Part 1:

(K) How many degrees of freedom, in total, does the model have? What degrees of freedom are not represented (i.e., Give an example of a motion that has been simplified and how).

Ans : There are 23 DOF for the model , 7 degree of freedom for each leg:
3 – Hip joint (flexion/extension, abduction/adduction, internal/external rotation)

1 – Knee Joint (flexion/extension)

1 – Ankle Joint (dorsiflexion/plantarflexion)

2 - subtalar joint (inversion/eversion, movement of the foot from left to right)

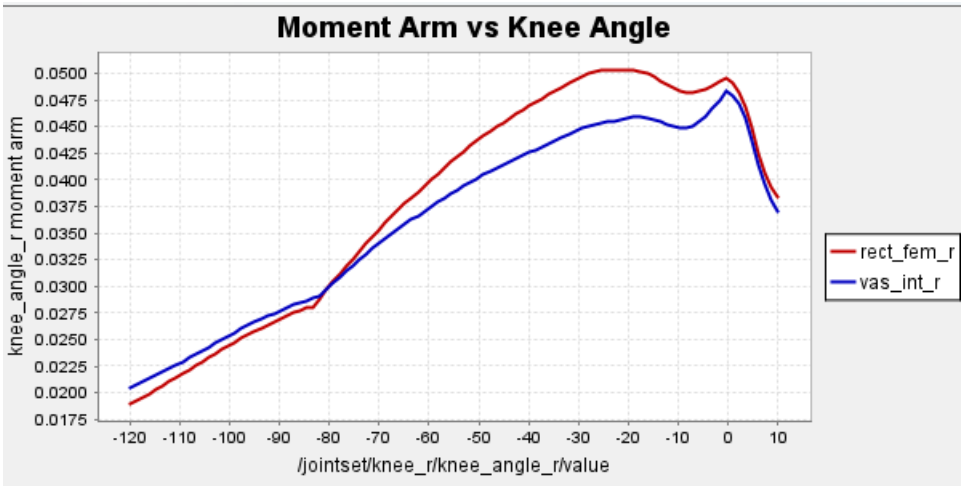
The model has simplified the knee flexion and extension, it assumes that the joint is single axis joint, which is not the case.

(K) How many muscles are in the model? Name 2 muscles that are represented with multiple lines of action and comment on why they may have been modeled this way.

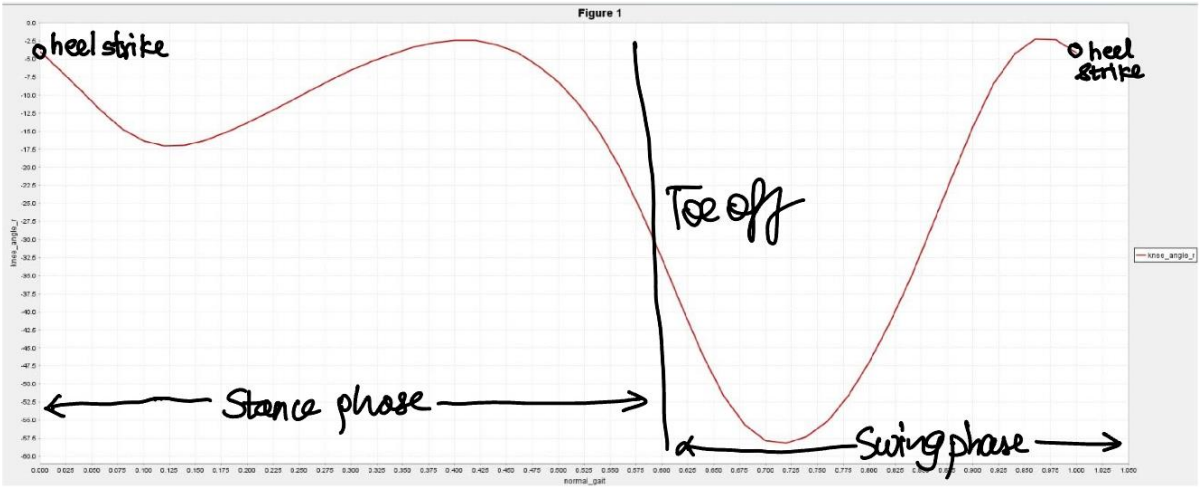
Ans: The model has total 92 muscles, the two muscles that are represented with multiple lines of action are gluteus medius and vastus lateralis. The gluteus medius is represented in that way because the muscle is responsible for hip abduction, external rotation etc. The vastus lateralis is represented that way because the muscle is responsible for knee extension. Another reason why these muscles are modeled in this way I think so is to include the pennation angle as well.

(K) At what knee angles do the rectus femoris and vastus intermedius moment arms peak?

Ans: The moment arm for rector femoris peaks at 30 ° Knee angle. The moment arm for vastus intermedius peaks at 0°.



