missing the relevant Patient Root Query/Retrieve C-FIND response item will be ignored and not imported by the application software.

Values of column "Imported":

X
The value gets imported in the application. Thus this value may have influence in Information Objects which will be created as a result of the performed examination.

Values of column "Displayed":

X
Values of this tag are instantly visible in the pick list.

Values of column “Copied into SOP Instance”:

X
Values of marked tags will be stored in created SOP Instances. See section "mapping of attributes" in 8.1.3 Attribute Mapping.

Table 4-21 Query key details

Tag	Tag Name	Description
(0010,0010)	Patient’s Name[1]	The value is used as provided from the previous activity “Select Patient”. This is a DICOM Standard query key on Patient level.
(0010,0020)	Patient ID	The value is used as provided from the previous activity “Select Patient”. This is a DICOM Standard query key on Patient level.
(0010,0021)	Issuer of Patient ID	The value is used as provided from the previous activity “Select Patient”. This is a DICOM Optional query key on Patient level, thus the effect of this query key on the query depends on Service Provider implementation.
(0010,0030)	Patient’s Birth Date	The value is used as provided from the previous activity “Select Patient”. This is a DICOM Optional query key on Patient level, thus the effect of this query key on the query depends on Service Provider implementation.
(0010,0040)	Patient’s Sex	The value is used as provided from the previous activity “Select Patient”. This is a DICOM Optional query key on Patient level, thus the effect of this query key on the query depends on Service Provider implementation.
(0008,0016)	SOP Class UID	The value is ”1.2.840.10008.5.1.4.1.1.66” for Raw Data SOP Class. This is a DICOM Optional query key on Instance level, thus the effect of this query key

		on the query depends on Service Provider implementation.

Note 1: Only Alphabetic part of the multicomponent group name is used as query key

4.2.1.3.4 Activity – Plan refractive surgery

This activity has no direct relation to DICOM messaging.

Once a patient is selected the operator can start planning a refractive surgery for each eye of the patient. In case, previous surgery planning data is loaded and the planning is resumed, the operator can manipulate already set planning parameters. This is denoted as the “follow-up case”. Otherwise, the operator can start a new surgery plan from the scratch. The Refractive Workplace application software supports the operator by instantly validating the clinical correctness of any surgery parameter. If done, the operator can either choose to store the plan or to discard the entered parameters.

This activity creates a refractive surgery plan for each edited eye side which then might become subjects of the activity "Store refractive surgery plan to remote AE".

4.2.1.3.5 Activity - Store refractive surgery plan to remote AE

This activity can be invoked manually by the operator by pressing the “Save” button from the “Surgery planning” screen of the Refractive Workplace application.

If new surgery planning data has been created for a patient’s eye during the workflow this will transferred to the configured remote Storage AE.

This includes the following SOP Class instances:

- 1..2 Raw Data SOP instances containing refractive surgery parameters planned for a single eye

In case the planning data to be transferred is based on a previously retrieved planning instance (“follow-up case”) some attributes of this retrieved instance will get copied into the new SOP instance. A detailed list of these attributes can be found in chapter 8.1.3 Attribute Mapping.

After successful storage the Refractive Workplace application software asks the configured Storage Commitment Provider to take over responsibility on data persistence for the data previously transferred to the remote Storage AE.

4.2.1.3.5.1 Description and Sequencing of Activities

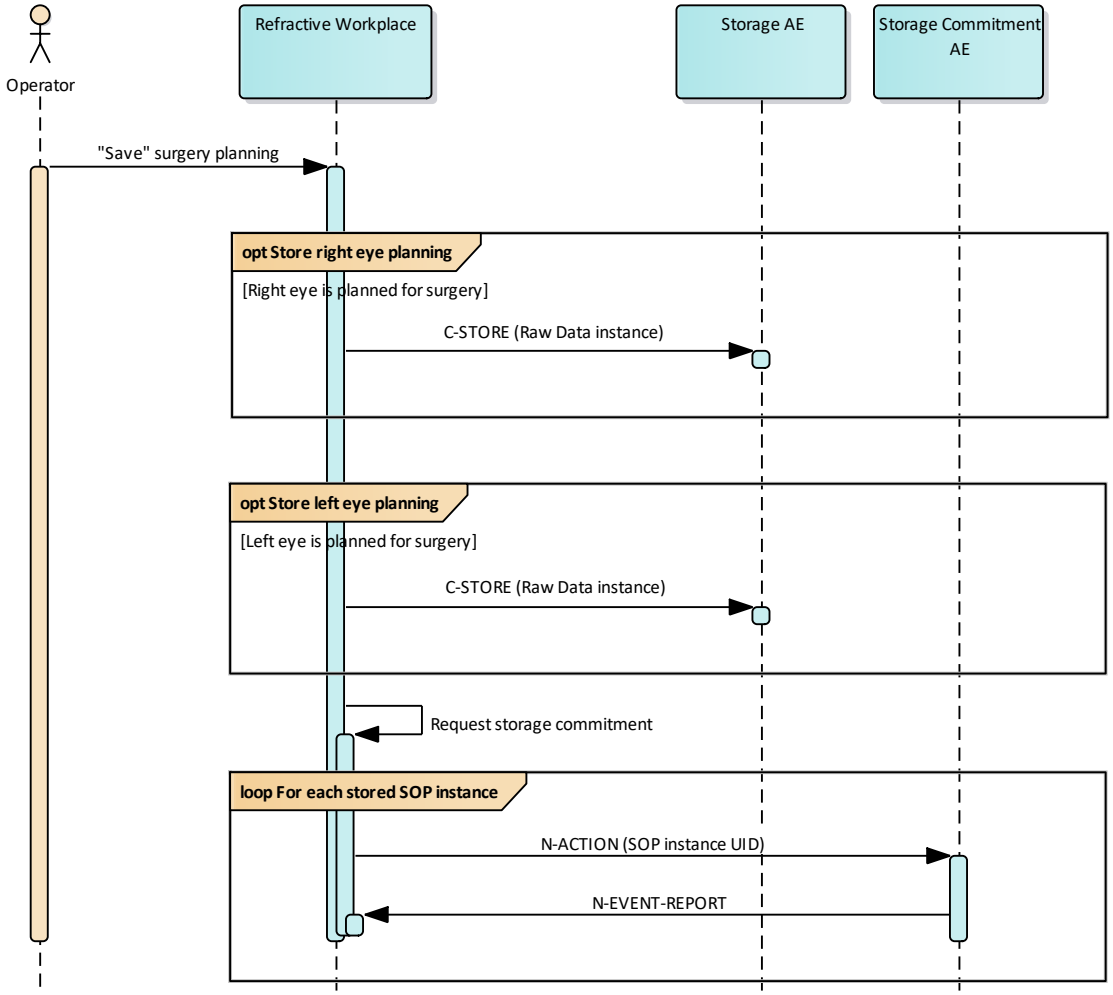


Figure 4-8 Store refractive surgery plan to remote AE

Store right/left eye planning
This activity can be invoked manually by the operator by pressing “Save” after creating a plan for a refractive surgery of a patient’s eye.

Once triggered, the application software transfers eye surgery planning data that has been created during the workflow and is subject of storage to the configured Storage AE.

Request Storage Commitment
To verify that the data has been safely archived, the Application Software can be set up to request the configured Storage Commitment AE in a configurable interval to commit the storage of instances.

4.2.1.3.5.2 Proposed Presentation Contexts

Following presentation contexts are offered for each initiated association. During this activity the Application Software uses only

- Raw Data Storage with Transfer Syntax ELE (Transfer Syntax ILE as fallback) as SCU
- Storage Commitment Push Model with Transfer Syntax ILE as SCU

Table 4-22 Proposed Presentation Contexts for Activity Store refractive surgery plan to remote AE

Presentation Context Table			
Abstract Syntax	**Transfer Syntax**	**Role**	**Ext.**

Name	UID 1.2.840.10008. ...	Name List	UID List 1.2.840.10008. ...		Neg.
Verification	1.1	ILE	1.2	BOTH	None
Storage Commitment Push Model	1.20.1	ILE	1.2	SCU	None
Raw Data Storage	5.1.4.1.1.66	ILE	1.2	BOTH[2]	None
		ELE	1.2.1	BOTH[2]	None
Patient Root Query/Retrieve IM – FIND	5.1.4.1.2.1.1	ILE	1.2	SCU	Yes[1]
Study Root Query/Retrieve IM – MOVE	5.1.4.1.2.2.2	ILE	1.2	SCU	No

Note 1: C-FIND extended negotiation is offered. Relational-query support is required by the SCP.

Note 2: Only acts as SCP when a C-Move-RQ was initiated first and this association is still open.

Table 4-23 Extended Negotiation as a SCU

SOP Class Name	SOP Class UID	Extended Negotiation
Patient Root Query/Retrieve IM – FIND	1.2.840.10008.5.1.4.1.2.1.1	See Note 1

Note 1: Extended negotiation for relational queries is offered. Relational-query support by the SCP is required for successful Patient Root Queries issued by the Refractive Workplace AE.

4.2.1.3.5.3 SOP Specific Conformance for Storage SOP Classes

Table 4-24 Storage C-STORE Response Status Handling Behavior

Service Status	Further Meaning	Status Code	Behavior
Failure	Refused: Out of Resources	A700-A7FF	Log message and retry c-store. If error persists then message to user.
Failure	Error: Data Set does not match SOP Class	A900-AFF	Log message and do not retry. Message to user.
Failure	Error: Cannot understand	C000-CFFF	Log message and do not retry. Message to user.
Failure	Duplicate SOP Instance	0111	Log message and no retry.
Failure	Refused: SOP class not supported	0122	Log message and show user alert.
Warning	Coercion of data Elements	B000	The Application Software logs this event.
Warning	Data Set does not match SOP Class	B007	The Application Software logs this event.
Warning	Elements Discarded	B006	The Application Software logs this event.
Success	Successful Storage	0000	None
Unknown	All other responses with unknown code	xxxx	Log message and do not retry. Message to user.

4.2.1.3.5.4 SOP Specific Conformance for Storage Commitment SOP Class

4.2.1.3.5.4.1 Storage Commitment Operations (N-ACTION)

The Application Software will request storage commitment for stored instances if the Remote AE is configured as Storage Commitment Provider and a presentation context for the Storage Commitment Push Model has been accepted.

The Storage Commitment Request addresses at least one SOP Instance and at maximum 500 SOP instances.

The behavior of the Application Software when encountering status codes in a N-ACTION response is summarized in the table below:

Table 4-25 Storage Commitment N-ACTION Response Status Handling Behavior

Service Status	Further Meaning	Status Code	Behavior
Failure	Class-instance conflict	0119	Log message and display user alert.
Failure	Duplicate invocation	0210	Log message.
Failure	Invalid argument value	0115	Log message and display user alert.
Failure	Invalid SOP Instance	0117	Log message and display user alert.
Failure	Mistyped argument	0212	Log message and display user alert.
Failure	No such action	0123	Log message and display user alert.
Failure	No such argument	0114	Log message and display user alert.
Failure	No such SOP class	0118	Log message and display user alert.
Failure	No such SOP Instance	0112	Log message.
Failure	Processing failure	0110	Log message and display user alert.
Failure	Resource limitation	0213	Log message.
Failure	Unrecognized operation	0211	Log message and display user alert.
Success	Success	0000	The Application Software will wait for an incoming N-EVENT-REPORT.
Unknown	All other responses with unknown code meaning.	xxxx	Log message and display user alert.

