SYNARC
WHERE SCIENCE MEETS SERVICE

XOMA Protocol XO52160

Quick Reference Guide
For MR Image Acquisition
Of The Hand

Philips 1.5T Scanners

HAND POSITIONING AND PATIENT SETUP

Patient Positioning in the Magnet and the Imaging Coil

There are two options for patient/hand positioning inside the scanner:
- Hand-over-Head (head-first-prone, arm-extended with palm-horizontal) or
- Hand-by-Side (arm parallel to the body/thigh with palm-vertical).

Hand-by-side position provides increased comfort and better patient tolerance as compared to hand-over-head position. However it requires extreme care in immobilizing the patient's hand relative to the body and the magnet bore. It also requires high-quality shimming to avoid problems associated with inhomogeneities of the field especially pronounced at the periphery of the magnet bore. The preferred imaging coil and the subject position for a particular imaging center will be decided during technologist training and confirmed by Synarc based on the review of the test dataset.

When entering the patient position into the exam setup page the true orientation of the patient in the magnet should be indicated. For a given patient the positioning of the target hand in the coil and magnet should be consistent at Baseline/Day 0 and follow-up visits.

Target Hand for Imaging

The laterality of the target hand will be the same during the course of the study. It is required that you document the laterality of the target hand on the Transmittal Form and in the Patient Registration (Patient History) section of your scanner. The Syn-M-RA™ and any needed foam pads should be used to position the hand and fingers and to hold the hand firmly but comfortably in place without touching the coil.
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How to Use the Positioner

- Prepare and connect the intravenous (I.V.) line to the arm which is contra-lateral to the target arm for imaging.

- Ensure the supplied imaging markers are affixed.

- Start by positioning the patient's target hand and wrist on the Syn-M-RA positioning device using tape, with the palm flat against the positioning surface. All fingers including the thumb should be together and straight.

- With the Syn-M-RA™ positioning device in place, secure the hand/wrist comfortably in the imaging coil. The forearm, wrist, and hand should be aligned.

- Presented below are the examples of the Right and the Left hand attached to the positioner. Note for a given patient you will only use one (target) hand for imaging.
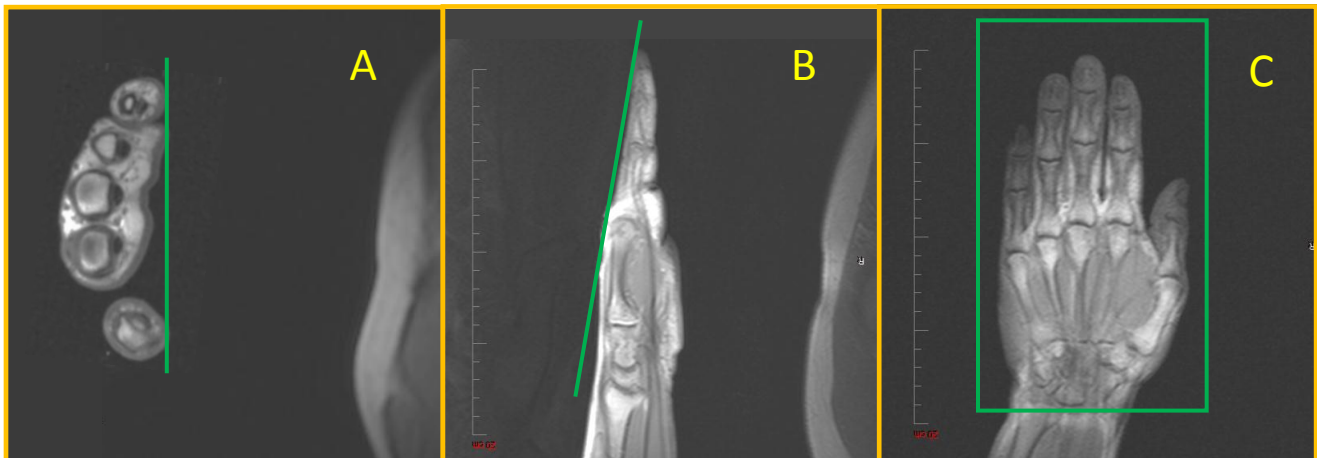
EXAM WORKFLOW - 1

Imaging Protocol

Pre Contrast
1. **3-Plane Localizers(s)**
2. **Coronal 3D T1-w Fat Sat**
3. **Coronal 2D STIR**
4. **Coronal 2D T1-w SE**
5. **Axial 2D T1-w SE**

Contrast Injection →

Post Contrast
6. **Coronal 2D T1-w SE**
7. **Axial 2D T1-w SE**

1. **3-Plane Localizer(s)** (1-2min). Acquire 3-plane localizers with large FOV. Make sure to have full anatomical coverage in all views.

