

ANSWER SHEET

OpenSim Tutorial #2

Simulation and Analysis of a Tendon Transfer Surgery

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Questions

1. *Which motion is expressed in positive angles: wrist flexion or wrist extension?*
2. *Which motion is expressed in positive angles: radial deviation or ulnar deviation?*
3. *What are the functions of the Extensor Carpi Ulnaris (ECU) muscle? Check all that apply.*
 wrist extension wrist flexion radial deviation ulnar deviation hip extension
4. *What are the functions of the Extensor Carpi Radialis Brevis (ECRB)? Check all that apply.*
 wrist extension wrist flexion radial deviation ulnar deviation hip extension
5. *Is the sign of the extension moment positive or negative?*
6. *What happens to the maximum moment of the wrist extensors if the ECU muscle is transferred to the ECRB? Hint: One of the goals of the surgery is to increase wrist extension strength.*
7. *Is the sign of the ulnar deviation moment positive or negative?*
8. *What happens to the maximum moment of the ulnar deviators if the ECU muscle is transferred to the ECRB location?*

9. *One goal of this tendon transfer surgery is to decrease excessive ulnar deviation. Has your simulated surgery achieved this goal? Explain.*
10. *What is the peak value of the ECU extension moment before transfer? At what flexion angle does it occur? Note: Remember, extension moments are negative.*
11. *What is the peak value of the ECU extension moment after transfer? At what flexion angle does it occur?*
12. *Does the moment-generating capacity of the ECU vary more with flexion angle before or after the simulated surgery?*
13. *Write down the peak values of each curve, the joint angle at which the peak occurs, and describe the general shapes of the curves.*
14. *What is the optimal fiber length of the ECU_pre-surgery muscle?*
15. *What is the optimal fiber length of ECU_post-surgery?*
16. *Calculate the ratio of optimal fiber length to peak moment arm for ECU_pre-surgery and ECU_post-surgery.*
17. *Explain the differences in the isometric moment vs. wrist flexion angle plots for the ECU_pre-surgery and ECU_post-surgery muscles, based on the plots of force and moment arm and the ratio of optimal fiber length to peak moment arm.*

18. *Specifically, what does the difference between the ratios of optimal fiber length to moment arm for the ECU before and after the tendon transfer tell you?*

19. *What is the tendon slack length of the ECRB muscle?*

20. *What is the optimal fiber length of the ECRB muscle?*

21. *How did changing the tendon slack length of the ECRB alter the tendon force vs. flexion angle curve?*

22. *How did changing the tendon slack length of the ECRB alter muscle-tendon length vs. flexion angle curve?*

23. *How did changing the tendon slack length of the ECRB alter the fiber length vs. flexion curve?*

24. *At what flexion angles do the fiber lengths of the ECRB and the edited ECRB reach the optimal fiber length? Compare these angles with the peaks of the force vs. flexion plots.*

25. *Explain the effect of tendon slack length on the force-angle relationship of a muscle based on what you have learned about its effect on fiber length and muscle-tendon length.*