

Is free moment related to tibial stress fracture in distance runners?

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Stress fractures are common in distance runners with the tibia being particularly susceptible. A stress fracture is arguably the most serious running overuse injury and occurs twice as frequently in female runners than in males. Free moment (FM) is the torsional force about a vertical axis due to friction between the foot and the ground during stance. Its possible role in lower extremity injury has not been widely studied. **PURPOSE:** The purpose of this study was to investigate the relationship between free moment variables and the occurrence of tibial stress fractures (TSF) in female distance runners. It was hypothesized that runners who had previously sustained a TSF would exhibit higher maximum free moment earlier in stance, spend more of stance with FM positive and have higher net angular impulse than runners who had not.

METHODS: Healthy runners who had sustained TSF previously (n = 13) and an age and mileage matched control group (n = 13) ran at 3.8m/s on a 25m runway containing a force platform sampling at 960 Hz. Data from five trials were normalized to body weight and height and averaged for statistical analysis. Maximum free moment (MAXFM), time to MAXFM (TTMAXFM), per cent stance with FM positive (%POSFM), net angular impulse (IMP), FM at peak vertical ground reaction force (FMVGRF) and FM at peak braking force (FMBRAK) were examined. **RESULTS:** (MAXFM, FMVGRF, FMBRAK values are $\times 10^{-3}$, IMP is $\times 10^{-4}$)

	MAXFM	TTMAXFM (%)	%POSFM (%)	IMP (s)	FMVGRF	FMBRAK
TSF	8.29	26.80	53.05	1.19	2.61	1.25
Controls	9.49	35.82	54.80	3.49	5.54	4.39
p	0.24	0.02	0.39	0.15	0.06	0.07

These data indicate that runners with a history of tibial stress fracture reach MAXFM earlier in stance. The magnitudes of MAXFM and %POSFM and IMP were the same in both groups. FMVGRF and FMBRAK showed a trend towards lower values in the TSF group: this may be related to the difference in timing of MAXFM. **CONCLUSIONS:** MAXFM occurs earlier in stance in runners who have sustained a TSF previously compared to a control group. Prospective investigations into TSF and FM are needed to determine cause and effect in this relationship and whether TTMAXFM is a marker of TSF risk.

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