2. **Coronal 3D T1-W FFE with Fat Sat** (5:00). Higher-order shimming (if applicable for your scanner) is required prior to acquiring this series. The shimming should be implemented exactly in the area where the slices are prescribed. Make sure to select **PB volume** (**Shim align no**) in the **Contrast** card of your scanner. Then proceed with the scan.
   - On a sagittal localizer choose the slice that contains Metacarpal bone 3 and angulate the image plane parallel to the dorsal surface of the proximal Phalanx 3 (B)
   - On an axial localizer the image plane should be aligned with the palm-positioner surface (A)
   - On a coronal localizer (C)
     - The proximal edge of the FOV should be at the level of the styloid process of the radius. Once the proximal edge is correctly prescribed, make sure the Distal Inter-Phalangeal (DIP) Joint 3 is also included. If the size of the hand is so large that the DIP joint 3 is outside the FOV, increase the FOV beyond the DIP joint 3 by 5mm. For small hands do not alter the default FOV size required by this protocol.
     - The FOV should be centered to include all MCP joints.
   - Skin-to-skin (dorsal-palmar) coverage is required for the slab. 40 slices should be used. For small hands the required number of slices should still be prescribed. For large hands, if necessary add more slices.

EXAM WORKFLOW – 2

3. **Coronal 2D STIR** (5:00). Slice and FOV prescription is as described above for sequence 2. Skin-to-skin (dorsal-palmar) coverage is required for the stack. 30 slices should be used. For small hands the required number of slices should still be prescribed. For large hands, if necessary add more slices. Use proximal saturation band to minimize flow artifacts.

4. **Coronal 2D T1-W SE** (3:30). Slice and FOV prescription is as described above for sequences 2 and 3. Skin-to-skin (dorsal-palmar) coverage is required for the stack. 26 slices should be used. For small hands the required number of slices should still be prescribed. For large hands, if necessary add more slices.

5. **Axial 2D T1-W SE** (4:00). Two slice groups should be prescribed based on coronal and sagittal localizers (refer to the figures below for illustration).
   - Choose the coronal localizer images(s) where you can see the following anatomical landmarks:
     - Proximal Inter-Phalangeal (PIP) joints 2-5
     - Distal Inter-Phalangeal (DIP) joints 2-5
     - Carpal-Metacarpal (CMC) joint 1
   - Choose the sagittal localizer image that contains Metacarpal bone 3.
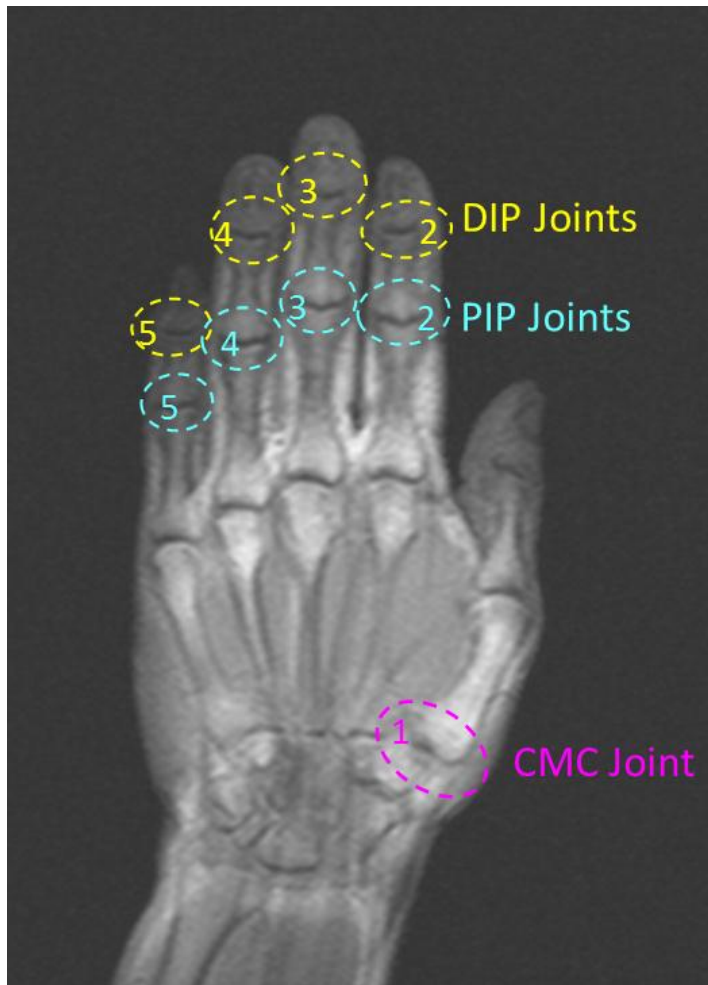
EXAM WORKFLOW - 3

