1. ABOUT THE DATASET

Title: Twenty cam-type hip shapes described using a new 'contour' shape map and assessed for impingement occurrence and depth

Creator(s): Trent Rayment, Dawn Groves-Williams, Sophie Williams, Alison Jones

Organisation(s): Institute of Medical and Biological Engineering, University of Leeds, Leeds, UK.

Publication Year: 2024

Description:

This dataset includes the input, raw output and processed data from a study investigating the predicted cam-type hip impingement of a set of human subjects using a newly developed contour method. The associated project aimed to investigate the severity of a subject's predicted impingement by assessing: the height of the cam entering the acetabulum during impingement; the frequency of impingement occurrence; and the impingement depth over a range of activities. The study looked to further investigate whether key shape features (maximum cam alpha angle, cam extent, cam location, average acetabular coverage) affected the severity of predicted impingement. The model input data is in the form of sets of points used to describe the femoral head-neck junction and acetabular rim of each subject. High level shape measures of cam apex, extent and location are included. Additional parametric data, such as femoral head size is provided for context along with the patient sex for comparison with previous work. The raw impingement occurrence output data of the shape-motion model providing information on which motion cases generate predicted impingement. Detailed data is included for the maximum impingement depth at every location around the acetabula, along with the post processed maximum impingement depth for each motion case for each subject. Methods documents are included explaining how measures were taken.

Cite as: Rayment T., Groves-Williams D., Williams S., Jones A. C. (2024) 'Twenty cam-type hip shapes described using a new 'contour' shape map and assessed for impingement occurrence and depth.' University of Leeds [Dataset] https://doi.org/10.5518/1492

Related publications:

Rayment T., Williams S., Jones A. C. (2024) 'A new height contouring method for severity prediction in cam-type hip joints: 20 subject-specific cases.' Under review.

Jones A. C., Stewart T. D., Maher N., Holton C., 'Can a Computational Model Predict the Effect of Lesion Location on Cam-type Hip Impingement' Clinical Orthopaedics and Related Research®, 2023. 481(7): p. 1432-1443. DOI: 10.1097/CORR.0000000000002565

Related datasets:

Jones A. Human hip joint impingement shape and motion model: input and output data for an initial study of eight typical cam-type hips. University of Leeds. Available at: https://doi.org/10. 5518/1231.

Layton R, Messenger N, Stewart TD. Data supporting characteristics of hip joint reaction forces during a range of activities. Available at: https://doi.org/10.5518/1253.

Cooper RJ, Mengoni M, Williams S, Jones AC. Dataset associated with "Three-dimensional assessment of impingement risk in geometrically parameterised hips compared with clinical measures". University of Leeds, UK. 2017. [Dataset] http://doi.org/10.5518/135.

Contacts: Trent Rayment (mntr@leeds.ac.uk), Alison Jones (a.c.jones@leeds.ac.uk)

2. TERMS OF USE

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3. PROJECT AND FUNDING INFORMATION

Rayment was funded for this PhD work by the University of Leeds. Jones was supported by the Royal Academy of Engineering under the Leverhulme Trust Research Fellowship scheme. Williams is supported by Royal Academy of Engineering, DePuy Synthes Chair.

4. CONTENTS

Angular shape data describing the acetabular rim

This data represents the angular shape data collected from the 20 segmented subject-specific acetabula, describing the coverage of the acetabular rim. This data is used as input data for the computational shape-motion model used for predicting cam-type hip impingement.

acetabular_coverage.zip 1 ZIP file, containing 20 CSV datasheets…	The data includes the angle associated with the coverage of the acetabulum at 24 evenly spaced locations about the joint centre. Three of the 24 points are excluded due to falling within the acetabular notch.
acetabular_coverage_XX.csv *Where XX is the local subject reference.*	The data includes the processed coverage angles to produce the input angles for the computational shape-motion model. Locations are given within a local reference system, labelled as different points on a clock plot. See methods document for details.

Angular shape data describing the contours of the femoral head-neck junction

This data represents the angular shape data collected from the 20 segmented subject-specific proximal femurs, describing the five 'height contours' of the femoral head-neck junction. This data is used as input for the computational shape-motion model used for predicting cam-type hip impingement.

femoral_contours.zip 1 ZIP file, containing 20 CSV datasheets	The data includes the angle associated with the height of the femoral head-neck junction at 24 evenly spaced locations about the femoral neck, for each of the five contours.
femur_contour_XX.csv *Where XX is the local subject reference.*	Contour heights are as follows: +0.35mm, +1mm, +2mm, +3mm, +4mm. Locations are given within a local reference system, labelled as different points on a clock plot. See methods document for details.

