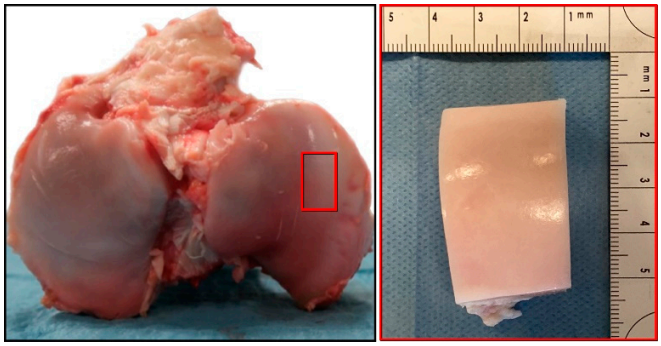
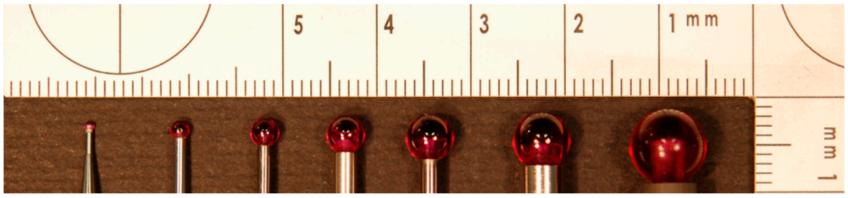
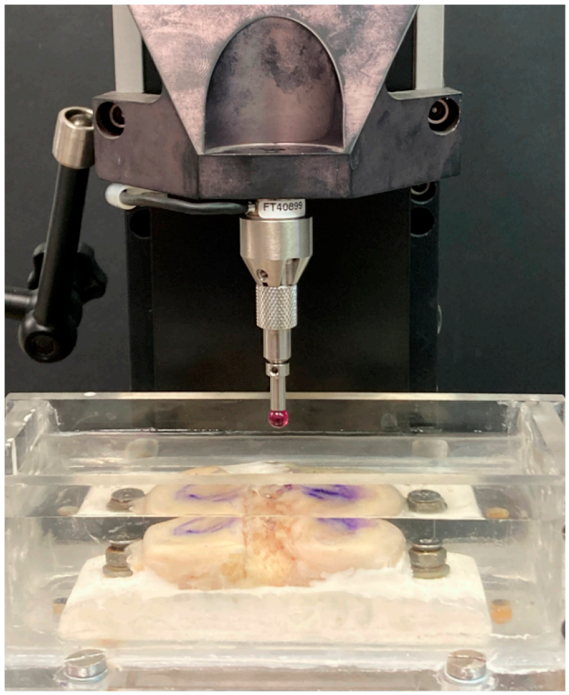


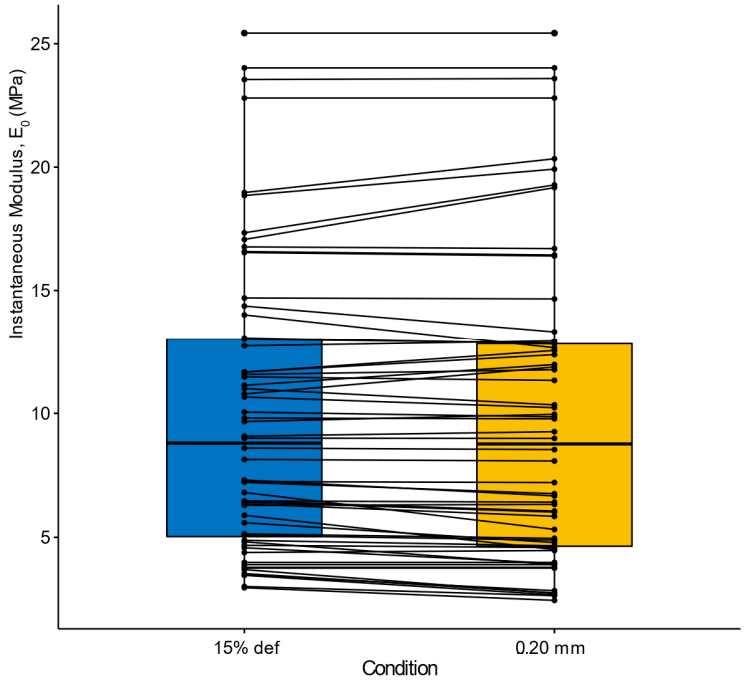
Supplementary Figure S1. Example of a bovine knee tibial plateau (left), from which samples suitable for indentation test were extracted (right).



