Image Acquisition for Sectra IMA®

Implant Movement Analysis

SECTRA

Knowledge and passion

Contents

1. Sectra Implant Movement Analysis

Sectra IMA® is a software offered by Sectra to facilitate the diagnosis of implant loosening or pathological movement. Often when a patient experiences pain after hip or knee replacement or spinal implant surgery.

Sectra IMA® is based on an analysis of paired CT volumes. These are acquired during the same examination, and both scans are acquired at an endpoint of possible motion. For example maximal internal and external rotation for a hip examination or maximal flexion and extension over the relevant segment for a spine examination. These two “provocation CT volumes” are used by a specially trained radiologist to perform the IMA analysis.

2. Preparatory Set-up

Use the parameters and conditions in the guidelines below to ensure optimal image quality.

2.1 Initial set-up of the protocol

Use your standard CT protocol for the relevant body part as a template. IMA is also compatible with low -dose protocols. Add the below modifications and save the resulting protocol with a name containing IMA, for example "IMA [body part]." Use this new modified protocol for all IMA scans of that body part.

Imaging modality: CT scanner

Scanner type: Any commercial brand can be used

Use a scout view to aid scaning the correct area

Where possible, keep settings unchanged between the two acquisitions

Increment: Slices preferably overlap by 50%

Slice thickness: Preferably 0.5–0.6 mm

Reconstruction: Use a bone enhancement algorithm. Use metal artefact reduction if available

Matrix: 512 × 512

Field of view:

- **Cervical spine:** The length of the volume should include at least one vertebra above and one vertebra below the area of interest
- **Thoracolumbar spine:** The length of the volume should include at least half a vertebra above and half a vertebra below the area of interest. For example, if scanning fusion L3–L5, then include half of L2 and part of the sacrum to secure that a provocation has taken place in this area
- **Hip:** Limit the field of view to the relevant half of the patient. Include at least 5 cm above and below the beginning and end of the studied implant in the field of view
- **Knee:** Include at least 5 cm above and below the beginning and end of the studied implant in the field of view

2.2 First scan

Before

- Ensure that the correct protocol and patient data are loaded. Completing this before the patient is placed in the CT will help minimize the time the patient needs to spend in an uncomfortable position and therefore also minimize movement artefacts

During

- Patient position and posture: See examples towards the end of the document
- It is important for patients to refrain from moving during a CT scan. Therefore, examination time should be kept to a minimum
- To enable a proper analysis of the cause of the patient's pain, sufficient provocation is required. This means that the body part should be put in extension/flexion until either maximum movement or discomfort occurs. Too little provocation, for example to avoid discomfort, might not provide data sets with adequate diagnostic value
- Inform the patient that they might experience discomfort in the provocet joint during the examination. Also tell the patient how long the scan will take.

After

- Check the quality: Make sure that the images are of adequate quality with correct patient positioning and without noticable motion artefacts. Else re-aquire the image

2.3 Second scan

Before

- Where possible use the same settings as with the first scan
- Note that for lumbar spine, the patient position setting needs to be changed in the CT since as the first scan is supine and the second scan is prone.

During

- Patient position and posture: See examples towards the end of the document
- All other considerations are the same as described for the first scan regarding motion artefacts and proper provocations

After

- Check the quality as you did after the first scan

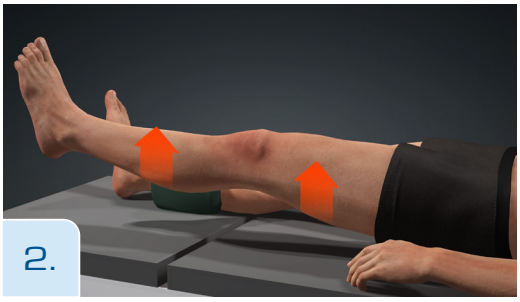
3. Patient placement

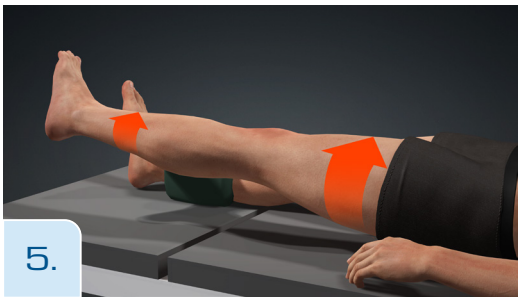
Below are some suggested patient placements for IMA provocations/examinations. The use of wedges, straps, and sandbags can make it easier for the patient to maintain a position during the imaging. This reduces the risk for movement artifacts.

