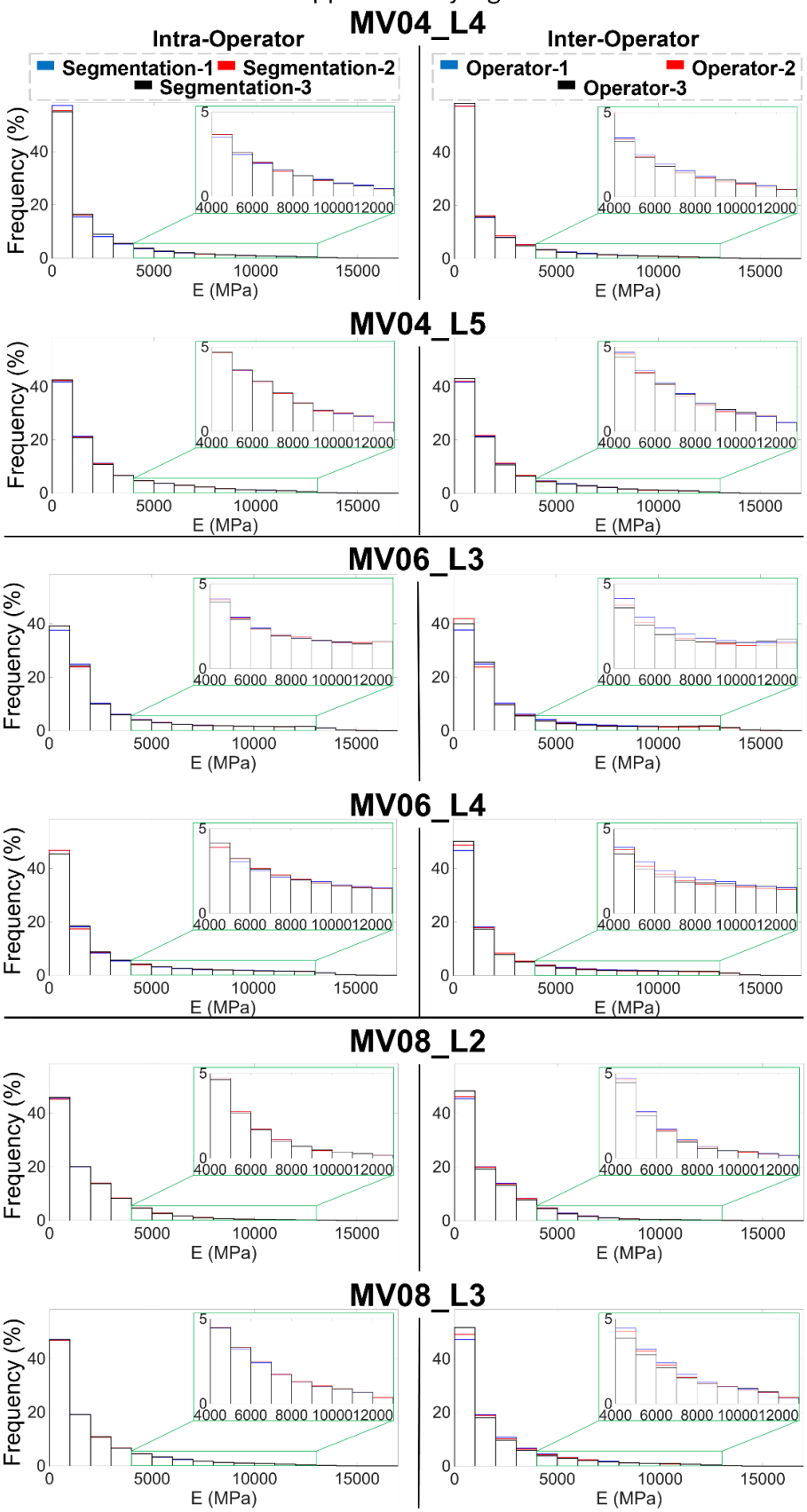
Supplementary Materials

*Supplementary Table A: Geometric and volumetric results of the whole vertebra for both intra- (top) and inter- (bottom) operator assessments. Each row is the average and standard deviation for the three comparisons of the vertebra, with the average and standard deviation across all vertebrae in the final row. *, **, *** represent significant differences between the metrics for the intra- and the inter-operator assessments with p<0.05, p<0.01 or p<0.001, respectively.*