The proximal group of 16 slices should be centered on CMC joint 1. Make sure the joint is completely covered.

The distal group should include the PIP and DIP joints 2-5 with the first slice positioned 5mm proximal to PIP joint 5. The most distal slice should be at least 5mm distal to DIP joint 3. If the hand is too large and the recommended 30 slices do not include the DIP joint 3, add as many slices as needed to include DIP joint 3.
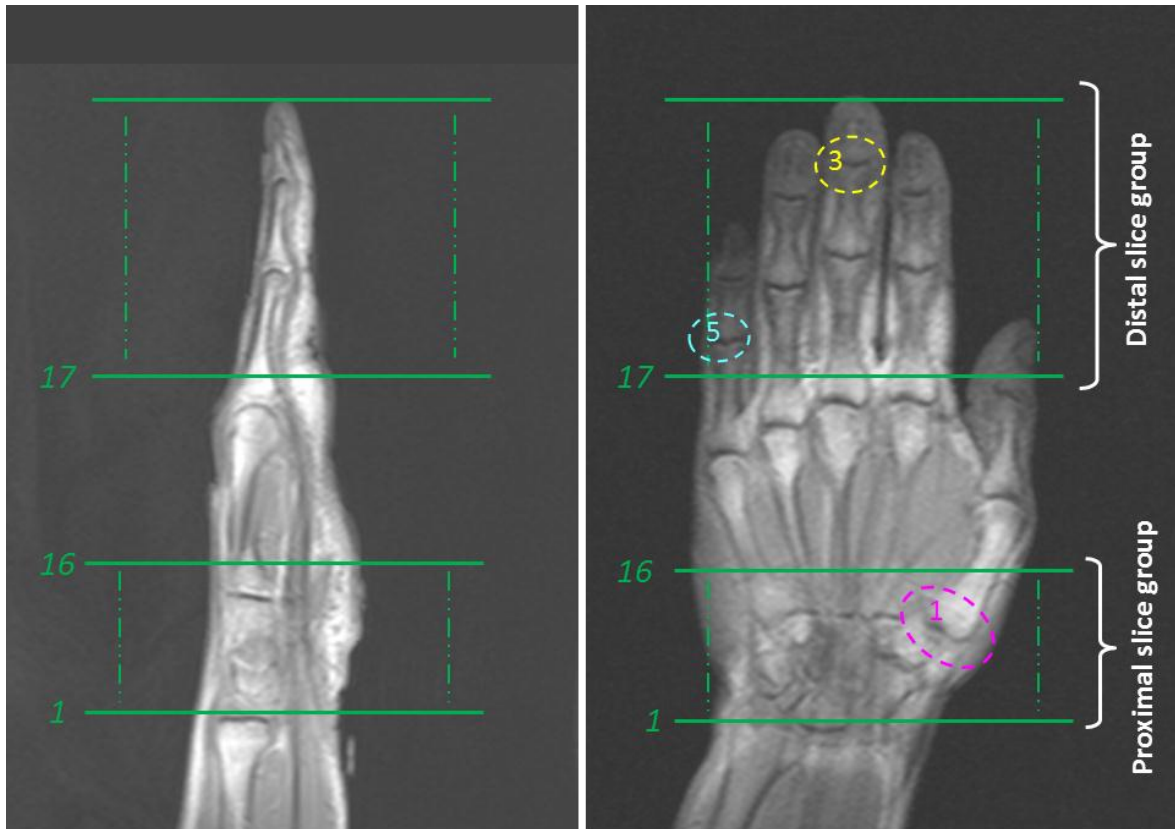
Contrast Injection. Use the same contrast agent for all patient-visits. The dose should be 0.1mmoL per kg of body weight. The injection should be implemented as a bolus at the rate of 2-3ml/sec and immediately followed by ~20mL of the saline chaser. Proceed with acquisition of sequence 6 without delay.