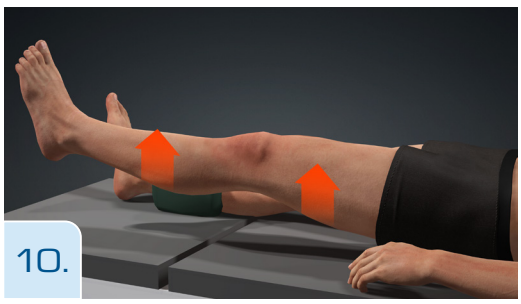
3.1 IMA hip provocation — Inward-outward rotation

1 of 2 CT images: Inward rotation of the hip

1.	The patient is lying supine. Optionally, a support at the height of the patient's hip can help the pelvis to stay still.
2.	Hold the patient's ankle and lift. See picture 2.
3.	Place your second hand under the **middle of the thigh**.
4.	Inform the patient that they may experience discomfort and ask them to relax.
5.	**Lift and rotate the entire leg inward** in a gentle manner according to the patient tolerance. See picture 5.
6.	**Place sandbags** around the ankle to secure the position. See picture 6.
7.	Inform the patient that it is important they stay in this position while the CT is taken.
8.	Perform image capture according to protocol.







2 of 2 CT images: Outward rotation of the hip

9.	Remove sandbags, pillows, and/or straps from first imaging.
10.	Hold the patient's ankle and lift. See picture 10.

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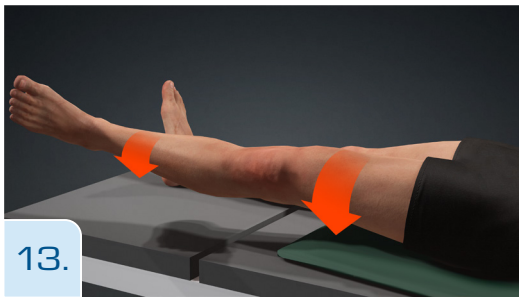
2 of 2 CT images: Outward rotation of the hip

11.	Place your second hand under the **middle of the thigh**.
12.	Inform the patient that they may experience discomfort and ask them to relax.
13.	**Lift and rotate the entire leg outward** in a gentle manner according to the patient tolerance. See picture 13.
14.	**Place sandbags** around the ankle to secure the position. See picture 14.
15.	Inform the patient that it is important they stay in this position while the CT is taken.
16.	Perform image capture according to protocol.
17.	Remove sandbags and assess the aquired images to check that there are no obvious movement artifacts.



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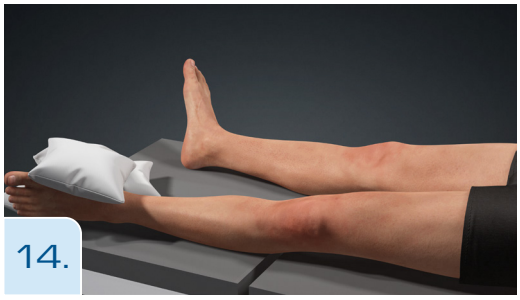


14.

3.2 IMA knee — Valgus-varus provocation

1 of 2 CT images: Valgus provocation

1.	The patient is lying supine. Place a folded sheet around the patient's thighs. See picture 1.
2.	Place a a wide fixed pillow between the patient's ankles (sometimes several pillows are needed). See picture 1.
3.	Place a strap about 10 cm above the knee. See picture 1.
4.	Inform the patient that they may experience discomfort and ask them to relax.
5.	**In communication with the patient tighten the strap** according to their tolerance.
6.	Inform the patient that it is important they stay in this position while the CT is taken.
7.	Perform image capture according to protocol.

1.

8.

2 of 2 CT images: Varus provocation

8.	Remove pillows, sheets and straps from first imaging. Place the folded sheet around the patient's ankles. See picture 8.
9.	Place 1-2 firm pillows between the patient's thighs above the knee. See picture 8.
10.	Place a strap around the ankle. See picture 8.
11.	**In communication with the patient tighten the strap** according to their tolerance.
12.	Inform the patient that it is important they stay in this position while the CT is taken.
13.	Perform image capture according to protocol.
14.	Remove sandbags and assess the aquired images to check that there are no obvious movement artifacts.

Alternative Knee provocation

For long stemmed knee implants a rotational provocation can be effective.

1 of 2 CT images: Inwards rotation

1.	The patient is lying supine. Ask the patient to try to keep the hip in a fixed position.
2.	Inform the patient that they may experience discomfort and ask them to relax.
3.	In communication with the patient hold the ankle and **rotate the foot and lower leg** as far inward as possible according to their tolerance.
4.	**Place sandbags** around the ankle to secure the position. See picture 4.
5.	Inform the patient that it is important they stay in this position while the CT is taken.
6.	Perform image capture according to protocol.

4.

10.

2 of 2 CT images: Varus provocation

7.	Remove sandbags from first imaging. Ask the patient to try to keep the hip in a fixed position.
8.	Inform the patient that they may experience discomfort and ask them to relax.
9.	In communication with the patient hold the ankle and **rotate the foot as far outwards as possible** according to their tolerance.
10.	**Place sandbags** around the ankle to secure the position. See picture 10.
11.	Inform the patient that it is important they stay in this position while the CT is taken.
12.	Perform image capture according to protocol.
13.	Remove sandbags and assess the aquired images to check that there are no obvious movement artifacts.

