# Mechanism of Improved Knee Flexion After Rectus Femoris Transfer Surgery

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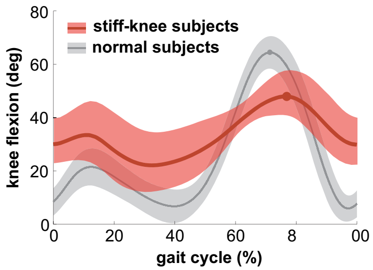
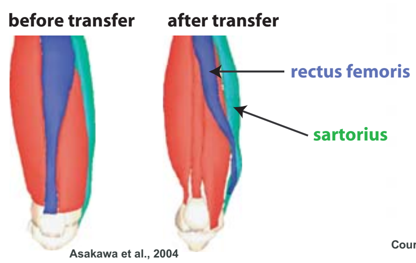
## WHAT IS STIFF-KNEE GAIT?

One of the most common gait problems in children with cerebral palsy is the inability to appropriately flex the knee during the swing phase of walking, or "stiff-knee gait" [1,2]. It makes walking difficult and can cause children to trip frequently.




## WHAT IS RECTUS FEMORIS TRANSFER SURGERY?

It is commonly thought that overactivity of the rectus femoris muscle may contribute to stiff-knee gait by creating an excessive knee extension moment. Rectus femoris transfer surgery releases the overactive muscle from the patella and reattaches it to one of several sites, such as the sartorius muscle or the ilio-tibial band.




Asakawa et al., 2004

Courtesy of Silvia Blemker

The surgery was originally intended to convert the muscle from a knee extensor to a knee flexor [3], thereby increasing knee flexion. However, experimental studies have shown that the muscle produces a knee extension moment after transfer.

Riewald & Delp, 1997

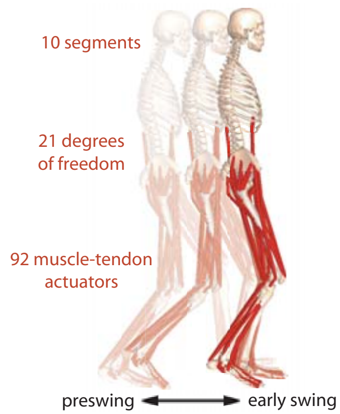
Asakawa et al., 2004

## PURPOSE

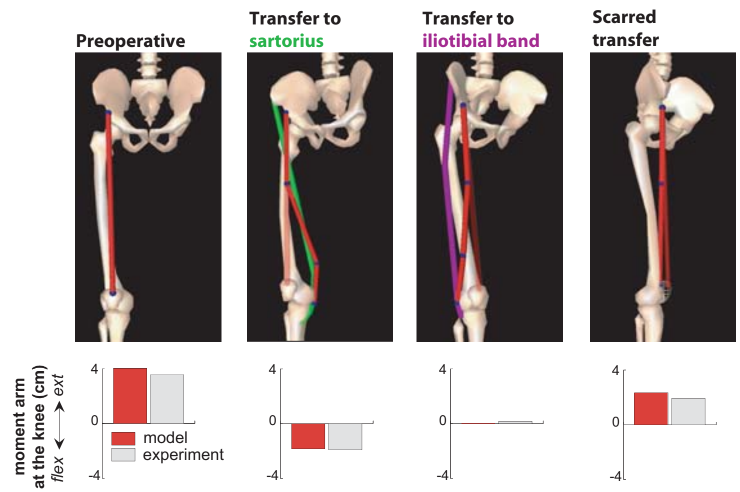
It is difficult to improve surgical outcomes because the mechanism by which knee flexion increases in some patients is unknown. This study examines three types of transfer to clarify the mechanism by which the transferred muscle improves knee flexion.

## METHODS

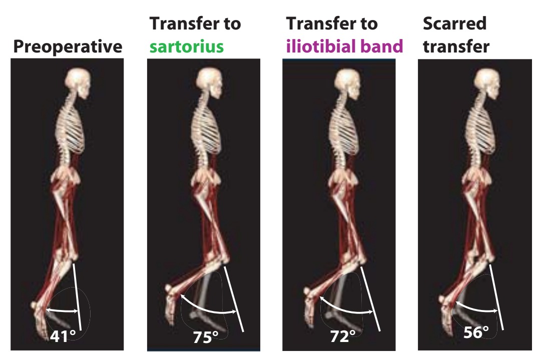
We simulated the preoperative gait of ten subjects with cerebral palsy and stiff-knee gait. The musculoskeletal model and dynamic simulation code were produced using SIMM [4] and SD/FAST [5].



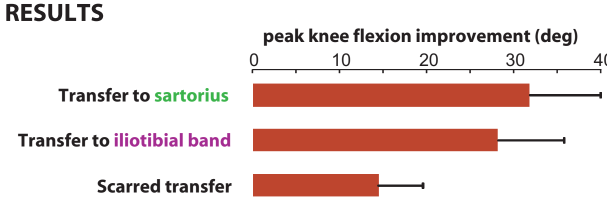

The musculoskeletal model of each subject was altered to represent 3 types of transfer of the rectus femoris.




Post-surgical simulations were created using the altered musculoskeletal models and muscle excitations from the preoperative simulation of each subject.




## RESULTS




## CONCLUSION

Simulation results suggest that the primary mechanism for improvement in knee flexion after surgery is reduction of the muscle's knee extension moment, rather than conversion to a knee flexion moment. Scarred transfer simulations resulted in an average peak knee flexion improvement (14° ± 5°) comparable to the average increase in knee flexion range of motion (13° ± 11°) in the subjects' postoperative data. Methods to reduce scarring may further augment knee flexion.

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[5]Parametric Technology Corporation, Waltham, MA

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