

Lower Extremity Joint Coupling and Patellofemoral Joint Pain During Running

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Patellofemoral joint pain (PFP) is the most prevalent pathology in runners. Abnormalities in joint coupling, in terms of timing differences, phasing relationships, and continuous excursion ratios, have been suggested to be sources of running related injuries. However, few studies have examined these parameters in an injured population. **PURPOSE:** To compare joint coupling in runners who have a history of PFP and those who have not by methods of timing differences, continuous relative phase (CRP), and coupling angles (CA). **METHODS:** As part of an ongoing study, 13 females with a history of PFP were compared to 13 uninjured females. All were competitive runners (minimum 20 miles/week) and uninjured at the time of data collection. Five trials of ground reaction force (GRF) data and kinematic data were collected during overground running at a speed of 3.65 ± 0.2 m/s. The stance phase was divided into four periods based on events of the GRF. Various joint coupling relationships of rearfoot eversion/inversion, tibial internal/external rotation, knee flexion/extension, and knee internal/external rotation were assessed. Timing difference values of 0% stance indicated synchronous coupling. CRP values of 0° indicated in-phase relationships between the two motions of interest while coupling angles of 45° inferred relatively equal excursions between the two motions. **RESULTS:**

		RF(ev/in)-K(f/e)		RF(ev/in)-T(rot)		T(rot)-K(f/e)		RF(ev/in)-K(rot)		T(rot)-K(rot)	
		PFP	Con	PFP	Con	PFP	Con	PFP	Con	PFP	Con
Timing[^]		3.5	2.8	**10.4	3.9	**6.9	-1.1	**3.6	-9.0	-14.0	-12.9
CRP^{^^}	P1	*-7.63	-24.12	33.43	21.66	-41.05	-45.79	1.40	-12.41	-32.03	-34.07
	P2	**13.74	-21.35	-0.68	5.37	*-13.06	-26.72	-30.20	-29.82	-29.53	-35.19
	P3	-7.87	-5.70	**21.15	-6.29	**13.28	-0.23	-7.30	-0.86	13.85	5.43
	P4	-6.60	6.56	3.96	12.46	**10.56	-19.02	25.17	25.67	21.21	13.21
CA^{^^}	P1	29.11	31.20	60.54	56.37	*17.47	23.44	**51.11	58.52	*36.94	48.69
	P2	*24.22	20.35	60.84	62.01	*15.65	11.79	49.79	51.40	34.43	34.73
	P3	**24.55	22.20	55.52	55.74	18.13	16.73	50.40	52.49	39.71	42.53
	P4	32.09	30.60	60.77	56.39	19.28	22.06	55.93	58.03	40.06	44.81

[^]Timing Differences only between motions in first half of stance.

^{^^}P1 - P4 are the 4 periods of stance.

*Independent t-test of $p < 0.10$. ** $p < 0.15$.

CONCLUSION: These preliminary data suggest that runners with a history of PFP may exhibit differences in joint timing, phasing relationships, and continuous excursion ratios. Differences were primarily observed between the tibial internal/external rotation with knee flexion/extension relationship, followed by the rearfoot eversion/inversion with knee flexion/extension relationship. Supported by Dept. of Defense grant DAMD17-00-1-0515.