JOINT KINETICS IN UNDERSTANDING POSSIBLE CAUSES FOR PAIN AND REDUCED RUNNING PERFORMANCE: A CASE STUDY

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PATIENT HISTORY

Patient is a 17-year-old male, who had a transverse fracture of his tibia and fibula two years prior when playing baseball. Surgical fixation took place 4 days following the injury with plate and screws in both the tibia and fibula followed by casting and crutch walking for two weeks and boot for two months with full healing. He had 8 months of PT following surgery before approval to return to baseball. However, he had ongoing pain while loading during running and was unable to perform at his pre-injury level. He was seen for a comprehensive gait analysis to gain insight into possible biomechanical mechanisms for the ongoing pain. Parent and patient goal was pain resolution and to attain preinjury running speed and agility.

CLINICAL DATA

A comprehensive gait analysis was completed both walking and running. Selected clinical exam findings are summarized in Table 1. Pain was located 1/3 the way down the anterior portion of the right shank and was graded 3-4/10 when at its worst. Additional assessments revealed difficulty with single leg hopping and squatting (eccentric loading of the quadriceps) on the right side only.

Table 1: Selected clinical exam and temporal findings.

	Right	**Left**
Hip flexion strength	5/5	5/5
Knee flexion strength	5/5	5/5
Knee extension strength	5/5	5/5
Ankle plantar flexion strength	5/5	5/5
Knee extension (deg)	0	0
Popliteal angle (deg)	-55	-45
Ankle dorsiflexion knee 0deg flexion (deg)	5	5
Ankle plantar flexion strength	5/5	5/5
Ankle dorsiflexion strength	5/5	5/5
Quads Girth (20 cm prox to patella) (cm)	57.8	60.0
Toe off walking range (% gait cycle)	62.2-62.5	59.3-61.7
Toe off running range (% gait cycle)	33.7-34.1	34.1-35.7

MOTION DATA

During level shod walking, motion analysis data showed a reduction in knee flexion loading and associated quadriceps avoidance knee moment pattern (no internal knee extensor moment) on the right in comparison to the left side (Fig. 1). When running, this asymmetry was more remarkable with no right knee flexion in loading and a continued quadriceps avoidance pattern during loading of the right side only (Fig. 1). Kinematic and kinetic data was very consistent stride to stride. The right side ankle showed no compensatory increased power absorption during the loading phase (not shown). Following visual review of sagittal plane kinetic data asymmetries, patient was videoed during unilateral squat movements.

TREATMENT DECISION AND INDICATIONS

Physical therapy to work on eccentric strengthening of the right quadriceps. Indications: reduction in right knee loading response flexion in comparison to the left and associated quadriceps avoidance during walking and more significantly during running. Ankle kinematics and kinetics were symmetric during running (not shown) indicating no ankle compensation for reduced knee loading on the right side. Goal: to improve eccentric loading capacity of the quadriceps muscle and distribute loading impact through both the knee and ankle thus reducing possible load on the right tibia.

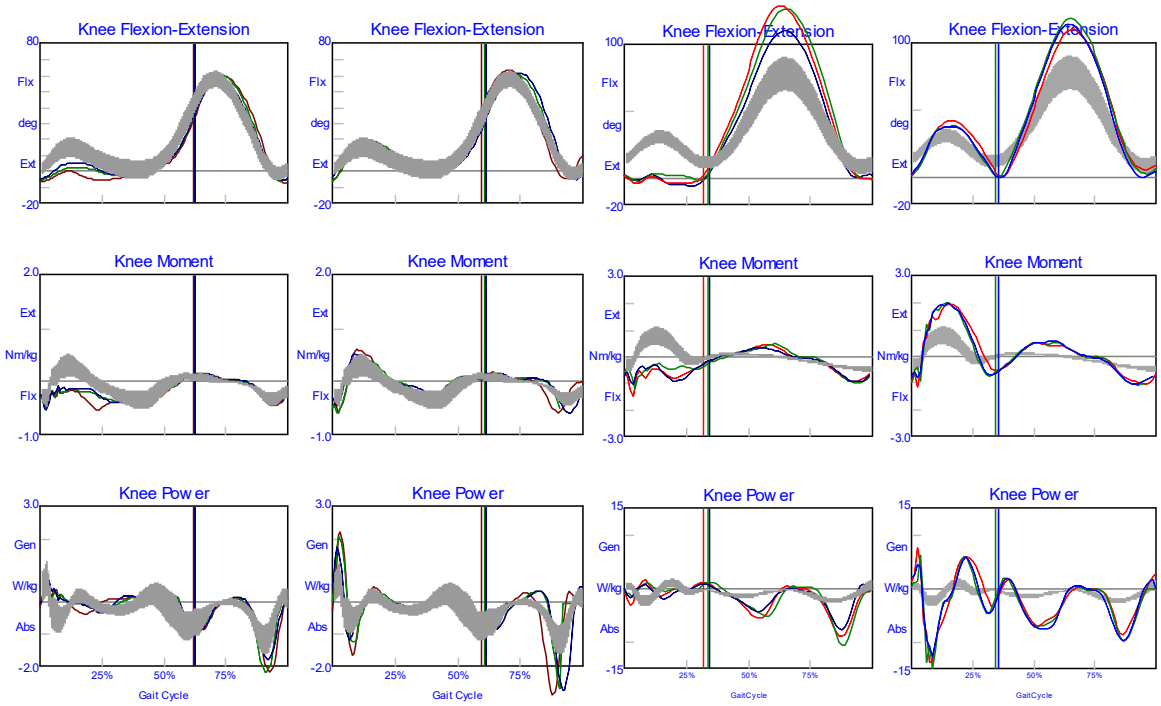

Figure 1: Comparison of the right and left side (three gait cycles each) sagittal plane knee kinematics and kinetics during walking and running.

TREATMENT OUTCOMES

The patient is currently undergoing rehabilitation to address the asymmetry in knee eccentric strength to allow muscle based absorption of landing loads during running on the right side.

SUMMARY

Comprehensive gait analysis allows objective measurement of walking and running function that is not possible in the clinic setting. The patient showed asymmetry in knee sagittal plane kinematics and kinetics both in walking and more so in running. The decreased eccentric loading at the right knee was not absorbed by increased right ankle absorption. These gait findings led to assessment of eccentric strength immediately following the gait analysis testing. The isometric strength symmetry did not provide evidence of this isokinetic strength asymmetry. The gait analysis results, specifically knee sagittal plane kinetics, helped to identify ongoing impairment that required rehabilitation.

DISCLOSURE STATEMENT

The authors have no conflicts of interest to disclose.