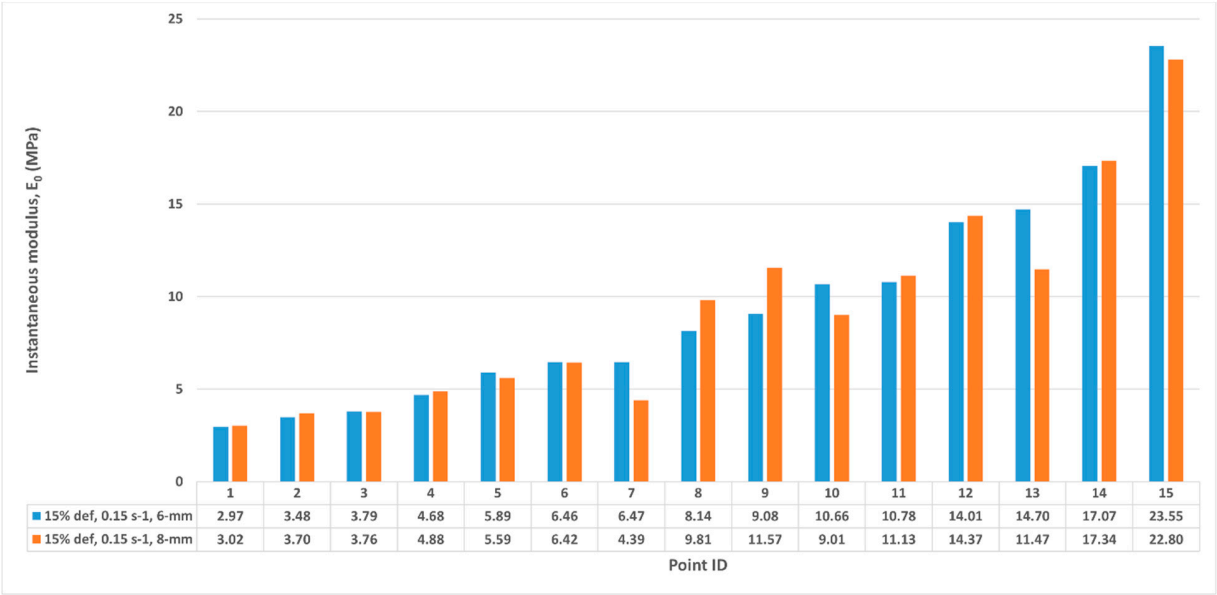
Supplementary Figure S2. Spherical indenters used to test knee articular cartilage, starting from 1-mm (left) to 8-mm (right) diameter indenter.



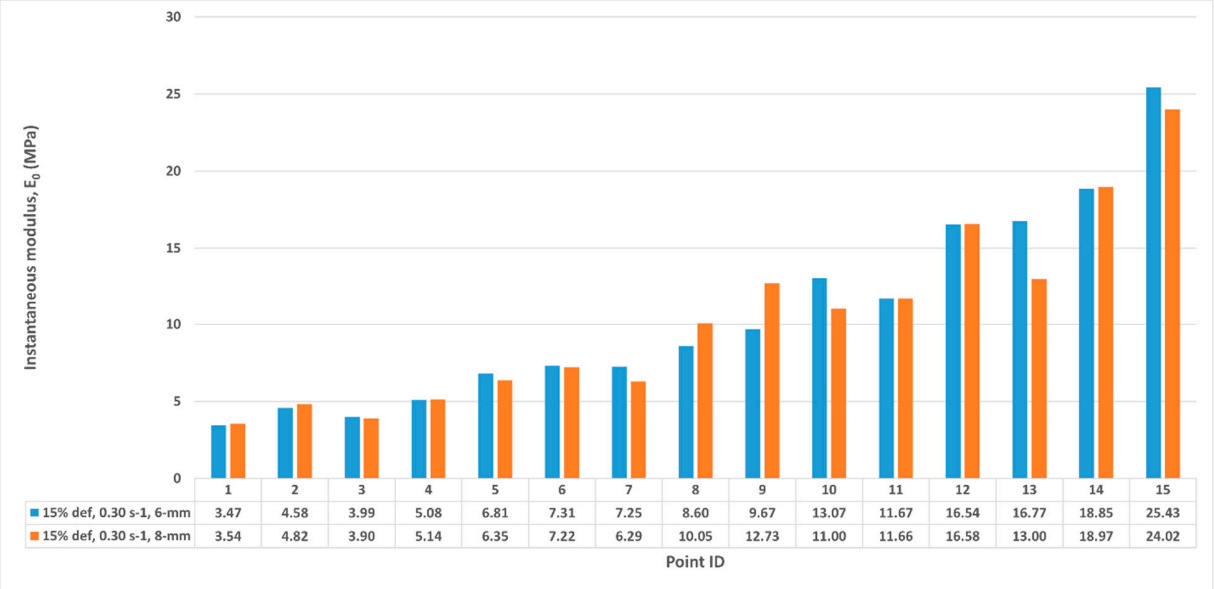
Supplementary Figure S3. The human tibial plateau constrained to the X-Y motorized table of the testing machine. The 6-mm diameter indenter is also visible.



Supplementary Figure S4. Distributions of E_0 values determined with different imposed deformation, i.e., a nominal deformation of 15%, and a 0.20 mm displacement.