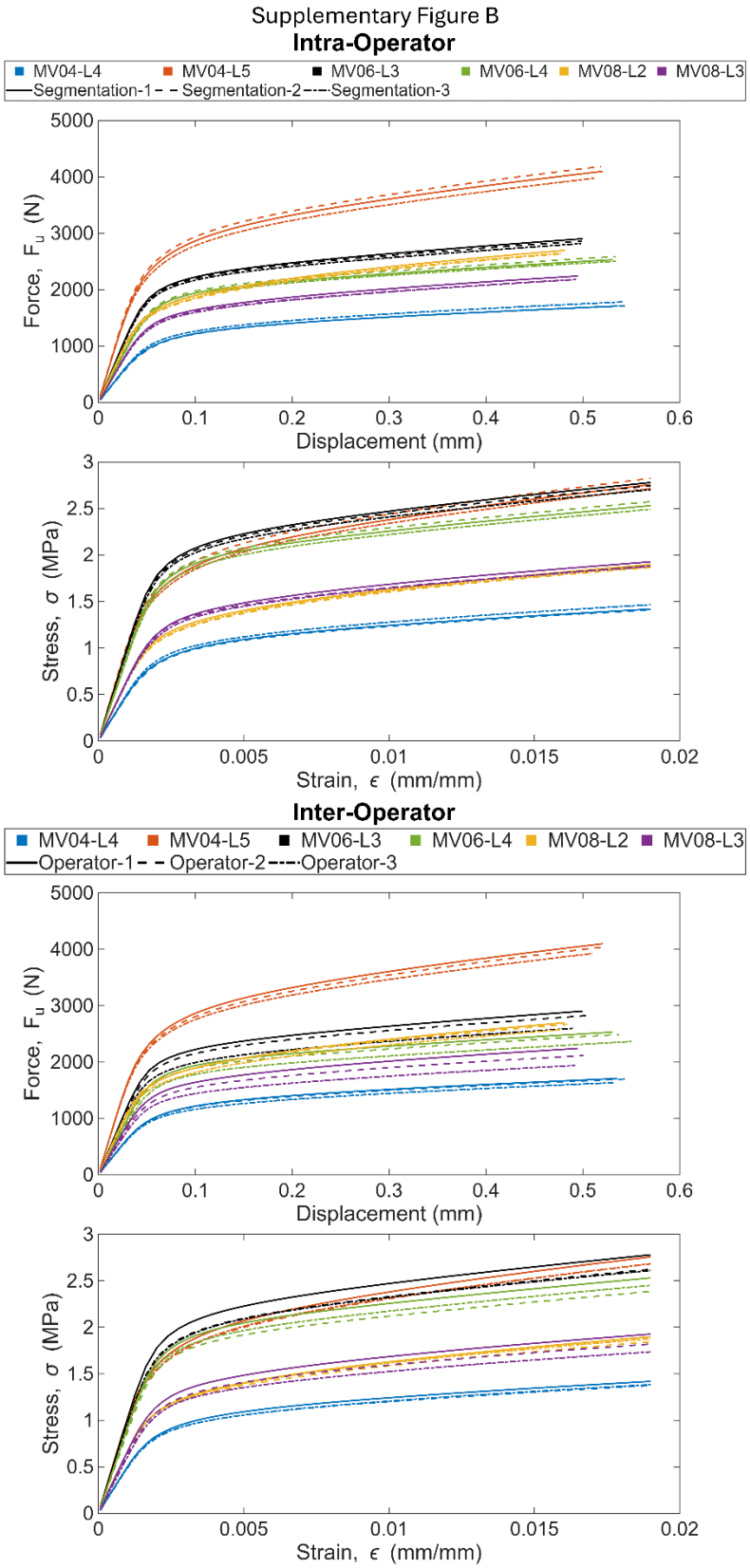
Supplementary Table A

Intra-Operator	Vertebrae Type	Mean Relative Volume Difference (%) *	Mean Dice Coefficient ***	Mean of Mean Surface Distance (mm) *	Mean Hausdorff Distance (mm) *
MV04_L4	Control	2.5 ± 1.3	0.98 ± 0.00	0.2 ± 0.0	1.8 ± 0.2
MV04_L5	Lytic	2.0 ± 0.9	0.97 ± 0.01	0.2 ± 0.0	2.4 ± 0.5
MV06_L3	Lytic	0.6 ± 0.4	0.98 ± 0.00	0.1 ± 0.0	1.3 ± 0.1
MV06_L4	Control	2.0 ± 1.0	0.98 ± 0.00	0.2 ± 0.0	1.3 ± 0.2
MV08_L2	Lytic	0.4 ± 0.2	0.97 ± 0.00	0.2 ± 0.0	1.5 ± 0.2
MV08_L3	Control	0.6 ± 0.3	0.97 ± 0.00	0.2 ± 0.0	4.0 ± 0.5
Mean ± Standard Deviation		**1.4 ± 0.8**	**0.98 ± 0.01**	**0.2 ± 0.0**	**2.1 ± 1.0**
Inter-Operator	Vertebrae Type	Mean Relative Volume Difference (%) *	Mean Dice Coefficient ***	Mean of Mean Surface Distance (mm) *	Mean Hausdorff Distance (mm) *
MV04_L4	Control	4.5 ± 1.7	0.94 ± 0.02	0.5 ± 0.1	8.0 ± 5.3
MV04_L5	Lytic	3.0 ± 2.1	0.94 ± 0.01	0.5 ± 0.1	12.0 ± 5.4
MV06_L3	Lytic	7.9 ± 3.7	0.93 ± 0.02	0.5 ± 0.1	7.0 ± 2.4
MV06_L4	Control	5.0 ± 1.9	0.94 ± 0.02	0.5 ± 0.1	2.5 ± 0.4
MV08_L2	Lytic	6.4 ± 2.7	0.94 ± 0.00	0.5 ± 0.0	4.2 ± 1.2
MV08_L3	Control	7.7 ± 4.7	0.93 ± 0.01	0.5 ± 0.1	6.1 ± 3.0
Mean ± Standard Deviation		**5.7 ± 1.7**	**0.94 ± 0.01**	**0.5 ± 0.0**	**6.6 ± 3.3**