Table 4-26 C-STORE Communication Failure Behavior

Exception	Behavior
DIMSE response timeout	The Association is aborted using A-ABORT. The reason is written to the log file. A user alert message is displayed.
Network Timeout	The Application Software is unable to connect to the remote Application Entity. The reason is written to the log file. A user alert message is displayed.
Maximum Association Idle Time exceeded	The Artim timer expires and the socket is closed. The reason is written to the log file.

4.2.1.3.5.4.2 Storage Commitment Communication Failure Behaviour

If the Application Software runs in a timeout or if the association is aborted by the provider or network layer, or if waiting duration for Storage Commitment N-EVENT-REPORT oversteps a configurable time

limit then the related SOP Instance is considered as not being committed. Then the SOP Instance is subject of a future Storage Commitment service call. It will be included again within next call of this activity.

In addition to that, the Application Software writes the SOP Instance UID to the log file, together with the failure reason.

4.2.1.4 Association Acceptance Policy

4.2.1.4.1 Activity - Verify Communication

The activity can be performed at any time. The service is available as soon as the Application Software has been started.

4.2.1.4.1.1 Description and Sequencing of Activities

The Software AE responds to verification requests made by remote AEs.

4.2.1.4.1.2 Accepted Presentation Contexts

Table 4-27 Presentation Context accepted for Activity Verify Communication

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID 1.2.840.10008. ...**	**Name List**	**UID List 1.2.840.10008. ...**		
Verification	… 1.1	ILE	… 1.2	BOTH	None

4.2.1.4.1.3 SOP Specific Conformance for Verification SOP Class as SCP

The Application Software AE provides standard conformance.

4.2.1.4.2 Activity - Find and get refractive surgery plans from remote AE

This chapter describes the aspect of association acceptance of the activity “Find and get refractive surgery plans from remote AE”. The activity retrieves refractive surgery planning data for a selected patient.

4.2.1.4.2.1 Description and Sequencing of Activities

The description and sequencing of activities is covered by chapter 4.2.1.3.3 Activity – Find and get refractive surgery plans from remote AE.

4.2.1.4.2.2 Accepted Presentation Contexts

Table 4-28 Acceptable Presentation Contexts for Activity Find and get refractive surgery plans from remote AE

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID 1.2.840.10008. ...**	**Name List**	**UID List 1.2.840.10008. ...**		
Verification	1.1	ILE	1.2	SCP	No
Raw Data Storage	5.1.4.1.1.66	ILE	1.2	SCP	No
		ELE	1.2.1	SCP	No

4.2.1.4.2.3 SOP Specific Conformance for Storage SOP Class as SCP

The Application Software AE provides standard conformance.

4.2.1.4.3 Activity - Store refractive surgery plan to remote AE

This chapter describes the aspect of association acceptance of the activity " Store refractive surgery plan to remote AE ". The activity stores refractive surgery planning data for a patient’s eyes as described in chapter 4.2.1.3.5 Activity - Store refractive surgery plan to remote AE.

After successful storage the Refractive Workplace application software asks the configured Storage Commitment Provider to take over responsibility on data persistence for the data previously transferred to the remote Storage AE.

4.2.1.4.3.1 Description and Sequencing of Activities

The description and sequencing of activities is covered by chapter 4.2.1.3.5 Activity - Store refractive surgery plan to remote AE.

4.2.1.4.3.2 Accepted Presentation Contexts

Table 4-29 Presentation Contexts accepted for Activity Store refractive surgery plan to remote AE

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID 1.2.840.10008. ...**	**Name List**	**UID List 1.2.840.10008. ...**		
Verification	1.1	ILE	1.2	BOTH	None
Storage Commitment Push Model	1.20.1	ILE	1.2	SCU	None

4.2.1.4.3.3 SOP Specific Conformance for Storage SOP Class as SCP

The Application Software AE provides standard conformance.

4.2.1.4.3.4 SOP Specific Conformance for Storage Commitment SOP Class

4.2.1.4.3.4.1 Storage Commitment Operations (N-EVENT-REPORT)

The Application Software is capable of receiving an N-EVENT-REPORT notification if it has successfully negotiated a Presentation Context for the Storage Commitment Push

The behavior of Application Software when receiving Event Types within the N-EVENT-REPORT is summarized in the table below.

Table 4-30 Storage Commitment N-EVENT-REPORT Request Failure Reasons

Service Status	Further Meaning	Status Code	Behavior
Failure	Processing Failure	0110	The SOP Instance is also considered as not being committed. For a configurable amount of re-trials the SOP Instance is subject of a future Storage Commitment service request. It will be included again within next call of these activities. In addition, the application software writes the SOP Instance UID to the log file with the failure reason.
Failure	No such object instance	0112	The SOP Instance is also considered as neither being archived nor being committed. The application will re-archive the original instance (for OP IOD) or a new instance based on the same measurement (for ePdf IOD). In addition, the application software writes the SOP Instance UID to the log file with the failure reason.
Failure	Resource limitation	0213	The SOP Instance is also considered as not being committed. For a configurable amount of re-trials the SOP Instance is subject of a future Storage Commitment service request. It will be included again within next call of these activities.

			In addition, the application software writes the SOP Instance UID to the log file with the failure reason.
Failure	Referenced SOP Class not supported	0122	The application software writes the SOP Instance UID to the log file with the failure reason.
Failure	Class / Instance conflict	0119	The SOP Instance is also considered as not being committed. For a configurable amount of re-trials the SOP Instance is subject of a future Storage Commitment service request. It will be included again within next call of these activities. In addition, the application software writes the SOP Instance UID to the log file with the failure reason.
Failure	Duplicate transaction UID	0131	The SOP Instance is also considered as not being committed. For a configurable amount of re-trials the SOP Instance is subject of a future Storage Commitment service request. It will be included again within next call of these activities. In addition, the application software writes the SOP Instance UID to the log file with the failure reason.
Unknown	All other responses with unknown code meaning	xxxx	Log message and retry storage commit for failed sop instance(s).

If the N-EVENT-REPORT contains failed instances the behavior of the application software depends on the failure reason associated with the failed instances. In general retry means a retry for 2 times, no retry will set the error counter to maximum. A reset of the error counter is possible in the application settings screen.

4.3 Network Interfaces

4.3.1 Physical Network Interface

The physical network interface is not visible for the application software which uses the communication stack as offered by the Operating System.

4.3.2 Additional Protocols

Both IP addresses and host names are supported and get resolved.
Else no additional protocols are supported.

4.3.3 IPv4 and IPv6 Support

Application software does only support IPv4 and does not support any IPv6 features.

4.4 Configuration

Local application entity and remote application entity information can be configured in the *FORUM Settings* section of the software application's *Settings* dialog. This dialog does also allow other networking and DICOM related settings like networking timeouts and patient query item limit parameters.

For institution related settings like Institution Name or Issuer of Patient ID an administrator can use the *System Settings* section of the *Settings* dialog.

For AutoConnect™-enabled systems from ZEISS the configuration can be performed automatically using the AutoConnect button.

4.4.1 AE Title/Presentation Address Mapping

The mapping from AE Title to TCP/IP addresses and ports is configurable and set at the time of installation by Installation Personnel.

4.4.1.1 Local AE Titles

The IP can be configured to be set up manually or to be administered by the Operating System. The Application Entity Title as well as the port number is configurable. The default port number is 11112. In case AutoConnect is enabled in both Refractive Workplace and FORUM, the Local AE configuration is registered automatically in the FORUM AE Title Administration.

4.4.1.2 Remote AE Titles

The mapping of external AE Titles to TCP/IP addresses and ports is configurable. The Refractive Workplace Application Software allows setting up a remote Application Entity for each service. For all Application Entities, the host name or IP, the Port and the Application Entity Title must be known.

Mapping of DICOM services to remote AE can be done either manually or by using the AutoConnect feature. In case AutoConnect is enabled in both Refractive Workplace and FORUM, the configuration of the Remote Application Entities can be performed automatically using the AutoConnect button.

4.4.2 Parameters

4.4.2.1 General Parameters

The general parameters are shared for associations to any of the configured AE.

Table 4-31 Configuration Parameters Table

Parameter	Configurable (Yes/No)	Default Value
General Parameters		
DIMSE RSP Timeout	Yes (10 – 60 sec.)	20 sec
Network Timeout	Yes (5-20 sec.)	20 sec.
Max. Association Idle Time	Yes (10 – 60 sec.)	30 sec
Network log level	Yes	Warning
(0008,1010) Station Name	Yes	EMPTY
AE Specific Parameters		
Number of simultaneous Associations by Service and/or SOP Class?	No	50
Verification SCU Parameters		
No specific configuration required.		
Patient Root Q/R and Study Root Q/R SCU Parameters		
Maximum Query Responses (Patient Root Q/R IM and Study Root Q/R IM)	Yes (10-999)	200
Storage Commitment SCU Parameters		
No specific configuration required		
Storage SCU Parameters		
No specific configuration required		
Verification SCP Parameters		
No specific configuration required		

The configuration of port number and Application Entity Title are part of the Local Application Entity setup (see 4.4.1.1 Local AE Titles).		

5 Media Interchange

Media Interchange is not scope of this document since Media Interchange is not supported by Refractive Workplace Application Software.

6 Support of Character Sets

All application entities described in the previous chapters support UTF-8 character set.

Table 6-1 Supported Character Set

Supported Specific Character Set	
Character Set Description	**Defined Term**
UTF-8 encoded Unicode	ISO_IR 192 (Default)

7 Security

The Refractive Workplace Application Software does not support any specific security profiles as defined in NEMA PS3.15.

However, the application requires a secured, TSL encrypted DICOM connection to the configured remote ZEISS FORUM application entities, based on the stunnel program and self-signed certificates. A specific setup document is available for more details.

Furthermore, it is assumed that Refractive Workplace Application Software is used within a secured environment. It is assumed that a secured environment includes at a minimum:

- Firewall or router protections to ensure that only approved external hosts have network access to Refractive Workplace Application Software
- Firewall or router protections to ensure that Refractive Workplace Application Software only has network access to approved external hosts and services.

Other network security procedures such as automated intrusion detection may be appropriate in some environments. Additional security features may be established by the local security policy and are beyond the scope of this conformance statement.

7.1 Association Level Security

The Refractive Workplace Application Software does not support any association level security.

7.2 Application Level Security

The Refractive Workplace Application Software requires a user to authenticate using a password controlled user account.

8 Annexes

8.1 IOD Contents

8.1.1 Created SOP Instance(s)

Abbreviations used for presence of values:

VNAP

Value Not Always Present (attribute sent zero length if no value is present) – Applicable for Type 2, 2C.

ANAP
Attribute is not always present – Applicable for Type 3

ALWAYS
Attribute is always present with a value – Applicable for Type 1

EMPTY
Attribute is sent without a value – Applicable for Type 2

Abbreviations used for sources of data:

USER
The attribute value source is from User input

AUTO
The attribute value is generated automatically

CONFIG
The attribute value source is a configurable parameter

PRQ
The attribute value is same as the value received using the DICOM service Patient Root Query (FIND).

SRR
The attribute value is same as the value received using the DICOM service Study Root Retrieve (MOVE).