Maximum depth of impingement – raw output

These data sheets include the full set of motion cases that were predicted to impinge for each subject, for each contour height of the cam, identifying the location around the acetabulum at which the impingement occurs and the maximum depth to which the impingement occurs at each location. Additionally, it includes the activity to which the particular case of impingement is attributed to.

impingement_max_depth.zip 1 ZIP file, containing 20 CSV datasheets	The data includes the post processed maximum depth of impingement for each motion case for each subject.
impingement_max_depth_01.csv *Where XX is the local subject reference.*	Contour heights are as follows: +0.35mm, +1mm, +2mm, +3mm, +4mm. Locations are given within a local reference system, labelled as different points on a clock plot. See methods document for details. The activities are given by their number codes from 1 to 14. See methods document for details.

Occurrence of impingement – raw output

These data sheets break down the impingement occurrence into each unique motion case for each subject and for each contour height.

impingement_occurence.zip 1 ZIP file, containing 20 CSV datasheets	Impingement is registered if the point belonging to a particular femoral head-neck junction height contour overlaps with the acetabular rim during a motion. The activities are given by their number codes from 1 to 14. The impingement occurrence is given as an integer out of nine. See methods document for details.
impingement_occurence_XX.csv *Where XX is the local subject reference.*	Contour heights are as follows: +0.35mm, +1mm, +2mm, +3mm, +4mm.

Cam extent – post processed data

This data sheet represents the post processed contour shape data to determine the 'extent' of the cam lesion for each of the 20 subjects, from the +0.35mm contour and the +1mm contour.

cam_extent.csv 1 CSV file	The location where each cam begins and ends are shown and are given within a local reference system, labelled as different points on a clock plot. See methods document for details. Extent is calculated at alpha angle thresholds of 50°, 55° and 60° for the +0.35mm contour. Extent is calculated at an alpha angle threshold of 50° for the +1mm contour.

Cam location – post processed data

This data sheet represents the post processed contour shape data to determine the cam lesion location for each of the 20 subjects, calculated from the +0.35mm contour.

cam_location.csv 1 CSV file	The location is given in degrees, with zero being the most anterior point of the proximal femur, heading anticlockwise about the femoral neck. See methods document for details.

Male/Female Comparison – assessment of sex differences in shape measures of the femur

This data sheet represents a summary of the differences between male and female subjects regarding three femoral shape measures, cam apex, cam extent and cam location.

male_female_comparison.csv 1 CSV file	All data is given as an average of the total subject group, an average of the male subjects and an average of the female subjects and the standard deviation for each shape measure. The results from this study are compared with previously published results from a study involving the same 20 subjects. Extent is calculated at an alpha angle threshold of 50°. The cam apex is the maximum alpha angle recorded from each subject. The location is given in degrees, with zero being the most anterior point of the proximal femur, heading anticlockwise about the femoral neck. See methods document for details.

Parameterisation – high level subject specific data

This data sheet represents a high-level summary of the information regarding the shape subjects used in this study.

subject_parameterisation.csv 1 CSV file	This data includes patient sex, the side of the body of the hip, femoral head radius (calculated by using a sphere of best fit) and the joint (head) centre given in the subject-specific 3D models coordinate system.

5. METHODS

Method documentation

acetabulum_rim_points.pdf	Includes 1) the orientation of the acetabulum with regards to the clock plot notation, 2) how the angular data describing the acetabular coverage was measured.
femur_head_neck_points.pdf	Includes 1) the orientation of the proximal femur with regards to the clock plot notation, 2) how the angular data describing the contoured heights of the femoral head-neck junction was measured.
activity_codes.csv 1 CSV file	This datasheet lists the activities included in the motion dataset next to the codes used in the other files. The code for each activity is taken from the codes used in the data processing. More details of the motion dataset can be found in the linked datasets (Section 1).
femoral_shape_measures.pdf	Includes a figure and description of how to interpret the following shape measures; cam extent, cam location and cam apex.