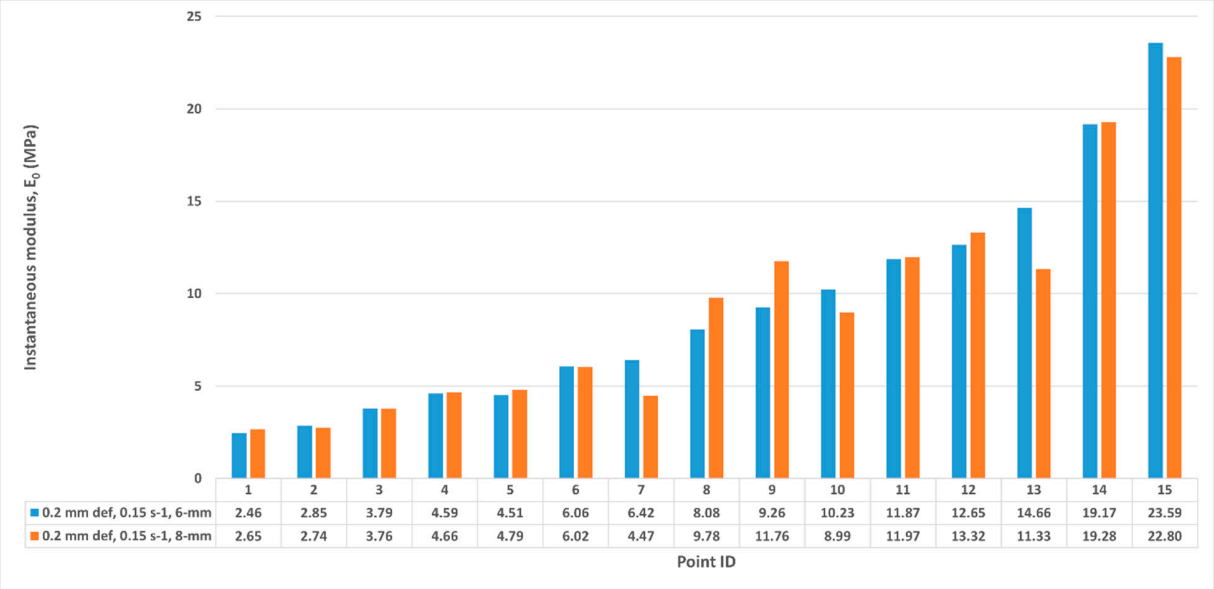


Supplementary Figure S5. E_0 values determined for the investigated points onto the human tibial plateau by using 6-mm and 8-mm indenters (nominal deformation of 15% of the cartilage thickness, 0.15 s^{-1} indentation rate).



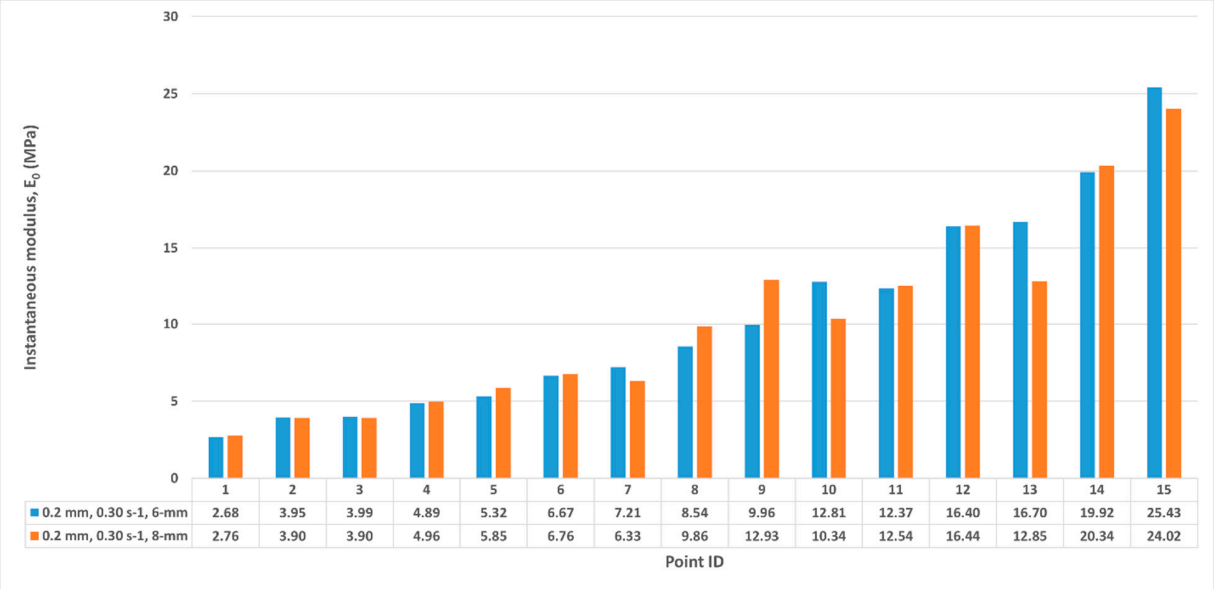
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
15% def, 0.30 s-1, 6-mm	3.47	4.58	3.99	5.08	6.81	7.31	7.25	8.60	9.67	13.07	11.67	16.54	16.77	18.85	25.43
15% def, 0.30 s-1, 8-mm	3.54	4.82	3.90	5.14	6.35	7.22	6.29	10.05	12.73	11.00	11.66	16.58	13.00	18.97	24.02

Supplementary Figure S6. E_0 values determined for the investigated points onto the human tibial plateau by using 6-mm and 8-mm indenters (nominal deformation of 15% of the cartilage thickness, 0.30 s^{-1} indentation rate).