8.1.1.1 Refractive Surgery Plan Raw Data Information Object Definition

IE	Module	Reference	Presence of Module
Patient	Patient	Table 8-1	ALWAYS
	Clinical Trial Subject		NEVER
Study	General Study	Table 8-2	ALWAYS
	Patient Study		NEVER
	Clinical Trial Study		NEVER
Series	General Series	Table 8-3	ALWAYS
	Clinical Trial Series		NEVER
Frame of Reference	Frame of Reference		NEVER
	Synchronization		NEVER
Equipment	General Equipment	Table 8-4	ALWAYS
Raw Data	Acquisition Context	Table 8-5	ALWAYS
	Specimen		NEVER

	Raw Data	Table 8-6	ALWAYS
	Sop Common	Table 8-7	ALWAYS
	CZM Pre-surgical Eye Status	Table 8-8	ALWAYS
	CZM Refractive Surgery Plan	Table 8-9	ALWAYS

8.1.1.2 Common Modules

Table 8-1 Common Modules - Module "Patient"

Name	Tag	VR	Description	PoV	Source
Patient's Name	(0010,0010)	PN	Patient's full name.	ALWAYS	PRQ
Patient ID	(0010,0020)	LO	Primary hospital identification number or code for the patient.	ALWAYS	PRQ
Issuer of Patient ID	(0010,0021)	LO	Identifier of the Assigning Authority (system, organization, agency, or department) that issued the Patient ID. Note: Equivalent to HL7 v2 CX component 4 subcomponent 1.	ANAP	PRQ
Patient's Birth Date	(0010,0030)	DA	Birth date of the patient.	ALWAYS	PRQ
Patient's Sex	(0010,0040)	CS	Sex of the named patient. Enumerated Values: M = male F = female O = other	ALWAYS	PRQ
Other Patient IDs	(0010,1000)	LO	Other identification numbers or codes used to identify the patient.	ANAP	PRQ
Patient Comments	(0010,4000)	LT	User-defined additional information about the patient.	ANAP	PRQ

Table 8-2 Common Modules - Module "General Study"

Name	Tag	VR	Description	PoV	Source
Study Instance UID	(0020,000D)	UI	Unique identifier for the Study. In the follow-up case the value is copied from the retrieved planning instance. Otherwise Refractive Workplace uses a constant prefix of "1.2.276.0.75.2.1.120.1.1." followed by a date/time stamp and machine specific identifier.	ALWAYS	SRR, AUTO
Study Date	(0008,0020)	DA	Date the Study started.	ALWAYS	SRR, AUTO
Study Time	(0008,0030)	TM	Time the Study started.	ALWAYS	SRR, AUTO
Referring Physician's Name	(0008,0090)	PN	Name of the patient's referring physician.	EMPTY	AUTO
Study ID	(0020,0010)	SH	User or equipment generated Study identifier. In the follow-up case the value is copied from the retrieved SOP instance. Otherwise the value is an Equipment generated Study identifier.	ALWAYS	SRR, AUTO
Accession Number	(0008,0050)	SH	A RIS generated number that identifies the order for the Study. In the follow-up case the value is copied from the retrieved SOP instance. Otherwise the value does not exist.	VNAP	SRR
Study Description	(0008,1030)	LO	Institution-generated description or classification of the Study (component) performed. In the follow-up case the value is copied from the retrieved SOP instance. Otherwise the value does not exist.	ANAP	SRR
Referenced Study Sequence	(0008,1110)	SQ	A sequence that provides reference to a Study SOP Class/Instance pair. The sequence may have zero or more Items. In the follow-up case the sequence is copied from the retrieved SOP instance. Otherwise the sequence does not exist.	ANAP	SRR

>Referenced SOP Class UID	(0008,1150)	UI	Uniquely identifies the referenced SOP Class.	ALWAYS	SRR
>Referenced SOP Instance UID	(0008,1155)	UI	Uniquely identifies the referenced SOP Instance.	ALWAYS	SRR
Procedure Code Sequence	(0008,1032)	SQ	A Sequence that conveys the type of procedure performed. One or more Items may be included in this Sequence. In the follow-up case the sequence is copied from the retrieved SOP instance. Otherwise the sequence does not exist.	ANAP	SRR
>Code Value	(0008,0100)	SH	See NEMA PS3.3 Section 8.1.	ALWAYS	SRR
>Coding Scheme Designator	(0008,0102)	SH	See NEMA PS3.3 Section 8.2.	ALWAYS	SRR
>Coding Scheme Version	(0008,0103)	SH	Required if the value of Coding Scheme Designator (0008,0102) is not sufficient to identify the Code Value (0008,0100) unambiguously.	ANAP	SRR
>Code Meaning	(0008,0104)	LO	See NEMA PS3.3 Section 8.3.	ALWAYS	SRR

Table 8-3 Common Modules - Module "General Series"

Name	Tag	VR	Description	PoV	Source
Modality	(0008,0060)	CS	The modality appropriate for the encapsulated document. This Type definition shall override the definition in the SC Equipment Module. Always "LVCPLAN"	ALWAYS	AUTO
Series Instance UID	(0020,000E)	UI	Unique identifier of the Series. In the follow-up case the value is copied from the retrieved planning instance. Otherwise Refractive Workplace uses a constant prefix of "1.2.276.0.75.2.1.120.1.2." followed by a date/time stamp and machine specific identifier.	ALWAYS	SRR, AUTO
Series Number	(0020,0011)	IS	A number that identifies this Series. In the follow-up case the value is copied from the retrieved SOP instance. Otherwise the value is an Equipment generated identifier.	ALWAYS	SRR, AUTO
Series Date	(0008,0021)	DA	Date the Series started. In the follow-up case the value is copied from the retrieved SOP instance. Otherwise the value is an Equipment generated time stamp.	ALWAYS	SRR, AUTO
Series Time	(0008,0031)	TM	Time the Series started. In the follow-up case the value is copied from the retrieved SOP instance. Otherwise the value is an Equipment generated time stamp.	ALWAYS	SRR, AUTO
Performing Physician's Name	(0008,1050)	PN	Name of the physician(s) administering the Series.	ALWAYS	AUTO
Related Series Sequence	(0008,1250)	SQ	Identification of Series significantly related to this Series. One or more Items are permitted in this Sequence. Notes: 1. For example, for a combined CT and PET acquisition, the CT images and PET images would be in separate series that could cross-reference each other with multiple purpose of reference codes meaning same anatomy, simultaneously acquired and same indication. 2. The related series may have different Frames of Reference and hence require some sort of registration before spatial coordinates can be directly	ANAP	AUTO

			compared. 3. This attribute is not intended for conveying localizer reference information, for which Referenced Image Sequence (0008,1140) should be used. Used for referring a related series in case of a multi-type refractive surgery.		
>Study Instance UID	(0020,000D)	UI	Instance UID of Study to which the related Series belongs	ALWAYS	AUTO
>Series Instance UID	(0020,000E)	UI	Instance UID of Related Series	ALWAYS	AUTO
>Purpose of Reference Code Sequence	(0040,A170)	SQ	Describes the purpose for which the reference is made. Zero or more Items shall be included in this sequence. When absent, implies that the reason for the reference is unknown.	ALWAYS	AUTO
>>Code Value	(0008,0100)	SH	For possible values see section 8.3 Coded Terminology and Templates - Table 8-16 Coded Values - Related Series Purposes of Reference	ALWAYS	AUTO
>>Coding Scheme Designator	(0008,0102)	SH	For possible values see section 8.3 Coded Terminology and Templates - Table 8-16 Coded Values - Related Series Purposes of Reference	ALWAYS	AUTO
>>Coding Scheme Version	(0008,0103)	SH	For possible values see section 8.3 Coded Terminology and Templates - Table 8-16 Coded Values - Related Series Purposes of Reference	ALWAYS	AUTO
>>Code Meaning	(0008,0104)	LO	For possible values see section 8.3 Coded Terminology and Templates - Table 8-16 Coded Values - Related Series Purposes of Reference	ALWAYS	AUTO
Body Part Examined	(0018,0015)	CS	Text description of the part of the body examined. See PS 3.16 Annexes on Correspondence of Anatomic Region Codes and Body Part Examined for Humans and for Animals for Defined Terms Note: Some IODs support the Anatomic Region Sequence (0008,2218), which can provide a more comprehensive mechanism for specifying the body part being examined. Always "EYE"	ALWAYS	AUTO

Table 8-4 Common Modules - Module "General Equipment"

Name	Tag	VR	Type	Description	PoV	Source
Manufacturer	(0008,0070)	LO	2	Manufacturer of the equipment that produced the composite instances Always "Carl Zeiss Meditec"	ALWAYS	AUTO
Station Name	(0008,1010)	SH	3	User defined name identifying the machine that produced the composite instances. Attribute does not exist if no Station Name is configured.	ANAP	CONFIG
Manufacturer's Model Name	(0008,1090)	LO	3	Manufacturer's model name of the equipment that produced the composite instances. Always "Refractive Workplace"	ALWAYS	AUTO
Device Serial Number	(0018,1000)	LO	3	Manufacturer's serial number of the equipment that produced the composite instances. Note: This identifier corresponds to the device that actually created the images, such as a CR plate reader or a CT console, and may not be sufficient to identify all of the	ALWAYS	AUTO

				equipment in the imaging chain, such as the generator or gantry or plate.		
Software Version(s)	(0018,1020)	LO	3	Manufacturer's designation of software version of the equipment that produced the composite instances. "1.1.0" higher versions: "1.1.x.y" where x denotes a patch version, y denotes a build version.	ALWAYS	AUTO

8.1.1.3 Refractive Surgery Plan Raw Data Modules

Table 8-5 Refractive Surgery Plan Raw Data IOD - Module "Acquisition Context"

Name	Tag	VR	Description	PoV	Source
Acquisition Context Sequence	(0040,0555)	SQ	A sequence of Items that describes the conditions present during the acquisition of the data of the SOP Instance. Zero or more items shall be included in this sequence. Always empty sequence	EMPTY	AUTO

Table 8-6 Refractive Surgery Plan Raw Data IOD - Module "Raw Data"

Name	Tag	VR	Description	PoV	Source
Instance Number	(0020,0013)	IS	A number that identifies this raw data. The value shall be unique within a Series.	ALWAYS	AUTO
Content Date	(0008,0023)	DA	The date the raw data creation started.	ALWAYS	AUTO
Content Time	(0008,0033)	TM	The time the raw data creation started.	ALWAYS	AUTO
Acquisition Datetime	(0008,002A)	DT	The date and time that the acquisition of data started. Note: The synchronization of this time with an external clock is specified in the synchronization Module in Acquisition Time synchronized (0018,1800).	ALWAYS	AUTO
Image Laterality	(0020,0062)	CS	Laterality of (possibly paired) body part examined. Enumerated Values: R = right L = left U = unpaired B = both left and right	ALWAYS	AUTO
Creator-Version UID	(0008,9123)	UI	Unique identification of the equipment and version of the software that has created the Raw Data information. The UID allows one to avoid attempting to interpret raw data with an unknown format. "1.2.276.0.75.2.1.100.1.6.4.3" for surgery plans be performed on an excimer laser model "MEL 90" by "Carl Zeiss Meditec" ⇨ General Parameters Sequence (2D01,xx19) > Refractive Surgery Type Code Sequence (2D01,xx1A) has one of the following item values (P1-A3835, SRT, n/a, PRK) (P0-0526F, SRT, n/a, LASIK) (LVCLBV, 99CZM, 20200130, Refractive surgery type Laser Blended Vision) "1.2.276.0.75.2.1.110.1.6.1.0" for surgery plans be performed on a femto-second laser model "VisuMax 600/800" by "Carl Zeiss Meditec" ⇨ General Parameters Sequence (2D01,xx19) > Refractive Surgery Type Code Sequence	ALWAYS	AUTO