6. Coronal 2D T1-W SE (2:30). The setup is the same as for sequence 4 above.

7. Axial 2D T1-W SE (4:30). The setup is the same as for sequence 3 above.

SEQUENCE SETTINGS AND PARAMETERS

To setup and save each sequence please refer to the following table. The sequences are based on suggested acquisition parameters that are typical for 1.5T Philips MRI scanners. Depending on specific hardware/software versions, some settings may vary. Start with your routine clinical sequences and modify settings as indicated below. The imaging protocol for your scanner should be saved at study initiation and subsequently used for all subjects. Consistency in acquisition across all visits is especially important!

Coronal 3D T1 FFE with Fat Sat

Geometry		
Coil Selection		SENSE Flex-M
Dual coil		no
Clear		no
Body tuned		no
FOV (mm)*	RL	125 (hand-over-head)
		60 (hand-by-side)
	FH	220
	AP	60 (hand-over-head)
		125 (hand-by-side)
Voxel size (mm)	RL	0.65 (hand-over-head)
		1.5 (hand-by-side)
	FH	0.25
	AP	1.5 (hand-over-head)
		0.65 (hand-by-side)
Slice thickness (mm)		1.5
Recon voxel size		0.215
Foldover suppression		no
Slice oversampling		default
Reconstruction matrix		880
SENSE		no
Overcontiguous slices		no
Stacks		1
slices		40
slice orientation		coronal (hand-over-head)
		sagittal (hand-by-side)
fold-over direction		RL (hand-over-head)
		AP (hand-by-side)
fat shift direction		F
Minimum # of packages		1
Plan allign		no
REST slabs		0

Contrast	
Scan type	Imaging
Scan mode	3D
technique	FFE
Modified SE	
Contrast Enhancement	T1
Echoes	1
partial echo	no
shifted echo	no
TE	shortest
TR	shortest
Flip angle (degree)	30
Half scan	no
Water-fat shift	user defined
value (pixels)	2
Shim	PB volume
shim align	no
Fat suppression	SPIR
strength	strong
frequency offset	default
Water suppression	no
MTC	no
Diffusion mode	no
PNS mode	high
Gradient mode	maximum
SofTone mode	no

Motion	
Cardiac synchronization	no
Respiratory compensation	no
Flow compensation	no
fMRI echo stabilization	no
NSA	1

Dyn/ang	
Cardiac synchronization	no
Ang/contrast enhancement	no
Quantitative flow	no
Manual start	no
Dynamic study	no

Postproc	
Preparation phases	auto
Manual offset freq.	no
MIP/MPR	no
Images	
AutoView	M
Calculated Images	
Reference Tissue	Skeletal muscle
Reconstruction mode	immediate
Save raw data	no
Hardcopy protocol	no
Ringing filtering	default
Geometry correction	default
Elliptical k-space shutter	default

** **The following entries in GEOMETRY card should be specified for software versions prior to version 2***

FOV (mm)	220
RFOV (%)	57
Matrix scan	880
reconstruction	880
Scan percentage	22

Coronal 2D STIR

Geometry

Coil Selection		SENSE Flex-M
Dual coil		no
Clear		no
FOV (mm)*	RL	125 (hand-over-head)
		66 (hand-by-side)
	FH	220
	AP	66 (hand-over-head)
		125 (hand-by-side)
Voxel size (mm)	RL	0.6 (hand-over-head)
		2.0 (hand-by-side)
	FH	0.428
	AP	2.0 (hand-over-head)
		0.6 (hand-by-side)
Slice thickness (mm)		2.0
Recon voxel size		0.42
Foldover suppression		no
Reconstruction matrix		512
SENSE		no
Stacks		1
type		parallel
slices		30
slice gap		user defined
value (mm)		0.2
slice orientation		coronal (hand-over-head)
		sagittal (hand-by-side)
fold-over direction		RL (hand-over-head)
		AP (hand-by-side)
fat shift direction		L
Minimum number of packages		1
Slice scan order		interleaved
Plan allign		no
REST slabs		1
type		free
orientation		transverse
thickness (mm)		60