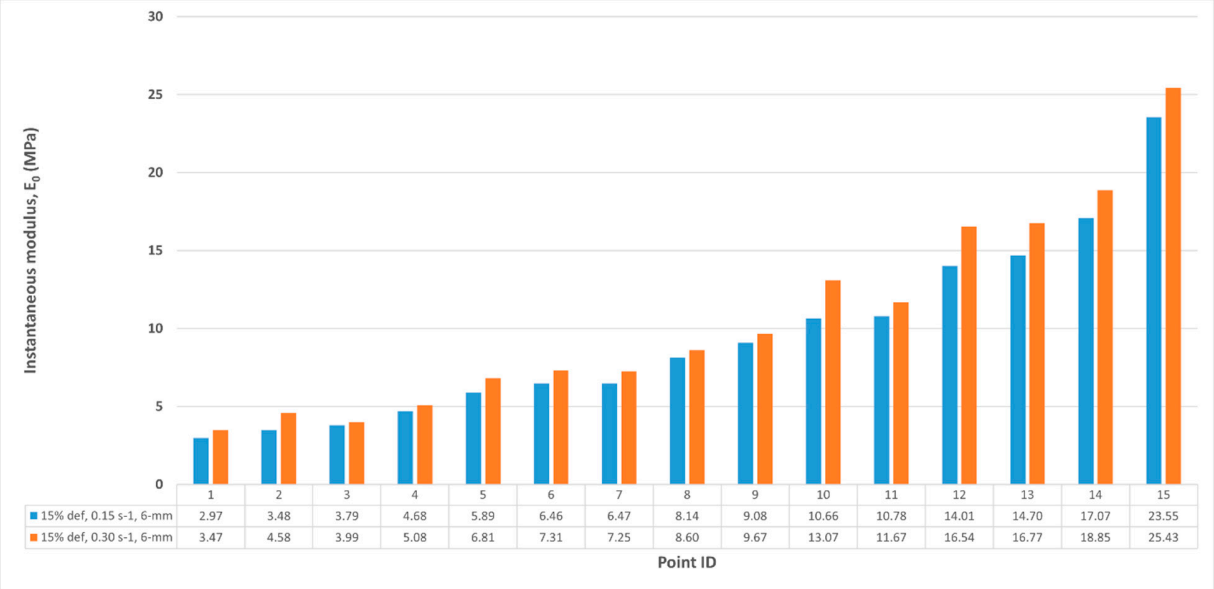
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0.2 mm def, 0.15 s-1, 6-mm	2.46	2.85	3.79	4.59	4.51	6.06	6.42	8.08	9.26	10.23	11.87	12.65	14.66	19.17	23.59
0.2 mm def, 0.15 s-1, 8-mm	2.65	2.74	3.76	4.66	4.79	6.02	4.47	9.78	11.76	8.99	11.97	13.32	11.33	19.28	22.80

Supplementary Figure S7. E_0 values determined for the investigated points onto the human tibial plateau by using 6-mm and 8-mm indenters (indentation depth of 0.20 mm, 0.15 s^{-1} indentation rate).



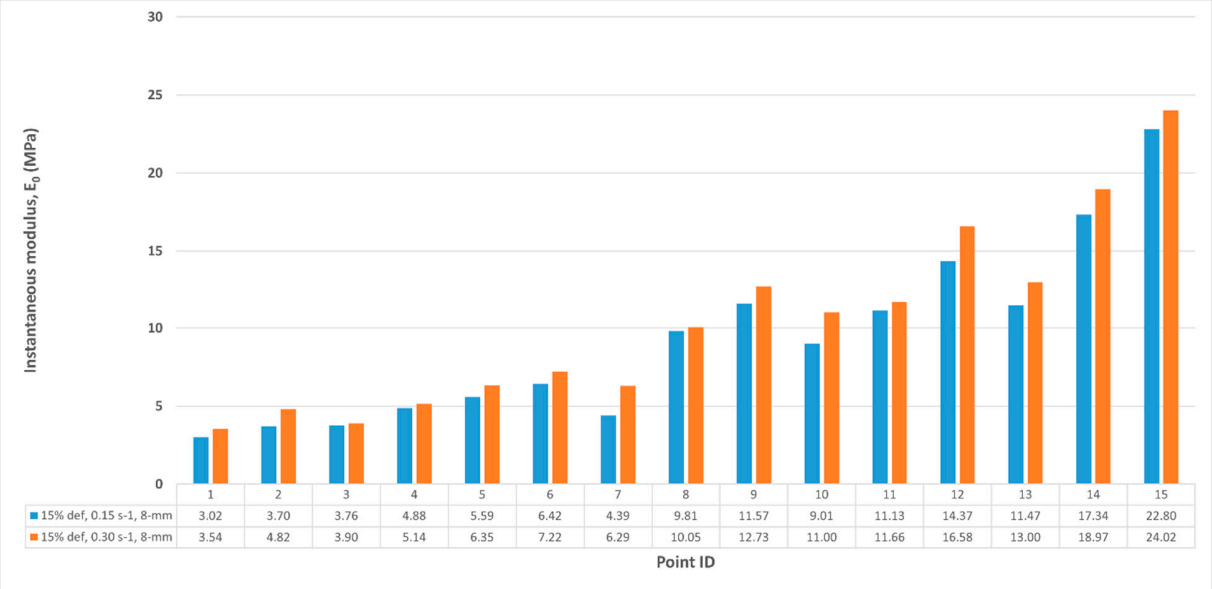
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0.2 mm, 0.30 s-1, 6-mm	2.68	3.95	3.99	4.89	5.32	6.67	7.21	8.54	9.96	12.81	12.37	16.40	16.70	19.92	25.43
0.2 mm, 0.30 s-1, 8-mm	2.76	3.90	3.90	4.96	5.85	6.76	6.33	9.86	12.93	10.34	12.54	16.44	12.85	20.34	24.02

Supplementary Figure S8. E_0 values determined for the investigated points onto the human tibial plateau by using 6-mm and 8-mm indenters (indentation depth of 0.20 mm, 0.30 s^{-1} indentation rate).