			(2D01,xx1A) has one of the following item values (111681, DCM, n/a, SMILE) (LVCFLAP, 99CZM, 20200130, Refractive surgery type FLAP) (LVCICR, 99CZM, 20200130, Refractive surgery type ICR) (KERATOPLASTY, 99CZM, 20200130, Refractive surgery type Keratoplasty) (LVCCIRCLE, 99CZM, 20200130, Refractive surgery type CIRCLE)		
Referenced Instance Sequence	(0008,114A)	SQ	Other Instances significantly related to this Instance. One or more Items are permitted in this Sequence. Contains references to other refractive surgery planning instances related to this plan.	ANAP	AUTO
>Referenced SOP Class UID	(0008,1150)	UI	Uniquely identifies the referenced SOP Class.	ALWAYS	AUTO
>Referenced SOP Instance UID	(0008,1155)	UI	Uniquely identifies the referenced SOP Instance.	ALWAYS	AUTO
>Purpose of Reference Code Sequence	(0040,A170)	SQ	Describes the purpose for which the reference is made. Only a single Item shall be included in this sequence. See C.7.6.16.2.5.1.	ALWAYS	AUTO
>>Code Value	(0008,0100)	SH	For possible values see section 8.3 Coded Terminology And Templates - Table 8-17 Coded Values - Referenced Instance Purposes of Reference	ALWAYS	AUTO
>>Coding Scheme Designator	(0008,0102)	SH	For possible values see section 8.3 Coded Terminology And Templates - Table 8-17 Coded Values - Referenced Instance Purposes of Reference	ALWAYS	AUTO
>>Coding Scheme Version	(0008,0103)	SH	For possible values see section 8.3 Coded Terminology And Templates - Table 8-17 Coded Values - Referenced Instance Purposes of Reference	ANAP	AUTO
>>Code Meaning	(0008,0104)	LO	For possible values see section 8.3 Coded Terminology And Templates - Table 8-17 Coded Values - Referenced Instance Purposes of Reference	ALWAYS	AUTO

Table 8-7 Refractive Surgery Plan Raw Data IOD - Module "Sop Common"

Name	Tag	VR	Description	PoV	Source
SOP Class UID	(0008,0016)	UI	Uniquely identifies the SOP Class. See NEMA PS3.3 C.12.1.1.1 for further explanation. See also PS 3.4. Always "1.2.840.10008.5.1.4.1.1.66"	ALWAYS	AUTO
SOP Instance UID	(0008,0018)	UI	Uniquely identifies the SOP Instance. See NEMA PS3.3 C.12.1.1.1 for further explanation. See also PS 3.4. Refractive Workplace uses a constant prefix of "1.2.276.0.75.2.1.120.1.3." followed by a date/time stamp and machine specific identifier.	ALWAYS	AUTO
Specific Character Set	(0008,0005)	CS	Character Set that expands or replaces the Basic Graphic Set. Required if an expanded or replacement character set is used. See PS3.3 C.12.1.1.2 for Defined Terms. See 6 Support of Character Sets.	ALWAYS	AUTO

Instance Creation Date	(0008,0012)	DA	Date the SOP Instance was created.	ALWAYS	AUTO
Instance Creation Time	(0008,0013)	TM	Time the SOP Instance was created.	ALWAYS	AUTO

Table 8-8 Refractive Surgery Plan Raw Data IOD - Module "CZM Pre-surgical Eye Status"

Name	Tag	VR	Description	PoV	Source
Corneal Thickness Sequence	(2D01,xx01)	SQ	Corneal thickness value and source. Only a single Item is permitted in this Sequence.	ANAP	AUTO
>Corneal Thickness	(2D01,xx02)	FD	The thickness of the cornea, in millimeters.	ALWAYS	USER, SRR
>Source of Corneal Thickness Code Sequence	(2D01,xx03)	SQ	Source of the value of Corneal Thickness. Zero or one Item shall be included in this sequence.	ALWAYS	AUTO
>>Code Value	(2D01,xx04)	SH	For possible values see section 8.3 Coded Terminology and Templates - Table 8-15 Coded Values - Ophthalmic Measurement or Calculation Data Source	ALWAYS	AUTO
>>Coding Scheme Designator	(2D01,xx05)	SH	For possible values see section 8.3 Coded Terminology and Templates - Table 8-15 Coded Values - Ophthalmic Measurement or Calculation Data Source	ALWAYS	AUTO
>>Code Meaning	(2D01,xx06)	LO	For possible values see section 8.3 Coded Terminology and Templates - Table 8-15 Coded Values - Ophthalmic Measurement or Calculation Data Source	ALWAYS	AUTO
>Referenced SOP Sequence	(2D01,xx07)	SQ	SOP Instance that is relevant to the interpretation of this SOP Instance. Only a single Item shall be included in this Sequence. See Section C.8.25.16.1.1 for further explanation. Required if Source of Corneal Thickness Code Sequence indicates another SOP instance as source of data.	ANAP	AUTO
>>Referenced SOP Class UID	(2D01,xx08)	UI	Uniquely identifies the referenced SOP Class.	ALWAYS	AUTO
>>Referenced SOP Instance UID	(2D01,xx09)	UI	Uniquely identifies the referenced SOP Instance.	ALWAYS	AUTO
Keratometry Sequence	(2D01,xx0A)	SQ	Keratometry values and source. Only a single Item is permitted in this Sequence.	ANAP	AUTO
>Steep Keratometric Axis Sequence	(2D01,xx0B)	SQ	A sequence that specifies the steepest meridian as defined by the greatest power of curvature and shortest radius of curvature. Only a single item shall be included in this sequence.	ALWAYS	AUTO
>>Radius of Curvature	(2D01,xx0C)	FD	The radius of curvature of the principal meridians of the cornea, measured in millimeters.	ALWAYS	USER, SRR
>>Keratometric Power	(2D01,xx0D)	FD	The refractive power of the cornea at the principal meridians, measured in diopters.	ALWAYS	USER, SRR

>>Keratometric Axis	(2D01,xx0E)	FD	The meridian where the keratometric radius of curvature or power is measured, in degrees.	ALWAYS	USER, SRR
>Flat Keratometric Axis Sequence	(2D01,xx0F)	SQ	A sequence that specifies the flattest meridian as defined by the least power of curvature and longest radius of curvature. Only a single item shall be included in this sequence.	ALWAYS	AUTO
>>Radius of Curvature	(2D01,xx0C)	FD	The radius of curvature of the principal meridians of the cornea, measured in millimeters.	ALWAYS	USER, SRR
>>Keratometric Power	(2D01,xx0D)	FD	The refractive power of the cornea at the principal meridians, measured in diopters.	ALWAYS	USER, SRR
>>Keratometric Axis	(2D01,xx0E)	FD	The meridian where the keratometric radius of curvature or power is measured, in degrees.	ALWAYS	USER, SRR
>Source of Keratometry Code Sequence	(2D01,xx10)	SQ	Source of the values of Steep and Flat Keraometry. Zero or one Item shall be included in this sequence.	ALWAYS	AUTO
>>Code Value	(2D01,xx04)	SH	For possible values see section 8.3 Coded Terminology and Templates - Table 8-15 Coded Values - Ophthalmic Measurement or Calculation Data Source	ALWAYS	AUTO
>>Coding Scheme Designator	(2D01,xx05)	SH	For possible values see section 8.3 Coded Terminology and Templates - Table 8-15 Coded Values - Ophthalmic Measurement or Calculation Data Source	ALWAYS	AUTO
>>Code Meaning	(2D01,xx06)	LO	For possible values see section 8.3 Coded Terminology and Templates - Table 8-15 Coded Values - Ophthalmic Measurement or Calculation Data Source	ALWAYS	AUTO
>Referenced SOP Sequence	(2D01,xx07)	SQ	SOP Instance that is relevant to the interpretation of this SOP Instance. Only a single Item shall be included in this Sequence. See Section C.8.25.16.1.1 for further explanation. Required if Source of Corneal Thickness Code Sequence indicates another SOP instance as source of data.	ANAP	AUTO
>>Referenced SOP Class UID	(2D01,xx08)	UI	Uniquely identifies the referenced SOP Class.	ALWAYS	AUTO
>>Referenced SOP Instance UID	(2D01,xx09)	UI	Uniquely identifies the referenced SOP Instance.	ALWAYS	AUTO
>Keratometer Index	(2D01,xx11)	FL	The translation factor specific to each keratometer that derives a number for power from the measured radius of curvature of the cornea.	ALWAYS	CONFIG
>Refractive Index of Cornea	(2D01,xx12)	FL	The refractive translation factor specific for the cornea.	ANAP	AUTO
Refractive State Sequence	(2D01,xx13)	SQ	Refractive state of the eye, values and source. One or more Items shall be included in this Sequence.	ANAP	AUTO
>Sphere Power	(2D01,xx14)	FD	Sphere value, in diopters.	ALWAYS	USER, SRR
>Cylinder Power	(2D01,xx15)	FD	Cylinder value, in diopters. Required if astigmatic correction or astigmatism is present.	ALWAYS	USER, SRR

>Cylinder Axis	(2D01,xx16)	FD	Axis value, in degrees. Required if astigmatic correction or astigmatism is present.	ALWAYS	USER, SRR
>Vertex Distance	(2D01,xx17)	FD	The vertex distance as distance between the back surface of a corrective lens, i.e. glasses (spectacles) or contact lenses, and the front of the cornea, in millimeters.	ALWAYS	USER, SRR
>Spherical Aberration	(2D01,xx42)	FD	Fourth-order spherical aberration coefficient of the eye, given as Z(4,0) in the Zernike polynomial expansion in Malacara notation, in microns.	ANAP	USER
>Source of Refractive State Code Sequence	(2D01,xx18)	SQ	Source of values of Refractive State. Only a single Item shall be included in this sequence.	ALWAYS	AUTO
>>Code Value	(2D01,xx04)	SH	For possible values see section 8.3 Coded Terminology and Templates - Table 8-15 Coded Values - Ophthalmic Measurement or Calculation Data Source	ALWAYS	AUTO
>>Coding Scheme Designator	(2D01,xx05)	SH	For possible values see section 8.3 Coded Terminology and Templates - Table 8-15 Coded Values - Ophthalmic Measurement or Calculation Data Source	ALWAYS	AUTO
>>Code Meaning	(2D01,xx06)	LO	For possible values see section 8.3 Coded Terminology and Templates - Table 8-15 Coded Values - Ophthalmic Measurement or Calculation Data Source	ALWAYS	AUTO
>Referenced SOP Sequence	(2D01,xx07)	SQ	SOP Instance that is relevant to the interpretation of this SOP Instance. Only a single Item shall be included in this Sequence. See Section C.8.25.16.1.1 for further explanation. Required if Source of Corneal Thickness Code Sequence indicates another SOP instance as source of data.	ANAP	AUTO
>>Referenced SOP Class UID	(2D01,xx08)	UI	Uniquely identifies the referenced SOP Class.	ALWAYS	AUTO
>>Referenced SOP Instance UID	(2D01,xx09)	UI	Uniquely identifies the referenced SOP Instance.	ALWAYS	AUTO
Corneal Epithelium Thickness Sequence	(2D01,xx80)	SQ	Corneal epithelium thickness values and source. One or more Items shall be included in this Sequence.	ANAP	AUTO
>Corneal Region Code Sequence	(2D01,xx81)	SQ	Region of the cornea where value is measured. Only a single Item shall be included in this sequence.	ALWAYS	AUTO
>>Code Value	(2D01,xx04)	SH	For possible values see section 8.3 Coded Terminology and Templates - Table 8-18 Coded Values – Corneal Region	ALWAYS	AUTO
>>Coding Scheme Designator	(2D01,xx05)	SH	For possible values see section 8.3 Coded Terminology and Templates - Table 8-18 Coded Values – Corneal Region	ALWAYS	AUTO
>>Code Meaning	(2D01,xx06)	LO	For possible values see section 8.3 Coded Terminology and Templates - Table 8-18 Coded Values – Corneal Region	ALWAYS	AUTO