(K) Draw the plot of the knee angle curve for a normal gait cycle, labeling the times at which heel strike and toe-off occur, and the stance and swing intervals.



(K) Wht differences do you observe between crouch gait and normal gait?

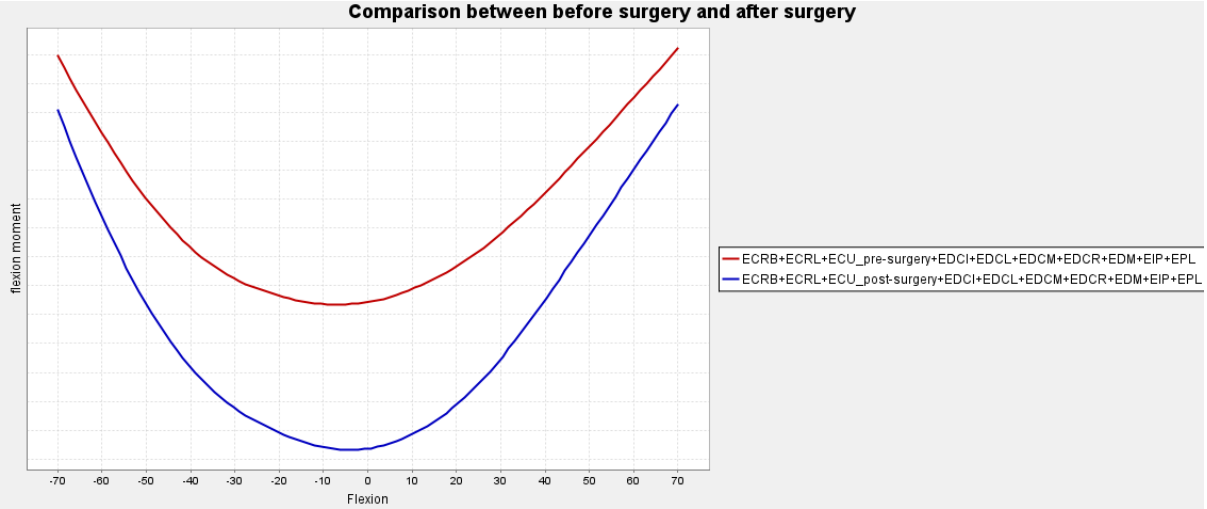
Crouch gait has a shorter step length than normal gait because the knees are not fully extended.

(K) After completing the tutorial, name 3 limitations that you observed with the model and explain why they occur.

- The model may not accurately represent the anatomy of all individuals, such as women, older adults, and people with different body types because it makes a general assumption.
- The model does not represent the interaction between the muscles and the other tissues in the body, such as the tendons, ligaments, and bones. This is because the model is a simplified representation of the human body.
- Since the model is simplified it doesn’t consider factors such as muscle fatigue.

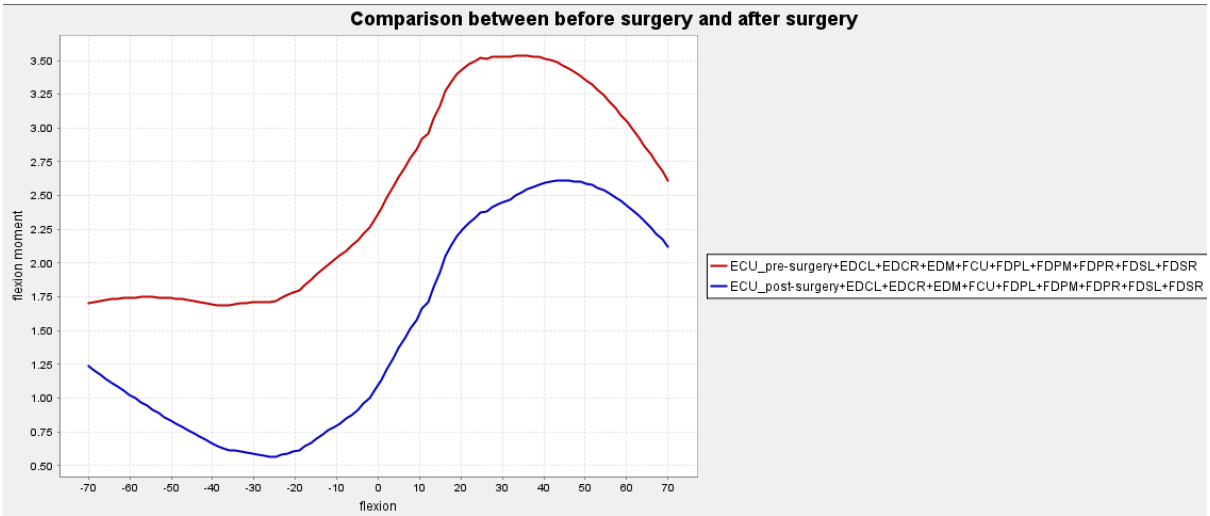
Part 2:

(K) What happens to the maximum moment of the wrist extensors if the ECU muscle is transferred to the ECRB?