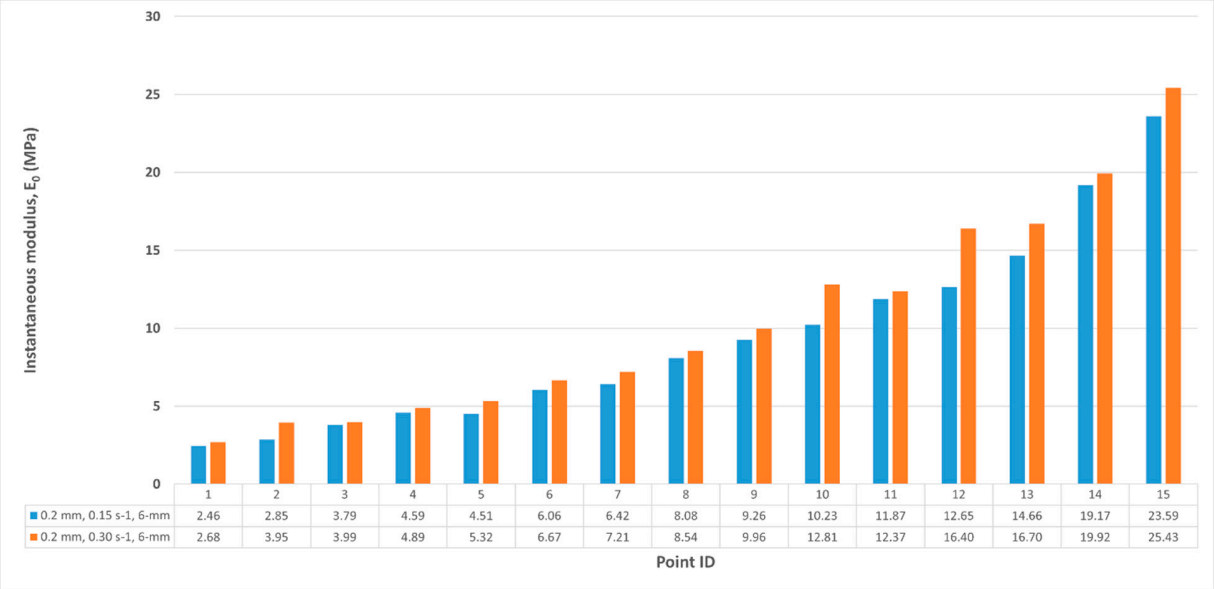
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
15% def, 0.15 s-1, 6-mm	2.97	3.48	3.79	4.68	5.89	6.46	6.47	8.14	9.08	10.66	10.78	14.01	14.70	17.07	23.55
15% def, 0.30 s-1, 6-mm	3.47	4.58	3.99	5.08	6.81	7.31	7.25	8.60	9.67	13.07	11.67	16.54	16.77	18.85	25.43

Supplementary Figure S9. E_0 values determined for the investigated points onto the human tibial plateau by using 0.15 s^{-1} and 0.30 s^{-1} indentation rate (nominal deformation of 15% of the cartilage thickness, 6-mm indenter diameter).



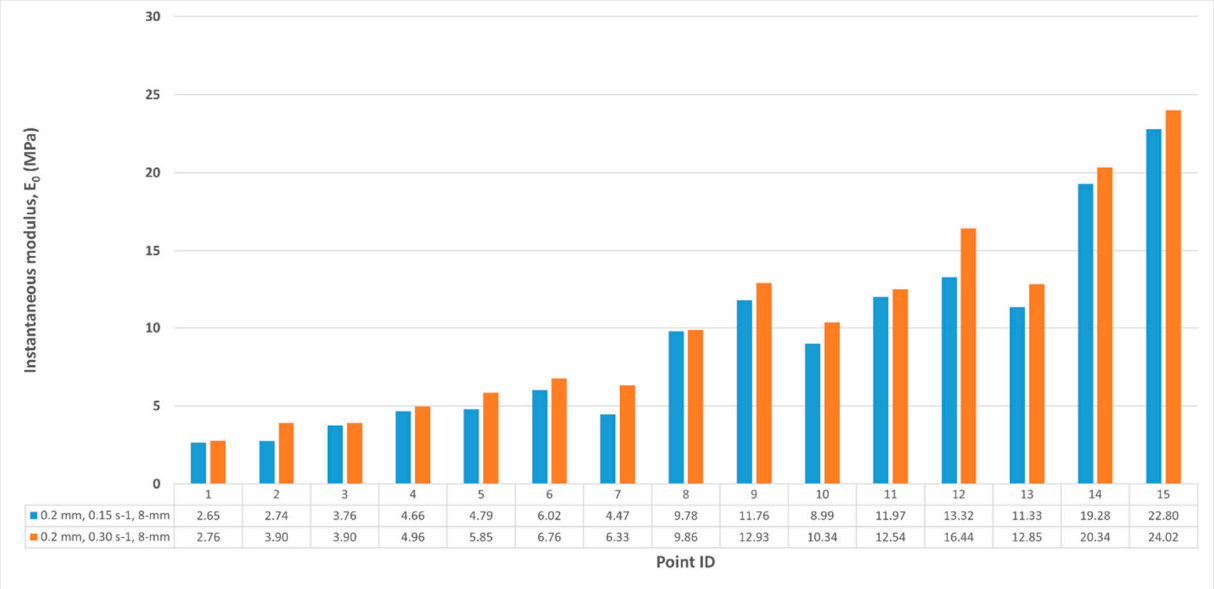
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
15% def, 0.15 s-1, 8-mm	3.02	3.70	3.76	4.88	5.59	6.42	4.39	9.81	11.57	9.01	11.13	14.37	11.47	17.34	22.80
15% def, 0.30 s-1, 8-mm	3.54	4.82	3.90	5.14	6.35	7.22	6.29	10.05	12.73	11.00	11.66	16.58	13.00	18.97	24.02

Supplementary Figure S10. E_0 values determined for the investigated points onto the human tibial plateau by using 0.15 s^{-1} and 0.30 s^{-1} indentation rate (nominal deformation of 15% of the cartilage thickness, 8-mm indenter diameter).