>Corneal Epithelium Thickness	(2D01,xx82)	FD	Thickness of the corneal epithelium, measured in millimeters	ALWAYS	AUTO
>Source of Corneal Epithelium Thickness Code Sequence	(2D01,xx83)	SQ	Source of the value of Corneal Epithelium Thickness. Zero or one Item shall be included in this sequence.	ALWAYS	AUTO
>>Code Value	(2D01,xx04)	SH	For possible values see section 8.3 Coded Terminology and Templates - Table 8-15 Coded Values - Ophthalmic Measurement or Calculation Data Source	ALWAYS	AUTO
>>Coding Scheme Designator	(2D01,xx05)	SH	For possible values see section 8.3 Coded Terminology and Templates - Table 8-15 Coded Values - Ophthalmic Measurement or Calculation Data Source	ALWAYS	AUTO
>>Code Meaning	(2D01,xx06)	LO	For possible values see section 8.3 Coded Terminology and Templates - Table 8-15 Coded Values - Ophthalmic Measurement or Calculation Data Source	ALWAYS	AUTO
>Referenced SOP Sequence	(2D01,xx07)	SQ	SOP Instance that is relevant to the interpretation of this SOP Instance. Only a single Item shall be included in this Sequence. See Section C.8.25.16.1.1 for further explanation. Required if Source of Corneal Thickness Code Sequence indicates another SOP instance as source of data.	ANAP	AUTO
>>Referenced SOP Class UID	(2D01,xx08)	UI	Uniquely identifies the referenced SOP Class.	ALWAYS	AUTO
>>Referenced SOP Instance UID	(2D01,xx09)	UI	Uniquely identifies the referenced SOP Instance.	ALWAYS	AUTO

Table 8-9 Refractive Surgery Plan Raw Data IOD - Module "CZM Refractive Surgery Plan"

Name	Tag	VR	Description	PoV	Source
General Parameters Sequence	(2D01,xx19)	SQ	General planning parameters relevant to any type of refractive surgery. Only a single Item is permitted in this Sequence.	ALWAYS	AUTO
>Refractive Surgery Type Code Sequence	(2D01,xx1A)	SQ	Type of the refractive surgery. Only one single Item is permitted in this Sequence.	ALWAYS	USER
>>Code Value	(2D01,xx04)	SH	For possible values see section 8.3 Coded Terminology and Templates - Table 8-14 Coded Values - Refractive Surgery Types	ALWAYS	AUTO
>>Coding Scheme Designator	(2D01,xx05)	SH	For possible values see section 8.3 Coded Terminology and Templates - Table 8-14 Coded Values - Refractive Surgery Types	ALWAYS	AUTO
>>Code Meaning	(2D01,xx06)	LO	For possible values see section 8.3 Coded Terminology and Templates - Table 8-14 Coded Values - Refractive Surgery Types	ALWAYS	AUTO
>Target Refraction Sequence	(2D01,xx1B)	SQ	The desired postoperative refractive error. Only a single Item is permitted in this Sequence.	ANAP	AUTO

>>Sphere Power	(2D01,xx14)	FD	Sphere value, in diopters.	ALWAYS	AUTO, USER
>>Cylinder Power	(2D01,xx15)	FD	Cylinder value, in diopters.	ALWAYS	AUTO, USER
>Refractive Correction Sequence	(2D01,xx1C)	SQ	The intended refractive correction. Only a single Item is permitted in this Sequence.	ANAP	AUTO
>>Sphere Power	(2D01,xx14)	FD	Sphere value, in diopters.	ALWAYS	AUTO
>>Cylinder Power	(2D01,xx15)	FD	Cylinder value, in diopters.	ALWAYS	AUTO
>Refractive Correction Laser Set Sequence	(2D01,xx1D)	SQ	The actual laser set refractive correction to be used for surgery. This is either equal to the intended correction or values calculated by a user nomogram. Only a single Item is permitted in this Sequence.	ANAP	AUTO
>>Sphere Power	(2D01,xx14)	FD	Sphere value, in diopters.	ALWAYS	AUTO
>>Cylinder Power	(2D01,xx15)	FD	Cylinder value, in diopters.	ALWAYS	AUTO
>Optical Zone	(2D01,xx1E)	FD	Diameter of the optical zone, in millimeters	ANAP	AUTO, USER
>Editors Name	(2D01,xx1F)	PN	Name(s) of the editor(s) involved in creating the refractive surgery plan.	ALWAYS	AUTO
>Scheduled Surgery DateTime	(2D01,xx3D)	DT	The scheduled surgery date and time.	ANAP	USER
>Refractive Surgery Plan Comments	(2D01,xx20)	LT	Comments on the refractive surgery plan.	ANAP	USER
>Refractive Module Info Sequence	(2D01,xx21)	SQ	Information about the refractive software modules applied on refractive surgery plan. One or more Items shall be included in this Sequence.	ANAP	AUTO
>>Module Type Code Sequence	(2D01,xx22)	SQ	The type of the module. Only one single Item is permitted in this Sequence.	ALWAYS	AUTO
>>>Code Value	(2D01,xx04)	SH	For possible values see section 8.3 Coded Terminology and Templates - Table 8-19 Coded Values – Refractive Module Type	ALWAYS	AUTO
>>>Coding Scheme Designator	(2D01,xx05)	SH	For possible values see section 8.3 Coded Terminology and Templates - Table 8-19 Coded Values – Refractive Module Type	ALWAYS	AUTO
>>>Code Meaning	(2D01,xx06)	LO	For possible values see section 8.3 Coded Terminology and Templates - Table 8-19 Coded Values – Refractive Module Type	ALWAYS	AUTO
>>Module Name	(2D01,xx23)	LO	A human readable name of the software module.	ALWAYS	AUTO
>>Module ID	(2D01,xx24)	LO	The identification of the software module.	ALWAYS	AUTO
>>Module Version	(2D01,xx25)	LO	The version of the software module.	ALWAYS	AUTO

>Residual Stroma Thickness	(2D01,xx26)	FD	The expected residual thickness of the stroma after surgery will be performed on the eye, in millimeters.	ANAP	AUTO
General Femtosecond Parameters Sequence	(2D01,xx27)	SQ	General planning parameters relevant to femtosecond laser based refractive surgery. Only a single Item is permitted in this Sequence. Required if Refractive Surgery Type Code Sequence contains an item that refers to a femtosecond laser based surgery type.	ANAP	AUTO
>Centration Target Position	(2D01,xx28)	FD	The target position of the centration relatively to pupil center specified by a numeric pair - x-position (delimiter) y-position, in millimeters.	ALWAYS	USER
>Selected Treatment Pack Code Sequence	(2D01,xx29)	SQ	The treatment pack selected for the refractive surgery. Only one single Item is permitted in this Sequence.	ALWAYS	AUTO
>>Treatment Pack Size	(2D01,xx2A)	CS	The treatment pack's size specification. Enumerated values: S M L	ALWAYS	USER
>>Treatment Pack Label	(2D01,xx2B)	LO	A descriptive or identifying label of the treatment pack.	ANAP	USER
General Excimer Parameters Sequence	(2D01,xx2C)	SQ	General planning parameters relevant to excimer laser based refractive surgery. Only a single Item is permitted in this Sequence. Required if Refractive Surgery Type Code Sequence contains an item that refers to an excimer laser based surgery type.	ANAP	AUTO
>Ablation Details Sequence	(2D01,xx2D)	SQ	Detailed parameters for the corneal tissue ablation performed on the patient's eye. Only one single Item is permitted in this Sequence.	ANAP	AUTO
>>Ablation Depth	(2D01,xx2E)	FD	Maximum thickness of corneal tissue ablated, in millimeters.	ALWAYS	AUTO
>>Distance	(2D01,xx2F)	FD	Radial coordinate of the location of maximum ablation in a polar coordinate system where the center of the optical zone represents the pole, in millimeters. Required if location of maximum ablation is neither at the center of the optical zone (myopic correction) nor at the edge of the optical zone (hyperopic correction).	ANAP	AUTO
>>Angle	(2D01,xx30)	FD	Angular coordinate of the location of maximum ablation in a polar coordinate system where the center of the optical zone represents the pole, in degrees. Required if location of maximum ablation is neither at the center of the optical zone (myopic correction) nor at the edge of the optical zone (hyperopic correction).	ANAP	AUTO
>Laser Frequency	(2D01,xx31)	FD	The pulse repetition frequency of the laser system. This frequency corresponds to the number of shots per second emitted by the laser system, in Hertz	ALWAYS	AUTO, USER
FLAP Parameters Sequence	(2D01,xx32)	SQ	Specific planning parameters relevant to a refractive surgery of type FLAP. Only a single Item is permitted in this Sequence. Required if Refractive Surgery Type Code Sequence contains an item with the value (LVCFLAP, 99CZM, 'Refractive surgery type FLAP').	ANAP	AUTO
>Flap Cut Parameters Sequence	(2D01,xx33)	SQ	Parameters defining a single flap cut of a refractive surgery. Only one single Item is permitted in this Sequence.	ALWAYS	AUTO

>>Cut Order Index	(2D01,xx34)	US	The unique zero-based position of this laser cut in the sequence of all laser cuts. All cuts are performed one after each other in a specific chronological order. The value of this attribute shall specify the position within this order. The attribute shall have no value if the cut will not be performed.	VNAP	AUTO
>>Flap Diameter	(2D01,xx35)	FD	The flap diameter, in millimeters.	ALWAYS	AUTO, USER
>>Flap Thickness	(2D01,xx36)	FD	The flap thickness, in millimeters.	ALWAYS	AUTO, USER
>Border Cut Parameters Sequence	(2D01,xx37)	SQ	Parameters defining a single flap border cut of a refractive surgery. Only one single Item is permitted in this Sequence.	ALWAYS	AUTO
>>Cut Order Index	(2D01,xx34)	US	The unique zero-based position of this laser cut in the sequence of all laser cuts. All cuts are performed one after each other in a specific chronological order. The value of this attribute shall specify the position within this order. The attribute shall have no value if the cut will not be performed.	VNAP	AUTO
>>Flap Side Cut Angle	(2D01,xx38)	FD	The width of the flap border side cut as angle, in degrees.	ALWAYS	AUTO, USER
>Hinge Sector Parameters Sequence	(2D01,xx39)	SQ	Parameters defining a single hinge sector of a refractive surgery. Only one single Item is permitted in this Sequence.	ALWAYS	AUTO
>>Hinge Position	(2D01,xx3A)	FD	The position of the hinge as angle, in degrees.	ALWAYS	AUTO, USER
>>Hinge Angle	(2D01,xx3B)	FD	The width of the hinge as angle, in degrees.	ALWAYS	AUTO, USER
>>Hinge Width	(2D01,xx3C)	FD	The width of the hinge, in millimeters.	ALWAYS	AUTO, USER
LBV Parameters Sequence	(2D01,xx3E)	SQ	Specific planning parameters relevant to a refractive surgery of type Laser Blended Vision (LBV). Only a single Item is permitted in this Sequence. Required if Refractive Surgery Type Code Sequence contains an item with the value (LVCLBV, 99CZM, 'Refractive surgery type Laser Blended Vision').	ANAP	AUTO
>Patient's Functional Age	(2D01,xx3F)	AS	The functional age of the patient according to the eye's accommodation ability.	ANAP	USER
>Dominant Eye	(2D01,xx40)	CS	Indicates whether this refractive surgery planning is for the patient's dominant eye or not. Enumerated Values: YES NO	ANAP	USER
>Monovision Acceptance	(2D01,xx41)	CS	Indicates whether the mono vision acceptance (+1.5 diopters test tolerance) is confirmed by the patient or not. Enumerated Values: YES NO	ANAP	USER
SMILE Parameters Sequence	(2D01,xx43)	SQ	Specific planning parameters relevant to a refractive surgery of type SMILE. Only a single Item is permitted in this Sequence. Required if Refractive Surgery Type Code Sequence contains an item with the value (111681, DCM, 'SMILE').	ANAP	AUTO
>Lenticule Edge Thickness	(2D01,xx44)	FD	The thickness of the lenticule at the edge that ensures that the edge has a finite height, in millimeters.	ALWAYS	AUTO, USER