Contrast

Scan type	Imaging
Scan mode	MS
technique	IR
Fast imaging mode	TSE
shot mode	multishot
TSE factor	9
TE spacing	user defined
value (ms)	10
startup echoes	0
profile order	asymmetric
DRIVE	no
ultrashot	no
Echoes	1
partial echo	no
TE	user defined
value (ms)	30
Refocusing control	no
TR	shortest
Half scan	no
Water-fat shift	maximum
IR delay (ms)	145-150
acquire during delay	no
dual	no
Shim	default
Fat suppression	no
Water suppression	no
MTC	no
SAR mode	high
B1 mode	default
SofTone mode	no

Motion

Cardiac synchronization	no
Respiratory compensation	no
Flow compensation	yes
Motion smoothing	no
NSA	2
SMART	no

Dyn/ang

Manual start	no
Dynamic study	no

Postproc

Preparation phases	auto
Manual offset freq.	no
MIP/MPR	no
AutoView	M
Calculated Images	
Reference Tissue	Skeletal muscle
Preset window contrast	soft
Reconstruction mode	real time
Save raw data	no
Hardcopy protocol	no
Ringing filtering	default
Geometry correction	default

*** The following entries in GEOMETRY card should be specified for software versions prior to version 2**

FOV (mm)	220
RFOV (%)	57
Matrix scan	512
reconstruction	512
Scan percentage	43

Coronal 2D T1 SE

Geometry

Coil Selection		SENSE Flex-M
Dual coil		no
Clear		yes
Body tuned		no
FOV (mm)*	RL	125 (hand-over-head)
		72 (hand-by-side)
	FH	220
	AP	72 (hand-over-head)
		125 (hand-by-side)
Voxel size (mm)	RL	0.65 (hand-over-head)
		2.5 (hand-by-side)
	FH	0.25
	AP	2.5 (hand-over-head)
		0.65 (hand-by-side)
Slice thickness (mm)		2.5
Recon voxel size		0.21
Foldover suppression		no
Reconstruction matrix		880
SENSE		no
Overcontiguous slices		no
Stacks		1
type		parallel
slices		26
slice gap		user defined
value (mm)		0.25
slice orientation		coronal (hand-over-head)
		sagittal (hand-by-side)
fold-over direction		RL (hand-over-head)
		AP (hand-by-side)
fat shift direction		L
Minimum # of packages		1
Slice scan order		default
Plan allign		no
REST slabs		0

Contrast

Scan type	Imaging
Scan mode	MS
technique	SE
Modified SE	no
Fast Imaging	no
Echoes	1
partial echo	no
TE	shortest
TR	user defined
value (ms)	600
Flip angle (degree)	90
Half scan	no
Water-fat shift	user defined
value (pixels)	2
Shim	volume
Fat suppression	no
Water suppression	no
MTC	no
SAR mode	high
Diffusion mode	no
B1 mode	default
PNS mode	low
Gradient mode	default
SofTone mode	no

Motion

Cardiac synchronisation	no
Respiratory compensation	no
Flow compensation	no
Motion smoothing	no
NSA	1
SMART	no

Dyn/ang

Cardiac synchronization	no
Manual start	no
Dynamic study	no

Postproc

Preparation phases	auto
Manual offset freq.	no
MIP/MPR	no
Images	
AutoView	M
Calculated Images	
Reference Tissue	Skeletal muscle
Preset window contrast	soft
Reconstruction mode	real time
Save raw data	no
Hardcopy protocol	no
Ringing filtering	no