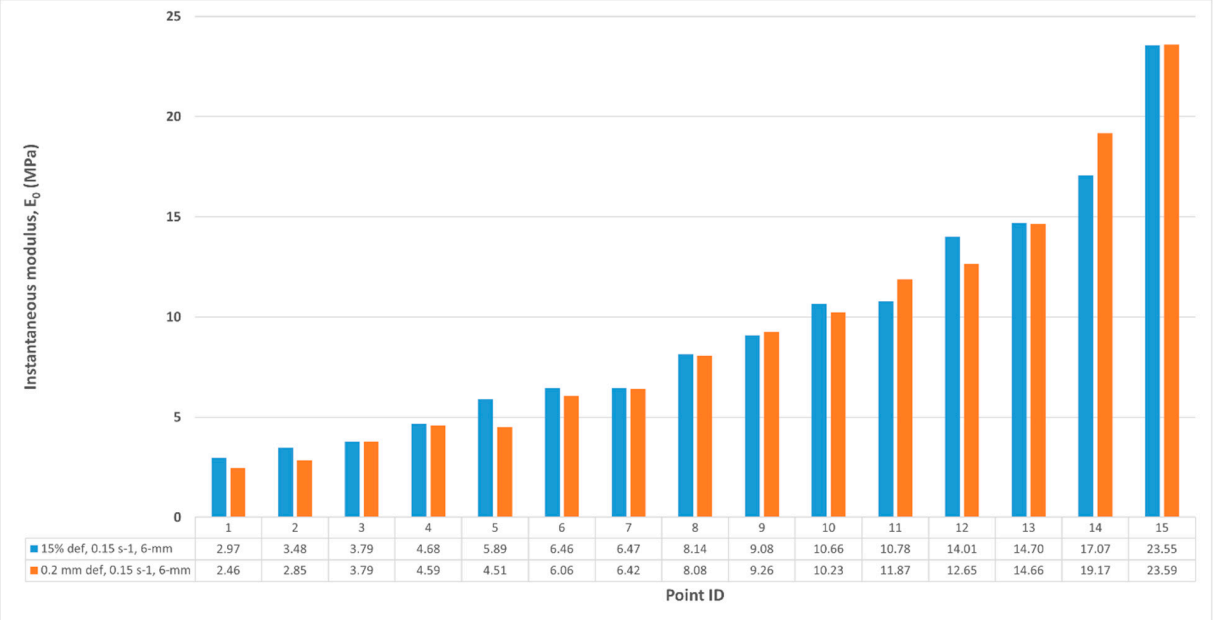
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0.2 mm, 0.15 s-1, 6-mm	2.46	2.85	3.79	4.59	4.51	6.06	6.42	8.08	9.26	10.23	11.87	12.65	14.66	19.17	23.59
0.2 mm, 0.30 s-1, 6-mm	2.68	3.95	3.99	4.89	5.32	6.67	7.21	8.54	9.96	12.81	12.37	16.40	16.70	19.92	25.43

Supplementary Figure S11. E_0 values determined for the investigated points onto the human tibial plateau by using 0.15 s^{-1} and 0.30 s^{-1} indentation rate (indentation depth of 0.20 mm, 6-mm indenter diameter).



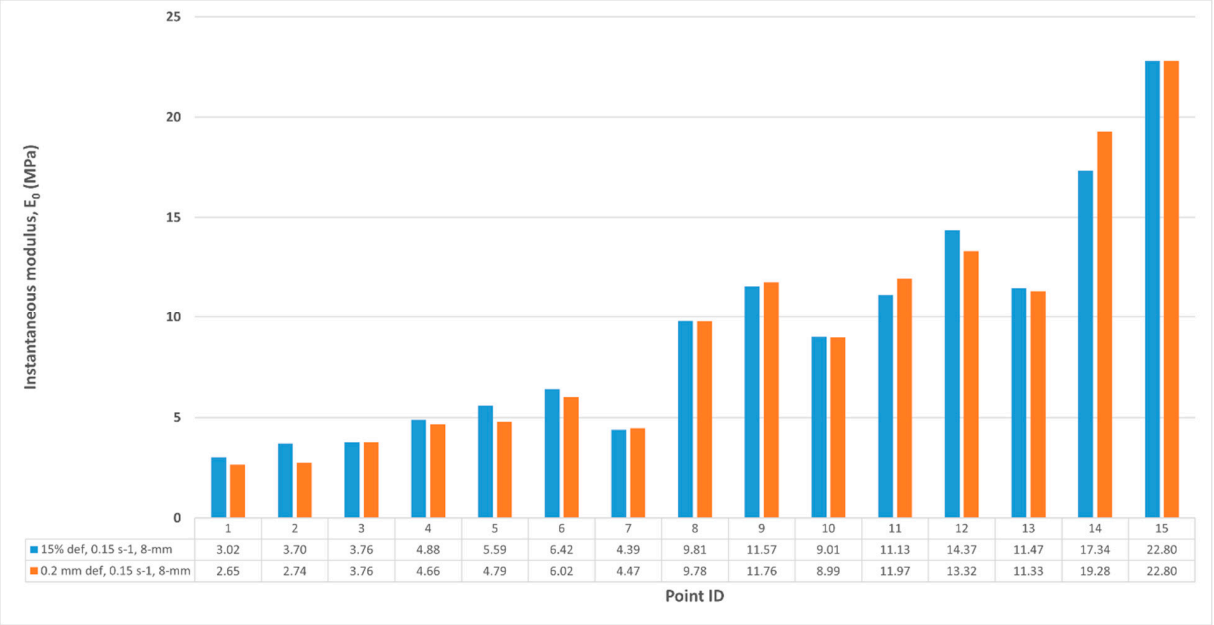
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0.2 mm, 0.15 s-1, 8-mm	2.65	2.74	3.76	4.66	4.79	6.02	4.47	9.78	11.76	8.99	11.97	13.32	11.33	19.28	22.80
0.2 mm, 0.30 s-1, 8-mm	2.76	3.90	3.90	4.96	5.85	6.76	6.33	9.86	12.93	10.34	12.54	16.44	12.85	20.34	24.02