>Lenticule Central Thickness	(2D01,xx45)	FD	Central thickness of the lenticule, in millimeters. Note: In the myopic case it is calculated from the specified correction and the edge thickness. In the hyeropic case this is the given by the user input	ALWAYS	AUTO, USER
>Lenticule Central Thickness User Entry	(2D01,xx46)	CS	Indicates whether the value for Lenticule Central Thickness originates from a user input or not. Enumerated Values: YES NO	ANAP	AUTO
>Lenticule Max Thickness	(2D01,xx47)	FD	Maximum thickness of the lenticule, in millimeters. Note: For the myopic case this is equal to the central thickness. In the hyperopic case the maximum thickness of the lenticule is decentral.	ALWAYS	USER, AUTO
>Lenticule Max Thickness radius	(2D01,xx48)	FD	Indicates the location where the lenticule has its max thickness, in millimeters.	ALWAYS	AUTO
>Cap Cut Parameters Sequence	(2D01,xx49)	SQ	Parameters defining a single cap cut of a refractive surgery. Only one single Item is permitted in this Sequence.	ALWAYS	AUTO
>>Cut Order Index	(2D01,xx34)	US	The unique zero-based position of this laser cut in the sequence of all laser cuts. All cuts are performed one after each other in a specific chronological order. The value of this attribute shall specify the position within this order. The attribute shall have no value if the cut will not be performed.	VNAP	AUTO
>>Cap Diameter	(2D01,xx4A)	FD	The diameter of the upper cut that is concentric to the surface of the cornea, in millimeters.	ALWAYS	AUTO, USER
>>Cap Thickness	(2D01,xx4B)	FD	The depth of the cap cut in the cornea, in millimeters.	ALWAYS	AUTO, USER
>Cap Side Cut Parameters Sequence	(2D01,xx4C)	SQ	Parameters defining a single cap side cut of a refractive surgery. Only one single Item is permitted in this Sequence.	ALWAYS	AUTO
>>Cut Order Index	(2D01,xx34)	US	The unique zero-based position of this laser cut in the sequence of all laser cuts. All cuts are performed one after each other in a specific chronological order. The value of this attribute shall specify the position within this order. The attribute shall have no value if the cut will not be performed.	VNAP	AUTO
>>Cap Side Cut Angle	(2D01,xx4D)	FD	The angle between cap side cut and cornea surface, in degrees. This is the cut angle of the incisions.	ALWAYS	AUTO, USER
>Incision Parameters Sequence	(2D01,xx4E)	SQ	Parameters defining a single incision cut of a refractive surgery. One or more Items shall be included in this Sequence.	ALWAYS	AUTO
>>Incision Position	(2D01,xx4F)	FD	The position of the incision as angle, in degrees. Note: A value of zero means postive x direction (on the right) independent from the eye selection.	ALWAYS	AUTO, USER
>>Incision Width	(2D01,xx50)	FD	The width of the incision as angle, in degrees. Note: The incision extends from Incision Position - 0.5 * Incision Width to Incision Position + 0.5 * Incision Width	ALWAYS	AUTO, USER
>Lenticule Cut Parameters Sequence	(2D01,xx51)	SQ	Parameters defining a single lenticule cut of a refractive surgery. Only one single Item is permitted in this Sequence.	ALWAYS	AUTO
>>Cut Order Index	(2D01,xx34)	US	The unique zero-based position of this laser cut in the sequence of all laser cuts. All cuts are performed one after	VNAP	AUTO

			each other in a specific chronological order. The value of this attribute shall specify the position within this order. The attribute shall have no value if the cut will not be performed.		
>>Lenticule Optical Zone	(2D01,xx52)	FD	The diameter of the optical relevant part of the lower cut, in millimeters.	ALWAYS	AUTO, USER
>>Lenticule Transition Zone	(2D01,xx53)	FD	Size of the transition zone that is present in case of myopic astigmatism and hyperopic corrections, in millimeters.	ANAP	USER
>Lenticule Side Cut Parameters Sequence	(2D01,xx54)	SQ	Parameters defining a single lenticule side cut of a refractive surgery. Only one single Item is permitted in this Sequence.	ALWAYS	AUTO
>>Cut Order Index	(2D01,xx34)	US	The unique zero-based position of this laser cut in the sequence of all laser cuts. All cuts are performed one after each other in a specific chronological order. The value of this attribute shall specify the position within this order. The attribute shall have no value if the cut will not be performed.	VNAP	AUTO
>>Lenticule Side Cut Angle	(2D01,xx55)	FD	The angle between lenticule side cut and cornea surface, in degrees.	ALWAYS	AUTO, USER
ICR Parameters Sequence	(2D01,xx56)	SQ	Specific planning parameters relevant to a refractive surgery of type ICR (intrastromal corneal ring implanting). Only a single Item is permitted in this Sequence. Required if Refractive Surgery Type Code Sequence contains an item with the value (LVCICR, 99CZM, 'Refractive surgery type ICR').	ANAP	AUTO
>ICR Preset Identification Sequence	(2D01,xx57)	SQ	Attributes identifying the parameters preset selected for the ICR surgery. Only one single Item is permitted in this Sequence.	ANAP	AUTO, USER
>>ICR Preset ID	(2D01,xx58)	LO	The unique ID of the selected ICR preset.	ALWAYS	AUTO
>>ICR Preset Name	(2D01,xx59)	LO	The name of the selected ICR preset.	ALWAYS	AUTO
>ICR Access Cut Parameters Sequence	(2D01,xx5A)	SQ	Parameters defining the a single access cut of a refractive surgery of type ICR. Only one single Item is permitted in this Sequence.	ALWAYS	AUTO
>>ICR Cut 1 enabled	(2D01,xx5B)	CS	Indicates if the first access cut shall be performed or not. Enumerated Values: YES NO	ALWAYS	AUTO, USER
>>ICR Cut 1 position	(2D01,xx5C)	FD	Calculated angular position of the first access cut, in degrees.	ANAP	AUTO, USER
>>ICR Cut 2 enabled	(2D01,xx5D)	CS	Indicates if the second access cut shall be performed or not. Enumerated Values: YES NO	ALWAYS	AUTO, USER
>>ICR Cut 2 position	(2D01,xx5E)	FD	Calculated angular position of the second access cut, in degrees.	ANAP	AUTO, USER
>>ICR Lower Width	(2D01,xx5F)	FD	Width of the bottom of the access cut in radial direction, in millimeters.	ALWAYS	AUTO, USER
>>ICR Upper Width	(2D01,xx60)	FD	Width of the top of the access cut in radial direction, in millimeters.	ALWAYS	AUTO, USER
>ICR Tunnel Cut Parameters Sequence	(2D01,xx61)	SQ	Parameters defining the a single tunnel cut of a refractive surgery of type ICR. Only one single Item is permitted in this Sequence.	ALWAYS	AUTO

>>ICR Inner Diameter	(2D01,xx62)	FD	Inner diameter of the ICR tunnel cut, in millimeters.	ALWAYS	AUTO, USER
>>ICR Outer Diameter	(2D01,xx63)	FD	Outer diameter of the ICR tunnel cut, in millimeters.	ALWAYS	AUTO, USER
>>ICR Inner Depth	(2D01,xx64)	FD	Depth of the ICR tunnel cut at the inner diameter, in millimeters.	ALWAYS	AUTO, USER
>>ICR Outer Depth	(2D01,xx65)	FD	Depth of the ICR tunnel cut at the outer diameter, in millimeters.	ALWAYS	AUTO, USER
>>ICR Position	(2D01,xx66)	FD	The position of the center axis of the ICR tunnel segment as angle, in degrees.	ALWAYS	AUTO, USER
>>ICR Angle	(2D01,xx67)	FD	The width of the center axis of the ICR tunnel segment as angle, in degrees.	ALWAYS	AUTO, USER
Keratoplasty Parameters Sequence	(2D01,xx68)	SQ	Specific planning parameters relevant to a refractive surgery of type Keratoplasty. Only a single Item is permitted in this Sequence. Required if Refractive Surgery Type Code Sequence contains an item with the value (KERATOPLASTY, 99CZM, 'Refractive surgery type Keratoplasty').	ANAP	AUTO
>Keratoplasty Type Code Sequence	(2D01,xx69)	SQ	The type of keratoplasty. Only one single Item is permitted in this Sequence.	ALWAYS	USER
>>Code Value	(2D01,xx04)	SH	For possible values see section 8.3 Coded Terminology and Templates - Table 8-20 Coded Values – Keratoplasty Type	ALWAYS	AUTO
>>Coding Scheme Designator	(2D01,xx05)	SH	For possible values see section 8.3 Coded Terminology and Templates - Table 8-20 Coded Values – Keratoplasty Type	ALWAYS	AUTO
>>Code Meaning	(2D01,xx06)	LO	For possible values see section 8.3 Coded Terminology and Templates - Table 8-20 Coded Values – Keratoplasty Type	ALWAYS	AUTO
>Donor ID	(2D01,xx6A)	LO	Identification of the donor of the transplanted cornea.	ANAP	AUTO, USER
>Graft Diameter	(2D01,xx6B)	FD	Diameter of the graft at the bottom circle of the side cut, in millimeters.	ALWAYS	AUTO, USER
>Keratoplasty Graft Cut Parameters Sequence	(2D01,xx6C)	SQ	Parameters defining a single lamellar graft cut of a refractive surgery of type Keratoplasty. Only one single Item is permitted in this Sequence. Required if Keratoplasty Type Code Value contains an item with the Code Value LAMELLAR.	ANAP	AUTO
>>Graft Thickness	(2D01,xx6D)	FD	Thickness of the graft relatively to the cornea surface, in millimeters.	ALWAYS	AUTO, USER
>Keratoplasty Side Cut Parameters Sequence	(2D01,xx6E)	SQ	Parameters defining a single graft side cut of a refractive surgery of type Keratoplasty. Only one single Item is permitted in this Sequence.	ALWAYS	AUTO
>>Graft Side Cut Angle	(2D01,xx6F)	FD	The angle between graft side cut and cornea surface, in degrees.	ALWAYS	AUTO, USER
Circle Parameters sequence	(2D01,xx70)	SQ	Specific planning parameters relevant to a refractive surgery of type CIRCLE. Only a single Item is permitted in this Sequence.	ANAP	AUTO

