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Finite element analysis of a total wrist replacement: determining implant lifetime due to fatigue

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Solidworks drawings

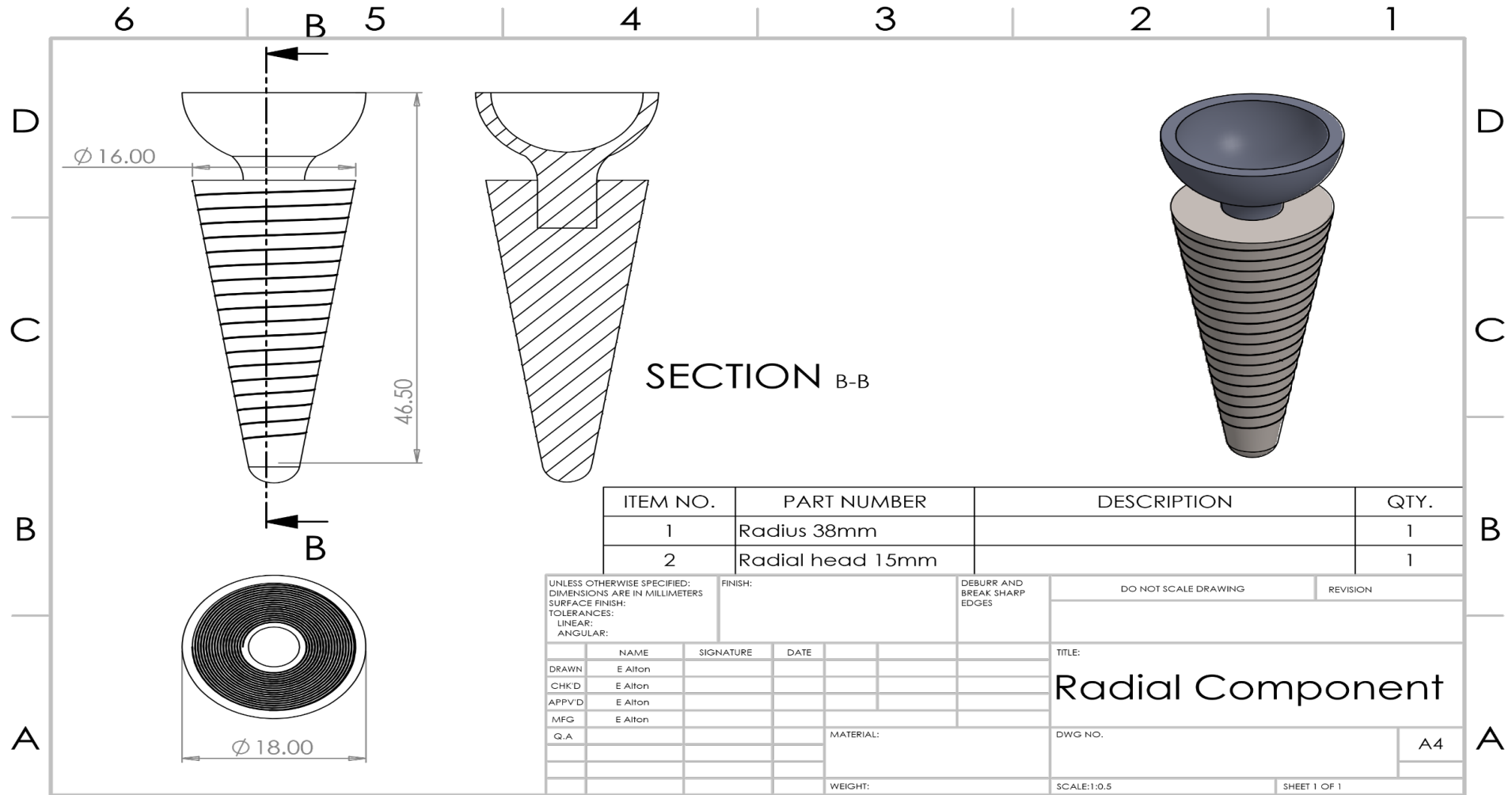


Figure 1 (appendix): Radial Component Drawing

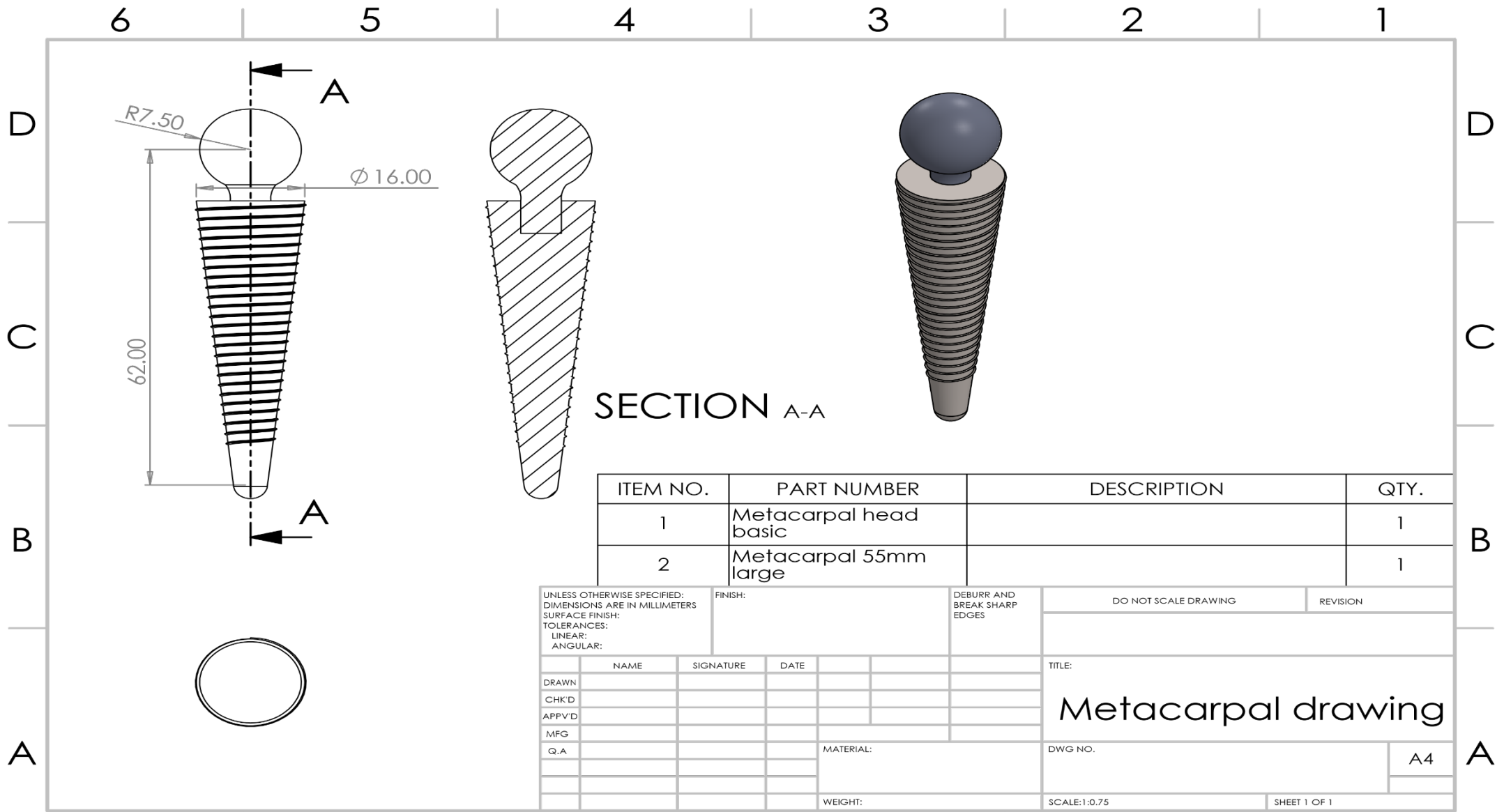


Figure 2 (appendix): Metacarpal Drawing

Table of FEA results

1N Normal movement not carrying anything									
Flexion Extension cycle					Radial Ulnar cycle				
Angle	Radial	Minimum years of use	Metacarpal	Minimum years of use	Angle	Radial	Minimum years of use	Metacarpal	Minimum years of use
	Maximum Stress (MPa)		Maximum Stress (MPa)			Maximum Stress (MPa)		Maximum Stress (MPa)	
0	0.23029367	50000	0.249859	50000	0	0.23029367	50000	0.249859	50000
10	0.2745785	500	0.24605205	500	2	0.24929191	500	0.241874	500
20	0.27103909	500	0.22463411	500	4	0.26298944	500	0.26994763	500
30	0.37097656	500	0.25988127	500	6	0.25205902	500	0.23308634	500
					8	0.24003089	500	0.23403591	500
					10	0.2745785	500	0.24605205	500
75N comparison with miners rule									
Flexion Extension cycle					Radial Ulnar cycle				
Angle	Radial	Minimum years of use	Metacarpal	Minimum years of use	Angle	Radial	Minimum years of use	Metacarpal	Minimum years of use
	Maximum Stress (MPa)		Maximum Stress (MPa)			Maximum Stress (MPa)		Maximum Stress (MPa)	
0	17.221326	50000	18.739424	50000	0	17.272028	50000	18.739424	50000
10	20.593382	500	18.453904	500	2	18.696894	500	18.140548	500