Supplementary Figure A

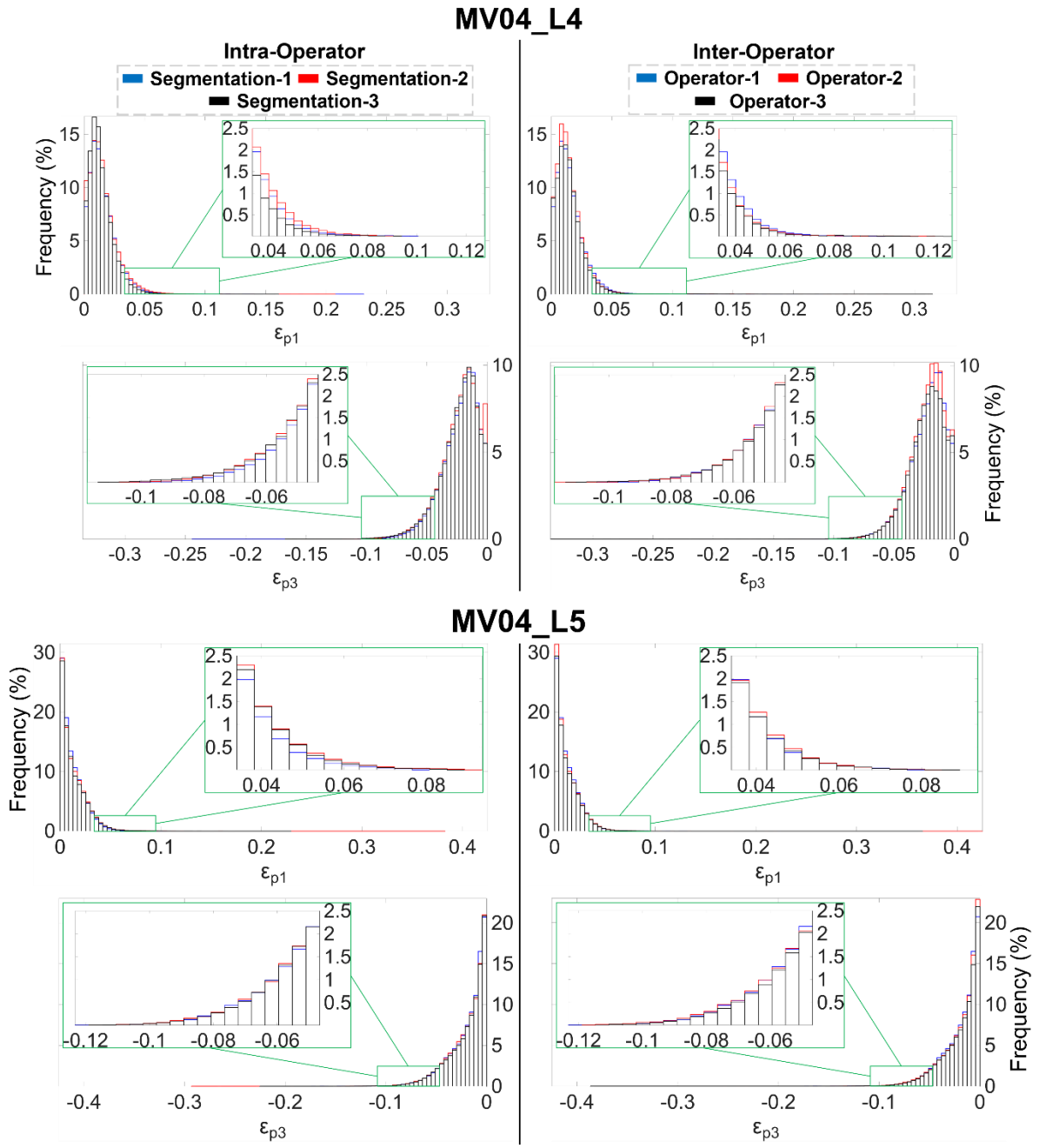


Supplementary Figure A: Frequency plots of elastic modulus assigned to elements for patient dataset MV04 (top), MV06 (middle) and MV08 (bottom)*. Bin width is 1000 MPa. Intra-operator is on the left and inter-operator is on the right.*