Supplementary Figure S12. E_0 values determined for the investigated points onto the human tibial plateau by using 0.15 s^{-1} and 0.30 s^{-1} indentation rate (indentation depth of 0.20 mm, 8-mm indenter diameter).



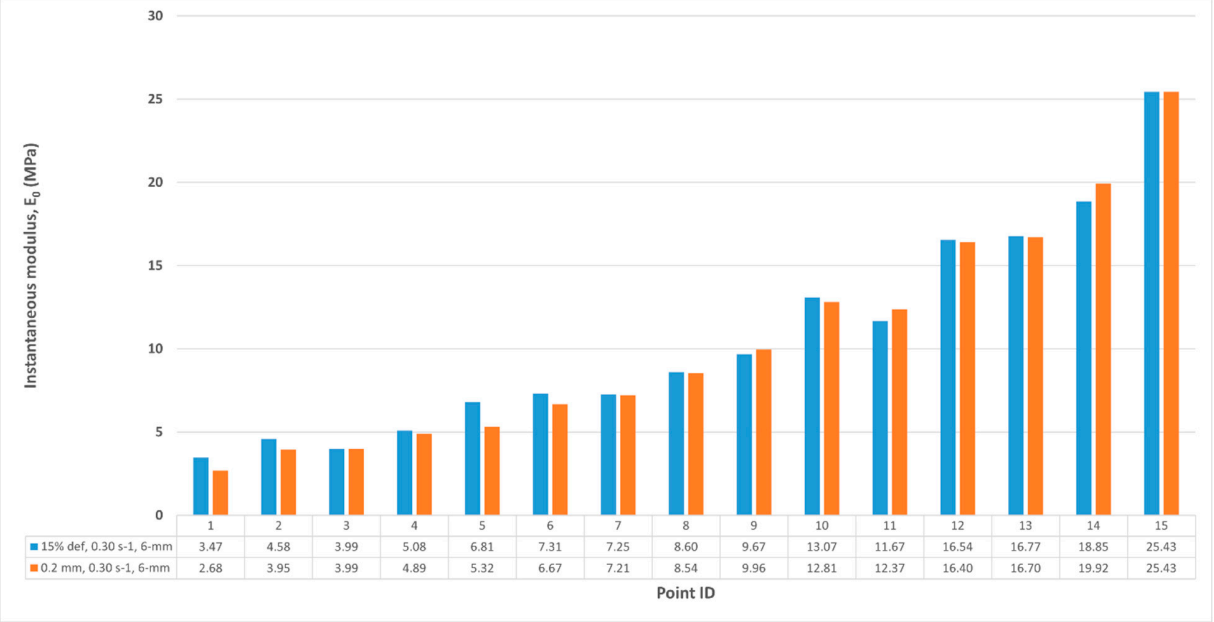
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
15% def, 0.15 s-1, 6-mm	2.97	3.48	3.79	4.68	5.89	6.46	6.47	8.14	9.08	10.66	10.78	14.01	14.70	17.07	23.55
0.2 mm def, 0.15 s-1, 6-mm	2.46	2.85	3.79	4.59	4.51	6.06	6.42	8.08	9.26	10.23	11.87	12.65	14.66	19.17	23.59

Supplementary Figure S13. E_0 values determined for the investigated points onto the human tibial plateau by applying a nominal deformation of 15% of the cartilage thickness, or an indentation depth of 0.20 mm (indentation rate of 0.15 s^{-1}, 6-mm indenter diameter).



