

Aim: Determine relationships between (1) MC1 volar beak recession and osteophyte volume and (2) ThOA index and osteophyte volume.

Section/Exp't No: N/A

Brief Rationale: We believe the progression of thumb osteoarthritis (OA) is accompanied by morphological changes in the first metacarpal (MC1) and trapezium (TPM). We have identified 2 variables, 1 each for MC1 and TPM, to measure morphological changes to compare to OA progression as measured by osteophyte growth.

Hypothesis: We hypothesize that (1) MC1 volar beak recession is associated with OA progression as measured by MC1 osteophyte volume, and (2) increasing thumb osteoarthritis index (ThOA) is associated with OA progression as measured by TPM osteophyte volume.

Block Diagram & Description of Experiment

- 1) Compare MC1 volar beak recession to MC1 osteophyte volume. Repeated measures within a subject (up to 5 time points of data).
 - a. Expect to see significantly different association by cohort (control vs. OAs).
 - b. Expect no significant difference *within* cohort separated by sex.
- 2) Compare ThOA index to TPM osteophyte volume. Repeated measures within a subject.
 - c. Expect to see significantly different association by cohort (control vs. OAs).
 - d. Expect no significant difference *within* cohort separated by sex.

MC1 Volar Beak Recession

Volar beak recession of the MC1 was measured by determining the displacement of the volar portion of the MC1 beak in the axial direction as shown in Figure 1. Positive displacement values correspond to recession (i.e. pushback of the volar beak). Progression of OA is measured using the adjusted total MC1 osteophyte volume measurements quantified via Boolean subtraction of the best-fit bone model.

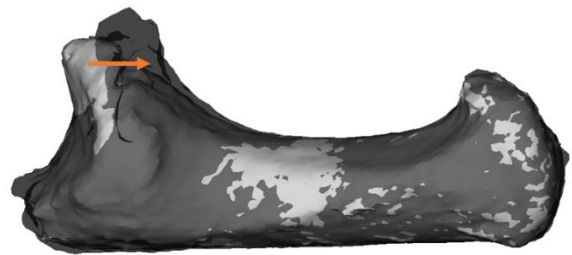


Figure 1. Overlapping MC1 from year 0 CT-scan (gray) and year 6 CT-scan (black) from one early OA patient demonstrating volar beak recession (orange arrow).

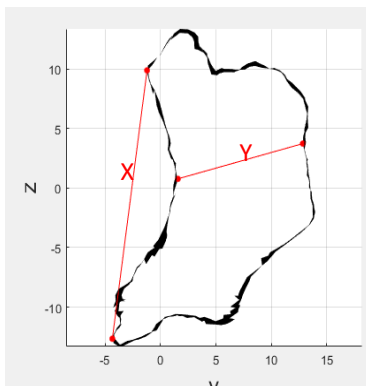


Figure 2. Radial-ulnar view of TPM with height (X) and width (Y). ThOA index is then X/Y .

TPM ThOA

The thumb osteoarthritis index was found using a similar procedure to Ladd et al. shown in Figure 2. X/Y is combined into one variable: ThOA. Overtime, we observe increasing length and decreasing width of the TPM, resulting in increasing ThOA values. We hypothesize this increase is associated with OA progression, which is measured using adjusted TPM osteophyte volume quantified using the same method as the MC1.

Outcome Variable Description	Outcome Variable Exact Name	Numeric	Descriptive
<i>(matches what was described on first page)</i>	<i>(as appears in data spreadsheet NO SPACES OR SPECIAL CHARACTERS)</i>	<i>(y/n)</i>	<i>(y/n)</i>
Scaled MC1 volar beak recession	s_dist	Y	N
Thumb osteoarthritis index (ThOA)	ThOA	Y	N
Scaled total MC1 osteophyte volume	s_total_ost_vol_mc1	Y	N
Scaled TPM osteophyte volume	s_ost_vol_tpm	Y	N
Grouping variable description			
Designator of OA or Control Group (OA = OA, N = control)	cohort	N	Y
Sex (M = male; F = female)	Sex	N	Y

Please provide a sample of your dataset below. Please include representative mean values for each outcome variable. The data of each row should be data of 1 observation. If the field is not applicable in your dataset (i.e. time- longitudinal), please leave blank.

		<i>timepoint (if longitudinal)</i>	<i>timepoint</i>	<i>study identifier</i>	<i>Category identifier A (i.e. sex(M/F); treatment group(0/1/2))</i>	<i>category identifier B</i>	<i>outcome variable (s)</i>			
	<i>header (exact variable names) --></i>	<i>redcap_event_name</i>	<i>elapseddayssubj</i>	<i>study_id</i>	<i>Cohort</i>	<i>Sex</i>	<i>s_dist</i>	<i>s_total_ost_vol_mc1</i>	<i>ThOA</i>	<i>s_ost_vol_tpm</i>
<i>please annotate if min/max/mean representative sample</i>	Median(s_dist)	60_year_followup_arm_1	2231	SA00612	OA	F	0.172	129.9	1.143	76.5
	Median(s_total_ost_vol_mc1)	60_year_followup_arm_1	2174	BA00231	OA	F	-0.073	224.2	1.436	269.6
	Median(ThOA)	baseline_arm_1	0	BA00204	OA	M	-0.268	159.6	1.256	60.8
	Median(s_ost_vol_tpm)	3_year_followup_arm_1	1088	SA00637	OA	M	-0.321	233.0	1.237	110.2