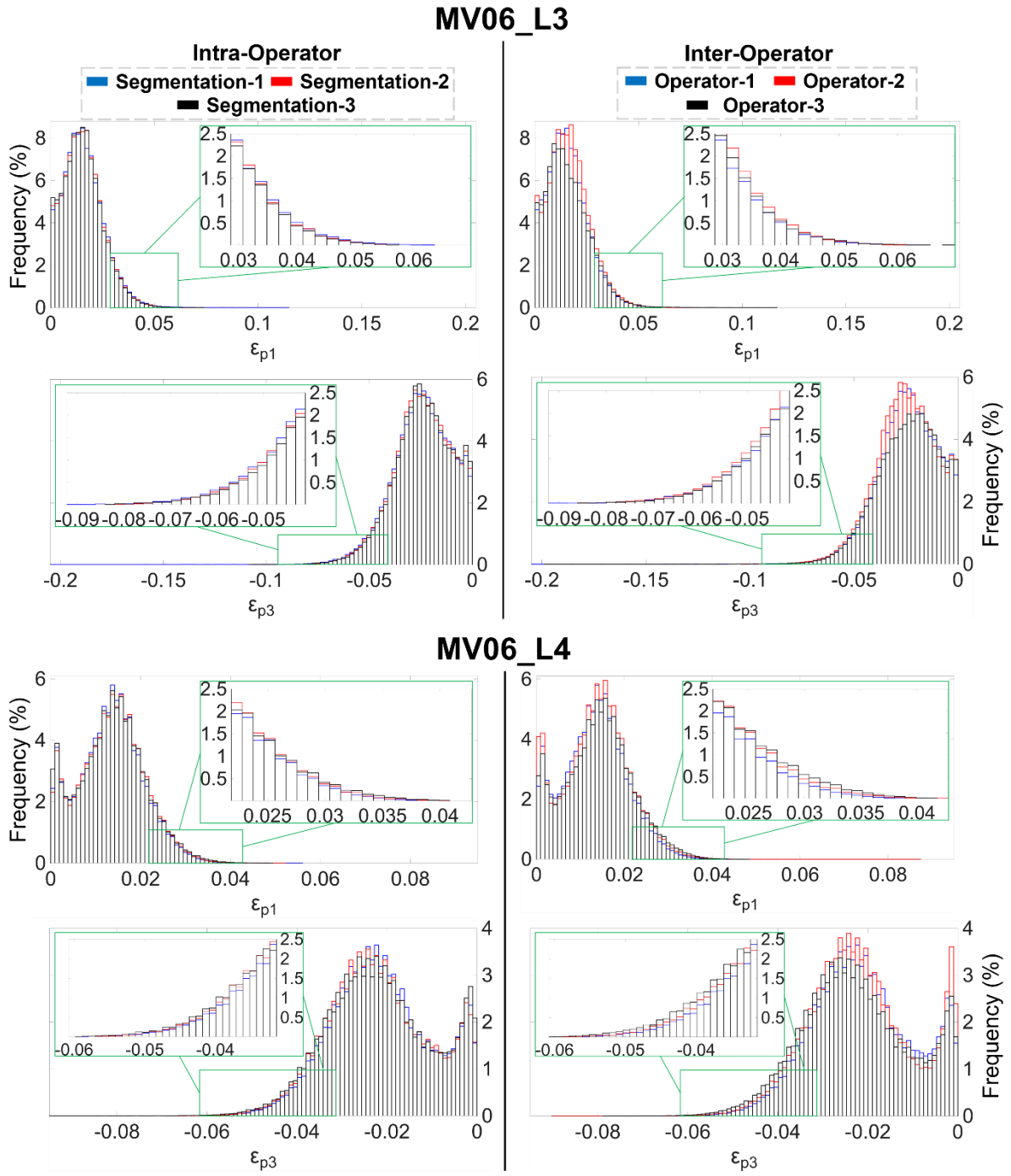
Supplementary Figure B: Force-displacement and stress-strain graphs for intra- (top) and inter-operator (bottom) assessments