			Required if Refractive Surgery Type Code Sequence contains an item with the value (LVCCIRCLE, 99CZM, 'Refractive surgery type CIRCLE').		
>Circle Mode Code Sequence	(2D01,xx71)	SQ	Type of the circle refractive surgery. Only one single Item is permitted in this Sequence.	ALWAYS	AUTO, USER
>>Code Value	(2D01,xx04)	SH	For possible values see section 8.3 Coded Terminology and Templates - Table 8-21 Coded Values – Circle Mode	ALWAYS	AUTO
>>Coding Scheme Designator	(2D01,xx05)	SH	For possible values see section 8.3 Coded Terminology and Templates - Table 8-21 Coded Values – Circle Mode	ALWAYS	AUTO
>>Code Meaning	(2D01,xx06)	LO	For possible values see section 8.3 Coded Terminology and Templates - Table 8-21 Coded Values – Circle Mode	ALWAYS	AUTO
>Lamellar Ring Cut Parameters Sequence	(2D01,xx72)	SQ	Parameters defining a single lamellar ring cut of a refractive surgery of type CIRCLE. Only one single Item is permitted in this Sequence. Required if Circle Mode Code Sequence contains an item with Code Value other than SIDECUTONLY.	ANAP	AUTO
>>Lamellar Ring Outer Diameter	(2D01,xx73)	FD	Outer diameter of lamellar ring, in millimeters.	ALWAYS	AUTO, USER
>>Lamellar Ring Inner Diameter	(2D01,xx74)	FD	Inner diameter of lamellar ring, in millimeters.	ALWAYS	AUTO, USER
>>Lamellar Ring Depth	(2D01,xx75)	FD	Depth of lamellar ring, in millimeters.	ALWAYS	AUTO, USER
>>Circle Junction Upper Depth	(2D01,xx76)	FD	Depth of the upper junction, starting from the inner diameter of the lamellar cut upwards, in millimeters. Required if Circle Mode Code Sequence contains an item with Code Value UPJUNCTION or UPDOWNJUNCTION.	ANAP	AUTO, USER
>>Circle Junction Lower Depth	(2D01,xx77)	FD	Depth of the lower junction, starting from the inner diameter of the lamellar cut downwards, in millimeters. Required if Circle Mode Code Sequence contains an item with Code Value DOWNJUNCTION or UPDOWNJUNCTION.	ANAP	AUTO, USER
>CIRCLE Side Cut Parameters Sequence	(2D01,xx78)	SQ	Parameters defining a single side cut of a refractive surgery of type CIRCLE. Only one single Item is permitted in this Sequence.	ALWAYS	AUTO
>>CIRCLE Side Cut Angle	(2D01,xx79)	FD	The angle between circle side cut and cornea surface, in degrees.	ALWAYS	AUTO, USER
>Hinge Sector Parameters Sequence	(2D01,xx39)	SQ	Parameters defining a single hinge sector of a refractive surgery. Only one single Item is permitted in this Sequence.	ALWAYS	AUTO
>>Hinge Position	(2D01,xx3A)	FD	The position of the hinge as angle, in degrees.	ALWAYS	AUTO, USER
>>Hinge Angle	(2D01,xx3B)	FD	The width of the hinge as angle, in degrees.	ALWAYS	AUTO, USER
>>Hinge Width	(2D01,xx3C)	FD	The width of the hinge, in millimeters.	ALWAYS	AUTO, USER

8.1.2 Usage of Attributes from Received IOD's

The usage of attributes of a received Refractive Surgery Plan Raw Data SOP instance is described in chapter 8.1.3 Attribute Mapping.

8.1.3 Attribute Mapping

The following attributes received from a Patient Root Query response are mapped into an exported Refractive Surgery Plan Raw Data SOP instance.

Table 8-10 Patient Root Query Response Attribute Mapping

Patient Root Query Response		Exported SOP Instance		Editable
Patient's Name[1]	(0010,0010)	Patient's Name[1]	(0010,0010)	No
Patient ID	(0010,0020)	Patient ID	(0010,0020)	No
Issuer of Patient ID	(0010,0021)	Issuer of Patient ID	(0010,0021)	No
Patient's Birth Date	(0010,0030)	Patient's Birth Date	(0010,0030)	No
Patient's Sex	(0010,0040)	Patient's Sex	(0010,0040)	No
Other Patient IDs	(0010,1000)	Other Patient IDs	(0010,1000)	No
Patient Comments	(0010,4000)	Patient Comments	(0010,4000)	No

Note 1: The Refractive Workplace application does not support multicomponent group name representation and only use the Alphabetic representation group.

In case of a follow-up planning a new refractive surgery plan for a patient's eye is created based on the data received from a previous surgery planning for that eye.

In this case the following attributes are mapped from the received Refractive Surgery Plan Raw Data SOP Instance to the exported instance.

Table 8-11 Received SOP Instance Attribute Mapping

Received SOP Instance		Exported SOP Instance		Editable
Study Instance UID	(0020,000D)	Study Instance UID	(0020,000D)	No
Study Date	(0008,0020)	Study Date	(0008,0020)	No
Study Time	(0008,0030)	Study Time	(0008,0030)	No
Series Instance UID	(0020,000E)	Series Instance UID	(0020,000E)	No
Series Date	(0008,0021)	Series Date	(0008,0021)	No
Series Time	(0008,0031)	Series Time	(0008,0031)	No
Related Series Sequence	(0008,1250)	Related Series Sequence	(0008,1250)	No
>Study Instance UID	(0020,000D)	>Study Instance UID	(0020,000D)	No
>Series Instance UID	(0020,000E)	>Series Instance UID	(0020,000E)	No
>Purpose of Reference Code Sequence	(0040,A170)	>Purpose of Reference Code Sequence	(0040,A170)	No
>>Code Value	(0008,0100)	>>Code Value	(0008,0100)	No
>>Coding Scheme Designator	(0008,0102)	>>Coding Scheme Designator	(0008,0102)	No
>>Coding Scheme Version	(0008,0103)	>>Coding Scheme Version	(0008,0103)	No
>>Code Meaning	(0008,0104)	>>Code Meaning	(0008,0104)	No

SOP Instance UID	(0008,0018)	Referenced Instance Sequence>Referenced SOP Instance UID[1]	(0008,114A) >(0008,1155)	No
Instance Number	(0020,0013)	Instance Number[2]	(0020,0013)	No
Referenced Instance Sequence	(0008,114A)	Referenced Instance Sequence	(0008,114A)	No
>Referenced SOP Class UID	(0008,1150)	>Referenced SOP Class UID	(0008,1150)	No
>Referenced SOP Instance UID	(0008,1155)	>Referenced SOP Instance UID	(0008,1155)	No
>Purpose of Reference Code Sequence	(0040,A170)	>Purpose of Reference Code Sequence	(0040,A170)	No
>>Code Value	(0008,0100)	>>Code Value	(0008,0100)	No
>>Coding Scheme Designator	(0008,0102)	>>Coding Scheme Designator	(0008,0102)	No
>>Coding Scheme Version	(0008,0103)	>>Coding Scheme Version	(0008,0103)	No
>>Code Meaning	(0008,0104)	>>Code Meaning	(0008,0104)	No

Note 1: Reference to the Surgery Plan SOP Instance the new created instance is based on. The Refractive Workplace application uses the Purpose of Reference Code Value “REPLACEDPLAN” for this reference.

Note 2: The Instance Number of the originating Surgery Plan SOP Instance is incremented by 1 and copied to the new created instance.

8.1.4 Coerced/Modified Files

Those tags are listed in chapter 8.1.3 Attribute Mapping. Any other attributes get lost and are not available in the Refractive Workplace Application Software.

8.2 Data Dictionary of Private Attributes

The Private Attributes added to created SOP Instances are listed in the tables below. Refractive Workplace reserves blocks of private attributes in groups 2D01 and 2201.

Table 8-12 Private Dictionary Group (2D01,00xx) = “99CZM_REF_SURGERYPARAMETERS”

Occurs in: Refractive Surgery Plan Raw Data SOP Instance

Tag	Attribute Name	VR	VM
(2D01,00xx)	Private Creator	LO	1
(2d01,xx01)	corneal thickness sequence	SQ	1
(2d01,xx02)	corneal thickness	FD	1
(2d01,xx03)	source of corneal thickness code sequence	SQ	1
(2d01,xx04)	code value	SH	1
(2d01,xx05)	coding scheme designator	SH	1
(2d01,xx06)	code meaning	LO	1
(2d01,xx07)	referenced sop sequence	SQ	1
(2d01,xx08)	referenced sop class uid	UI	1
(2d01,xx09)	referenced sop instance uid	UI	1
(2d01,xx0a)	keratometry sequence	SQ	1
(2d01,xx0b)	steep keratometric axis sequence	SQ	1

(2d01,xx0c)	radius of curvature	FD	1
(2d01,xx0d)	keratometric power	FD	1
(2d01,xx0e)	keratometric axis	FD	1
(2d01,xx0f)	flat keratometric axis sequence	SQ	1
(2d01,xx10)	source of keratometry code sequence	SQ	1
(2d01,xx11)	keratometer index	FL	1
(2d01,xx12)	refractive index of cornea	FL	1
(2d01,xx13)	refractive state sequence	SQ	1
(2d01,xx14)	sphere power	FD	1
(2d01,xx15)	cylinder power	FD	1
(2d01,xx16)	cylinder axis	FD	1
(2d01,xx17)	vertex distance	FD	1
(2d01,xx18)	source of refractive state code sequence	SQ	1
(2d01,xx19)	general parameters sequence	SQ	1
(2d01,xx1a)	refractive surgery type code sequence	SQ	1
(2d01,xx1b)	target refraction sequence	SQ	1
(2d01,xx1c)	refractive correction sequence	SQ	1
(2d01,xx1d)	refractive correction laser set sequence	SQ	1
(2d01,xx1e)	optical zone	FD	1
(2d01,xx1f)	editors name	PN	1-n
(2d01,xx20)	refractive surgery plan comments	LT	1
(2d01,xx21)	refractive module info sequence	SQ	1
(2d01,xx22)	module type code sequence	SQ	1
(2d01,xx23)	module name	LO	1
(2d01,xx24)	module id	LO	1
(2d01,xx25)	module version	LO	1
(2d01,xx26)	residual stroma thickness	FD	1
(2d01,xx27)	general femtosecond parameters sequence	SQ	1
(2d01,xx28)	centration target position	FD	2
(2d01,xx29)	selected treatment pack code sequence	SQ	1
(2d01,xx2a)	treatment pack size	CS	1
(2d01,xx2b)	treatment pack label	LO	1
(2d01,xx2c)	general excimer parameters sequence	SQ	1
(2d01,xx2d)	ablation details sequence	SQ	1
(2d01,xx2e)	ablation depth	FD	1
(2d01,xx2f)	distance	FD	1