20	22.3565	500	16.990716	500	4	19.72421	500	20.246072	500
30	30.153066	500	21.123748	500	6	18.904422	500	17.481478	500
					8	18.002318	500	17.552692	500
					10	20.593382	500	18.453904	500
350N point FEA starts damage to part									
Flexion Extension cycle					Radial Ulnar cycle				
Angle	Radial	Minimum years of use	Metacarpal	Minimum years of use	Angle	Radial	Minimum years of use	Metacarpal	Minimum years of use
	Maximum Stress (MPa)		Maximum Stress (MPa)			Maximum Stress (Pa)		Maximum Stress (Pa)	
0	80.602792	50000	87.450656	50000	0	80.602792	50000	87.450656	50000
10	96.102472	500	86.118216	500	2	87.252168	500	84.65592	500
20	104.330328	500	79.290008	500	4	92.04632	500	94.481672	500
30	140.71432	382.0688	98.577496	500	6	88.220648	500	81.580224	500
					8	84.010824	500	81.912576	500
					10	96.102472	500	86.118216	500
425N half a mans average weight (handstand/pushup)									
Flexion Extension cycle					Radial Ulnar cycle				
Angle	Radial	Minimum years of use	Metacarpal	Minimum years of use	Angle	Radial	Minimum years of use	Metacarpal	Minimum years of use
	Maximum Stress (MPa)		Maximum Stress (MPa)			Maximum Stress (Pa)		Maximum Stress (Pa)	
0	97.874816	50000	106.190088	50000	0	97.874816	50000	106.190088	50000
10	116.695864	500	104.57212	500	2	105.949048	500	102.796456	500
20	126.68684	500	96.280712	500	4	111.770528	500	114.727752	500
30	170.867392	11.2135	119.70124	500	6	107.125072	500	99.061696	500
					8	102.013144	500	99.465256	500
					10	116.695864	500	104.57212	500