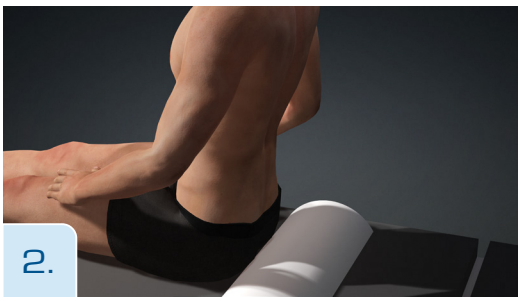
3.3 IMA lumbar spine

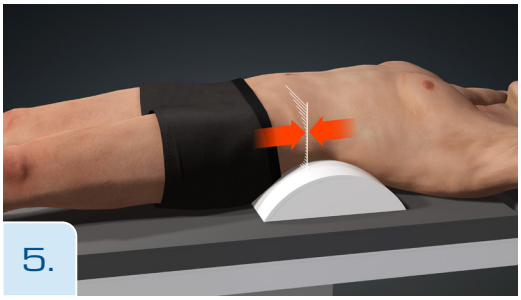
The pillow should be positioned so that its **thickest point is below the anatomy** to be examined. In the example below, a fusion in level L4–L5 is being investigated.

1 of 2 CT images: Supine

1. **Use the thickest pillow possible** based on the patient's pain tolerance.
2. Place the patient sitting on the table. See picture 2.
3. Inform the patient that they may experience discomfort and ask them to relax.
4. Help the patient **to assume a supine position** over the pillow. See picture 4.
5. Locate Iliac Crest and **move the pillow down** so the Iliac Crest is about 2–3 cm below the top of the pillow.

   L4–L5 should then end up where the pillow is thickest. See picture 5.
6. Inform the patient that it is important that they stay still while the CT is taken. Putting the patient's arms above their head may help reduce discomfort.
7. Perform image capture according to protocol.





2 of 2 CT images: Prone

8. Assist the patient in switching to a prone position.
9. **Put pillows under the stomach.** Match the number of pillows to the patient's anatomy. Too few pillows may result in insufficient provocation.

   NOTE Be sure to **change the patient position setting** in the CT.

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2 of 2 CT images: Prone

10. Inform the patient that they may experience discomfort and ask them to relax.

11. Have the patient settle in a prone position over the pillows.

The anatomy you want to examine should be over the **thickest part of the pillow**. See picture 11.

12. If possible place the patient's arms outside of the scanned area, for example above their head.

13. Inform the patient that it is important that they stay still while the CT is taken.

14. Perform image capture according to protocol.

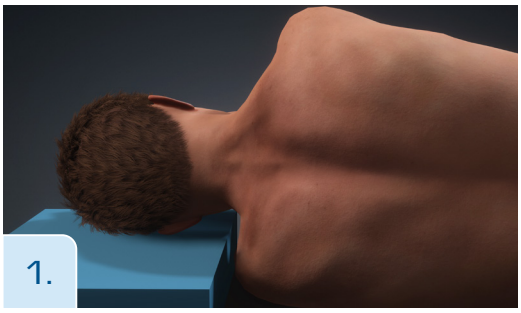
15. Assist the patient and assess the aquired images to check that there are no obvious movement artifacts.

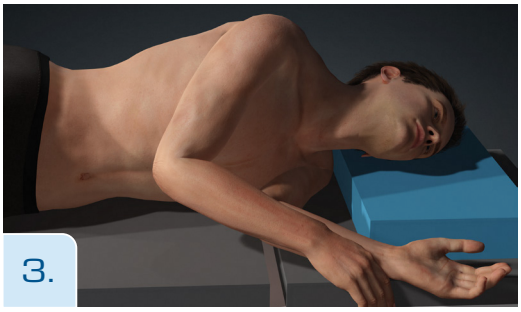
11.

3.4 IMA cervical spine

1 of 2 CT images: Extension

1. **Have the patient settle on their side.** The hip, shoulder and spine should be straight. Place pillows under the head to make the neck straight in the starting position. See picture 1.
2. Inform the patient that they may experience discomfort and ask them to relax.
3. Ask the patient to **lean their head backwards** as far as possible. See picture 3.
4. Inform the patient that it is important that they stay still while the CT is taken.
5. Perform image capture according to protocol.





2 of 2 CT images: Flexion

6. Inform the patient that they may experience discomfort and ask them to relax.
7. Ask the patient to **lean their head forward** as far as possible. Move the pillows if necessary. See picture 7.
8. Inform the patient that it is important that they stay still while the CT is taken.
9. Perform image capture according to protocol.
10. Assist the patient and assess the aquired images to check that there are no obvious movement artifacts.

For more information or inquiries, please visit:
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