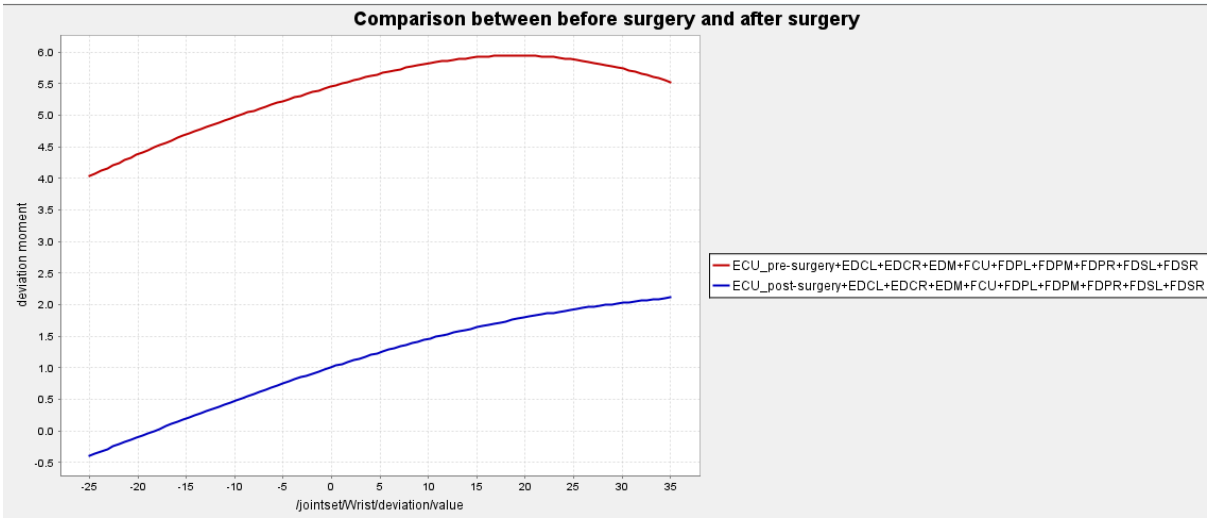
The maximum moment decreases with the transfer

(K) What happens to the maximum moment of the ulnar deviators if the ECU muscle is transferred to the ECRB?



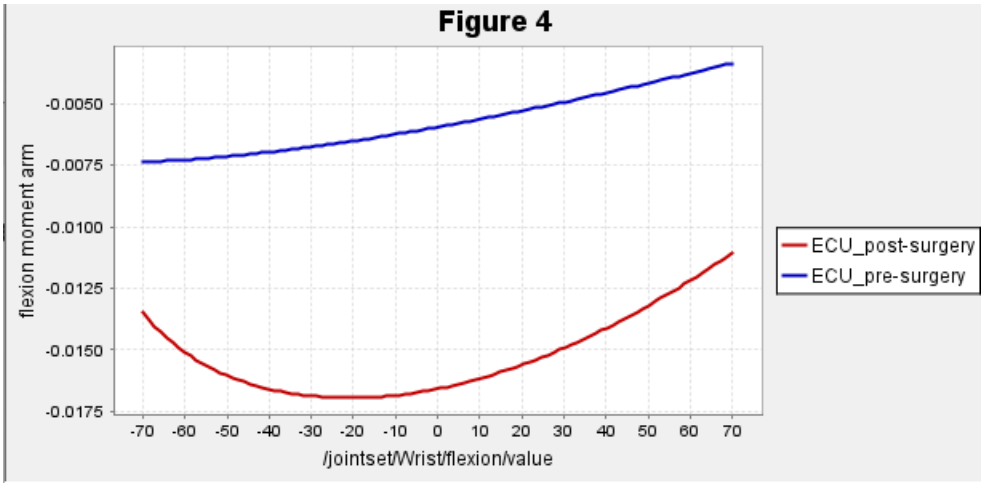
The maximum moment decreases with the transfer

(K) One goal of this tendon transfer surgery is to decrease excessive ulnar deviation. Has your simulated surgery achieved this goal? Explain.



Yes the surgery has achieved this. We can see it from the plots where the blue curve represents the post surgery and the red shows the pre surgery.

(K) Calculate the ratio of optimal fiber length to peak moment arm for ECU_pre-surgery and ECU_post-surgery.



Pre surgery – Lo/r = 0.0622/0.007 = 8.88

Post surgery – Lo/r = 0.0622 /0.017 = 3.65

(C) 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.

We can see that the moment arm for post surgery is greater than pre surgery moment arm, this implies that the moment will be greater and thus the force will be greater for the post surgery.