(2d01,xx30)	angle	FD	1
(2d01,xx31)	laser frequency	FD	1
(2d01,xx32)	flap parameters sequence	SQ	1
(2d01,xx33)	flap cut parameters sequence	SQ	1
(2d01,xx34)	cut order index	US	1
(2d01,xx35)	flap diameter	FD	1
(2d01,xx36)	flap thickness	FD	1
(2d01,xx37)	border cut parameters sequence	SQ	1
(2d01,xx38)	flap side cut angle	FD	1
(2d01,xx39)	hinge sector parameters sequence	SQ	1
(2d01,xx3a)	hinge position	FD	1
(2d01,xx3b)	hinge angle	FD	1
(2d01,xx3c)	hinge width	FD	1
(2d01,xx3d)	scheduled surgery datetime	DT	1
(2d01,xx3e)	lbv parameters sequence	SQ	1
(2d01,xx3f)	patients functional age	AS	1
(2d01,xx40)	dominant eye	CS	1
(2d01,xx41)	monovision acceptance	CS	1
(2d01,xx42)	spherical aberration	FD	1
(2d01,xx43)	smile parameters sequence	SQ	1
(2d01,xx44)	lenticule edge thickness	FD	1
(2d01,xx45)	lenticule central thickness	FD	1
(2d01,xx46)	lenticule central thickness user entry	FD	1
(2d01,xx47)	lenticule max thickness	FD	1
(2d01,xx48)	lenticule max thickness radius	FD	1
(2d01,xx49)	cap cut parameters sequence	SQ	1
(2d01,xx4a)	cap diameter	FD	1
(2d01,xx4b)	cap thickness	FD	1
(2d01,xx4c)	cap side cut parameters sequence	SQ	1
(2d01,xx4d)	cap side cut angle	FD	1
(2d01,xx4e)	incision parameters sequence	SQ	1
(2d01,xx4f)	incision position	FD	1
(2d01,xx50)	incision width	FD	1
(2d01,xx51)	lenticule cut parameters sequence	SQ	1
(2d01,xx52)	lenticule optical zone	FD	1
(2d01,xx53)	lenticule transition zone	FD	1

(2d01,xx54)	lenticule side cut parameters sequence	SQ	1
(2d01,xx55)	lenticule side cut angle	FD	1
(2d01,xx56)	icr parameters sequence	SQ	1
(2d01,xx57)	icr preset identification sequence	SQ	1
(2d01,xx58)	icr preset id	LO	1
(2d01,xx59)	icr preset name	LO	1
(2d01,xx5a)	icr access cut parameters sequence	SQ	1
(2d01,xx5b)	icr cut1 enabled	CS	1
(2d01,xx5c)	icr cut1 position	FD	1
(2d01,xx5d)	icr cut2 enabled	CS	1
(2d01,xx5e)	icr cut2 position	FD	1
(2d01,xx5f)	icr lower width	FD	1
(2d01,xx60)	icr upper width	FD	1
(2d01,xx61)	icr tunnel cut parameters sequence	SQ	1
(2d01,xx62)	icr inner diameter	FD	1
(2d01,xx63)	icr outer diameter	FD	1
(2d01,xx64)	icr inner depth	FD	1
(2d01,xx65)	icr outer depth	FD	1
(2d01,xx66)	icr position	FD	1
(2d01,xx67)	icr angle	FD	1
(2d01,xx68)	keratoplasty parameters sequence	SQ	1
(2d01,xx69)	keratoplasty type code sequence	SQ	1
(2d01,xx6a)	donor id	LO	1
(2d01,xx6b)	graft diameter	FD	1
(2d01,xx6c)	keratoplasty graft cut parameters sequence	SQ	1
(2d01,xx6d)	graft thickness	FD	1
(2d01,xx6e)	keratoplasty side cut parameters sequence	SQ	1
(2d01,xx6f)	graft side cut angle	FD	1
(2d01,xx70)	circle parameters sequence	SQ	1
(2d01,xx71)	circle mode code sequence	SQ	1
(2d01,xx72)	lamellar ring cut parameters sequence	SQ	1
(2d01,xx73)	lamellar ring outer diameter	FD	1
(2d01,xx74)	lamellar ring inner diameter	FD	1
(2d01,xx75)	lamellar ring depth	FD	1
(2d01,xx76)	circle junction upper depth	FD	1
(2d01,xx77)	circle junction lower depth	FD	1

(2d01,xx78)	circle side cut parameters sequence	SQ	1
(2d01,xx79)	circle side cut angle	FD	1
(2d01,xx80)	corneal epithelium thickness sequence	SQ	1
(2d01,xx81)	corneal region code sequence	SQ	1
(2d01,xx82)	corneal epithelium thickness	FD	1
(2d01,xx83)	source of corneal epithelium thickness code sequence	SQ	1

Table 8-13 Private Dictionary Group (2201,00xx) = "99CZM_NIM_INTERNAL_01"

Occurs in: Refractive Surgery Plan Raw Data SOP Instance

Tag	Attribute Name	VR	VM
(2201,00xx)	Private Creator	LO	1
(2201,xx00)	IOD Name Meta Info	LT	1
(2201,xx01)	CZM-XML Version	LT	1
(2201,xx02)	Private Module Names and Versions	LT	1

8.3 Coded Terminology and Templates

This chapter describes the coded terminology and templates used by the application entity. This includes especially the used codes and DICOM Content Mapping Resource context groups where the codes are taken from.

8.3.1 CID 4234. Refractive Surgery Types

The application software uses (0022,1040)/(1203,xx0B) Refractive Surgery Type Code Sequence to specify detailed information on the type of refractive surgery occurred to a patient's eye.

Occurs in: Refractive Surgery Plan Raw Data SOP Instance

Table 8-14 Coded Values - Refractive Surgery Types

Code Value	Coding Scheme Designator	Coding Scheme Version	Code Meaning / Comments
P1-A3102	SRT	n/a	RK
P1-A3835	SRT	n/a	PRK
P0-0526F	SRT	n/a	LASIK
P1-A3846	SRT	n/a	LASEK
111681	DCM	n/a	SMILE
LVCFLAP	99CZM	20200130	Refractive surgery type FLAP
LVCLBV	99CZM	20200130	Refractive surgery type Laser Blended Vision
LVCICR	99CZM	20200130	Refractive surgery type ICR
KERATOPLASTY	99CZM	20200130	Refractive surgery type Keratoplasty
LVCCIRCLE	99CZM	20200130	Refractive surgery type CIRCLE
LVCSHAPING	99CZM	20200130	Refractive surgery type SHAPING

8.3.2 CID 4240. Ophthalmic Measurement or Calculation Data Source

The application software uses

- (2D01,xx03) Source of Corneal Thickness Code Sequence
- (2D01,xx10) Source of Keratometry Code Sequence

- (2D01,xx18) Source of Refractive State Code Sequence

to specify detailed information on the source of the measured value.

Occurs in: Refractive Surgery Plan Raw Data SOP Instance

Table 8-15 Coded Values - Ophthalmic Measurement or Calculation Data Source

Code Value	Coding Scheme Designator	Coding Scheme Version	Code Meaning / Comments
111780	DCM	n/a	Measurement From This Device
113857	DCM	n/a	Manual Entry
111781	DCM	n/a	External Data Source
111782	DCM	n/a	Axial Measurements SOP Instance
111783	DCM	n/a	Refractive Measurements SOP Instance
111784	DCM	n/a	Autorefraction Measurements SOP Instance
111757	DCM	n/a	Keratometry Measurements SOP Instance

8.3.3 CID 7210. Related Series Purposes of Reference

The application software uses (0008,1250) Related Series Sequence to specify Series instances significantly related to this Series and therein (0040,A170) Purpose of Reference Code Sequence to describe the purpose for which the reference is made.

Occurs in: Refractive Surgery Plan Raw Data SOP Instance

Table 8-16 Coded Values - Related Series Purposes of Reference

Code Value	Coding Scheme Designator	Coding Scheme Version	Code Meaning / Comments
122400	DCM	n/a	Simultaneously Acquired
122401	DCM	n/a	Same Anatomy
122402	DCM	n/a	Same Indication
122403	DCM	n/a	For Attenuation Correction
121323	DCM	n/a	Source series for image processing operation
COMBINEDSERIES	99CZM	20200130	Related series of a combined plan

8.3.4 No CID. Referenced Instance Purposes of Reference

The application software uses (0008,114A) Referenced Instance Sequence to specify SOP instances significantly related to this Surgery Plan and therein (0040,A170) Purpose of Reference Code Sequence to describe the purpose for which the reference is made.

Occurs in: Refractive Surgery Plan Raw Data SOP Instance

Table 8-17 Coded Values - Referenced Instance Purposes of Reference

Code Value	Coding Scheme Designator	Coding Scheme Version	Code Meaning / Comments
REPLACEDPLAN	99CZM	20200130	Replaced plan
COMBINEDPLAN	99CZM	20200130	Related plan instance of a combined plan
DONORPLAN	99CZM	20200130	Surgery plan of the graft donor
RECIPIENTPLAN	99CZM	20200130	Surgery plan of the graft recipient
CYCLOREFIMG	99CZM	20200130	Reference image for cyclotorsion correction

8.3.5 No CID. Corneal Region

The application software uses (2D01,xx81) Corneal Region Code Sequence to specify a certain region of the cornea, e.g. as a location where a certain value is measured.

Occurs in: Refractive Surgery Plan Raw Data SOP Instance

Table 8-18 Coded Values – Corneal Region

Code Value	Coding Scheme Designator	Coding Scheme Version	Code Meaning / Comments
AVERAGE	99CZM	20201022	Average value over all regions
CENTRAL	99CZM	20201022	Central cornea

8.3.6 No CID. Refractive Module Type

The application software uses (2D01,xx21) Refractive Module Info Sequence to specify information about refractive software modules applied on refractive surgery plan and therein (2D01,xx22) Module Type Code Sequence to specify the type of the refractive software module.

Occurs in: Refractive Surgery Plan Raw Data SOP Instance

Table 8-19 Coded Values – Refractive Module Type

Code Value	Coding Scheme Designator	Coding Scheme Version	Code Meaning / Comments
EXCIMERPROFILE	99CZM	20200130	Excimer profile
RANGEGUARD	99CZM	20200130	Range guard
USERNOMOGRAM	99CZM	20200130	User nomogram

8.3.7 No CID. Keratoplasty Type

The application software uses (2D01,xx69) Keratoplasty Type Code Sequence to specify the type of the Keratoplasty to perform.

Occurs in: Refractive Surgery Plan Raw Data SOP Instance

Table 8-20 Coded Values – Keratoplasty Type

Code Value	Coding Scheme Designator	Coding Scheme Version	Code Meaning / Comments
LAMELLAR	99CZM	20200130	Lamellar keratoplasty
PENETRATING	99CZM	20200130	Penetrating keratoplasty

8.3.8 No CID. Circle Mode

The application software uses (2D01,xx71) Circle Mode Code Sequence to specify the type of the Circle surgery to perform.

Occurs in: Refractive Surgery Plan Raw Data SOP Instance

Table 8-21 Coded Values – Circle Mode

Code Value	Coding Scheme Designator	Coding Scheme Version	Code Meaning / Comments
SIDECUTONLY	99CZM	20200130	Only side cut is performed
NOJUNCTION	99CZM	20200130	Lamellar cut and side cut with no junction
UPJUNCTION	99CZM	20200130	Lamellar cut and side cut with junction cut upwards
DOWNJUNCTION	99CZM	20200130	Lamellar cut and side cut with junction cut downwards
UPDOWNJUNCTION	99CZM	20200130	Lamellar cut and side cut with junction upwards and downwards

8.4 Greyscale Image Consistency

Not applicable.

8.5 Standard Extended / Specialized/ Private SOP Classes

The following standard extensions are used in the IODs described in chapter 8.1.1 Created SOP Instance(s):

- Table 8-8 Refractive Surgery Plan Raw Data IOD - Module "CZM Pre-surgical Eye Status"
- Table 8-9 Refractive Surgery Plan Raw Data IOD - Module "CZM Refractive Surgery Plan"

8.6 Private Transfer Syntaxes

No Private Transfer Syntax is supported.

Carl Zeiss Meditec AG
Goeschwitzer Strasse 51-52
07745 Jena
Germany
www.zeiss.com/visumax
www.zeiss.com/mel90
www.zeiss.com/med
www.zeiss.com/dicom