Supplementary Figure C



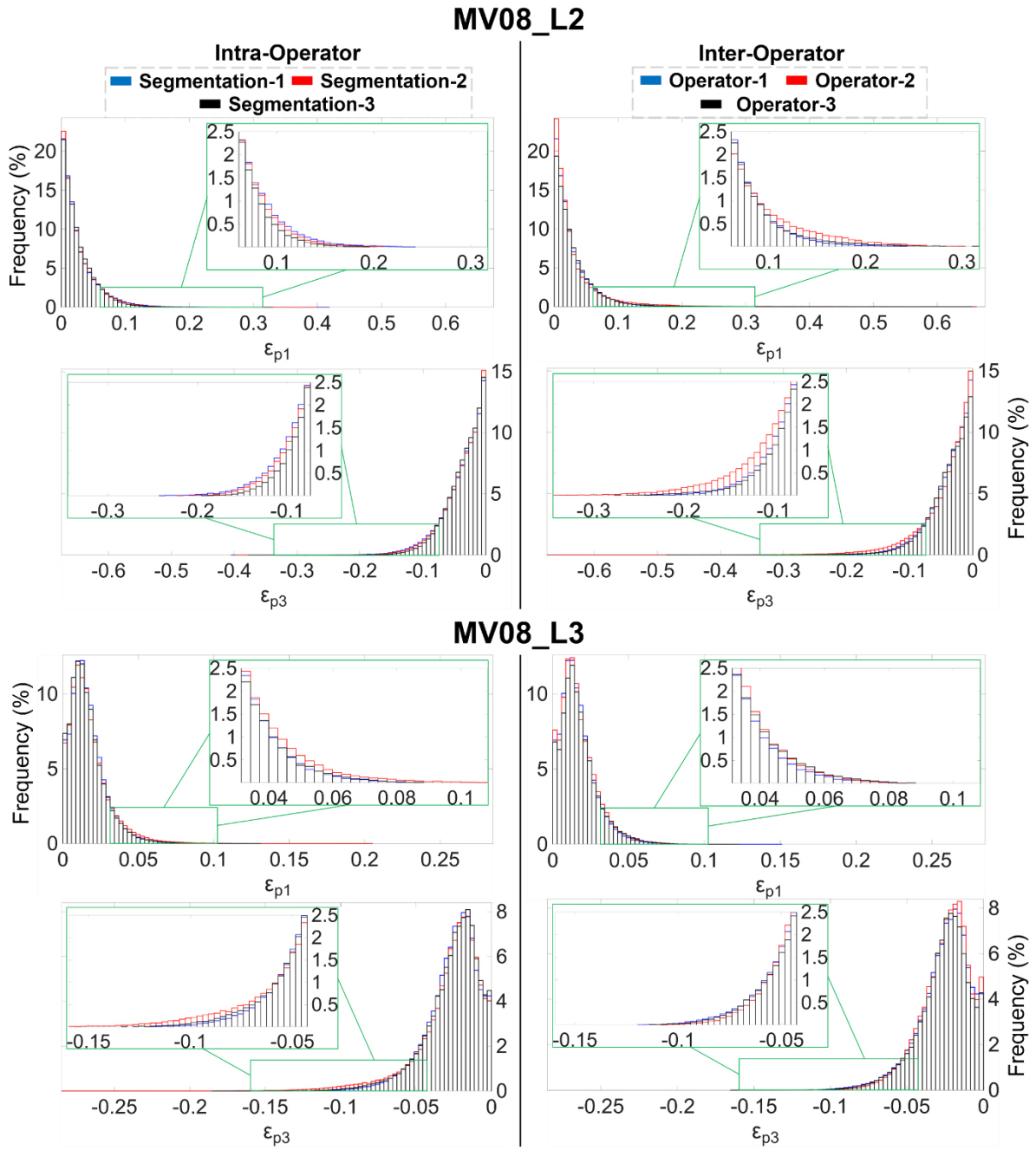
Supplementary Figure C: Frequency plots of the minimum and maximum total principal strain for both intra- and inter-operator for patient dataset MV04, L4 (top) and L5 (bottom). Bin width is 1% of the highest value of strain on the vertebra, 0.3 for L4 and 0.4 for L5. Intra-operator is on the left and inter-operator is on the right. For each vertebra maximum principal strain (ε_{p1}) is on the top and minimum principal strain (ε_{p3}) is on the bottom. The zoom in (green square) shows strain values that have a frequency of between 0.01% and 2.5%.

