

microCT Scanning 電腦斷層掃描

1. Purpose

- 1.1 Micro-computed tomography (Micro CT) is an emerging technique which can achieve three dimensional X-ray photographs. Under anaesthetizing, it can provide nondestructive assessment and analysis for bone density and body fat percentage.

2. Safety Requirements

- 2.1 General laboratory procedures should be followed, which include: no eating, no chewing gum, no drinking, and no applying of cosmetics in the work area. Laboratory coats and gloves must be worn at all times in the work area, unless the protocol specifically describes the appropriate attire for the procedure.

3. Associated Documents

- 3.1 SkyScan 1076 Micro-CT System

4. Notes

- 4.1 Isoflurane is metabolized nearly all by lung, only extremely on a small quantity by liver, and very small to cardiovascular influence.
- 4.2 The TV-camera in the animal bed produces real-time visual image. Operator can see the animal on the computer screen in any time including X-ray scanning, to make sure that mouse is living.
- 4.3 X-ray Exposure to Animal: 0.1-0.5 Gy per scan typical.

5. Quality Control

- 5.1 X-ray source will be calibrated to preset values before scanning.

6. Equipment

- 6.1 SkyScan 1076 Micro-CT System
- 6.2 Host computer
- 6.3 Inhalation Anesthesia System

7. Supplies

- 7.1 Gloves
- 7.2 Paper mask
- 7.3 Paper towel
- 7.4 Isoflurane
- 7.5 Pure oxygen
- 7.6 Animal holder
- 7.7 Tape
- 7.8 Animal mask
- 7.9 Plastic air tube
- 7.10 Ethanol 70%

8. Procedures

- 8.1 Turn on the computer.
- 8.2 Switch on the 1076 scanner.
- 8.3 Aging time of scanner x-ray source about 15min.
- 8.4 Narcosis of mouse by 2 vol.% isoflurane with oxygen, rate of 2 L/min .

8.5 Installation of mouse.

8.6 Start scout scan and select position of scan.

8.7 Setting the scanning parameters.

8.7.1 Standard Resolution:

Scanning Modes [std]

Camera format:	4032x2688	2016x1344	1008x672	504x336		
Rot.Step (deg):	0.20	0.40	0.80	1.60		
Filter Name :	No Filte	Al 0.25r	Al 0.5m	Al 1mm	Al+Cu	Low dose
X-Ray Source						
Voltage, kV :	40	55	70	85	100	100
Current, uA :	200	200	200	200	200	200
Camera exposures (ms)						
4032x2688	350	473	453	433	468	437
2016x1344	249	335	322	308	332	306
1008x672	88	117	113	108	116	109
504x336	28	38	36	35	37	35

8.7.2 High Resolution:

Scanning Modes [Hi_Res]

Camera format:	4032x2688	2016x1344	1008x672	504x336		
Rot.Step (deg):	0.20	0.40	0.80	1.60		
Filter Name :	No Filte	Al 0.25r	Al 0.5m	Al 1mm	Al+Cu	Low dose
X-Ray Source						
Voltage, kV :	40	55	70	85	100	100
Current, uA :	100	72	57	47	40	40
Camera exposures (ms)						
4032x2688	780	1396	1669	1911	2441	2215
2016x1344	554	991	1186	1357	1732	1576
1008x672	195	351	421	476	608	554
504x336	62	109	133	156	195	179

8.8 Start Scanning.

8.9 Wipe clean the apparatus with 70% EtOH and renew animal holder before testing another group of mouse.

8.10 After testing the last mouse, wipe clean the apparatus with 70% EtOH.

8.11 Reconstruction of the whole dataset.

8.11.1 Open NRecon software.

8.11.2 Loading data in NRecon.

8.11.3 selecting position of interest.

8.11.4 Setting the reconstruction parameters.

Item	Fat & Lean %	BMD	Trabecular bone
Smoothing	4	0	0
Ring artifacts reduction	5	0	0
Beam-hardening correction	34%	30%	30%
Change dynamic image range	0 - 0.0275	0 – 0.07	0.01 – 0.07

8.11.5 Start reconstruction.

8.12 Analysis of image and measuring of Fat%.

8.12.1 Open CTAn software and dataset.

8.12.2 Selecting position of abdominal cavity on raw image.

8.12.3 Run task program.

8.12.4 Obtain total VOI volume (TV), object volume (Obj.V) and percent object volume (Obj.V/TV)

8.13 Analysis of image and measuring of ROI for BMD.

8.13.1 Open CTAn software and dataset.

8.13.2 Selecting position of femur or other else (one per mouse) on raw image.

8.13.3 Separation of bone was done using freehand drawing tool for delineating of complex regions of interest (ROI).

8.13.4 Obtain BMD value by formula.

8.14 Analysis of image and measuring of trabecular morphometric parameters.

8.14.1 Open CTAn software and dataset.

8.14.2 Selecting position of trabecular bone that commenced about 0.4 mm (0.8 mm for rat) from the growth plate level in the direction of the metaphysic, and extended from this position for a further 1.5 mm (3.0 mm for rat).

8.14.3 Separation of trabecular bone was done using freehand drawing tool for delineating of complex regions of interest.

8.14.4 3D and 2D morphometric parameters were calculated for the trabecular selected ROIs.