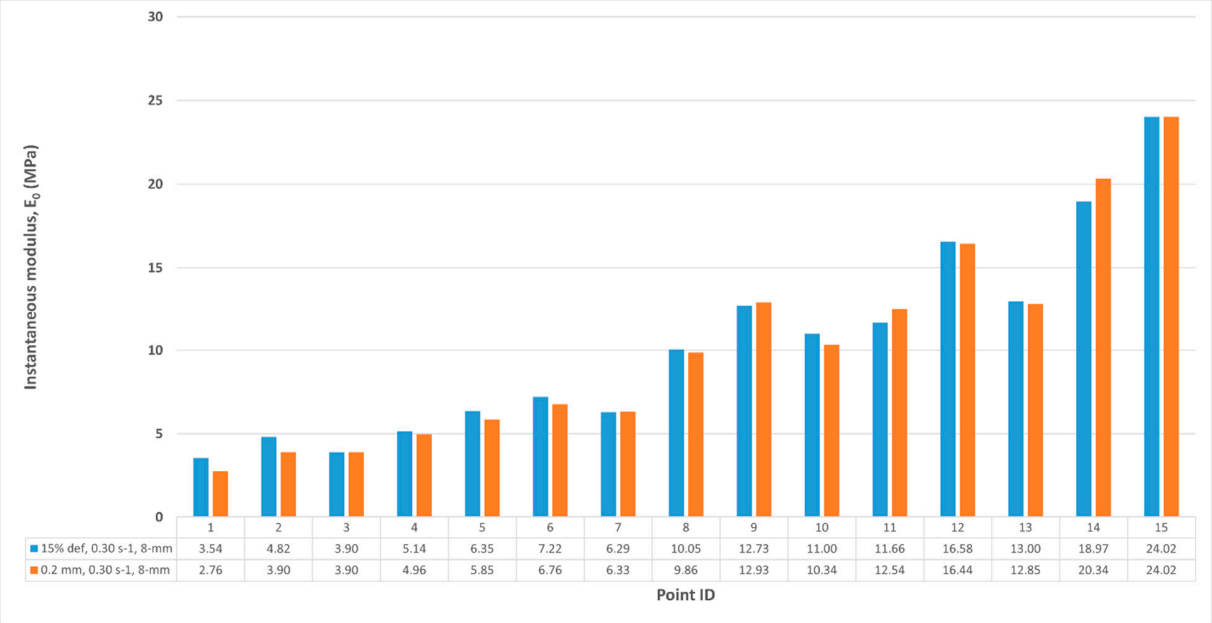
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
15% def, 0.15 s-1, 8-mm	3.02	3.70	3.76	4.88	5.59	6.42	4.39	9.81	11.57	9.01	11.13	14.37	11.47	17.34	22.80
0.2 mm def, 0.15 s-1, 8-mm	2.65	2.74	3.76	4.66	4.79	6.02	4.47	9.78	11.76	8.99	11.97	13.32	11.33	19.28	22.80

Supplementary Figure S14. E_0 values determined for the investigated points onto the human tibial plateau by applying a nominal deformation of 15% of the cartilage thickness, or an indentation depth of 0.20 mm (indentation rate of 0.15 s^{-1}, 8-mm indenter diameter).



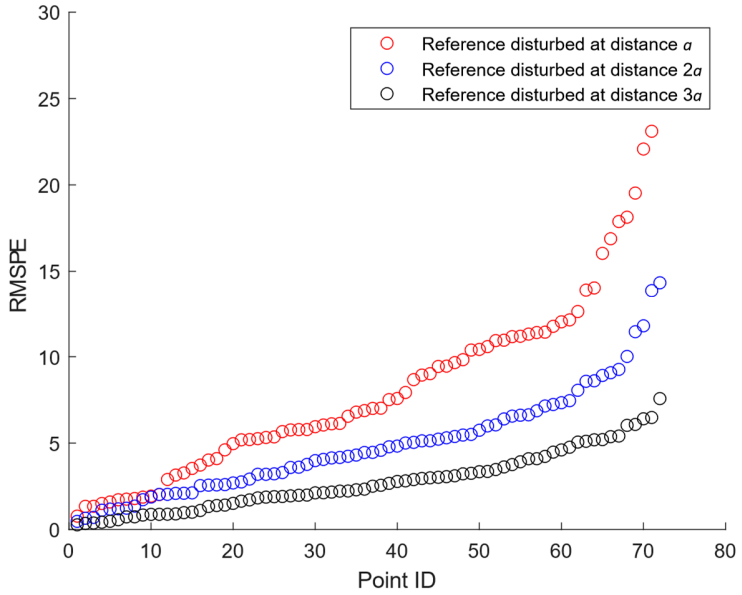
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
15% def, 0.30 s-1, 6-mm	3.47	4.58	3.99	5.08	6.81	7.31	7.25	8.60	9.67	13.07	11.67	16.54	16.77	18.85	25.43
0.2 mm, 0.30 s-1, 6-mm	2.68	3.95	3.99	4.89	5.32	6.67	7.21	8.54	9.96	12.81	12.37	16.40	16.70	19.92	25.43

Supplementary Figure S15. E_0 values determined for the investigated points onto the human tibial plateau by applying a nominal deformation of 15% of the cartilage thickness, or an indentation depth of 0.20 mm (indentation rate of 0.30 s^{-1}, 6-mm indenter diameter).



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
15% def, 0.30 s-1, 8-mm	3.54	4.82	3.90	5.14	6.35	7.22	6.29	10.05	12.73	11.00	11.66	16.58	13.00	18.97	24.02
0.2 mm, 0.30 s-1, 8-mm	2.76	3.90	3.90	4.96	5.85	6.76	6.33	9.86	12.93	10.34	12.54	16.44	12.85	20.34	24.02

Supplementary Figure S16. E_0 values determined for the investigated points onto the human tibial plateau by applying a nominal deformation of 15% of the cartilage thickness, or an indentation depth of 0.20 mm (indentation rate of 0.30 s^{-1}, 8-mm indenter diameter).



Supplementary Figure S17. Root mean square percentage error (RMSPE) calculated comparing the 72 stretched-exponential functions describing the response of the cartilage without perturbation (noPI) with each of the stretched-exponential function describing the response of the perturbed cartilage (PI*a*, PI2*a*, PI3*a*) in the same 72 measuring points.