Supplementary Figure D



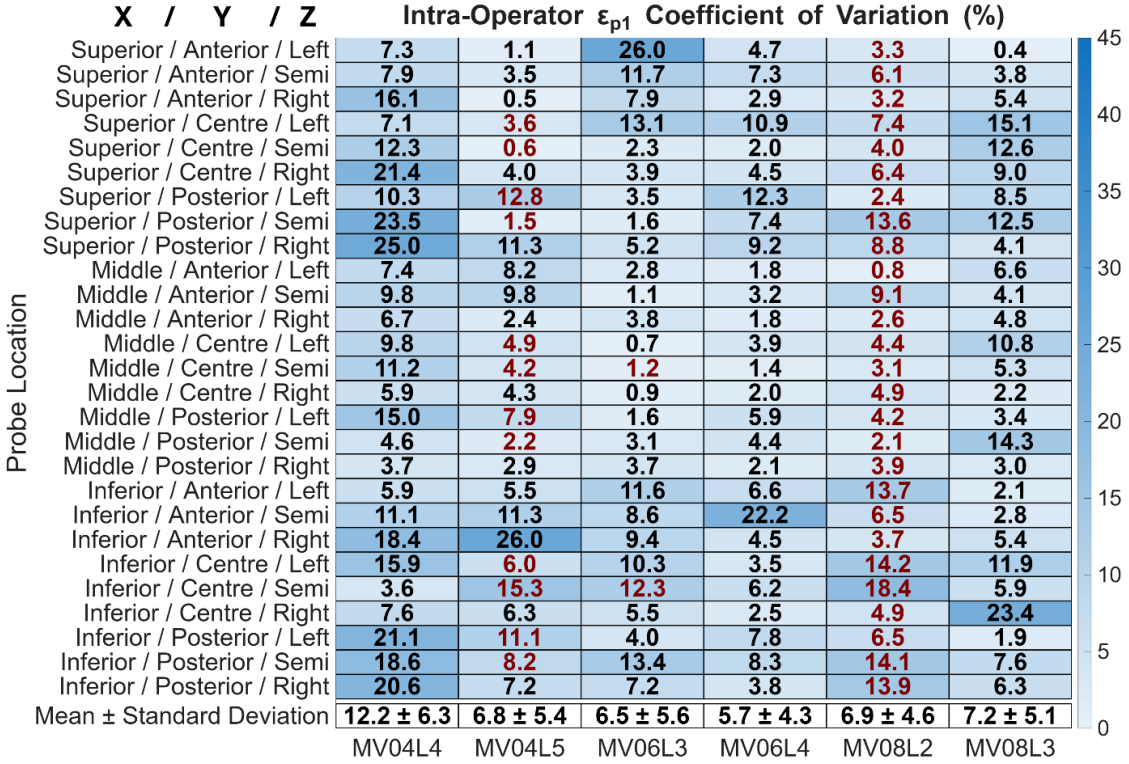
Supplementary Figure D: Frequency plots of the minimum and maximum total principal strain for both intra- and inter-operator for patient dataset MV06, L3 (top) and L4 (bottom). Bin width is 1% of the highest value of strain on the vertebra, 0.2 for L3 and 0.09 for L4. Intra-operator is on the left and inter-operator is on the right. For each vertebra maximum principal strain (ε_{p1}) is on the top and minimum principal strain (ε_{p3}) is on the bottom. The zoom in (green square) shows strain values that have a frequency of between 0.01% and 2.5%.