**** The following entries in GEOMETRY card should be specified for software versions prior to version 2***

FOV (mm)	220
RFOV (%)	57
Matrix scan	880
reconstruction	880
Scan percentage	22

Axial 2D T1 SE

Geometry

Coil Selection		SENSE Flex-M	
Dual coil		no	
Clear		yes	
Body tuned			
FOV (mm)*	RL	120	
	FH	A (proximal stack)	43.75
		B (distal stack)	82.25
	AP	120	
Voxel size (mm)	RL	0.47	
	FH	2. 5	
	AP	0.47	
Slice thickness (mm)		2.5	
Recon voxel size		0.234	
Foldover suppression		no	
Reconstruction matrix		512	
SENSE		no	
Overcontiguous slices		no	
Stacks		2	
type		parallel	
slices		A (proximal stack)	16
		B (distal stack)	30
slice gap		user defined	
value (mm)		0.25	
slice orientation		transverse	
fold-over direction		AP or RL	
fat shift direction		L	
Minimum # of packages		1	
Slice scan order		default	
Plan allign		no	
REST slabs		0	

Contrast

Scan type	Imaging
Scan mode	MS
technique	SE
Modified SE	no
Fast Imaging	no
Echoes	1
partial echo	no
TE	shortest
TR	user defined
value (ms)	600
Flip angle (degree)	90
Half scan	no
Water-fat shift	user defined
value (pixels)	2
Shim	volume
Fat suppression	no
Water suppression	no
MTC	no
SAR mode	high
Diffusion mode	no
B1 mode	default
PNS mode	low
Gradient mode	default
SofTone mode	no

Motion

Cardiac synchronisation	no
Respiratory compensation	no
Flow compensation	no
Motion smoothing	no
NSA	1
SMART	no

Dyn/ang

Cardiac synchronization	no
Manual start	no
Dynamic study	no

Postproc

Preparation phases	auto
Manual offset freq.	no
MIP/MPR	no
Images	
AutoView	M
Calculated Images	
Reference Tissue	Skeletal muscle
Preset window contrast	soft
Reconstruction mode	real time
Save raw data	no
Hardcopy protocol	no
Ringing filtering	no

* The following entries in GEOMETRY card should be specified for software versions prior to version 2

FOV (mm)	120
RFOV (%)	100
Matrix scan	256
reconstruction	512
Scan percentage	100

ENTERING SUBJECT DATA IN THE ELECTRONIC HEADER

In order to ensure patient confidentiality, please enter the following information into the <u>electronic MRI header</u>:

► **Subject Information**" enter the 4-digit Subject Number and Subject date of birth

EXAMPLE: | 1979 |

► "**Date of Birth**" enter: **DD-MMM-YYYY**

EXAMPLE: | Date of Birth: 01-Jan-1950 |

► "**Patient History**" enter: **[Visit] [Laterality of the target hand]**

EXAMPLE: | Patient History: **Day 0, Right** |

> The possible entries for the Visit identification:
>
> **Day 0**
> **Day 84**
> **Day 168**

SUBMITTING DATA TO SYNARC

The data to be sent from the imaging site should contain both the imaging study and the transmittal form. There are two options for sending data to Synarc:

- Electronic transfer using secure FTP website (SynarcConnect) - the preferred method of submission
- Postal mail/courier service.

Electronic Data Transfer (FTP) Using SynarcConnect

SynarcConnect is a web-based portal that allows sites to submit images via secure file transfer protocol (FTP). It eliminates delays and expenses associated with shipping images via courier. The Transmittal Form (TF) is completed and submitted electronically as well.

Sending Data Using Courier Service

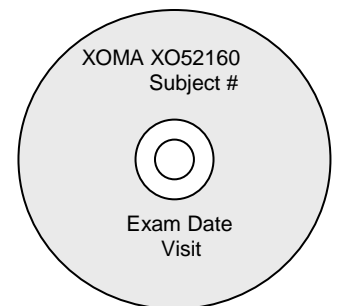The complete package should contain a CD with imaging data and the filed TF.

Export the data to the CD in **uncompressed DICOM** format. Use an indelible marker to label directly on the CD with:
- o Study Protocol Number (XOMA X052160)
- o Subject Identifiers as indicated above
- o MRI Exam Date (DD-MMM-YYYY)
- o Visit Name

Sending a Package to Synarc

1. Complete the sender sections of the air waybill, keeping a copy for tracking purposes.
2. Place the white and yellow copies of the TF and the CD for each patient into a shipping envelope. **Please keep pink copy at site.**
3. Call courier to schedule package pick-up.

Ship data to: Alma Sonza
XOMA X052160 Study
Synarc Inc.
7707 Gateway Blvd, 3rd Floor
Newark, CA 94560

XOMA XO52160
Subject #

Exam Date
Visit

To Synarc