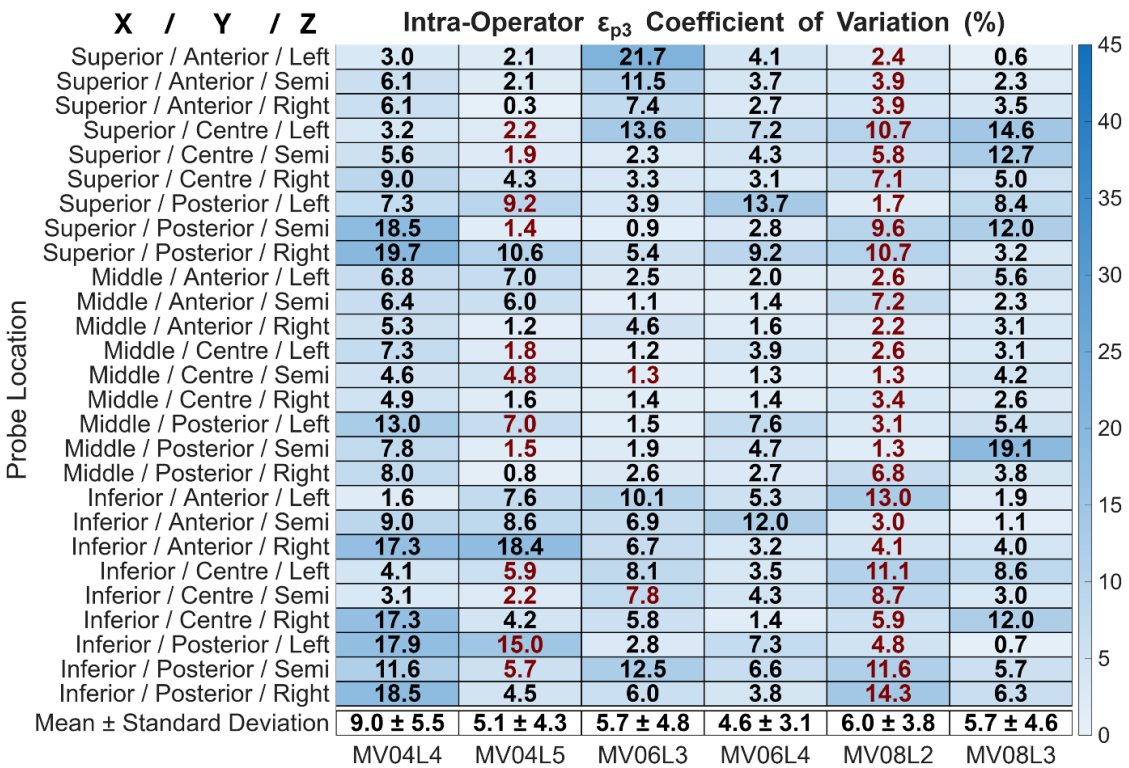
Supplementary Figure E



Supplementary Figure E: Frequency plots of the minimum and maximum total principal strain for both intra- and inter-operator for patient dataset MV08, L2 (top) and L3 (bottom). Bin width is 1% of the highest value of strain on the vertebra, 0.62 for L2 and 0.3 for L3. Intra-operator is on the left and inter-operator is on the right. For each vertebra maximum principal strain (ε_{p1}) is on the top and minimum principal strain (ε_{p3}) is on the bottom. The zoom in (green square) shows strain values that have a frequency of between 0.01% and 2.5%.

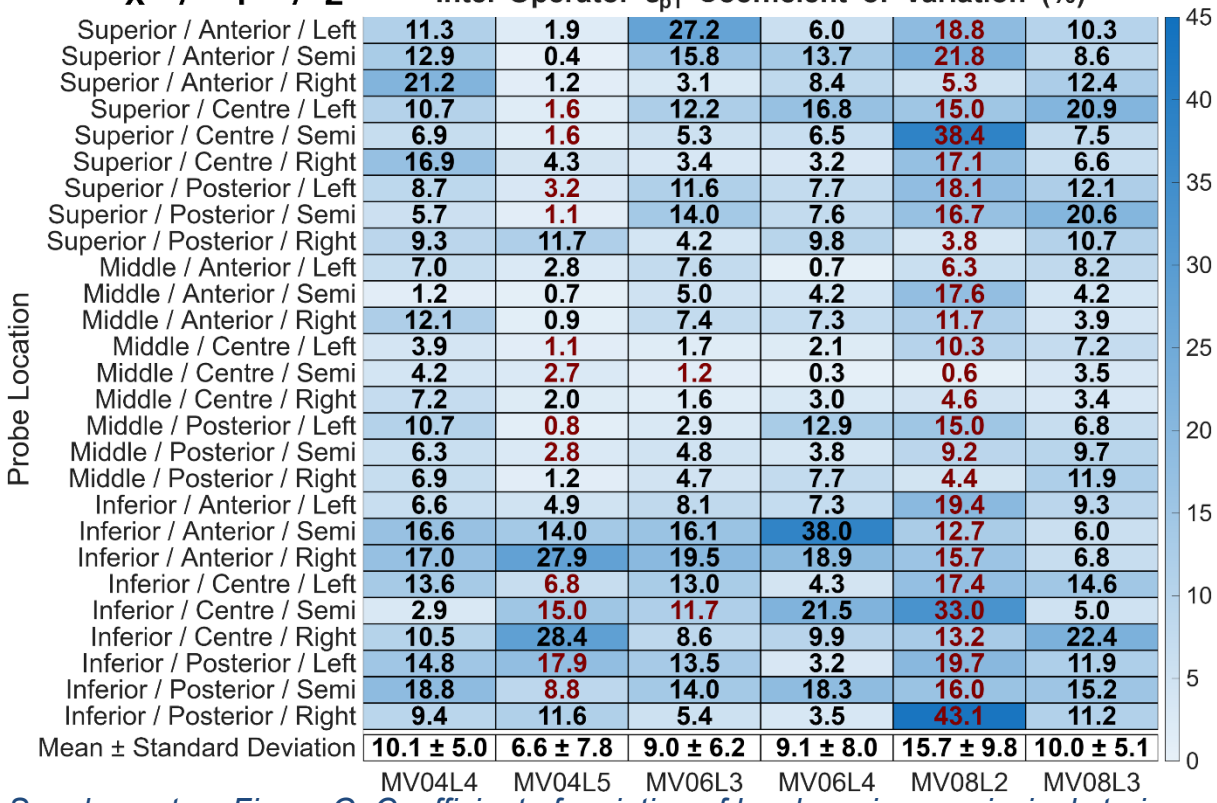
Supplementary Figure F





Supplementary Figure F: Coefficient of variation of local maximum principal strain (ε_{p1}) (top) and local minimum principal strain (ε_{p3}) (bottom). Each column represents a different vertebra, and each row represents a probes XYZ location (shown in legend). The last row shows the average coefficient of variation across the probes and the standard deviation. The scale of the heatmap is from 0% to 45%. Numbers shown in red represent probes that have elements located within a lesion.

Supplementary Figure G



Supplementary Figure G: Coefficient of variation of local maximum principal strain (ε_{p1}). Each column represents a different vertebra, and each row represents a probes XYZ location (shown in legend). The last row shows the average coefficient of variation across the probes and the standard deviation. The scale of the heatmap is from 0% to 45%. Numbers shown in red represent probes that have elements located within a lesion.

*Supplementary Table B: Mechanical results for both intra- (top) and inter- (bottom) operator assessments. Each row is the average and standard deviation for the three comparisons of the vertebra, with the average and standard deviation across all vertebrae calculated. *, **, *** represent significant differences between the metrics for the intra- and the inter-operator assessments with $p<0.05$, $p<0.01$ or $p<0.001$, respectively. The last row for both intra- and inter- shows the precision error (%) for each metric.*

Supplementary Table B

Intra-Operator	Vertebrae Type	Mean Ultimate Force (kN)**	Mean Ultimate Stress (MPa)**	Mean Stiffness (kN/mm) **	Mean Apparent Modulus (MPa) **
MV04_L4	Control	1.7 ± 0.0	1.4 ± 0.0	18.2 ± 0.5	426.6 ± 9.3
MV04_L5	Lytic	4.1 ± 0.1	2.8 ± 0.0	47.8 ± 1.0	879.7 ± 19.2
MV06_L3	Lytic	2.9 ± 0.0	2.7 ± 0.0	34.8 ± 0.4	875.1 ± 10.2
MV06_L4	Control	2.5 ± 0.0	2.5 ± 0.0	28.9 ± 0.6	809.2 ± 15.4
MV08_L2	Lytic	2.7 ± 0.0	1.9 ± 0.0	31.3 ± 1.0	557.4 ± 17.5
MV08_L3	Control	2.2 ± 0.0	1.9 ± 0.0	25.7 ± 0.3	574.8 ± 7.3
Mean ± Standard Deviation		**2.7 ± 0.7**	**2.2 ± 0.5**	**31.8 ± 9.1**	**687.2 ± 175.4**
Precision Error (%)		**1.5**	**1.3**	**2.1**	**2.1**
Inter-Operator	Vertebrae Type	Mean Ultimate Force (kN)**	Mean Ultimate Stress (MPa)**	Mean Stiffness (kN/mm) **	Mean Apparent Modulus (MPa) **
MV04_L4	Control	1.7 ± 0.0	1.4 ± 0.0	17.8 ± 0.2	417.0 ± 1.8
MV04_L5	Lytic	4.0 ± 0.1	2.7 ± 0.0	47.0 ± 0.5	860.6 ± 12.4
MV06_L3	Lytic	2.7 ± 0.1	2.7 ± 0.1	33.6 ± 1.3	850.9 ± 25.8
MV06_L4	Control	2.5 ± 0.1	2.5 ± 0.1	27.9 ± 1.2	789.8 ± 19.1
MV08_L2	Lytic	2.6 ± 0.1	1.9 ± 0.0	30.8 ± 0.6	552.4 ± 0.9
MV08_L3	Control	2.1 ± 0.1	1.8 ± 0.1	24.5 ± 1.2	556.3 ± 19.5
Mean ± Standard Deviation		**2.6 ± 0.7**	**2.2 ± 0.5**	**30.3 ± 9.0**	**671.1 ± 170.4**
Precision Error (%)		**3.6**	**2.5**	**3.3**	**2.3**

Supplementary Table C: Relative difference of mechanical metrics for both intra- (top) and inter- (bottom) operator assessments. Each row is the relative difference for the three comparisons of the vertebra, with the average and standard deviation across all vertebrae in the final row.

Supplementary Table C

Intra-Operator	Ultimate Force Relative Difference (%)	Ultimate Stress Relative Difference (%)	Stiffness Relative Difference (%)	Apparent Modulus Relative Difference (%)
MV04_L4	2.8	2.6	4.0	3.5
MV04_L5	3.4	2.6	3.4	3.6
MV06_L3	2.0	1.9	1.8	1.9
MV06_L4	2.2	2.2	3.1	3.0
MV08_L2	1.5	1.1	5.2	5.0
MV08_L3	1.9	1.7	2.0	2.0
Mean ± Standard Deviation	**2.3 ± 0.6**	**2.0 ± 0.6**	**3.3 ± 1.2**	**3.2 ± 1.1**
Inter-Operator	Ultimate Force Relative Difference (%)	Ultimate Stress Relative Difference (%)	Stiffness Relative Difference (%)	Apparent Modulus Relative Difference (%)
MV04_L4	3.0	2.1	2.2	1.8
MV04_L5	2.9	1.8	1.4	2.3
MV06_L3	7.4	4.2	6.4	4.5
MV06_L4	4.6	3.9	6.9	3.9
MV08_L2	3.1	1.9	2.9	0.2
MV08_L3	9.6	6.9	7.9	5.6
Mean ± Standard Deviation	**5.1 ± 2.6**	**3.5 ± 1.8**	**4.6 ± 2.5**	**3.1 ± 1.8**